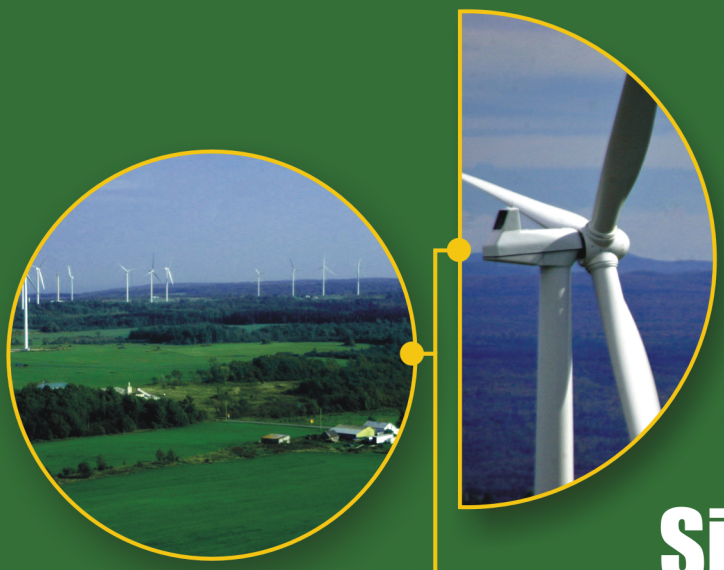

American Wind Energy Association®

Wind Energy Siting Handbook

FEBRUARY 2008

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WIND ENERGY SITING HANDBOOK

February 2008

Terms and Conditions

This Wind Energy Siting Handbook (the "Handbook") presents general information about regulatory and environmental issues associated with the development and siting of wind energy projects in the United States. It is intended to be a general guidance document providing technical information and tools for identifying potential issues that may arise with wind energy projects. The Handbook contains links to resources on the Internet. Those links are provided solely as aids to assist you in locating other Internet resources that may be of interest. They are not intended to state or imply that AWEA or the Contributors endorse, approve, sponsor, or are affiliated or associated with those linked sites. The Handbook is not intended as a comprehensive discussion of all wind energy project issues and should be used in conjunction with other available resources. The Handbook also is not intended as legal or environmental advice or as a best practices manual, nor should it be considered as such. Because the Handbook is only a general guidance document, independent legal counsel and/or environmental consulting services should be obtained to further explore any wind energy siting issue, matter, or project. In reviewing all or any part of the Handbook, you acknowledge and understand that the Handbook is only a general guidance document and does not constitute a best practices manual, legal or environmental advice, or a legal or other relationship with the American Wind Energy Association ("AWEA") or any of the persons or entities who contributed to or helped prepare the Handbook, including but not limited to Tetra Tech EC, Inc., Nixon Peabody LLP, Aviation Systems Inc., and Comsearch (collectively "Contributors"). You further disclaim any rights against and release AWEA, Contributors, and their affiliates, successors, assigns, representatives, agents, and employees from any and all claims, demands, rights, costs, expenses, attorneys' fees, causes of action, or liabilities arising out of or relating to material contained in the Handbook.

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CHAPTER 1

Introduction

Global warming is considered one of the most serious problems facing the global community. Certain gases, such as carbon dioxide, when released in the atmosphere through the burning of fossil fuels, create a "greenhouse effect." Clean, renewable energy solutions, such as wind, solar, and hydroelectric systems, that do not rely on fossil fuels for energy generation help curb the effects of global warming. Throughout the United States, many local and state governments have set mandates or passed laws to encourage clean energy generation by requiring utilities to produce a portion of electricity from renewable sources. Although wind has been used as an energy source for centuries, only within the last 30 years have advances in technology allowed wind energy to become an increasingly important part of the nation's energy mix. Since 1974 the American Wind Energy Association (AWEA) has been committed to encouraging and assisting wind energy development in the United States.

This handbook was developed by the AWEA Siting Committee to inform wind energy developers and other interested parties about environmental siting issues relevant to land-based commercial-scale wind energy project development in the United States. This handbook has been designed to provide technical information and useful tools based on the industry's collective experience in siting wind energy projects and assessing potential impacts.

1.1 Scope

The purpose of this handbook is to assist wind energy developers in addressing the regulatory and environmental issues associated with commercial-scale, land-based wind projects within the United States. It is intended to be a guidance document for use in conjunction with other available resources (listed in this document and on the AWEA website and consultations with environmental professionals and regulators. This handbook should be the starting point in a process of evaluating the environmental impacts, regulatory setting, and compliance requirements relative to the siting of a wind energy project.

The potential involvement of three levels of government –federal, state, and local – makes a "one-size-fits-all" approach to siting impractical. This handbook is intended to facilitate navigation of a wide array of

Resource

The Database of State Incentives for Renewables & Efficiency (DSIRE) provides information on state, local, utility, and federal incentives that promote renewable energy and energy efficiency.

statutory and regulatory programs, some of which have significant overlap. Project impacts that may be significant in one locale may not be pertinent elsewhere. Developers must determine the specific federal, state, and local requirements that are relevant to a particular project, recognizing that not all requirements discussed in this handbook will apply to every project, and additional requirements not addressed may also be applicable.

Although this handbook guides the reader through the entire development process, certain aspects of this process that are not directly related to environmental issues are not described in detail. Items that are not considered part of the scope include:

- Land acquisition
- Power contracts
- Financing
- Engineering Procurement Construction (EPC) contract negotiation
- Transmission issues
- Turbine specifications
- Operations and Maintenance (O&M) issues
- Host community and tax agreements

The purpose of this handbook is to assist wind energy developers in addressing the regulatory and environmental issues associated with commercial-scale, land-based wind projects within the United States.

1.2 Overview of Handbook

This handbook has been designed to take the reader from the basic steps and considerations within the development process through to construction of the wind project.

Chapter 2, Wind Energy Basics, provides an overview of the development process and describes the basic components of a wind project.

Chapter 3, Critical Environmental Issues Analysis, describes the initial environmental due diligence portion of the development process.

Chapter 4, Regulatory Framework, provides a discussion of the regulatory and permitting requirements often associated with the development of a wind project.

A note on navigating through the handbook:
When clicking the *italic green* text will take the reader to other sections within this handbook. The bold brown text will take the reader to the glossary. The blue text will take the reader to external links on the world wide web.

Chapter 5, Impact Analysis and Mitigation, describes the environmental studies and other techniques available to assess the potential environmental impacts associated with the development of a wind project. This chapter also provides a discussion of possible mitigation measures and monitoring techniques to be used for addressing unavoidable or unknown impacts.

Chapter 6, ASTM Environmental Site Assessments, discusses the basic elements of conducting an environmental site assessment generally required for financing of wind projects.

Chapter 7, Public Outreach, describes the importance of, and techniques often used by developers for, coordinating closely with the community in which they are operating throughout the development process.

Additional resources for the reader have been provided within the *Glossary*, *Resources*, and *References* chapters of the handbook.

Each wind energy project requires due diligence in its particular locale. Developers must determine which environmental features are found on the site, determine any potential impacts associated with the project, and the specific regulatory agencies that have jurisdiction over the project. The developer should consult with the relevant agencies as early as possible in the development process without jeopardizing the competitiveness of project. The value of engaging an environmental professional early in the process should be considered in light of the regulatory hurdles that inevitably arise in siting a wind energy project. The studies required in the permitting process should be science-based and tailored to the specific site. Each wind developer has a responsibility to further the reputation of the industry by providing appropriate and sound oversight of the regulatory process. This handbook has been designed for use as a tool in this process.

Elkhorn Valley Wind Farm in Union County, Oregon. Photo courtesy of Horizon Wind Energy and Vestas.

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CHAPTER 2

Wind Energy Basics

Wind projects vary in size, from small projects of one to a few turbines (known as "behind the meter" or "distributed wind systems") serving individual customers, to large projects ("commercial," "utility-scale," or "wind farms") designed to provide wholesale electricity to utilities or an electricity market. Wind energy projects may be on land or off-shore. This handbook focuses on land-based commercial-scale wind projects. These wind projects are generally owned and operated by independent power producers, which traditionally sell their power to electric utilities. Individual wind turbines are connected to one another and to a substation via an electrical collection system and then, in turn, connected to the electrical transmission system. Commercial-scale wind projects range in generating capacity from 5 megawatts (MW) to several hundred MW and can consist of a few to hundreds of wind turbines.

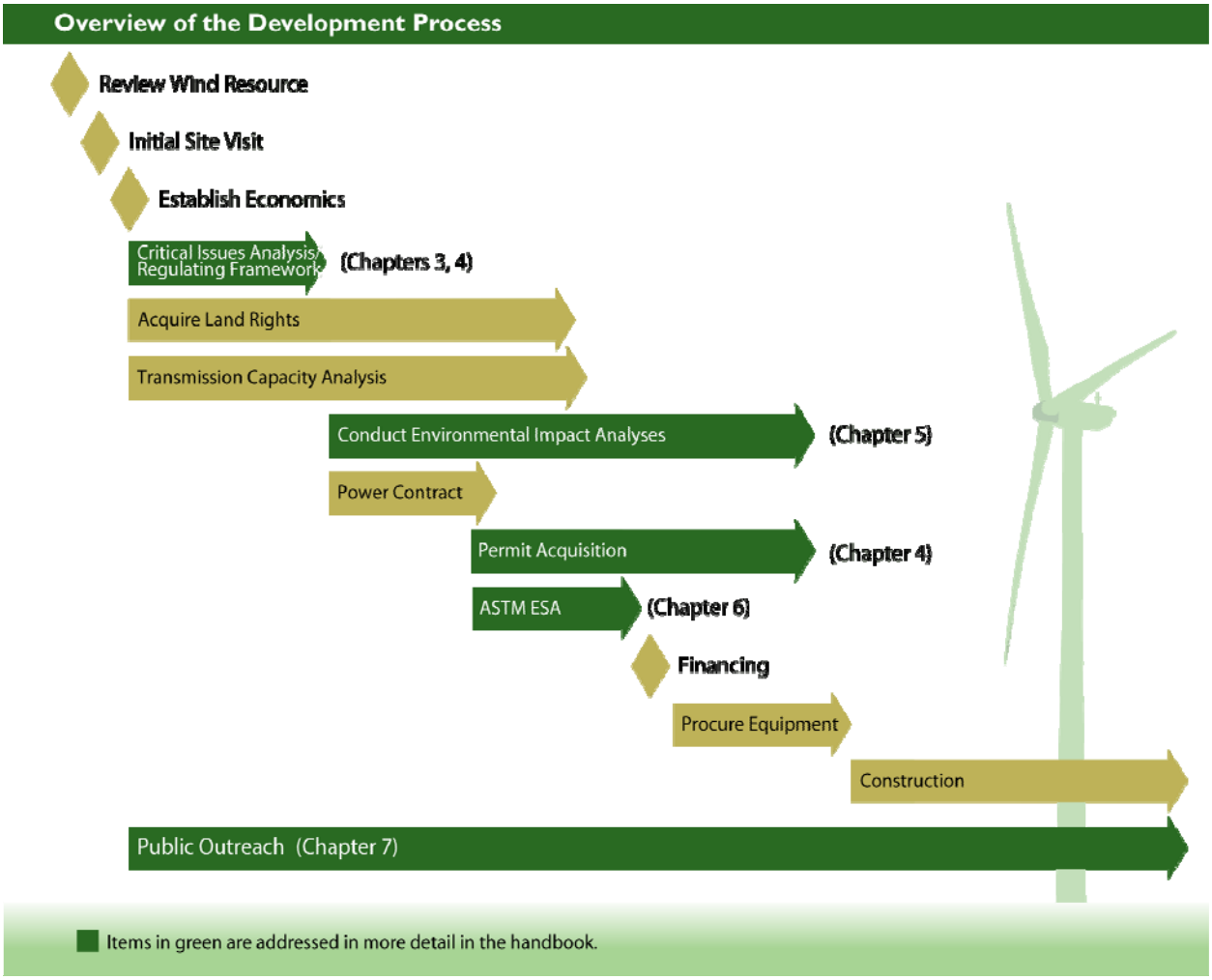
This handbook focuses on land-based, commercial-scale wind projects. Distributed wind projects, such as the Hull Wind Project in Hull, Massachusetts, are not specifically discussed in this handbook, although regulatory and environmental considerations for larger projects are relevant on a smaller scale for distributed wind projects.

Wind farm in Mojave, California. Photo courtesy of Mitsubishi Power Systems America and AWEA.

2.1 Overview of the Development Process

This section provides a general overview of the wind project development process and provides a basic flowchart of one possible development scenario. This section is organized in the same order as the handbook as a whole. It is important to note, however, that the

"steps" within the process may vary greatly from project to project depending on the developer, the size and location of the project, and other factors. Some steps are beyond the scope of this handbook but are briefly described in this section to provide a broader view of the entire process.



This figure provides an example of the development process through construction. The timing and duration of events vary considerably from project to project depending on many factors, including size and location of the project and developer preference.

2.1.1 Conduct Preliminary Site Characterization

Once a site has been identified for further investigation, the developer will conduct a Preliminary Site Characterization to determine the initial suitability of that site. The Preliminary Site Characterization can also be a useful tool for performing an alternative analysis of multiple potential sites. The major steps involved in this initial stage include:

- **Analyze the wind resource** – The developer will review the available wind data to determine the wind speed and reliability within the proposed project site. This information is generally ascertained through **meteorological towers** installed within or

close to the project site. When existing site data is not available, this process typically takes one to three years.

- **Conduct an initial site visit** – The developer will conduct an initial site visit to determine any obvious constructability and/or environmental constraints. Depending upon available land access, this step may be conducted by an engineer and/or biologist.

- **Establish the economics of the project** – The developer will identify the criteria for economic success and how this might be achieved for the project. This step is highly dependent upon the developer and/or the business model used to develop the wind project. As such, this handbook does not discuss this component of the development process.

- **Conduct critical environmental issues analysis and identify regulatory framework** – Once the developer has determined the general project area to be investigated, a critical environmental issues analysis is often conducted to better understand the possible environmental and land use constraints in the area. This step is discussed in further detail in *Chapter 3*.

  Regulatory drivers may vary from project to project depending on the location and the size of the project. The developer must identify early in the development process the federal, state, and local regulatory issues that will influence the project. This step is often conducted in conjunction with the critical environmental issues analysis described in *Chapter 3*. Regulatory framework is also discussed in greater detail in *Chapter 4*.

- **Conduct transmission capacity analysis** – To determine if the existing transmission system will be able to support the proposed project, the developer will work with the local independent system operator (ISO), regional transmission operator (RTO), or utility to conduct a transmission capacity analysis. This handbook does not address this type of analysis. However, for reference we have listed ISOs and RTOs in North America in the *Resources* section of the handbook.

- **Conduct ASTM Environmental Site Assessment** – During the early stages, developers typically perform a screening-level assessment of the potential for environmental contamination to impact the property. As the project becomes better defined and/or the developer nears acquisition of the property, a more

Example

The legal process of acquiring land rights may vary from state to state. The New York State Energy Research and Development Authority (NYSERDA) has published guidance for establishing lease agreements under the Land Acquisition section of its Wind Energy Toolkit.

detailed site assessment in compliance with American Society for Testing and Materials (ASTM) standards should be considered to minimize liability for pre-existing contamination. An ASTM environmental site assessment is often required for financing. This process is discussed in greater detail in *Chapter 6*.

- **Assess public acceptability** – Reaching out to the community and understanding the level of public acceptability within the project area is a critical component of successfully developing a wind project. The public outreach process is best initiated in the early stages of development and maintained throughout the entire development process and operations. *Chapter 7* provides more information regarding the public outreach process.

2.1.2 Acquire Land Rights

Wind projects are generally located on leased land that is publicly or privately owned. Developers will often engage in land acquisition activities in the earliest stages of the development process and continue these activities until construction. This handbook does not discuss this component of the development process in detail, but provides some guidance with respect to the regulatory framework applicable to lands managed by government entities.

2.1.3 Conduct Environmental Impact Analysis and Mitigation

The results of the critical environmental issues analysis often provide the developer with a better understanding of the site and the key issues that may require further investigation due to environmental concerns and/or regulatory drivers. The next stage of the development process often consists of conducting detailed environmental and land use studies to identify potential impacts and develop avoidance and mitigation strategies. These studies are often used to comply with regulatory or permitting requirements. Regulatory considerations are described in *Chapter 4* and the Impact Analysis and Mitigation component is discussed in greater detail in *Chapter 5*.

2.1.4 Other Considerations

Other key components that, while outside the scope of this handbook, often are part of the development process include:

- The type and terms of the power contract to be negotiated with the power purchaser, often called a power purchase agreement (PPA)

- The type and terms of the financing to be established depending on the developer and the economics of the project
- Engineering procurement and construction (EPC) contract negotiation
- Issues relating to interconnection to the power grid
- Turbine acquisition agreements
- Operations and Maintenance (O&M) agreements and issues
- Litigation and appeals associated with permits
- Host community agreements
- Payment-in-lieu-of-taxes (PILOT) and other tax abatement agreements

2.2 Components of a Wind Project

Although wind projects vary in scale, the same general components comprise any size project. The typical modern wind energy project consists of three major systems: wind turbines mounted on towers, an electrical collection system, and transmission/interconnection facilities. Most projects also include access roads, O&M facilities, and meteorological towers.

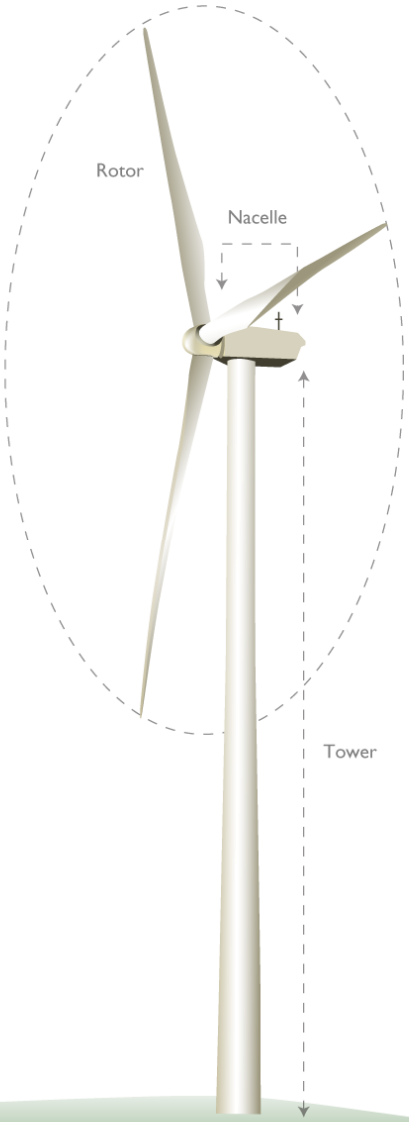
Wind turbine in Stratford, Texas. Photo courtesy of Generation Energy and AWEA.

2.2.1 Wind Turbines

A wind turbine consists of three major mechanical components: tower, nacelle, and rotor. These are described in the following figure.

Wind Turbine Components

- Rotor—The rotor generally consists of two or three fiberglass blades that extend out of the hub. In most turbines, the rotor is mounted to a driveshaft within the nacelle (defined below) to operate upwind of the tower. In some cases, the rotor is located behind the tower and nacelle. The rotor attaches to the drive train emerging from the front of the nacelle. Hydraulic motors within the rotor hub feather each blade according to wind conditions, which enables the turbine to operate efficiently at varying wind speeds.
- Nacelle—The nacelle is a large housing that sits atop the tower behind the rotor. It houses the main mechanical components of the wind turbine: drive train, gearbox, transformer, and generator. The nacelle is generally externally equipped with an anemometer and a wind vane that signals wind speed and direction information to an electronic controller. The nacelle is mounted over a yaw gear, which constantly positions the rotor upward of the tower.
- Tower—The tower supports the nacelle and rotor. Towers are generally made of steel and can be either tubular or lattice. Most tubular towers will have an access door and an internal safety ladder and/or elevator to access the nacelle.



2.2.2 Electrical Collection System

Power generated by each wind turbine is transferred to a transformer located in the nacelle or adjacent to the base of the turbine to raise the voltage of electricity produced by the turbine generator to the level of the collection system. This electrical collection system consists of underground and overhead cables that carry electricity from and within groups of wind turbines and transmit it to a collection substation and

point of interconnection switchyard, which transfers the electricity generated by the project to the regional power grid.

2.2.3 Transmission System

The collection substation terminates collection feeder cables and steps up the voltage to that of the transmission system to which the project ultimately connects.

Construction of a substation at the Big Horn Wind Project in Klickitat County, Washington. Photo courtesy of PPM Energy.

2.2.4 Access Roads

There usually are a number of access roads into and around a wind project. These roads provide construction and service access to the wind turbines.

2.2.5 Operations and Maintenance (O&M) Facility

Large wind projects generally require an O&M facility for storing equipment and supplies required during operation. O&M facilities can be located on- or off-site. Some O&M facilities include control functions such as the supervisory control and data acquisition (SCADA) system. This system provides two-way communication with each wind turbine. A SCADA system allows a central computer system to monitor and control each turbine's operation.

2.2.6 Meteorological Towers

Meteorological towers, or wind measurement systems, include three major components: 1) anemometers, which are sensors that measure wind speed and direction, 2) a data logger, and 3) a meteorological

mast. These towers can also be equipped with sensors to measure temperature and pressure. Meteorological towers can be of steel tube or lattice construction, and can be free-standing or guyed. These towers may be temporary to assess the wind resource prior to the development of a project, or permanent to assist in operation of the facility by transmitting information about wind speed and direction to each wind turbine and to the control facility. Permits are often required to install a meteorological tower, which are separate from the permits necessary to construct and operate the wind energy project.

2.3 Building a Wind Farm

Although this handbook focuses primarily on the environmental considerations through the development process it is worth noting the key aspects of the construction process to better assess potential impacts.

Construction of a wind farm involves much more than erecting turbines. Land must be temporarily cleared and graded for a construction trailer, laydown yard, and equipment staging area. What follows is a list of common improvements and issues to be considered during construction:

- Improvements to public roads to handle heavy construction equipment and widening of intersections to accommodate oversize vehicles.
- Creation of access roads for construction access to each turbine location.
- Preparation of each turbine location for construction, which typically requires the clearing and grading of a diameter of 150 to 250 feet around the tower site.
- Installation of temporary and/or permanent meteorological towers.
- Addition of lights or connection to a power source for larger meteorological towers.
- Construction of miles of underground and/or overhead electrical collection lines to connect turbines to the collection substation.

Construction at a wind project in Chattanooga, Tennessee. Photo courtesy of AWEA.

- Clearing and grading of the site(s) for the substation(s).
- Creation of transmission lines to connect the project to the power grid, including construction of access roads and laydown areas to support transmission line construction.
- Construction of an O&M building, which requires clearing and grading, and sometimes the construction of new roads, septic facilities, sewer connections, and installation of a private well or municipal water connection.
- Identification of disposal areas for construction debris, such as slash from clearing and excess soil and rock.
- Consideration of environmental compliance measures during construction including environmental training for construction crews. For some projects, environmental inspectors may be required.

Erecting a wind turbine at the Munnsville Wind Power Project. Photo courtesy of AWEA.

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CHAPTER 3 Critical Environmental Issues Analysis

Early in the siting process, the developer may conduct a critical environmental issues analysis (often called a preliminary analysis, a preliminary site assessment, an environmental screening analysis, and/or a preliminary risk assessment) to assess site suitability from an environmental perspective. The critical environmental issues analysis is typically a desktop review performed by professionals with expertise in various environmental disciplines whose findings are documented in one or several reports. Experienced developers use this documentation to determine whether to proceed with site development, and to develop plans, schedules, and budgets for conducting more-detailed environmental studies (if deemed necessary) and for obtaining applicable government permits/approvals. In addition to guiding a developer's decision-making process, the documentation prepared during the critical environmental issues analysis is often reviewed by potential investors as they evaluate the feasibility and risks associated with a proposed project and how much capital may be required.

A Critical Issues Analysis is typically conducted using desktop resources only. Limited agency consultation and field studies may be appropriate for some projects.

3.1 Fatal Flaws/Major Considerations

The basic elements that are reviewed at this stage include, but are not limited to, the following:

- **Required permits, licenses, and regulatory approvals** - This includes identifying the appropriate federal, state, and/or local regulations, the regulating agencies, the required approvals, and the steps necessary to obtain such approvals, including: studies, duration, cost, and the level of certainty that each approval may be required for the specific project. *Chapter 4* provides additional discussion regarding regulatory issues.

- **Threatened or Endangered Species or Habitat** - This includes identifying Federal and/or State-listed threatened or endangered species or habitat within the project area, and their approximate location. *Section 4.1.2* provides additional detail on the regulatory drivers with respect to fish and wildlife.

- **Avian and Bat Species or Habitat** – This involves identifying bird and bat species, habitat (year-round and seasonal), and migration pathways that may occur within the project area. *Section 5.1* provides information on evaluating the potential for avian and bat impacts during later stages of project development.

- **Wetlands and Protected Areas** - This involves identifying known locations of wetlands and other protected areas through a desktop analysis using available information such as the National Wetlands Inventory (NWI) Program, and other state specific data. *Section 5.2.1* provides further detail regarding the identification of wetlands and water resources.

- **Location of known archaeological and historical resources** - This involves the identification of archaeological and historical resources through a desktop analysis using readily available resources such as the National Register of Historic Places (NRHP) maintained by the National Parks Service (NPS). *Section 5.6* provides additional detail regarding the identification of these resources.

- **Community facilities and services** - This involves the identification of the community facilities, such as churches, parks and recreational areas, services such as police and fire departments, and other details that can provide a better picture of the community in the area of the proposed project and its character.

- **Land development constraints** - This involves identifying land development constraints that may influence the location of proposed facilities. These can be both regulated constraints as well as guidelines suggested by the community or developer. Some of these constraints include:

  - Noise limits (state and local standards)
  - Setback requirements
  - Floodplain issues
  - Height restrictions
  - Zoning constraints

- **Telecommunications interference** - This includes the preliminary investigation of known telecommunications transmissions and microwave paths. *Section 5.9* provides additional details regarding potential telecommunications interference and studies that can be conducted at later stages of project development.

- **Aviation considerations** - This includes the identification of known airports, landing strips and other aviation considerations. Further coordination with the Federal Aviation Administration (FAA) often occurs later in the development process as described in *Section 4.1.5*.

- **Visual/Aesthetic Considerations** - To the extent possible, at this early stage, visually sensitive areas, such as designated scenic vistas, parks, and residences may be identified. Analysis of the potential impacts to these resources is described further in *Section 5.3*.

  Because each potential site is unique and state and local regulatory requirements can vary substantially, it is impossible to create an early-stage scope of study that can be used for all projects.

  As the analysis proceeds and the developer gains a better understanding of the environmental issues and constraints of a particular site, the developer may choose to add to or eliminate property from the original study area. For example, the presence of sensitive species habitat may constrain access road layout.

  The critical environmental issues analysis is typically conducted using desktop resources only and involves limited agency consultation. Some developers also engage an environmental consultant, land specialist, and/or civil engineer to conduct limited field studies to collect more site-specific data. In either scenario, the study is preliminary in nature, providing the developer with an affordable but limited inquiry into the environmental and land use issues at the proposed site.

3.2 Constraints Map

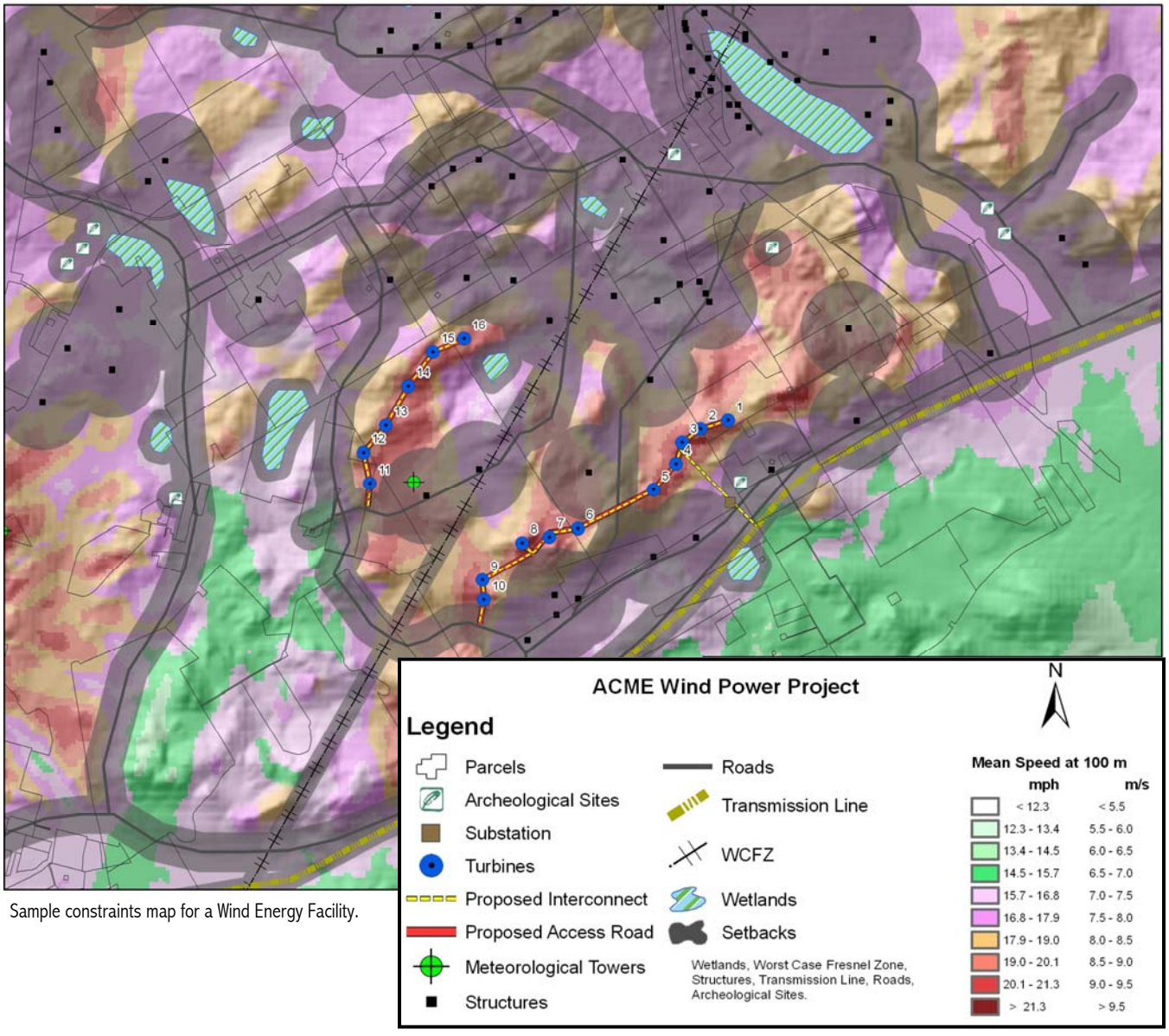
A constraints map graphically depicts environmental and land use constraints that limit the desirable area for development at a site.

A constraints map is a useful tool for graphically depicting the environmental and land use constraints that limit the desirable area for development at a site. The constraints map enables the developer to ascertain the number of turbines that can be located on the site. It also identifies features that may present challenges for siting ancillary facilities. The constraints map uses a base map that shows the wind resource and parcel information. Mandatory or other appropriate setbacks can be overlaid on the map. An example map is provided at the end of this section.

These setback constraints may include:

- Setbacks from sensitive buildings such as residences, schools, hospitals, and churches
- Setbacks from outbuildings such as barns, garages, and hunting camps
- Setbacks from roads, trails, and recreational areas
- Setbacks from electric transmission lines; oil and gas wells; oil and gas transmission, gathering, and service lines; sub-surface mining operations; and other such infrastructure/facilities
- Setbacks from non-participating parcel boundaries
- Wetlands, surface waters, drinking water supplies, and any regulatory buffers surrounding them
- Sensitive cultural resources and any regulatory boundaries surrounding them
- Locations of special-status wildlife or vegetation species and/or critical habitat
- Areas of known geotechnical instability
- Fresnel zones and other communication/radar-related constraints
- Areas impacted by air traffic (both civilian and military)
- Any other environmental and land use constraints identified for the site

The map may include additional constraints that can create development challenges. For example, constraint maps often indicate parcels that cannot be developed, such as conservation easements, and residences close to the site. Engineering constraints, such as steep slopes and areas of geotechnical instability, are also often depicted on the constraints map.



Sample constraints map for a Wind Energy Facility.

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CHAPTER 4 Regulatory Framework

Many of the issues identified during and subsequent to the Critical Environmental Issues Analysis described in *Chapter 3* will require regulatory review and approval by one or more government authorities.

Early identification of regulatory requirements and applicable thresholds may afford the developer time to modify project plans to minimize impacts and potentially costly and time consuming regulatory reviews.

Early in project development, it is important to conduct a detailed analysis of the potential permits, approvals, and consultations that might apply to a wind project. The developer should use the results of this analysis to develop a comprehensive regulatory strategy for the project. Factors such as required field studies, approval timeframes, potential for public review and/or hearings, avenues for appeal and application and/or review fees should all be included in regulatory planning. Early identification of regulatory requirements and applicable thresholds may afford the developer time to modify project plans to minimize impacts and potentially costly and time consuming regulatory reviews. A developer may wish to involve consultants and legal counsel early in the process to help identify and implement the best approach.

This chapter of the handbook provides a synopsis of federal, state, and local regulatory programs and permitting issues frequently encountered by wind energy projects.

4.1 Federal Regulatory Framework

Several federal policies provide directives and guidance to federal agencies and developers of wind projects. On May 18, 2001, Executive Order 13212 "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" directed federal agencies involved in reviewing energy-related projects to streamline their internal approval processes and established an interagency task force to coordinate federal efforts at expediting approval mechanisms. The Energy Policy Act of 2005 and the National Energy Policy of 2001 report provide additional guidance to federal agencies and developers to promote the development of domestic renewable energy supplies. Interagency working groups such as The Federal Interagency Wind Siting Collaboration have evolved out of such national initiatives to facilitate the coordination among federal agencies regarding wind energy specifically and to develop a federal agency wind energy information center.

In addition to carrying out general federal policy regarding wind energy development, federal agencies must review potential impacts from the construction and operation of a wind project as with any development project. When a project is located on privately, locally, or state-owned land, the potential impacts of the project to resources such as wildlife, water, and aviation may also trigger a federal approval process. *Sections 4.1.1 to 4.1.6* discuss the federal statutes that may apply to a project regardless of where it is located. *Section 4.1.7* discusses additional federal procedures specific to projects that are located on federally managed lands. The following table provides a summary of commonly required federal approvals for wind power projects. This table is reproduced in the *Resources* section of the handbook with links to guidance documents for further information on each requirement.

Typical Federal Permitting Requirements for Wind Energy Projects

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

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

4.1.1 National Environmental Policy Act

For wind projects that are not located on federal lands, comprehensive environmental reviews most often occur as part of state or local permitting processes rather than as part of a federal agency NEPA review.

Signed into law on January 1, 1970, the National Environmental Policy Act (NEPA) (42 USC 4321) was the first major environmental law in the United States. This important statute established a national environmental policy and required federal agencies to undertake an assessment of the environmental effects of their proposed actions prior to making decisions. Regulations promulgated by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500 – 1508) implement the procedural provisions of NEPA, and each federal agency has its own set of regulations to implement the CEQ's NEPA regulations.

The extent of the environmental assessment necessary during a NEPA review varies based on the significance of the potential impacts associated with a project. For wind projects that are not located on federal lands, comprehensive environmental reviews most often occur as part of state or local permitting processes rather than as part of a federal agency NEPA review (*Section 4.2* and *Section 4.3*). Wind projects in the western part of the United States encounter comprehensive NEPA reviews more often than in the eastern part due to the greater amount of federal lands available for development. Although federal reviews for wind projects generally consist of consultations or permits that do not require the preparation of lengthy environmental assessment documents, activities that might trigger a comprehensive NEPA review include:

Example

The Bureau of Land Management (BLM) developed a Programmatic Environmental Impact Statement to evaluate issues associated with wind energy development on western public lands administered by the BLM, including Alaska. The Final EIS was released and approved in 2005.

- granting rights to use federally managed land
- required federal permits or approvals, such as
  - U.S. Fish and Wildlife Service Incidental Take Permit
  - individual permit from the U.S. Army Corps of Engineers pursuant to Section 404 of the Clean Water Act for discharge of fill or dredged materials into waters of the United States (including federal wetlands)
  - permit under Section 10 of the Rivers and Harbors Act for work in navigable waters of the United States
- accessing federally-owned transmission lines
- receipt of federal grant monies or other federal funds

For the purposes of NEPA review, federal agency actions are divided into the three categories listed below. When performing NEPA review, the agency must determine which of the following categories applies:

1. ***Categorical Exclusion*:** Each agency is permitted to adopt a list of Categorical Exclusions (CX) which are types of actions that individually or cumulatively do not have significant effects on the environment. For example, the use of a CX for the issuance of short-term right-of-way authorizations by the Bureau of Land Management may be applicable to some wind energy site testing and monitoring locations. Unless extraordinary circumstances exist, an agency can proceed with an action that is a listed CX without further NEPA review.

2. ***Environmental Assessment*:** The vast majority of actions fall within the category requiring an Environmental Assessment (EA). An EA is a concise public document that provides sufficient evidence and analysis to assist the agency in determining whether to prepare an Environmental Impact Statement (EIS) for a proposed action, and to comply with NEPA when no EIS is required. Developers can increase their chances of remaining in the EA category by minimizing project impacts and/or including mitigation measures in the initial proposal.

   After performing an EA, if an agency determines that the action would not significantly affect the environment, it prepares a Finding of No Significant Impact (FONSI). A FONSI is a brief document that presents why an agency has determined that no EIS is required for a particular action. The FONSI includes the EA or a summary and references to related documents. The agency is required to make the FONSI available to the public, but unless certain circumstances are triggered, the agency is generally not required to make the FONSI available for a 30-day public review.

3. ***Environmental Impact Statement:*** If the agency determines that the action would have a significant effect on the quality of the human environment, the agency must prepare an EIS. Agency regulations or guidelines may specify those actions that typically would require an EIS. Alternatively, an agency may prepare an EA to determine whether an EIS is necessary.

Federal agency actions under NEPA review are divided into three categories:

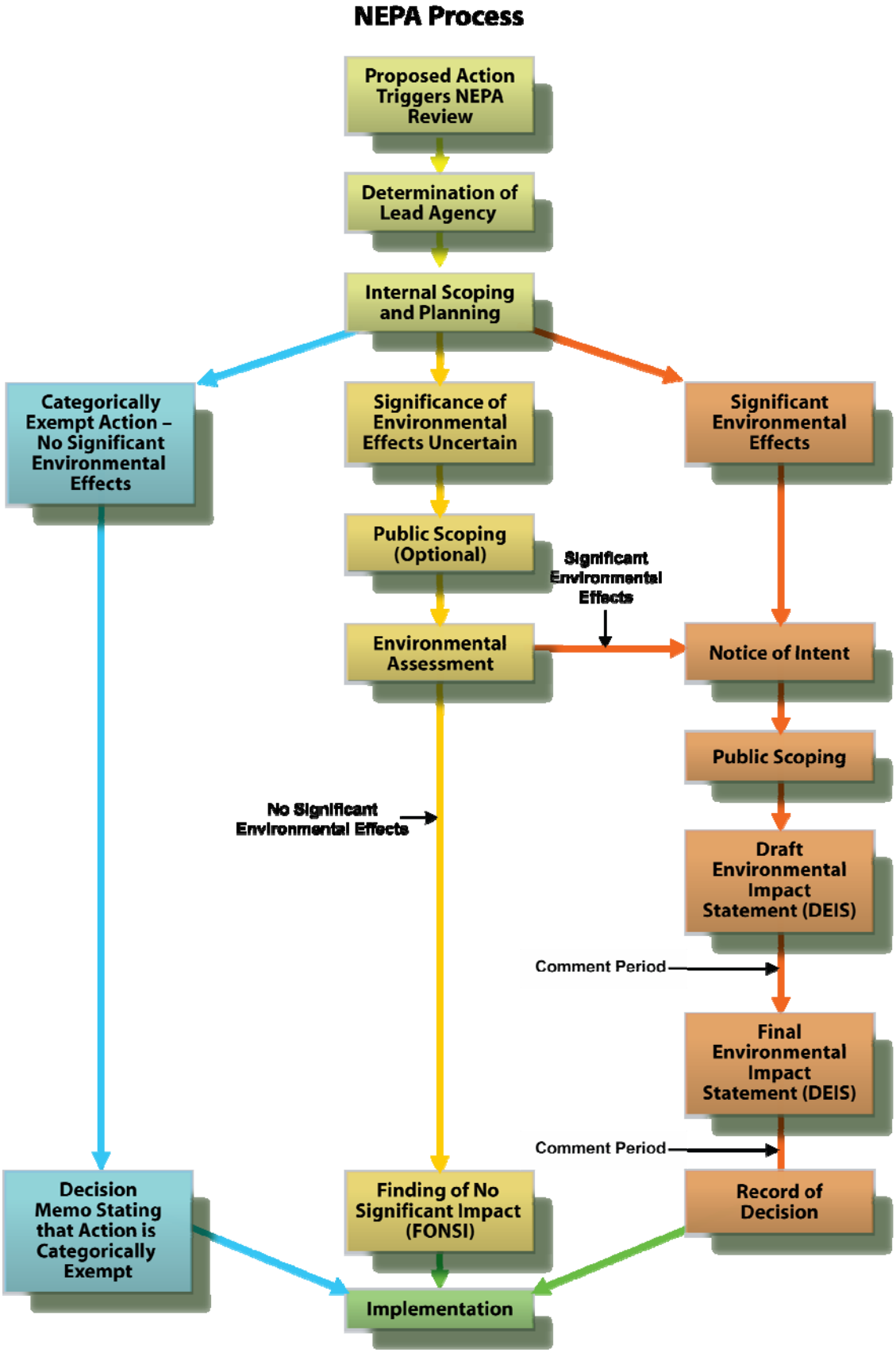
1) Categorical Exclusion

2) Environmental Assessment

3) Environmental Impact Statement

If an agency determines that an EIS is required, it must prepare a Notice of Intent (NOI), publish the NOI in the Federal Register, and commence the scoping process.

The following flowchart provides a step-by-step account of the NEPA process.



In general, an agency may not take any project-related action (such as issuing a permit) while the EIS is pending. During this interim period, applicants can develop plans or designs, or undertake other work to support an application, such as conduct meteorological, environmental, cultural, and engineering studies. Although the federal agency is responsible for preparing an EA and/or EIS, applicants usually provide the agency with supporting studies and documentation.

NEPA requires that its mandates be met with a minimum of delay and duplication with other state and federal agencies. The CEQ regulations strongly urge state and local agencies and the relevant federal agencies to cooperate with one another to reduce duplication between NEPA and comparable state and local requirements. Such cooperation should include joint planning processes, environmental research and studies, public hearings, and the preparation of joint EISs under NEPA and state environmental impact laws (see "Little-NEPAs" discussion in *Section 4.2.3*), so that one document will satisfy both federal and state requirements.

4.1.2 Fish and Wildlife

4.1.2.1 Endangered Species Act

The Endangered Species Act (ESA) (16 USC §§ 1531 – 1544) establishes measures to prevent extinction of fish, wildlife, and plant species. The purpose of the ESA is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved" and "to provide a program for the conservation of such … species." (ESA §2(b)). Section 3 of the ESA defines terminology. Section 7 mandates interagency consultation for activities that may affect protected species. Section 9 establishes activities that are prohibited by the ESA. Section 10 establishes permits and exceptions that may be granted to the prohibitions in Section 9. Section 11 describes the penalties for violations of the ESA.

- **Section 3 of the ESA defines terminology.**
- **Section 7 mandates interagency consultation for activities that may affect protected species.**
- **Section 9 establishes activities that are prohibited by the ESA.**
- **Section 10 establishes permits and exceptions that may be granted to the prohibitions in Section 9.**
- **Section 11 describes the penalties for violations of the ESA.**

The land-based provisions of the ESA are implemented and enforced under regulations promulgated by the U.S. Fish and Wildlife Service (FWS) (50 CFR Parts 13 and 17). The FWS is responsible for terrestrial and freshwater organisms, while the National Marine Fisheries Service (NMFS) is responsible for marine organisms. (The role of NMFS is not discussed further because offshore wind projects are beyond the scope of this handbook.) Several principal aspects of wind energy project

development, including site clearing and wind turbine operation, may trigger the regulatory requirements of the ESA.

Section 3 - Section 3 of the ESA defines three fundamental terms:

- "Endangered species" means "any species which is in danger of extinction throughout all or a significant portion of its range." (ESA §3(6)).
- "Threatened species" means "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (ESA §3(20)). Regulations for a threatened species may be less restrictive than if it were endangered.
- "Critical habitat" for a threatened or endangered species means "specific areas within the geographical area occupied by the species...on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and specific areas outside the geographical area occupied by the species ...upon a determination by the Secretary [of the Interior] that such areas are essential for the conservation of the species" (ESA §3(5)).

Section 7 - Section 7 of the ESA states that federal agencies shall "insure that any action authorized, funded, or carried out...is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification" of designated critical habitat" (ESA §7(a)(2)). The Section 7 provisions require that a federal agency authorizing, funding or carrying out any action that may affect protected species consult with the FWS. Project developers should work with the reviewing agencies to engage the FWS in a discussion about impacts to species protected by the ESA.

Where wind energy projects require a federal approval (e.g., land use authorization from the Bureau of Land Management), a Section 7 consultation will occur as part of the federal permit review process. Although such consultation is only required for activities that involve federal action or approval, consulting with the FWS is always recommended for wind energy projects due to the potential to incur liability under Section 9 of the ESA, a strict liability provision that does not require intent or knowledge of a violation. Early consultation with the FWS to identify potential impacts to protected species can help to minimize liability under the ESA.

Resource

The Section 7 consultation process is outlined in detail in the Endangered Species Consultation Handbook issued jointly by the FWS and NMFS in March 1998.

Developers should confer with environmental consultants and legal counsel to determine ESA applicability to their project and to establish an early dialogue with the FWS, state endangered species authorities, and other stakeholders. The consultation process involves requesting a list of endangered, threatened, and candidate species and a list of critical habitats from the FWS and relevant state authorities. The FWS may provide species lists and other information under an informal consultation process or under a formal consultation process. If a formal process is required, the FWS issues a "Biological Opinion" at the end of the consultation process regarding the potential effects of the proposed action on threatened and endangered species and their habitat.

If the consultation determines that development of the wind project is likely to result in an "incidental take" of a threatened or endangered species, the FWS may issue an Incidental Take Statement as part of the Biological Opinion. The Incidental Take Statement exempts the project from the Section 9 prohibitions discussed below and thus from the permitting requirements of Section 10, provided reasonable and prudent measures are taken to minimize the impacts of the incidental take. An "incidental take" is a taking that "is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." (ESA §10(a)(1)(B))

Section 9 - Section 9 of the ESA prohibits any person from "taking" endangered species of fish or wildlife. (ESA §9(a)(1)). The FWS regulations extend this prohibition to threatened species. The definition of "take" is broad and includes harassing or harming a listed species. (ESA §3(19)). "Harass" is defined by the FWS regulations as an action likely to injure a listed species by significantly disturbing normal behavior patterns such as breeding, feeding or sheltering (50 CFR 17.3). "Harm" is defined by the FWS regulations to include habitat modification or degradation that "actually kills or injures wildlife ... by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering" (50 CFR § 17.3). The "take" prohibition covers fish and wildlife but not plants. However, it is unlawful to remove an endangered species of plant from federal land and reduce it to possession (ESA §9(a)(2)). When Section 7 consultation is not required, engaging in voluntary consultation with the FWS would reduce liability from unknowingly violating Section 9.

Section 10 - Section 10 of the ESA establishes permits and exceptions to the prohibitions listed in Section 9. If the developer of a wind project determines that a "take" is likely to occur as a result of a project that is not otherwise subject to Section 7 consultation (because no federal approval is required), the developer can apply for an Incidental Take

Resource

In 1996, the FWS and NMFS issued a joint Handbook for Habitat Conservation Planning and Incidental Take Permitting Process, which provides guidance for developing HCPs.

Permit (ITP) from the FWS. To apply for an ITP, the developer must submit a habitat conservation plan (HCP), including proposed mitigation measures and alternatives to the proposed action (ESA §10(a)(2)(A)). Since the issuance of an ITP by the FWS would be a federal action subject to Section 7, an intra-FWS consultation would be conducted. Approval of the ITP would also require NEPA compliance. For wind projects, the FWS usually requires preparation of an EA or EIS to accompany the HCP. However, if the FWS determines that the HCP is a "low-effect" HCP, the ITP approval would be considered as a categorically excluded action and would not require additional review under NEPA.

If the FWS finds that the taking will be incidental and satisfactorily mitigated, the HCP is adequately funded, and the taking will not "appreciably reduce the likelihood of the survival and recovery of the species in the wild," it must issue the ITP (ESA §10(a)(2)(B)). While the decision to apply for an ITP is within the developer's discretion, if a take attributable to the project occurs and the take has not been authorized by an ITP, the developer would be subject to liability under Section 9.

Knowledge or intent is not required for violation of the ESA. Consultation with the FWS to identify potential impacts to protected species at the start of project development is important to minimize liability under the ESA.

FWS's "No Surprises" rule allows an applicant for an ITP to negotiate long-term assurances that no additional mitigation of impacts will be required, even if circumstances change (50 CFR §§ 17.22, 17.32). The rule provides some assurance that no additional land use restrictions or financial compensation will be required from the permit holder if unforeseen circumstances arise indicating that additional mitigation is necessary. The rule was recently upheld by a Federal District Court in *Spirit of the Sage Council v. Kempthorne* (Aug 2007).

Section 11 - Section 11 of the ESA establishes penalties and enforcement provisions. Violations of the ESA can result in stringent civil and criminal penalties and/or injunctions by the FWS against operation of a project. Section 11 also includes a citizen suit provision that allows any individual to file a civil action to enjoin any person, including any governmental agency, from violating the ESA. A citizen can also commence a civil suit to compel the FWS to comply with the provisions of the ESA or to perform a nondiscretionary duty under the ESA. Citizens must provide sixty (60) days written notice to the alleged violator and to the Secretary before commencing a civil action.

Section 11(b) of the ESA makes it a crime to "knowingly violate" any provision of the ESA, or any permit, certificate, or regulation issued under the ESA. As noted earlier, the ESA is a strict liability statute and

does not require intent or knowledge. Early consultation with the FWS reduces the possibility of unknowingly violating the ESA.

4.1.2.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 USC §§ 703-712) establishes provisions for the protection of migratory birds. The MBTA forbids anyone "at any time, by any means, or in any manner, to pursue, hunt take, capture, kill [or] any part, nest, or eggs of any such bird...." (16 USC § 703(a)). The MBTA is distinct from the ESA because it protects migratory bird species that are not necessarily threatened or endangered. Over 800 species of migratory birds are protected by the MBTA (50 CFR 10.13). The FWS implements and enforces the MBTA.

Several principal aspects of wind energy project development, including site clearing and wind turbine operation, are subject to the provisions of the MBTA. Consultation with the FWS regarding MBTA compliance and permitting can happen concurrently with the FWS review of impacts on protected species under the ESA.

However, the MBTA is a strict liability statue and does not provide for permits similar to an ITP to cover accidental impacts from a wind energy project. Knowledge or intent is not required to be liable under the MBTA. (16 USC § 707(a)). Courts have held that even the accidental killing of a migratory bird can be a criminal act under this law. Proactive measures, such as involving the FWS early in project development, would minimize the risk of mortality and avoid costly enforcement.

Knowledge or intent is not required for violation of the MBTA or the Eagle Protection Act. Consultation with the FWS to identify potential impacts to protected species at the start of project development is important to minimize liability.

4.1.2.3 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (Eagle Protection Act) was passed in 1940 to prevent the extinction of the bald eagle and was amended in 1962 to include protection of the golden eagles (16 USC §§ 668-668d). The Eagle Protection Act makes it unlawful to "take, possess, sell, purchase, barter...transport, export or import ..." any bald eagle or golden eagle, their parts, nests, or eggs (16 USC § 668(a)). "Take" means to shoot at, poison, wound, kill, capture, trap, collect, molest or disturb", the eagles (16 USC § 668c). The Eagle Protection Act authorizes substantial fines for misdemeanor and felony violations of the Act by individuals and organizations as well as possible imprisonment (16 USC §§ 668, 668b). As with the ESA and MBTA, the FWS oversees the implementation of the Eagle Protection Act.

Several principal aspects of wind energy project development are subject to the provisions of the Eagle Protection Act. Consultation and permitting can happen concurrently with the FWS review of impacts of

proposed actions on protected species under the ESA. A Golden Eagle Nest Take permit is available for obtaining permission to move a golden eagle nest in order to prevent harm to the nest or eggs. However, the Eagle Protection Act is a strict liability statue and does not provide for permits that cover accidental impacts from wind energy projects.

The Eagle Protection Act protects bald and golden eagles regardless of whether or not they are threatened or endangered. In July 2007, the U.S. Secretary of the Interior published a final rule removing the bald eagle from the federal list of endangered and threatened wildlife (72 Fed. Reg. 37346). Although the Bald Eagle no longer receives protection under the ESA, both the Eagle Protection Act and the MBTA continue to provide protection for the species. Additionally, in May 2007, the FWS published the National Bald Eagle Management Guidelines to elaborate on regulations for implementing the Eagle Protection Act.

Resource

The FWS issued the final rule to announce the removal of the bald eagle from the endangered species list in July 2007. Although the Bald Eagle no longer receives protection under the ESA, both the Eagle Protection Act and the MBTA continue to provide protection for the species.

Training operating staff to recognize protected birds. Photo courtesy of PPM Energy.

4.1.2.4 Interim Guidelines/Federal Advisory Committee

On May 13, 2003, the FWS within the DOI issued Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines (Interim Guidelines). The FWS indicated its intent to evaluate the guidance over a two-year period.

On December 8, 2003, AWEA submitted comments on the Interim Guidelines to the FWS. AWEA noted that the lack of consultation with the wind industry prior to issuance of the guidance had resulted in a document that has technical flaws, contains inaccurate assumptions, and calls for a level of regulation disproportionate to wind's impacts on wildlife, especially as compared to impacts from other activities.

Additionally, although the Interim Guidelines are voluntary, AWEA noted that permitting agencies throughout the country were beginning to adopt the guidance as required procedure. AWEA encouraged the FWS to engage in a dialogue with the wind industry, providing an opportunity to exchange research and information on the potential effects of wind energy projects on wildlife.

On April 26, 2004, the FWS issued a memorandum regarding implementation of the Interim Guidelines. Among other things, the FWS clarified that the guidance is intended to be general in nature and should be applied as appropriate based on local conditions. The FWS stated: the "Interim Guidelines are not to be construed as rigid requirements, which are applicable to every situation, nor should they be read literally." Nevertheless, government agencies and other stakeholders continued to apply the Interim Guidelines as mandatory requirements, without taking into consideration site-specific considerations.

The potential mandatory nature of the Interim Guidelines makes it imperative that the wind industry continue to provide the FWS with current information and resources.

On March 13, 2007, DOI announced the formation of a Wind Turbine Guidelines Federal Advisory Committee (FACA) to provide recommendations and advice to the DOI and the FWS "on developing effective measures to protect wildlife resources and enhance potential benefits to wildlife that may be identified." On October 26, 2007, the Secretary of the Interior announced in a press release that 22 individuals had been named to serve on the FACA. Meetings of the Committee will be open to the public and notice of upcoming meetings will be published in the Federal Register. The public will have an opportunity to provide input at the meetings.

The FACA presents a critical opportunity for the FWS to publish a revised document that is protective of wildlife without imposing an undue economic burden on the industry. The potential mandatory nature of the Interim Guidelines makes it imperative that the wind industry continue to provide the FWS with current information and resources. *Section 5.1* describes studies and methodologies for assessing and mitigating potential impacts to biological resources.

4.1.3 Cultural and Paleontological Resources

4.1.3.1 Cultural Resources

Cultural resources include archaeological, architectural, and traditional resources that include, but are not limited to, objects, sites, buildings, structures, and traditional cultural places. Archaeological and architectural cultural resources generally may be related to either the prehistoric (before written records) or the historic (starting with written

records) time periods. Traditional cultural places include natural features as well as man-made locations that have cultural associations important to a particular ethnographic or ethnic population.

4.1.3.1.1 The National Historic Preservation Act

The National Historic Preservation Act (NHPA) (16 USC 470) is the basis for current national policy on cultural resource issues and historic preservation. The NHPA promotes historic preservation, which includes "the protection, rehabilitation, restoration and reconstruction of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, or culture" (16 USC 470).

Resource

The National Park Service maintains the list of sites on the NRHP.

The NHPA:

- created the National Register of Historic Places (NRHP), a listing of historic properties of national, regional, state, and local significance
- established the Advisory Council on Historic Preservation, an independent federal agency responsible for administering the protective provisions of the Act
- directed states to appoint State Historic Preservation Officers (SHPOs)
- requires federal agencies to take into account the effects of their undertakings on properties on or eligible for the NRHP (Section 106 consultation process)

In addition to federal requirements under the NHPA, many states have developed their own historic preservation policies. These state policies may mirror or relate to the federal process but may also include unique requirements. Developers need to be familiar with state-specific guidelines and requirements to understand the steps that may be involved in permitting a project. Additional details on the state process are included in *Section 4.2.5*.

If federal action (i.e., permits, financial assistance or federal lands) is required for a wind project, the developer will be expected to support the lead federal agency in the agency's compliance with Section 106 of the NHPA. The Advisory Council on Historic Preservation has identified procedures to be followed by federal agencies to comply with Section 106 at 36 CFR 800. If no federal permits are required, developers may be required to support SHPO offices or the relevant state lead agency in complying with the state's process for addressing cultural resources issues.

Whether guided by the federal or state process, a wind developer will likely be required to sponsor studies necessary to provide information that will allow agencies to understand if a proposed project may have an effect on historic properties, i.e., cultural resources that are listed in, or qualify as eligible for listing in, the NRHP. *Section 5.6* discusses cultural and historical resources impact analysis and mitigation with respect to cultural resources.

4.1.3.1.2 Other Regulatory Considerations

Prior to implementing studies, a project on federal, state, or tribal lands may need to obtain a permit under the Archaeological Resources Protection Act of 1979 (ARPA) (16 USC 470aa et seq.). An ARPA Permit would be obtained through the landowning agency or tribe. If studies are performed on federal or tribal lands, researchers will be required to comply with the Native American Graves Protection and Repatriation Act (NAGPRA) (25 USC 3001) if human remains attributable to Native American populations are discovered.

Resource

The Bureau of Indian Affairs and Tribal Historic Preservation Officers can provide additional guidance on compliance with NAGPRA and other Native American cultural resource concerns.

4.1.3.2 Paleontological Resources

Paleontological resources are the fossil or organic remains, traces, or imprints of an organism preserved in the earth's crust since some time in the geologic past, such as shells, bones, diatomite beds, and associated rock and soil matrices. Paleontological resources are non-renewable and can, in some instances, be quite rare. They have the potential to inform scientists about past environments and evolution.

Paleontological resources located on federal lands are protected by several major laws, including the Federal Land Policy and Management Act of 1976 (43 USC § 1701-1782), NEPA, and various sections of Title 43 of the Code of Federal Regulations. Developers may be required to conduct surveys prior to development of final project design, consider avoidance of adverse effects, and/or take action following unanticipated discovery of fossils during construction.

4.1.4 Water Resources

Two major pieces of federal legislation, the Clean Water Act (CWA) (33 USC 1251-1387) and the Rivers and Harbors Act (33 USC 401 et seq.), govern impacts to water resources. The CWA has a broad goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Among other things, the CWA establishes the basic structure for regulating discharges of pollutants into the waters of the United States and managing polluted runoff. In particular, wind energy projects may be subject to Water Quality Certification under

Two major pieces of federal legislation, the Clean Water Act (CWA) and the Rivers and Harbors Act, govern impacts to water resources. In particular, wind energy projects may be subject to Water Quality Certification under Section 401 of the CWA and permit requirements under Sections 402 and 404 of the CWA and Section 10 of the Rivers and Harbors Act.

Section 401 of the CWA and permit requirements under Sections 402 and 404 of the CWA.

Section 10 of the Rivers and Harbors Act applies to work in or over navigable waters of the United States. Under Section 10, the placement of structures that affect the course, location, condition, or capacity of navigable waters requires a permit from the Army Corps of Engineers (USACE). For example, land-based wind projects might require a Section 10 permit if construction activities require building or replacing a bridge in a navigable waterway or creating docks to receive materials via waterway.

4.1.4.1 Section 401 - Water Quality Certification

Water Quality Certification under Section 401 of the CWA is required for certain activities in wetlands and waters. Water Quality Certification sets out the conditions that have identified as being necessary to ensure that a proposed project will comply with state or tribal water quality standards and other appropriate requirements of state or tribal law. This process gives states and tribes the authority to review projects that require federal approval (such as a permit or license) and that might result in a discharge to state or tribal waters, including wetlands. For a wind energy facility, needed federal approvals that could trigger the need for a 401 Water Quality Certification include a permit from the USACE pursuant to Section 404 of the CWA or Section 10 of the Rivers and Harbors Act.

The EPA has primary authority under Section 401, but authority is often delegated to a state agency. In general, Section 401 Water Quality Certification should not cause delays in project approval. In many cases, Section 401 review is conducted at the same time as the federal agency approval process pursuant to a joint permit process. A state also may issue a general Section 401 Water Quality Certification for a Nationwide Permit (NWP) or Regional Programmatic General Permit (PGP) promulgated under Section 404 of the CWA. Some states use their CWA authority to impose additional conditions on or deny a NWP. Developers should consult with the applicable state environmental agency for more information about Section 401 Water Quality Certification.

4.1.4.2 Section 402 - National Pollutant Discharge Elimination System

The National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. The CWA authorizes EPA to implement the NPDES program. However, EPA has delegated its authority to most states and some Indian tribes. In those jurisdictions where EPA remains the permitting authority, the applicable

regional office of EPA issues the NPDES permits. A chart summarizing NPDES delegation authority can be found on EPA's website.

During construction of a wind energy facility, a NPDES General Stormwater Permit for Construction Activities (CGP) is required for any land disturbance equal to or greater than 1 acre (including smaller sites that are part of a larger common plan of development). This includes clearing, grading, and excavation activities. In areas where EPA is the permitting authority, the "operator" must comply with EPA's CGP. The operator is the entity (e.g., an owner, general contractor, or subcontractor) that has operational control over the construction plans or day-to-day activities at the site.

States that administer the NPDES program have developed their own CGPs that incorporate, at a minimum, the requirements of the federal CGP. Federal regulations allow states, territories, and tribes to add certain conditions to the CGP that apply only in that area, even where EPA is the permitting authority and the federal CGP applies. EPA or the permit issuing state can require that a project obtain an individual Stormwater Permit for Construction Activities if the site is particularly large or in sensitive areas if the state determines that the protection offered by the CGP is inadequate.

The CGP application form is called a Notice of Intent (NOI). When EPA is the permitting authority, an applicant is authorized to discharge stormwater from construction activities seven calendar days after acknowledgment of receipt of a complete NOI is posted on EPA's NPDES website. Some states require NOIs to be submitted earlier in the process, especially if there are special circumstances (e.g., the activity is located near surface water that has one or more water quality issues). Developers should confirm the deadlines in the applicable state.

If eligible for coverage under a CGP, prior to submitting an NOI the operator must develop a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the CGP. Among other things, the SWPPP must identify pollutant sources and non-storm water discharges; establish procedures to identify, construct, implement, and maintain Best Management Practices (BMPs); develop a maintenance schedule for post-construction BMPs; and identify a sampling and analysis strategy and schedule for discharges from construction activity into regulated water bodies. SWPPPs can typically incorporate by reference other required plans and procedures required under other laws or regulations such as a Spill Prevention, Control, and Countermeasure (SPCC) Plan. *Section 5.11* contains additional discussion of SPCC Plans.

During construction, the developer will be required to have a qualified professional regularly inspect the construction site for compliance with the SWPPP. An official inspection log book must be kept at the construction site. Requirements are established in the CGP, and the compliance system is detailed in the SWPPP. Failure to file an NOI or comply with the CGP or SWPPP can lead to enforcement action, including fines, civil and criminal penalties, and incarceration.

- **Stormwater Permits for Industrial Activities** - In addition to a stormwater permit for construction activities, some wind energy facilities may need an industrial stormwater permit to cover their operations. Although EPA regulations do not currently require an industrial stormwater permit for wind energy generation, many states that implement the NPDES program require all electricity-generating facilities to obtain coverage under an industrial stormwater general or individual permit.

- **Other Water Discharges** - Although most wind energy facilities will not have a non-stormwater-related discharge of process or other wastewater, if such a discharge is planned, an individual NPDES permit to cover the discharge must be obtained from EPA and/or the applicable state agency. Applications for a new discharge must be filed at least 180 days in advance of the anticipated first discharge. Typically work on such an application should begin at least 3 to 6 months before the application due date (i.e., 9 to 12 months before the first discharge).

4.1.4.3 Section 404 - Discharge of Dredged or Fill Materials

Section 404 of the CWA (33 USC 1344) regulates a particular source of water pollution, specifically the discharge of dredged or fill material into waters of the United States, including wetlands. The USACE, rather than EPA, manages and administers the regulatory program (33 CFR 320-331) and issues permit decisions. Section 404 requires a federal permit before dredged or fill material may be discharged into waters of the United States, unless the activity is exempt from regulation. Examples of wind energy-related activities that might require a Section 404 permit include (but are not limited to) clearing and grading, building project infrastructure such as turbines, access roads, and collection systems, and performing road work, such as culvert replacements or intersection improvements.

Under Section 404, regulated waters of the United States include surface waters that are navigable waters and their tributaries, all interstate surface waters and their tributaries, natural lakes, all

impoundments of these waters, and all wetlands adjacent to these waters. Wetlands generally include vegetated areas that are wet at least during some parts of the year such as swamps, marshes, bogs, and similar areas. The USACE uses the 1987 Corps of Engineers Wetlands Delineation Manual, regional supplements, and related guidance to identify and delineate wetlands under Section 404 of the CWA. The USACE manual organizes the characteristics of a potential wetland into three categories—soils, vegetation, and hydrology—and establishes criteria for each category.

If a wind energy project will involve construction in the vicinity of an area subject to Section 404, it may require a permit. The applicable USACE district office makes the final determination as to whether an area is jurisdictional (subject to the CWA) and whether the proposed activity requires a permit. If a permit is required, the USACE may issue either a general (national or regional) or individual permit.

Several recent U.S. Supreme Court and lower court decisions have addressed the issue of the extent to which the CWA covers isolated wetlands and tributaries (see e.g., *Rapanos v. United States* and *Carabell v. United States* (126 S. Ct. 2208 (2006)). In response to the Supreme Court decisions, USACE and EPA issued guidance clarifying which waters are subject to Section 404 of the CWA. New regulatory interpretations and their relevancy for compliance under Section 404 may be identified during consultation with the USACE.

Example

Recent U.S. Supreme Court and lower court decisions have addressed the issue of jurisdiction over wetlands. In response to the Supreme Court decisions, USACE and the EPA issued guidance clarifying which waters are subject to Section 404 of the CWA.

General Permit - Discharges that have only minimal adverse impacts may be eligible for a general permit. General permits cover categories of activities the USACE has identified as being substantially similar in nature and causing only minimal individual and cumulative environmental impacts. The USACE issues general permits on a nationwide, regional, county, or state basis. General permits eliminate the individual review process and allow eligible activities to proceed with minimal delay provided the conditions of the general permit are satisfied. Some wind projects may not be able to satisfy the minimal disturbance criteria necessary to be eligible for a general permit.

There are currently 50 Nationwide Permits (NWPs) that address specific types of construction activities. NWPs are reissued every 5 years and were last issues in 2007. NWPs that typically apply to wind projects include NWP 12 (utility line discharges), NWP 33 (access roads), NWP 39 (commercial and institutional developments), and NWP 27 (wetland restoration). Different permits may apply to different components of a wind energy facility. However, USACE considers the total acreage of wetland affected by the entire project to determine whether a permit is

necessary. Consultation with the appropriate regional office is necessary to identify which permits apply to a particular project. Proposed work must satisfy the NWP criteria (e.g., limits on the area of project disturbance). Under some circumstances, the NWP requires the applicant to submit a Preconstruction Notification (PCN) to the USACE. It can take 45 to 90 days to complete the NWP process.

Regional permits address activities in a limited geographic area, typically a specific basin or watershed. Many states have chosen to pursue a Programmatic General Permit (PGP). PGPs enable states to simplify the regulation process, reduce duplicative regulatory programs, and preserve limited resources while protecting the aquatic environment.

Individual Permit - An individual permit is required for activities that have the potential to significantly impact surface waters and wetlands or if there is no NWP, regional permit, or PGP that covers the proposed activity. In addition, "Letters of Permission" are sometimes available when the proposed project involves a lesser degree of impact on aquatic resources and the project is non-controversial. The review process for an individual permit application can be time consuming, taking 6 to 12 months or longer, and can require costly studies and preparation of an EIS. If required, an individual Section 404 permit is frequently the last authorization obtained prior to construction. It may be possible to shorten the review process by requesting a pre-application consultation with the USACE and other federal, state, and local agencies involved in the review. The consultation allows for informal discussions about the proposal before an applicant makes irreversible commitments of resources. The process can assist the applicant in understanding the review criteria applied by USACE, assess whether there are any feasible alternatives, and provide a forum for discussing potential mitigation measures.

Failure to obtain and comply with a Section 404 permit when necessary can delay the project and result in potential liability. It is important that the developer and construction contractor review and understand the permit conditions. In addition to federal requirements, many states and some local municipalities also require permits for wetland and/or dredge and fill-related work (*Section 4.2.4.2*).

4.1.5 Aviation

The Federal Aviation Administration (FAA) Office of Obstruction Evaluation and Airport Airspace Analysis is responsible for the safety of civil aviation. The FAA has jurisdiction over any object that may impact or

interfere with the navigable airspace or communications technology used in aviation operations. Construction of wind turbines and meteorological towers often require FAA review.

The FAA requires a developer to file a Notice of Proposed Construction (NPC) (Form 7460-1) for any structure greater than 200 feet above ground level. In some circumstances, the filing of a Form 7460-1 may also be required for a structure less than 200 feet above ground level depending on the distinction and length of nearby runway. The NPC must include a plan for appropriate markings and lighting based on FAA requirements. Following receipt of FAA Form 7460-1, the FAA conducts a study process to determine whether the proposed action will create a hazard to navigable airspace. At the end of the process, the FAA issues either a Determination of No Hazard (DNH) or a Notice of Presumed Hazard (NPH). An NPH may initiate a process of negotiation and appeal. Form 7460-1 also requires a proposal for affixing appropriate markings and lighting to the wind turbines and met towers. Advisory Circular 70/7460-1K describes the kinds of markings and lighting applicable to airspace navigation.

Example

The F.E. Warren Air Force Base in Wyoming erected two 660-kW turbines that are estimated to offset 4,855 tons per year of carbon dioxide and save the Air Force more than $3 million in energy costs over 20 years.

Since most turbines exceed the 200-foot height criterion, and therefore trigger FAA review, developers must understand and comply with applicable FAA regulations. Consultation with the FAA during the completion of Form 7460-1 may help lead to a DNH.

Since most turbines exceed the 200-foot height criterion, and therefore trigger FAA review, developers must understand and comply with applicable FAA regulations.

4.1.6 Electromagnetic Interference

Studies in the United States and Britain have concluded that wind turbines may interfere with radar systems. In a last-minute amendment to the National Defense Authorization Act for Fiscal Year 2006, Congress mandated that the Secretary of Defense submit a report to Congress on the effects of wind farms on military readiness and specifically whether wind facilities interfere with Long Range Surveillance Radar, often called Air Defense radar. On September 27, 2006, the DoD published its report, The Effect of Windmill Farms on Military Readiness. The report concluded that wind farms located within radar line-of-sight of an air defense radar facility may degrade the ability of the radar to perform its intended function. This impact is essentially due to “shadowing” and increased “clutter” caused by the mere presence of the turbine structures and the rotational movement of the turbine blades. The magnitude of the impact, according to the report, depends upon the number and location of the turbines.

Resource

The DOE Federal Wind Siting Information Center provides information on agency efforts to develop analytical tools, collect test data, and create solutions to mitigate the impact of wind turbines on advanced radar systems.

Consultation with a number of federal agencies that have jurisdiction over radar systems is often part of obtaining regulatory approvals. As

part of its hazard determination described in *Section 4.1.5*, the FAA engages other agencies to review a project that has filed an NPC and provide feedback on the potential for the project to obstruct military radar. The FAA would also conduct internal evaluations for complications to FAA radar systems. The National Telecommunications and Information Administration (NTIA) Interdepartment Radio Advisory Committee (IRAC) also provides federal agencies the opportunity to comment on potential radar issues, as discussed in *Section 5.9.1*. The National Weather Service is another federal agency that operates a radar system, the National Weather Service Next Generation Weather Radar (NEXRAD).

Consultants that are familiar with FAA regulations and DOD radar concerns can conduct screening analyses to examine the potential for interference with federal radar. Consultation with agencies such as the FAA and NTIA early in the development process may also identify potential impacts to radar systems. However, the FAA and NTIA consultation processes do not entirely eliminate the potential for protest. Standardized consultation procedures need to be established, and developers should stay apprised of improvements as the process evolves.

Resource

The FAA Long Range Radar Tool is publicly available for the initial evaluation of the potential to obstruct Air Defense and Homeland Security radar.

4.1.7 Federally Managed Lands

Federal approvals and reviews under federal statutes such as NEPA, ESA, and NHPA may apply to wind projects anywhere in the United States, regardless of whether the project is located on private, local, state, or federal land. Where a project is proposed on federally-managed lands, additional federal regulations and guidelines apply.

Various agencies have jurisdiction over federal lands and land management programs. The discussion in this section highlights the regulations and policies of a number of agencies that regulate development on federal lands. As noted earlier, federal guidance regarding wind development, such as the Energy Policy Act of 2005 and the National Energy Policy of 2001, encourage agencies to collaboratively develop policies for more efficient review and permitting of wind energy projects. Currently, some agencies, such as the Bureau of Land Management (BLM), already have policies specific to wind energy. Other agencies review wind projects using the same procedures as for other development projects. Some agencies, such as the United States Forest Service (FS), are in the process of amending their regulations to create permitting processes specific to wind energy.

For all wind projects on federally managed lands, issuance of land use permits and right-of-way authorizations does not relieve the applicant of obtaining any and all other permits and authorizations that may be required for the proposed project, such as NEPA compliance, consultations under the NHPA and ESA, and CWA Section 404 permits.

Agencies with Jurisdiction over Projects on Federally Managed Lands

Agency	Wind Siting Policy	Guidance
Department of Interior Bureau of Land Management	Yes	▪ Wind Energy Development Policy (Instruction Memorandum No 2006-216) ▪ Programmatic EIS and Record of Decision
Department of Interior Bureau of Reclamation	No	▪ Reclamation Manual ▪ Directives and Standards LND 08-01 "Land Use Authorizations
Department of Interior Bureau of Indian Affairs	No	▪ Energy Consumption and Renewable Energy Development Potential on Indian Lands ▪ Energy Policy Act of 2005, Section 1813 Indian Land Rights-of-Way Study
U.S. Department of Agriculture Forest Service	Proposed	▪ Forest Service Manual 2726 ▪ Forest Service Handbook 2709.11 ▪ Amendments to internal agency directives for special use authorizations proposed in September 2007 (72 Federal Register 184).
U.S. Department of Agriculture Natural Resource Conservation Service	No	▪ 2002 Farm Bill amended Section 3832 of the Farm Security and Rural Investment Act
U.S. Department of Defense	No	▪ Renewable Energy Assessment Team
U.S. Fish and Wildlife Service	No	▪ The FWS manages land under easements for wetlands, water fowl production areas, and grasslands. ▪ Consultation with the FWS is necessary to identify these areas.

4.1.7.1 Bureau of Land Management

The Bureau of Land Management (BLM), an agency within the DOI, manages approximately 262 million acres of public lands in the United States and is responsible for the development of wind energy resources on BLM-administered lands. BLM has established a Wind Energy Development Program.

On August 24, 2006, BLM issued its Wind Energy Development Policy (BLM Wind Policy) (Instruction Memorandum No. 2006-216) which supports development of wind energy in acceptable areas on BLM-administered lands and minimizes potential environmental and sociocultural impacts. The policies and best management practices (BMPs) contained in the BLM Wind Policy establish mechanisms to protect and enhance natural and cultural resources and identify the issues and concerns that need to be addressed by project-specific plans. Mitigation measures to protect these resources must be incorporated into each project's Plan of Development. These mitigation measures may include the specific programmatic BMPs, as well as

additional mitigation measures contained in relevant BLM guidance and stipulations.

The BLM Wind Policy authorizes private ROW grants for three types of wind energy projects:

1. Site-specific ROW for site testing and monitoring for individual meteorological towers and instrumentation facilities (3-year term) (Site-Specific Grant).
2. ROW for testing and monitoring for a larger testing and monitoring area (renewable 3-year term) (Testing and Monitoring Grant).
3. ROW for long-term commercial wind energy projects (unlimited term, generally 30 to 35 years) (Project Development Grant).

The table below summarizes the salient features of each type of BLM ROW grant.

Features of Types of BLM Right-of-Way Grants for Wind Energy Projects

	Site-Specific Grant	Testing and Monitoring Grant	Project Development Grant
Purpose	Authorization for individual meteorological towers and instrumentation facilities	Authorization for use of project area for testing and monitoring; not only for individual meteorological towers or instrumentation facilities	Authorization for use of project area for the construction of all facilities necessary for a long-term, commercial wind energy project, including construction of turbines, access roads, distribution lines, and associated facilities
Land Area of Grant	Grant authorizes use of minimum amount of land necessary for permitted equipment	Grant authorizes the use of reasonable amount of land necessary for a full-scale wind energy project in the future	Grant authorizes use of reasonable amount of land area for the proposed facilities and allows for reasonable setbacks from right-of-way boundaries
Term of Grant	Three years	Three years	Typically 35 years
Renewal Terms	None	May include the right to extend term for one additional 3-year period	May include the right to extend the term of the grant
Exclusivity of Grant	Grant does not include exclusive or preferential rights	Grant includes the exclusive right to use project site for wind energy projects for the term of the grant, but grantee must file an application for Project Development Grant if it elects to develop the project	Grant includes the exclusive right to use the project site for wind energy projects for the term of the grant, but may require developer to allow public access to the site for public awareness and education purposes
BLM Retained Rights	BLM retains right to use land for compatible uses	BLM retains right to use land for compatible uses, subject to grantee's exclusive right for wind energy project	BLM retains right to use land for compatible uses, subject to grantee's exclusive right for wind energy project
Applicable Fees	Minimum annual rent of $50 per tower or instrumentation facility	Annual rent is greater of $1.00 per acre per year or $1,000.00	Annual rent is $2,365.00 per megawatt of anticipated installed generation capacity
Best Management Practices	Not required	Required, with site-specific covenants (e.g., bonding, road construction and maintenance, vegetation removal)	Required, with site-specific covenants (e.g., bonding, road construction and maintenance, vegetation removal)
Assignment	Not required	Assignment is allowed with BLM approval	Assignment is allowed with BLM approval

Developers interested in applying for any of the above types of projects must submit an application using a standard form provided by BLM (Standard Form 299). Under the BLM Wind Policy, developers are encouraged to schedule pre-application meetings with BLM to assist in preparing and processing the application, identify potential issues and conflict areas, identify any environmental or cultural resource studies that may be needed, assess public interests and concerns, identify other authorized uses, identify other general recreation and public uses in the area, discuss potential alternative site locations, and discuss potential financial obligations that the applicant must be willing to assume. Early public notification and involvement of local communities and other stakeholders is also important to increase public acceptance and avoid potential conflicts, especially in areas where other land uses are involved. Timelines for processing ROW applications are set forth in BLM's regulations.

As with all projects proposed on federally-managed lands, wind energy projects on BLM lands are subject to review under NEPA. Pursuant to NEPA, BLM prepared a Programmatic EIS (PEIS) and Record of Decision (ROD) for its Wind Energy Development Program. The PEIS assesses the environmental, social, and economic impacts associated with wind energy development on BLM-administered land, and the ROD establishes policies and BMPs for the administration of wind energy development activities as well as minimum requirements for mitigation measures.

To the extent that the Programmatic EIS addresses anticipated issues and concerns associated with an individual wind energy project, including potential cumulative impacts, BLM will "tier off" the analysis in the PEIS and limit the scope of additional, project-specific NEPA analyses. The site-specific NEPA analyses will include analysis of project site configuration and micrositing considerations, monitoring program requirements, and appropriate site-specific stipulations. In some circumstances, compensatory mitigation may be appropriate. The BLM Wind Policy describes the scope of NEPA review required for the various types of ROW grants. For example, the scope of environmental analysis for a Project Development Grant application will be broader than for a Testing and Monitoring Grant application.

Resource

The Bureau of Land Management (BLM) developed a Programmatic Environmental Impact Statement to evaluate issues associated with wind energy development on western public lands administered by the BLM, including Alaska. The Final EIS was released and approved in 2005.

4.1.7.2 Bureau of Reclamation

The DOI's Bureau of Reclamation (BOR), makes federal lands available for renewable energy development. As of 2007, approximately 14,700 MW of hydro-generation was owned and operated by the BOR. The BOR does not have an official policy for siting wind turbines or wind project

components on its land, but follows the general guidance provided by national initiatives and directives for promoting wind energy development on federal lands. The National Energy Policy of 2001 directs the Secretary of the Interior to reevaluate access limitations to federal lands to increase domestic production of renewable energy, specifically wind energy, and the Energy Policy Act of 2005 directs the DOI to take actions to promote the development of domestic renewable energy supplies.

The BOR's Reclamation Manual provides guidance for applying for "use authorization" of BOR lands under Directives and Standards LND 08-01. Use authorizations include easements, leases, and permits/licenses for activities on or across lands or interests in lands and water surfaces under the jurisdiction of the BOR. The BOR will grant use authorizations only when the proposed use is compatible with BOR purposes and is consistent with applicable Resource Management Plans. The BOR reserves the right to refuse to authorize any use that may be incompatible with the federally authorized purposes of BOR projects or interferes with BOR's rights or operations.

The BOR has not granted exclusive use authorizations to wind developers for wind measurement or wind project facility development, as are available under the BLM's ROW grant system.

The processing of BOR commercial use applications involves the five steps listed below.

Step One - Pre-Application Meeting

- Meet with the realty specialist in the BOR Area Office with oversight over the proposed site.
- Familiarize the BOR staff with the proposed project.
- Applicant informed of the approval criteria and the process by which the agency will evaluate applications.
- A map and detailed project description may be presented to the BOR at the pre-application meeting to enhance understanding early on in the process.

Step Two - Completing an Application

- Follow the instructions on how to apply for a use authorization set forth in BOR regulations at 43 CFR 429, which are referenced in the following application forms:

- Right-of-Use Application, Form 7-2540
- Application for Transportation and Utility Systems and Facilities on Federal Lands, Standard Form 299

Step Three - Initial Application Review

- Review by BOR.
- BOR will inform the applicant whether or not the proposed use is compatible with BOR projects and programs in the area.

Step Four - Additional Review Processes

- If the application is deemed complex, involving construction or environmental compliance, or requires an appraisal to determine the market-based rent, several months may be needed to conclude the application process.
- Developer conducts the studies requested by BOR specialists. Developer may need to negotiate scope of studies, citing nearby projects, if appropriate.

Step Five - Issuance of the Use Authorization

- BOR processes the application and notifies the applicant in writing of its decision.
- Developer and BOR sign contract and developer pays rent. Developer authorized to use the land requested in the application.

Resource

The Tribal Energy Program, under the Department of Energy's Office of Energy Efficiency and Renewable Energy, provides financial and technical assistance to tribes for feasibility studies of renewable energy development on tribal lands and offers assistance to tribes for the initial steps toward renewable energy and energy efficiency development.

4.1.7.3 Bureau of Indian Affairs/Indian Reservations

The Bureau of Indian Affairs (BIA) within the DOI is responsible for the administration and management of 55.7 million acres of land held in trust by the United States for American Indians, Indian tribes, and Alaska Natives. There are 561 federally recognized tribal governments in the United States. Among the agency's responsibilities are developing forestlands, leasing assets on these lands, directing agricultural programs, protecting water and land rights, developing and maintaining infrastructure, and economic development.

The BIA and tribal governments are authorized to grant ROW across tribal lands for energy resources, electric transmission lines, and natural gas and oil pipelines. Title V of the EPAct of 2005 includes important additional provisions relating to energy on tribal lands. Among other things, Title V authorizes DOI to enter into "Tribal Energy Resource

Agreements" (TERA) with Indian tribes and to establish and implement regulations governing the TERA approval process. The intent of these agreements is to promote tribal oversight and management of energy and mineral resource development on tribal lands and further the goal of Indian self-determination. The DOI published proposed regulations in August 2006 in the Federal Register. Additionally, pursuant to Section 1813 of the EPAct of 2005, the DOI and the DOE submitted a joint Report to Congress in May 2007 on issues associated with Indian Land ROWs.

The BIA works with tribes to develop renewable energy on tribal lands. The BIA has funded Wind Energy Feasibility Studies and economic evaluations that indicate high wind energy potential on 93 reservations located in California, New Mexico, Nevada, Utah, Wyoming, Arizona, Montana, North Dakota, Minnesota, and Wisconsin. The BIA is using a recent study by the Energy Information Administration, Energy Consumption and Renewable Energy Development Potential on Indian Lands, on a reservation level to evaluate particular opportunities for economic benefit from renewable energy development.

To explore the possibility of siting a wind generating facility on BIA-managed trust land, a developer may take the following three steps.

Step One - Contact Tribal Executive and Appropriate BIA Office

- Each Native American tribe is organized with its own treaty and constitution; therefore, there is no standard process.
- The tribal executive will refer the developer to the appropriate tribal committees or offices to explore whether the tribe is interested in the developer's proposed project.
- Upon obtaining assurance of the tribal government's interest, the developer should ask the tribal executive for a referral to the appropriate BIA regional personnel for preliminary discussions.

Step Two - Determine Regulatory Processes

- Federal law allows tribes to fully implement or share in implementation of energy permitting authority on tribal lands if certain planning conditions have been met.
- Developer must ascertain the level of involvement the tribe will have in relation to the BIA in determining how to develop a proposed wind project on tribal land.

- Permitting requirements are reservation-specific.
- Consult with the tribe and the BIA to determine the permits that will be required, to whom applications must be submitted, and which entity has the ultimate authority over the issuance of the permits.

Step Three - Complete All Required Permit Applications and Studies and Comply with other Federal Requirements

- Applications accepted.
- Cost reimbursement account is established.
- Developer conducts the studies that the tribe and/or BIA have requested. Developer may need to negotiate scope of studies, citing nearby projects, if possible.
- Comply with NEPA, ESA, NHPA, and any other federal requirements. Either the BIA or the tribe could be designated as the lead agency pursuant to NEPA.

4.1.7.4 Forest Service

The Forest Service, within the U.S. Department of Agriculture (USDA), is responsible for managing 193 million acres of National Forest System (NFS) lands. Wind energy uses are governed by the Forest Service's special use regulations at 36 CFR part 251, subpart B. Wind energy proposals and applicants are currently processed in accordance with 36 CFR 251.54 and direction in Forest Service Manual 2726 and Forest Service Handbook 2709.11 on administration of special uses. Requests for utilization of NFS lands for wind energy facilities are currently processed in the same manner as other proposed commercial uses of public lands.

In September 2007, the Forest Service proposed to amend its internal agency directives for special use authorizations and wildlife monitoring, which would provide direction and guidance specific to wind energy development on NFS lands. Developers using this handbook should confirm the status of the proposed amendments prior to proceeding with a proposal on NFS lands.

In September 2007, however, the Forest Service proposed to amend its internal agency directives for special use authorizations and wildlife monitoring, which would provide direction and guidance specific to wind energy development on NFS lands (72 Federal Register 184). According to the proposed rule, these amendments would "supplement, rather than supplant or duplicate, existing special use and wildlife directives to address issues specifically associated with siting, processing proposals and applications, and issuing special use permits for wind energy uses. The proposed directives would ensure consistent and adequate analyses for evaluating wind energy proposals and applications and issuing wind energy permits."

Developers using this handbook should confirm the status of the proposed amendments prior to proceeding with a proposal on NFS lands.

Unlike the BLM ROW grant systems, under current Forest Service regulations, the Forest Service does not specifically allow for the exclusive use of a portion of public land while testing for wind. The Forest Service is instructed to limit the land granted to a minimum for the actual installation. The Forest Service must consider a competitive offering if it appears that multiple commercial entities are interested in the same services or the same geographic area. To avoid being required to apply for the facility before the wind testing is completed, the proponent must demonstrate that the installation of one or a few meteorological towers on NFS lands does not necessarily indicate that a wind energy facility would subsequently be developed there.

Forest Service regulations require the agency to respond to an application for the use of public lands with a two-tier screening process to determine if the use is in the public interest.

Under current law, a developer would take the following steps when seeking to site a wind energy facility on Forest Service land:

Step One - Pre-Application Meeting

- Meet with the officer managing special uses within the District where the use is desired.
- Determine if the project will pass the two-tier screening process. The screening process is very broad and most of the concerns do not apply to wind energy facilities.
- If proponent demonstrates that the project passes the screening process, is in the public interest, and will not interfere with other uses of NFS lands, then the Forest Service officer will allow the submittal of an application for a special use permit.

Step Two - Apply for a Special Use Permit

- Submit a detailed project description and proof of financial and technical capability.

Step Three - Complete All Required Studies and Comply with other federal requirements

- Application accepted.

- Establish a cost reimbursement account.
- Proponent conducts the studies requested by the Forest Service. Because the Forest Service has limited experience with wind energy applications, Forest Service specialists may request numerous studies to evaluate the potential environmental impacts. Developer may need to negotiate scope of studies, citing nearby projects, if appropriate.

4.1.7.5 National Resource Conservation Service/Farm Service Agency

The USDA Natural Resources Conservation Service (NRCS) provides leadership to help private land owners and managers conserve soil, water, and other natural resources. NRCS provides technical and financial assistance for many conservation activities.

The NRCS and the USDA's Farm Service Agency (FSA) administer a number of conservation-based programs for private landowners. The Conservation Reserve Program (CRP) conserves soil and water resources and provides wildlife habitat by encouraging farmers to voluntarily remove croplands from production and plan permanent areas of grass and trees on lands that need protection from erosion, to act as windbreaks, or in places where vegetation can improve water quality or provide habitat for wildlife. Farmers enter into contracts for between 10 and 15 years and receive annual payments, incentive payments for certain activities, and cost-share assistance to establish the protective cover. An off-shoot of the CRP is the FSA Conservation Reserve Enhancement Program (CREP) with similar management constraints and goals. These tracts cannot be hayed, tilled, seeded, or otherwise disturbed (including disturbance associated with power line or other project construction) without authorization from the USDA. The 2002 Farm Bill amended Section 3832 of the Farm Security and Rural Investment Act to allow the use of CRP land for wind energy generation and biomass harvesting for energy production.

In addition to managing land that may be used for wind energy facility siting, local NRCS service centers are available to assist wind developers in constructing and operating their wind facilities in a manner consistent with soil, water, and natural resource conservation. The NRCS Conservation Technical Assistance program provides voluntary conservation technical assistance to land users, communities, units of state and local government, and other federal agencies. NRCS also provides expertise in soil science and leadership for soil surveys and for the National Resources Inventory, which assesses natural resource conditions and trends in the United States.

Example

The 2007 Farm Bill also addresses energy issues. Title IX "Energy" recommends expanding federal research on renewable fuels and bioenergy and reauthorizing, revising, and expanding programs that provide valuable tools for the advancement of renewable energy production and commercialization.

4.1.7.6 Department of Defense

Wind initiatives are being pursued by each of the U.S. military branches that make up the Department of Defense (DOD). In 2002, funding was set aside by Congress to assess the renewable energy potential of U.S. military installations. The DOD created a Renewable Energy Assessment Team to explore wind and other renewable energy resources at military installations. Led by the U.S. Air Force, the team conducted on-site assessments at military bases in the continental United States (CONUS). The completed reports summarize the wind, solar, and geothermal resources identified at and within 100 miles of military installations. The team found potential to develop up to 70 MW of wind projects on 109 installations. Additionally, the team made recommendations on how to purchase affordable renewable energy and encourage the growth of on-site energy development at select military bases.

It is DOD policy to pursue on-site production of renewable energy where feasible because it provides energy savings, reduces the military's dependence on foreign energy, and saves money while increasing energy security. The best potential for developing wind projects on DOD installations occurs where utility rates are high or where power is generated at remote sites and a wind/diesel hybrid can be developed.

The DOD's renewable energy programs include financial support for demonstration projects, sponsorship of a wide variety of demonstration projects (compatible with operations at the installation), continuing evaluation of renewable energy opportunities, and innovative approaches for attracting private capital for on-installation development.

Wind generation projects at military institutions are typically funded through the Energy Conservation Investment Program (ECIP) or Energy Savings Performance Contracting (ESPC). The Office of the Secretary of Defense controls ECIP funding allocation. ESPC is a contracting agreement that enables agencies and institutions to implement energy-saving projects without having to make hefty up-front investments. The contractor, or other potential partners such as venture capitalists, "green" investors, state energy offices or utilities, owns the energy system and incurs all costs involved—including design, installation, startup/testing, operations, and maintenance—in exchange for a share of any energy cost savings. The contractor recovers its investment and ultimately earns a profit by charging the institution for the supplied energy at a rate that is less expensive than energy from a conventional system. To explore the possibility of siting a wind generating facility on a

Example

The DOD has installed wind turbines at several locations, including the Naval Auxiliary Landing Field in San Clemente Island and the Air Force Space Command at Ascension Island.

Resource

The following list provides offices that are available to contact for information on wind energy development relative to each military service.

Army:

- Army Contracting Agency

Navy:

- Navy Technology Validation Program
- Naval Facilities Engineering Command
- Navy Small Business Office

Air Force:

- Air Force Civil Engineering Support Center
- Air Force Small Business Office

DOD military installation, a developer should start by contacting the appropriate branch of the service.

The U.S. General Services Administration (GSA) and the U.S. Department of Energy (DOE) also provide support to wind developers interested in doing business with the federal government. Additionally, the DOD suggests that wind companies interested in siting facilities on military installations attend the annual Energy Workshop and Exposition, an event sponsored by DOE, DOD, and GSA that attracts over 1,000 energy, environmental, and transportation professionals.

4.2 State Regulatory Framework

The regulatory process for siting a wind energy project varies widely from state to state. Prior to commencing a wind energy project in any state, a developer should determine the applicable regulatory structure and understand the allocation of responsibility among federal, state, and local government agencies.

The regulatory process for siting a wind energy project varies widely from state to state. For example, some states have vested primary siting authority in a state agency while others have left this authority to local governments to handle through their land use and zoning ordinances. Recognizing the great diversity among state programs, this section discusses the more typical state-level regulatory frameworks that a wind developer is likely to encounter. Prior to commencing a wind energy project in any state, a developer should determine the applicable regulatory structure and understand the allocation of responsibility among federal, state, and local government agencies. The lack of uniformity among regulatory programs means that what may be a simple, stream-lined review process before a single agency in one state may be a complex, time-consuming process involving multiple levels of review in another state. The following table provides a summary of commonly required state approvals for wind energy projects.

4.2.1 State Energy Facility Siting Commissions/Public Utility Commissions

In some states, the state legislature has given a single agency primary jurisdiction for siting decisions for wind energy projects. In these states a dedicated agency oversees all issues relating to the siting of new energy generation facilities, allowing other state agencies to participate as interested parties. Examples of these types of agencies include public utilities commissions, state siting boards, or environmental agencies. The *Resources* section provides a list of state agencies with siting authority. The review process before a primary agency may involve detailed adjudicatory hearings during which attorneys and expert witnesses provide information about numerous issues. This detailed review may include environmental impact review, superseding that under the state "little NEPA" program (see *Section 4.2.3*).

In Ohio, siting authority is vested in the Ohio Power Siting Board for wind projects with generating capacity greater than or equal to 50 MW or an electric transmission line greater than or equal to 125 kV.

Example

Typical State Permitting Requirements for Wind Energy Projects

Agency	Approval	Trigger	Description
State			
Lead Agency varies by project	"Little NEPA" decision	Review threshold established by state statute	Many states have their own environmental impact review or environmental planning laws that are similar to the federal NEPA process. The state review may be required when the federal process is not. When both the federal and state reviews are required, one environmental impact assessment is typically coordinated among federal and state agencies to satisfy both sets of requirements.
Public Service/Utility Commission or State Energy Facility Siting Commission/ Board/Council	Siting approval and/or Certificate of Public Use and Convenience	Often required for transmission lines above established voltage or length or that cross county boundaries. May be required for wind projects above established MW.	Some states delegate siting approval of wind projects and transmission lines to a public service or utility commission or to an energy facility siting authority. These agencies may review all energy projects, only specific types of projects as defined by state regulations, or projects that request a consolidated state process.
State environmental quality agency	Permit for stormwater discharges	Potential for discharge from site assessment, construction, and operation	Administration of the federal National Pollution Discharge Elimination System (NPDES) program is often delegated to state agencies. Many states have developed general permits and permits-by-rule as part of their programs.
State environmental quality agency	Water Quality Certification under Section 401 of Clean Water Act	Need for Section 404 permit.	Section 401 Water Quality Certification is necessary to demonstrate that a project will comply with state water quality standards. The Water Quality Certification is typically required before USACE can approve a Section 404 permit. Some states may also require Water Quality Certification as part of a state water quality permit.
State environmental quality agency	Other water-related permits	Impacts to state waters	In addition to state NPDES permits, many states have additional water-related permits, such as isolated wetlands permits, floodplain permits, and water use/water rights permits. Often, states use a joint process with USACE to regulate impacts to state waters, especially to wetlands.
State Historic Preservation Office/ State Archaeologist	Cultural, historic, and archaeological resources consultation/ studies/permits	Potential impacts to cultural resources	Many states have preservation regulations programs similar to the federal historic preservation program. Consultation with the SHPO and State Archaeologist identifies potential impacts and any studies and permits that would be required.
State department of natural resources/ department of parks and wildlife	Wildlife and habitat consultation/permit	Impacts to state wildlife	Some states, such as Texas, issue permits for impacts to protected wildlife or habitat. More often, these agencies do not have permits like the FWS Incidental Take Permit, but consultation is necessary to identify state-protected species and habitat within a project area and to determine need for mitigation measures.
State Department of Transportation	Oversize/overweight vehicle permits	Travel of oversize or overweight vehicles on state roads	Most states set size and weight limits for vehicles traveling on state roads. Permits are required for vehicles that exceed the established limits, such as vehicles carrying turbine components. Special permits for construction equipment are often available.
State Department of Transportation	Utility Permit	Placement of utility lines within state rights-of-way	If project transmission line plans require utilities along state rights-of-ways, this permit would be required.
State Department of Transportation	Entrance/Access Permit	Construction of access road onto state road	If project plans require the construction of new roads that enter state roads, this permit would be required.

A state-issued permit may serve as a consolidated or comprehensive permit, providing a "one-stop" siting process and exempting the project from other state and/or local regulation. Sometimes authority to issue delegated federal permits (such as authority to issue permits under the CWA) that is typically administered by a state environmental agency has not been delegated to the state siting agency, in which case those federal permits must be separately obtained. Alternatively, the state-issued permit may require that any other state and local permits be consistent with the primary state permit. In other states, various state and local agencies retain the autonomy to review matters under their jurisdiction and issue separate permits and approvals.

In Washington, the Energy Facility Site Evaluation Council provides a "one-stop" siting process for major energy facilities.

Example

Some states may not treat wind energy projects any differently than other large-scale electricity generating facility projects. There may be a state siting law that applies generally to all electric generation and transmission facilities, or to generating and transmission facilities above a certain size or length. Alternatively, a state law may apply to all energy facilities, but may have specific provisions applicable only to renewable energy projects. Or the law may apply on a voluntary basis to any renewable energy facilities (regardless of size) that choose to participate in the review process. Other states have laws that specifically address wind energy projects above a threshold generating capacity and that may apply on a voluntary basis for smaller projects.

Kansas does not have a siting board or public utility/service commission that oversees siting of energy projects. Instead, siting authority is vested in local government entities.

Example

4.2.2 Model Ordinances and Guidelines

Some states have developed model wind ordinances, providing a regulatory framework for cities, towns, and counties reviewing wind energy projects. Other states have developed voluntary guidelines for local governments to consider in response to proposed wind energy projects. Such guidelines are also useful tools for developers to consult as they commence a project. The *Resources* section provides a list of model wind ordinances and guidelines.

4.2.3 State Environmental Impact Review Laws ("Little-NEPAs")

Many states have their own environmental impact review or environmental planning laws. The impetus for these laws can be traced to passage of NEPA in 1969, discussed in *Section 4.1.1*. The review and documentation required under these state laws often parallel those required under the federal statute. As a result, these "state equivalents" are often referred to as "little-NEPAs."

In New York, commercial-scale wind projects typically have to prepare an environmental impact statement under the State Environmental Quality Review Act.

Example

Little-NEPA statutes typically do not result in issuance of a permit, but rather require an investigative process to occur before state and local agencies issue permits. The process generally involves an assessment of the environmental consequences of a project or various aspects of the project. In some states, the little-NEPA may substantively require taking all feasible measures to avoid, minimize, and mitigate project impacts. The reports required by the little-NEPA may be drafted by the state or local agency overseeing the review process, or the developer may be required to prepare this information for the agency's review.

In states with this type of legislation, not every project is subject to little-NEPA review. For example, in some states environmental impact review is superseded by the review process applying to energy generation, interconnection, and/or transmission facilities. Elsewhere, however, environmental impact review procedures apply irrespective of any energy specific review. Developers should review the applicable statute and regulations to determine whether their project triggers any of the jurisdictional thresholds or criteria. The potential for adverse impacts associated with the proposed project will likely dictate the extent of environmental review required. For example, siting a commercial-scale wind energy project in or adjacent to protected resource areas may require detailed studies documenting potential impacts and mitigation measures. Such studies can be costly and time-consuming. It is critical for a developer to determine the scope of review to identify those studies reasonably necessary to assess potential impacts.

The *Resources* section provides a table that identifies states with environmental impact review/environmental planning requirements similar to NEPA, along with the statutory citations and links to the relevant agency websites.

4.2.4 State Environmental Laws

Numerous state regulatory programs are likely to be triggered by a proposed wind energy project. While such programs often mirror, implement (through delegated authority), or complement similar federal laws, the state version is typically more stringent than its federal counterpart. One or more of the following regulatory programs are typically encountered by wind energy projects. This list is not exclusive, and in planning a project it is critical for a developer to identify any potentially applicable state regulatory programs and to understand the process for obtaining necessary approvals.

4.2.4.1 Endangered Species

Wind energy projects will often be subject to state laws governing endangered, threatened, and rare species. Even with careful planning, turbines, access roads, transmission lines, and other infrastructure may impact the habitat of one or more species of concern to a state. Significantly, the state list of species of concern almost always includes species in addition to those listed under the federal Endangered Species Act (*Section 4.1.2.1*). State endangered species laws typically require the developer to coordinate with the applicable state agency to determine whether the proposed project could potentially impact any state protected plant or animal. Incidental "takes" of a protected species and/or alteration of its habitat may be allowed, subject to a permit and/or mitigation plan. Violation of these laws is generally a serious offense, potentially resulting in criminal fines and incarceration. A list of state resources for endangered species can be found in the *Resources* section of this handbook.

4.2.4.2 Wetlands and Waterways

Wind energy projects are often located near wetlands and waterways. While it is often possible to site a project to avoid or minimize impacts on these resources, permits and approvals may be required.

4.2.4.2.1 Section 401 State Water Quality Certification

As discussed in *Section 4.1.4.1*, state Section 401 Water Quality Certification is required under the federal CWA for certain activities in wetlands and waters. Section 401 of the CWA gives states and tribes the authority to review projects that require federal licenses or permits and that might result in a discharge to state or tribal waters, including wetlands. For a wind energy facility, such federal approval might include a permit from the USACE pursuant to Section 404 of the CWA or Section 10 of the Rivers and Harbors Act. The purpose of Section 401 review is to ensure that a project will comply with state or tribal water quality standards and other appropriate requirements of state or tribal law.

Section 401 Certification should generally not cause delays in project approval. In most cases, Section 401 Certification review is conducted at the same time as the federal agency review. Many states have established a joint permit process to ensure this occurs. For Section 404 permits, the USACE has developed Nationwide and Regional Programmatic General Permits to streamline the approval process for specific activities that disturb a minimum acreage of jurisdictional wetlands (i.e., where an individual wetland permit is not required). These Nationwide and General permits may already have been approved, denied, or partially denied by the applicable state agency, including

Example

Many states, such as Iowa and Minnesota, have developed joint applications that are submitted to USACE and the state simultaneously for a consolidated review of wetland jurisdiction and the need for permitting.

completing the Section 401 review. Thus, if a state has approved the Nationwide or General permit, no further state review is required for Section 401 Certification; otherwise, varying degrees of state review and certification are required.

4.2.4.2.2 Wetlands

Most states have regulatory programs that address wetlands and/or isolated wetlands. The requirements of such programs vary from state to state. Certain programs are more comprehensive than others and some states regulate wetlands that are not governed under federal law. Although most programs are mandatory, a few rely on voluntary compliance to protect wetlands. State wetland laws also typically differ in both the activities and types of wetlands that are subject to jurisdiction. Resource areas that may be broadly regulated in one state may be wholly unregulated in another. For example, some states regulate extensive buffer areas outside of the wetlands area itself, while others are focused solely on the defined wetland. Wind energy developers should become familiar with the applicable state wetland protection programs to ensure that state regulated wetlands are identified and properly delineated according to applicable protocols and necessary approvals are obtained.

Wind energy developers should become familiar with the applicable state wetland protection programs to ensure that state regulated wetlands are identified and properly delineated according to applicable protocols and necessary approvals are obtained.

4.2.4.2.3 Waterways Crossings

Wind energy projects may also be subject to state regulatory programs governing river and stream crossings. For example, construction of an access road may require a bridge or culvert, and installation of a transmission line may alter a streambed. Among other impacts, such activities can damage water quality by stirring up sediment and harming fish and other aquatic organisms. Most states retain ownership of the beds and banks of navigable waterways, and in addition to an environmental permit for a water crossing, a use authorization from the state may also be necessary. Once again, applicable state programs vary widely and developers should familiarize themselves with the applicable state regulations and guidelines. In addition to state permits, waterway crossings often trigger the need to seek coverage under one of the USACE's Nationwide or Regional permits, because these activities can lead to incidental "filling" of a waterbody.

4.2.5 Historic Preservation and Cultural Resources

As discussed in *Section 4.1.3*, State Historic Preservation Officers (SHPOs) administer the national historic preservation program at the state level. Federal agencies consult with the SHPO when implementing Section 106 of the National Historic Preservation Act of 1966. The SHPO

reviews federal undertakings for their impacts upon cultural resources. To carry out this role, a state will generally have a statewide preservation program tailored to the state and designed to support and promote state historic preservation interests and priorities. The state program may also be applicable to state projects (e.g., projects that require funding, licenses, or permits from any state agency). These regulations often establish a process that mirrors the federal Section 106 regulations: identification of historic properties; assessment of effect; and consultation among interested parties to avoid, minimize, or mitigate any adverse effects. The state agency will typically work closely with tribal and local communities.

Regarding paleontological resources, wind energy developers must determine if such resources exist within the proposed project area and, if so, whether they are regulated at the state level. If regulations exist, developers should consult with the regulating agency to determine what types of activities may be required. Some requirements include: conduct surveys prior to development of final project design, consider avoidance of adverse effects, and/or action following unanticipated discovery of fossils during construction. *Section 5.6* discusses impact analysis and mitigation with respect to paleontological resources.

4.2.6 Stormwater

Stormwater runoff from construction activities can have a significant impact on water quality. As stormwater flows over a construction site, it picks up pollutants like sediment, debris, and chemicals. Polluted stormwater runoff can harm or kill fish and other wildlife. Sedimentation can destroy aquatic habitat, and high volumes of runoff can cause stream bank erosion.

Mandated by the federal CWA, the NPDES stormwater program requires operators of construction sites that are one acre or larger to obtain authorization to discharge stormwater under an NPDES construction stormwater permit (*Section 4.1.4.2*). Most states have been authorized to implement the NPDES stormwater program. EPA remains the permitting authority in a few states, territories, and on most tribal lands. States that administer the NPDES program have developed their own general permits that incorporate, at a minimum, the requirements of an EPA Construction General Permit (CGP). Even where EPA is the permitting authority and the CGP applies, federal regulations allow states, territories, and tribes to add certain conditions to the CGP that apply only in that area.

Prior to performing construction activity, developers should determine whether the state has its own regulatory program pertaining to stormwater.

4.2.7 Agricultural Protection

Wind energy projects are often constructed on active agricultural lands. To ensure non-agricultural uses are compatible with farming operations, some states have developed applicable regulatory programs and mitigation policies. For example, in New York State, the Agriculture and Markets Law prevents unreasonable restrictions by local government rules on land use within agricultural districts unless it can be demonstrated that public health or safety is threatened.

Example

The New York Department of Agriculture and Markets has created wind energy agricultural mitigation guidelines to facilitate the review process.

Mars Hill Wind Farm in Aroostook County, Maine. Photo courtesy of UPC Wind.

4.2.8 Other Applicable State Regulations

In addition to the above-referenced regulations, a wind energy project may be subject to myriad additional state regulatory programs. Although such matters will often be subject to state jurisdiction, in some cases, authority is delegated to local governments. For example, issues related to transportation of turbines and site access may require special approvals from state highway or transportation departments. Curb cut permits may be required, and separate approvals may be necessary to remove certain trees or make improvements along scenic roads. Other requirements may include permission to use former railroad property or ROW, permits to install water wells, issuance of a notice prior to demolition work, compliance with state building codes, and environmental inspection during construction.

Failure to identify and properly address these additional regulatory programs can have dramatic repercussions. Even one missing approval can impact a developer's ability to obtain financing or result in costly construction delays. Constructing without the appropriate permits can lead to civil and criminal fines and penalties, including incarceration.

4.2.9 State-Owned Lands

A proposed project may necessitate acquiring the right to use land owned and controlled by a state government. For example, the project developer may identify a possible site that is located within a state forest, state park, wildlife management area, recreation area, scientific study area, or other state preservation area. Several agencies may have jurisdiction over the various types of state-owned lands, so it is important to identify the agency that is delegated with the authority to provide a use authorization for the site in question. Use authorizations are typically governed by legislative or regulatory guidelines, and are sometimes prohibited altogether by state law or constitution. The project developer may need to obtain a use authorization, which can be in the form of a lease, an easement, a permit, or a license to use the state's land; some states even require special vote by the state legislature in order for state-held lands to be used for private purposes. Other lands may be privately owned but subject to certain restrictions to protect the public's interests, such as land beneath tidally influenced waters that have been filled.

Developers should consult with local agencies to identify applicable requirements specific to the area where a wind project would be located.

4.3 Local Approvals

At most proposed wind energy project sites, one or more local approvals will be required. Local approvals are a critical component of the siting process for most proposed wind energy projects, particularly because local authorities often have jurisdiction to approve the actual construction of the proposed project. The *Resources* section of this handbook provides a list of state siting guidelines that are available to local governments for consideration when reviewing wind projects and working with wind developers. The U.S. Department of Energy's Renewable Energy Laboratory, in collaboration with the National Association of Counties, created a Wind Energy Guide for County Commissioners that can as also be a useful resource for developers. A detailed discussion of local approval requirements is beyond the scope of this handbook because of the wide variety of local ordinances, regulations and policies. The following table provides a summary of commonly required local approvals for wind energy projects. Developers should consult with local agencies to

identify applicable requirements specific to the area where a wind project would be located.

Typical Local Permitting Requirements for Wind Energy Projects

Agency	Approval	Trigger	Description
Local			
County/Township Zoning Administrator	Conditional Use/Special Use Permit	Development of wind project within county/township	Many counties have zoning ordinances that classify parts of the county or township into different districts. A wind project is often allowed as a conditional use in agricultural or industrial districts. A permit is required to demonstrate that the wind project will be compatible with the zoning ordinance. Many counties are incorporating requirements into their zoning ordinances specifically for wind projects, or "Wind Energy Conversion Systems (WECS)." Other counties may not have zoning ordinances.
County/Township Building/Engineer's Department	Building Permit	New construction within county/township	Building permits are often required to demonstrate that construction adheres to building and engineering codes and standards. Septic Permits are often required in addition to the building permit for installation of septic systems, such as for operations and maintenance buildings.
Road Department	Oversize/Overweight Permit, Access/Entrance Permit, Utility Permit	Project affecting county roads	Counties and townships may have transportation and rights-of-way permits comparable to those issued at the state level. Counties may restrict which roads and bridges are available for overweight/oversize transportation. Coordination with local road and public works departments is necessary to create transportation plans that address county restrictions and transportation concerns.

As discussed in *Chapter 3*, local approvals required for a wind energy project are often identified during the preliminary site characterization. The issuing authority may be a local planning commission, zoning board, town, city or village council, county board of supervisors or commissioners, or a similar entity. Although some state siting boards are authorized to supersede local procesess, most if not all, state siting boards must first demonstrate that construction and operation of the proposed wind project would be consistent with local ordinances and that there is no reasonable objection to the development of the project. Many state (and federal) agencies are uncomfortable with or prohibited from issuing their own approvals for a wind farm before controversies with local officials are resolved. Thus, it is essential for developers to work cooperatively with local officials and make a good-faith effort to comply with all local requirements to obtain necessary approvals.

Similar to the state regulatory process, the need for local approvals and the process for obtaining approvals vary throughout the country. In some areas, the local approval process will be time-consuming and the project will be subject to close scrutiny. In contrast, some municipalities

require only a building permit. Before embarking upon a wind energy project, a developer should assess which local approvals will be required and consult with local counsel.

4.3.1 Preliminary Regulatory Analysis

This list can be used as a checklist when carrying out a preliminary inquiry into local permitting requirements to identify whether or not these typical permits apply to a project.

As indicated above, it is important to distinguish between permitting requirements for a meteorological tower and the actual wind turbines and equipment comprising an operational wind energy project. Often a meteorological tower can be permitted as a temporary structure, an accessory or ancillary use to the existing use at the property, or a scientific device. Depending on the zoning regulation, a wind energy developer may seek to have the turbines deemed to be accessory or ancillary uses, especially if the landowner continues to use the underlying land for a viable use such as farming.

In some cases, the proposed location for a wind energy project is within or in close proximity to more than one municipality. Depending on state and local requirements, abutting communities may need to be notified of requests for zoning relief due to their potential interest in the proposed wind facility. For example, even if a project is located in only one town, it may be visible from another town. The developer should consult with local counsel with respect to the public

At a minimum, a wind energy developer should ask the following questions regarding local approvals:

- ✓ Is there a Comprehensive Plan or Master Plan for land use in the area? Does it include information regarding wind energy projects, renewable energy, or sustainability?
- ✓ Do the local zoning regulations provide for wind energy projects? If so:
  - In which zoning district or districts are wind energy projects permitted?
  - Is the wind energy project allowed as of right with no zoning approval required?
  - Is a special permit, special exception or variance required for use of property as a wind energy project in the applicable zoning district?
  - Will the wind energy project satisfy all dimensional requirements such as height and setbacks? If not, is a dimensional variance available? What are the applicable standards for such zoning relief? What is the likelihood of obtaining relief?
  - Does one entity, such as a planning board, provide an advisory recommendation to a second entity, such as a zoning board, where zoning relief is required?
  - Are there any relevant overlay districts that might impact the ability to site the wind energy project (e.g., Groundwater Protection Overlay District that would restrict the ability to install foundations at certain depths)?
  - Are the standards relaxed if the wind energy project is deemed to be a public utility project?
  - Is development plan review or site plan review required?
  - What are the landscaping or screening requirements?
  - Do access roads need to comply with certain standards for construction of roads?
- ✓ Is there a local building code that regulates wind energy projects?
  - Is a building permit required?
  - Are electrical or other permits required?
- ✓ If the local zoning regulations or building code do not address wind energy projects, is there an opportunity for the developer to work with the community to enact or amend the zoning regulations to include provisions that are favorable to the development of wind energy projects?
- ✓ Is there a moratorium in place regarding wind energy projects? If so, is it possible to lift the moratorium?
- ✓ What provisions of the zoning regulations apply to a meteorological tower?
  - Are there provisions for temporary uses? Scientific or research uses? Accessory or ancillary uses?
  - If none, then what zoning relief is available (e.g., special permit, special exception, variance)? What are the standards for such zoning relief? What is the likelihood of obtaining such relief?

notification requirements. Failure to comply with all applicable public notification requirements could delay or prejudice the approval of the developer's applications for approval.

It is important to distinguish between permitting requirements for a meteorological tower and the actual wind turbines and equipment comprising an operational wind energy project.

4.3.2 Pre-Application Process and Preliminary Design

Once the applicable zoning and permitting requirements have been identified, it is useful for the wind energy developer to meet with the municipal planning staff responsible for zoning and planning issues. It is helpful to prepare a draft application and preliminary plans to review with staff to identify issues and outstanding application requirements. Wind energy developers should consider working with local officials and residents to ensure that the issues important to the municipality and its residents are adequately addressed prior to the submission of an application for the necessary approvals. This process of cooperative consultation may involve modifying or creating a comprehensive plan that provides for wind energy, revising zoning regulations, or identifying the universe of potential wind energy facility sites within the municipality. After initial meetings with local officials, some developers will set up community meetings or open houses to educate the public about the project. *Chapter 7* provides more details on public outreach.

During the pre-application process, the developer should anticipate questions of the following nature:

- Is another access road or route available that would have fewer impacts on the community?
- Can mitigation measures be taken to avoid potential conflict of adjacent uses?
- Could construction be limited to a certain time of the year to avoid noise impacts?
- Could the turbines be located differently to decrease visual impacts or minimize wetland impacts?
- Could the transmission line be moved to a different alignment?
- What types of traffic mitigation measures would be taken to minimize impacts?
- Will best management practices be implemented for stormwater?

4.3.3 Formal Application and Approval Process

Once a formal zoning application is filed, local and state laws generally require notice to the public and abutters and an opportunity for public comment, followed by a public hearing or series of hearings. At the conclusion of the public hearings, the board or commission will generally issue a written decision either approving or denying the proposed project. As noted above, a wind energy project developer should consult with local counsel with respect to the applicable public notification requirements. Failure to comply with all applicable public notification requirements could jeopardize the developer's applications for approval.

Local approvals typically include a list of conditions. The conditions generally specify how the developer must construct, operate, decommission, and mitigate the project. The conditions may also include legal restrictions or establish procedural requirements. If possible, the developer should review the conditions in approval draft form and negotiate the final language of the approval to ensure the conditions are feasible. When reviewing and negotiating proposed conditions, the developer should consider at least the following questions:

- Do the conditions of approval allow the permit to be transferred or assigned to someone else?
- What happens if the developer wants to modify an aspect of the project?
- Was the project proposed in phases? If so, all phases should be permitted, with clear timelines on how long each phase will last to avoid any discrepancies in the future.

4.3.4 Appeal

A developer may be able to appeal an adverse local decision (e.g., an approval with conditions or denial) within a limited timeframe after issuance of the decision; however, many states limit the review to the record created during the local process, so it may be important to develop a clear and legally defensible record during the initial approval process. An abutter or other party affected by the wind energy development may also have the right to appeal a decision granting approval for a wind energy project. In the event of a third-party appeal, the threshold issue is generally whether the party appealing the approval has standing to appeal. Standing is the legal principle that the person has some right(s) that will be affected by the granting of the approval.

4.3.5 Timing

Timing is a critical element for any project. Most zoning and land use regulations contain minimum public notice and comment periods, and some contain maximum timeframes for permitting authorities to render decisions. These timeframes are often extended upon agreement by the applicant. An appeal of a decision must be filed within a certain period, often as short as 10 to 30 days. The developer must become familiar with the applicable deadlines and appeal periods for each permit and approval that is required for a proposed project. In planning a proposed wind energy project, a developer should build enough time into the permitting process to account for procedural requirements.

4.3.6 Payment-in-Lieu-of-Taxes (PILOT)

Often the key to reaching agreement with local officials on siting issues and various other local project impacts, regardless of their particular approval process used by such officials, is the size and form of annual community compensation that will be received from the project developer, owner, or operator. Virtually all wind farm facilities will be subject to property taxes and from more than one local taxing entity (e.g., town, school system, county). Because the property tax obligation can be sizable enough to adversely impact project economics and jeopardize a project's financial viability (affecting the decision to build), most developers seek to negotiate an agreement with the local taxing entities to reduce that tax obligation, often called a Payment-in-Lieu of Taxes (PILOT) Agreement. By establishing a fixed set of payments over a specific long period of time in a PILOT agreement, the developer (and the project financers) will be assured of a known long-term expense that is not subject to either assessment change risk or tax rate risk.

4.3.7 Locally Owned Lands

Some portions of a wind energy project may be located on land owned or controlled by a municipality or local government entity. For example, the project developer may seek to place turbines on locally owned land, locate underground lines across public property (e.g., a park or open space), or make necessary road improvements on locally owned or controlled rights-of-way. In such cases, the wind energy developer will need to acquire the right to use the land.

It is important for a developer to identify the local entity responsible for granting authorization to use the property in question. The project developer will need to obtain the appropriate form of authorization, such as a lease, easement, permit, or license to use the local government's land. Certain types of conveyances may require regional or state approval as well.

Example

In Massachusetts, if a town or city takes property for use as public open space pursuant to Article 97 of the State Constitution, the release of that land for any other use requires approval of the state legislature and the town or city government.

CHAPTER 5 Impact Analysis and Mitigation

Upon completion of the Critical Environmental Issues Analysis described in *Chapter 3*, a developer may determine that a potential site is not feasible. Alternatively, initial indicators may demonstrate that a site is feasible and worth pursuing. Under the latter circumstances, the developer will need to perform more-detailed analyses of most, if not all, of the issues studied during the preliminary stages. At this point, it is important to address any regulatory or permitting requirements identified. This chapter describes the necessary impact analyses and possible mitigation techniques often used to address project impacts.

Please note that the mitigation techniques offered in this handbook are examples of what wind developers have employed in the past or methods that wind developers could employ in the future. Each proposed wind development project must assess its impacts and identify proposed measures to mitigate those impacts.

5.1 Biological Impacts

The potential impact of wind energy projects on wildlife is one of the primary factors to consider in selecting sites for such facilities. The wind industry as a whole is investing a substantial amount of time and money to better understand the relationship between wind energy and wildlife. The potential impacts of wind projects include fatalities of birds and bats from collisions with wind turbines, meteorological towers, and transmission lines; electrocution from transmission lines; habitat loss; habitat alteration and fragmentation; and displacement. Wind energy facilities can be sited in ways that minimize these impacts.

This section describes the current methods used to assess these potential impacts during the development phase and possible mitigation and monitoring techniques to address these impacts. There are still a number of unknowns about the impacts of wind energy facilities on some wildlife groups and in some areas of the United States. Ongoing research will provide answers to some of these questions, which will assist in future siting decisions to minimize wildlife impacts.

Resource

The National Wind Coordinating Collaborative (NWCC) prepared a summary of what is known and unknown about wind power effects on wildlife in its 2004 publication "Wind Turbine Interaction with Birds and Bats." The NWCC-sponsored, peer-reviewed publication "Studying Wind Energy/ Bird Interactions: A Guidance Document – Metrics and Methods for Determining or Monitoring Potential Impacts on Birds at Existing and Proposed Wind Energy Sites" and its 2003 addendum "The proper use of "Studying Wind Energy/Bird Interactions" provide guidance on conducting avian impact analysis. A companion document entitled "Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document" was published in 2007.

Red tailed hawk.

5.1.1 Birds

5.1.1.1 Impact Analysis

The most common impacts to birds associated with wind development include collisions, electrocution, habitat removal, and habitat alteration and fragmentation, and displacement effects to some species.

Collisions

Collisions of birds with turbines and meteorological towers can happen at wind energy projects. As with electricity projects in general, collisions with transmission lines may also occur. The majority of bird fatalities recorded are passerines (songbirds)(Erickson et al. 2001).

The following table on the next page provides a summary of baseline studies that can performed at sites where bird fatalities are of concern. The studies listed would not necessarily be conducted at every wind energy project, and there are other studies not listed in the table that may be appropriate at certain project sites. Some states have specific permitting requirements and guidelines for wind projects, and others do not. The studies needed at a particular site would be dictated by the permitting process and agency coordination and negotiation.

Example

The California Energy Commission and California Department of Fish & Game have developed the "California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development." The final report was published in October 2007.

Pre- and Post-construction Studies for Assessing Potential Collision Impacts to Birds

Brief Description of Methodology	Purpose	Limitations
Point Counts for Avian Use - *Diurnal birds*		
▪ consist of surveys from a series of fixed observation points ▪ all birds observed within a specific radius (circular plot) of the observation point are recorded for a set period of time ▪ observation data includes bird flight heights and flight direction ▪ circular plot size varies depending on the terrain and vegetation	▪ evaluates the potential for bird collisions by estimating the number of times birds fly through the rotor swept area ▪ provides information on species composition	▪ does not provide population density because double counting of individual birds can occur ▪ inferences limited by season and coverage of habitat
Point Counts for Breeding Birds - *Diurnal birds*		
▪ surveys from a series of fixed observation points ▪ all birds observed within a specific radius of the observation point are recorded for a set period of time ▪ observer makes an effort to avoid double-counting of individual birds ▪ conducted in the early morning during the breeding season during calm weather conditions	▪ provides estimated abundance and species composition of breeding birds in discrete areas and habitats	▪ does not provide use data (number of flights within the rotor swept area of the turbine), because double-counting of individuals is avoided, which would underestimate use if the same bird was observed flying through the rotor swept area more than once
Habitat Mapping - *Birds*		
▪ maps are prepared from a desktop analysis of aerial photos, existing literature, and available GIS data and then field verified	▪ this information can be used to avoid siting wind turbines and other project components near sensitive bird habitats	▪ the presence of a specific wildlife species is not guaranteed by the presence of potentially suitable habitat ▪ additional information is necessary to evaluate bird use of the habitat (i.e. point count surveys)
Raptor Nest Surveys - *Raptors (most often conducted for buteos and eagles)*		
▪ searches of visible potential nesting habitat ▪ conducted from the ground or from aircraft, depending on the species of concern and nature of the study area ▪ conducted during the nesting season	▪ results can be used to evaluate raptor presence in an area (i.e. nests of species of concern can be added to constraints mapping) ▪ provides data on breeding activity by counting of incubating adults and/or young during surveys	▪ only effective for tree- and cliff-nesting buteo hawks and eagles ▪ not effective in finding ground and cavity nests ▪ nests found may not be active every year and some nests may be used by a different species in a single year
Visual Counts - *Birds*		
▪ numerical census of specific species or groups of concern	▪ if standardized methods are used, these data can be compared to data from other areas to determine the relative importance of the study area to the species	▪ depending on the schedule of counts and conditions during a particular year, one year of data may not be representative of "typical" years, and could result in over- or underestimation of the importance of the site ▪ seasonal constraints on data collection for some species ▪ surveys are weather dependent

Pre- and Post-construction Studies for Assessing Potential Collision Impacts to Birds (Cont'd)

Brief Description of Methodology	Purpose	Limitations
Portable Marine Radar Surveys - *Nocturnal and diurnal birds, bats*		
▪ conducted using portable marine radars on trailers or mounted on vehicles ▪ not required or appropriate for all projects ▪ typically used when a migration or movement pattern issue is raised by a regulatory agency or NGO, or when a wind project is proposed in a new region of the country or habitat type where bats may be at risk	▪ provides information on passage rates and heights above ground of birds or bats flying during the day and night ▪ can be used to quantify the number of targets (which may be birds or bats) flying through the rotor swept area	▪ reliable radar data cannot be obtained on nights when insects are abundant or during heavy rains ▪ radar data alone cannot be used to identify specific species
Acoustic Surveys of Night Migrants - *Nocturnal migrant birds*		
▪ acoustic detectors are set to detect and record flight calls of night-migrating birds that vocalize during migration ▪ currently, there is extensive ongoing research into flight calls and improved tools are being developed	▪ may provide information on passage rate of some nocturnal migrants ▪ identifies some species	▪ not all species vocalize during migration, and not all calls heard can be identified ▪ only identifies migrants when they call and gives no information on the number of migrants passing through
NEXRAD Radar Data - *Nocturnally migrating birds*		
▪ weather radars throughout the country retrieve and store data that show migrating birds descending and ascending from stopover or staging areas ▪ data is publicly available and can be analyzed to identify migration activity in the vicinity of a project site	▪ can be used to quantify the timing and amount of bird migration occurring aloft in the region or vicinity of a site ▪ covers a much larger area (~ 55-mile radius) than portable marine radar (~3.5-mile radius) and can be used to identify areas in the vicinity from which large numbers of birds embark and descend to on migration flights	▪ restricted to elevation zones above turbine height so not directly translatable to number of birds flying within the rotor swept area ▪ does not provide species identification ▪ does not distinguish between bats and birds ▪ not all parts of the U.S. are covered
Wildlife Reporting Systems (post-construction) - *All potential fatalities*		
▪ personnel follow a set procedure for reporting and dealing with wildlife fatalities found outside of formal carcass searches ▪ varies by company	▪ provides limited information on species composition of fatalities. More likely to find larger, more conspicuous species than smaller, cryptic ones	▪ provides only data on species of fatalities found because the searches are not standardized. Not used by all wind companies
Carcass searches (post-construction) - *Birds and bats*		
▪ observers conduct standardized searches for dead and injured wildlife ▪ scavenging rates and observer detection efficiency is calculated and used to estimate the number of fatalities occurring, since not all carcasses are found by searches	▪ obtains empirical estimates of fatality rates resulting from the turbines	▪ finding carcasses often difficult ▪ expensive and requires searcher efficiency and scavenging trials to provide correction factors for estimating actual fatalities ▪ in areas where turbines are located in active agricultural areas often developers must regularly mow areas to improve searcher efficiency, and when this occurs, developers may have to pay for crop losses ▪ not conducted in forest or shrubland habitats due to vegetation density ▪ error estimates can be very large

Electrocution

Power generating plants create electricity that is transported by transmission lines carrying high voltage to substations where the voltage is reduced. This reduced voltage electricity is then transferred to distribution lines that carry the electricity to various customers. Although lower in voltage, distribution lines are more often associated with bird mortality than transmission lines, because of the closer spacing of their electrical conductors (2 to 6 feet, versus 7 to 30 feet) (Harness and Wilson, 2001). Bald eagles are particularly susceptible to this danger because their body size and wingspan are large enough to span the distance between the conductors. Risk of electrocution to raptors can be reduced by raptor-safe designs.

Guidelines, such as those developed by the FWS and the Avian Powerline Interaction Committee (APLIC), may be considered in power line design to reduce the potential for electrocution of large birds. Other mitigation measures that can be used to minimize the risk of mortality from collision with new transmission lines or during upgrades to existing distribution lines include:

- the installation of bird flight diverters where the transmission line crosses riparian corridors;
- the use of perch guards or insulated cover-ups;
- inspection and insulation of jumper/ground wires; and
- construction of new transmission lines such that all transmission conductors are a minimum of 60 inches apart.

Example

APLIC and FWS prepared the 2005 Avian Protection Plan Guidelines with suggested practices for reducing the potential for electrocution of birds.

Habitat Loss

Habitat loss is relatively easy to quantify as it can be measured from design drawings or post-construction surveys. At a wind energy project, the habitat loss includes the acres of habitat converted to a permanent industrial facility, or the permanent project footprint. The permanent project footprint consists of all permanent facilities, including access roads, turbine locations, substations, O&M facilities, right-of-way under the transmission line, and any other ancillary facilities. The permanent project footprint of a wind energy project is relatively small in comparison with the entire project area. Habitat loss could result in small reductions in populations of some species, or in extreme cases, the loss of a species if an essential habitat area or feature were eliminated.

Habitat Alteration and Fragmentation

Habitat alteration is a broad term that includes many kinds of changes to habitats. In this context, alteration is defined as any change in the biological characteristics of a habitat that supports a particular assemblage of species. Alteration can have beneficial, adverse, or no impact on a particular species. Examples of habitat alteration resulting from wind energy projects include changes in plant communities from invasion by weeds, increased wildfires, habitat conversion, increased human disturbance due to changes in access, and fragmentation. Habitat fragmentation occurs when large, continuous blocks of habitat are converted into smaller patches separated by project roads and features. The scale of the fragmentation and the tolerance of the species (or even local resident individuals) determine the severity of the effect. The effects of alteration and fragmentation could range from no effect on some species, to reductions in local populations, to loss of a species from the site during one or more seasons.

Displacement

Displacement is poorly studied compared to the other types of impacts associated with wind energy projects. Although some limited data have been obtained at wind energy facilities, most of the concerns and predicted impacts have been based on data from analogous, non-wind developments such as roads and power plants. Displacement effects are species-specific; some species do not appear to be affected, while others are. Spatial displacement can occur when certain grassland and possibly shrub steppe species avoid areas around turbines for breeding, which can result in potentially significant population decline.

A concern of the FWS is displacement of prairie and shrub-steppe grouse due to grouse avoidance of tall structures (such as wind turbines). This issue was addressed in the FWS' 2003 Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines (Interim Guidelines), and discussion of this issue is continuing with presentations at NWCC Research Results meetings. The FWS has established a Federal Advisory Committee (slated to meet in the spring of 2008) to revise the 2003 interim guidelines, and the grouse displacement issue will be addressed in detail. The NWCC, with funding from a variety of public and private sources, commissioned a 4-year, comprehensive study of the effect of wind energy development on greater prairie chickens by Kansas State University in 2006.

Until displacement effects are better understood, early coordination with state and federal agencies regarding prairie and shrub-steppe grouse is recommended for those wind energy facility sites in which year-round or important seasonal habitat for grouse are present.

Example

Studies are underway to investigate the impact from displacement on grassland birds in the Dakotas by the Northern Prairie Research Center, and on greater prairie chickens in Kansas by Kansas State University. Pre-construction breeding grassland surveys were initiated by the National Biological Survey, now a part of the U.S. Geological Survey (USGS), in 2005, in collaboration with the NWCC to develop a grassland bird survey protocol (then click on songbird protocol).

Studies

Studies of effects using a Before-After-Control-Impact (BACI) design can provide credible evidence as to whether any post-construction changes observed are the result of the wind energy facility itself or other action, such as mitigation, instead of natural or other man-made variations or land management. Aside from fatalities, species scarcity results from displacement when species avoid the area within a certain distance of a wind turbine. To a lesser extent, before-after studies at a project site (without a control area), can provide some information on whether displacement occurs.

A simple example of a BACI study in relation to a wind energy project would be to conduct surveys of raptor nests and nesting success for two or three years, using the same methods, before and after project development, at a nearby control area where no wind energy project has been developed, and at the impact area where the wind energy project is located. The control and impact areas should be as similar as possible. The control area is essential because observed declines or increases in raptor nesting numbers in the impact area may actually be the result of environmental conditions such as weather or prey density, rather than the wind project. This would only be revealed if similar declines were observed at the control site during the same year(s).

The following table provides a list of studies that can be used to monitor the results of habitat fragmentation and displacement after construction. Some of the studies are the same as those listed in the Collision section. As noted previously, the studies listed in the following table may not be appropriate for all projects, and there may be other studies that are appropriate for specific situations. The level of assessment that is necessary varies from one project to another based on the existing avian use of the area and project specific regulatory requirements. Some states have specific permitting requirements and guidelines for wind projects, and others do not.

The studies needed at a particular site would be dictated by the permitting process and agency coordination and negotiation. For projects that require more comprehensive impact assessment, a weight of evidence approach, in which information from several types of studies can be synthesized to derive a specific hypothesis, may be useful. For example, a weight of evidence approach could consist of reviewing and comparing the results of both raptor nesting surveys and point count use data before and after construction to determine whether the project resulted in reduced local populations of breeding raptors.

Studies for Assessing Post-construction Displacement Impacts to Birds

Brief Description of Methodology	Purpose	Limitations
Point Counts for Avian Use in Circular Plots - *Diurnal birds*		
▪ consist of surveys from a series of fixed observation points ▪ all birds observed within a specific radius (circular plot) of the observation point are recorded for a set period of time ▪ observation data includes bird flight heights and flight direction ▪ circular plot size varies depending on the terrain and vegetation	▪ provides quantitative information on bird flight behavior ▪ evaluates changes in bird behavior when conducted before and after construction at the same points	▪ may be appropriate for documenting potential displacement of large birds but not smaller grassland and shrub/ steppe birds
Belt Transects - *Birds*		
▪ belt transects segmented into different distances from turbines ▪ transects originate adjacent to a turbine and are broken into a series of segments of a specified length ▪ if turbine locations are known in advance, a BACI design can be used and transects originating at turbine locations can begin before wind farm construction and be replicated after construction	▪ provides quantitative information on bird density for evaluating whether displacement occurs, and if so, how far birds are displaced	▪ results are affected by vegetation density ▪ appropriate distance sampling methods should be used to account for the detection probability of birds in different habitat types
Visual Counts - *Birds*		
▪ numerical census of specific species or groups of concern	▪ if standardized methods are used, can be compared to data from other areas to determine the relative importance of the study area to the species ▪ pre- and post-construction count data can be compared to evaluate whether displacement is occurring if sample size is adequate	▪ depending on the schedule of counts and conditions during a particular year, one year of data may not be representative of "typical" years, and could result in over- or underestimation of the importance of the site ▪ seasonal constraints on data collection for some species ▪ surveys are weather dependent
Raptor Nest Surveys - *Raptors (most often conducted for buteos and eagles)*		
▪ searches of visible potential nesting habitat ▪ conducted from the ground or from aircraft, depending on the species of concern and nature of the study area ▪ conducted during the nesting season	▪ results can be used to evaluate raptor presence in an area ▪ pre- and post-construction count data can be compared to evaluate whether displacement is occurring	▪ only effective for tree- and cliff-nesting buteo hawks and eagles ▪ not effective in finding ground and cavity nests ▪ nests found may not be active every year and some nests may be used by a different species in a single year
Radio tracking - *Birds, mammals, reptiles*		
▪ individuals are captured and radio transmitters are attached ▪ movements are tracked either by observers with antennae or by satellites	▪ assesses potential impacts in cases where a specific species is of high concern ▪ useful in identifying range of movements of individuals and can identify migration routes ▪ pre- and post-construction data can be compared to determine whether displacement is occurring	▪ relatively expensive in terms of labor and equipment. ▪ inferences are limited by the number of individuals monitored

Displacement may be temporary (short-term), or permanent. There are numerous examples of birds becoming habituated to new disturbances. Habituation may occur over the longer term at wind energy projects if the basic needs of a species are meteorological. Developers should, therefore, consider conducting follow-up research five or more years after a project is constructed in addition to the initial one or two years of post-construction monitoring. It may take a turnover of generations for the habituation to reach its full potential, as young raised in the changed environment are accustomed to it in a way that their parents are not. Displacement effects to the same species may also vary considerably among locations, depending on habitat conditions and the level and type of disturbance the local animals are accustomed to.

Singing savannah sparrow.

5.1.1.2 Mitigation and Monitoring

This section presents many of the current avian mitigation, and monitoring techniques that are being used within the wind industry. Appropriate mitigation and monitoring methods vary depending on the specific species of concern, the project location and the regulatory agencies' responsible for review. It is very important that before making decisions on mitigation and monitoring measures for any project, developers educate themselves on the most recent advances and consider engaging a biologist with expertise in the field to guide decision making.

In many cases, impacts are minimized by siting wind projects in already-disturbed landscapes that do not support native vegetation, such as agricultural cropland. In general, the best mitigation is to set turbines back from bird flight paths or to avoid habitat features attractive to relatively high numbers of birds. Examples of these habitat features include open water, wetlands, cliffs and caprocks that are used by nesting raptors and where the wind creates an updraft, or known migration or staging areas. Setbacks also should be considered where species are present that are sensitive to habitat loss or show avoidance behavior. A 50-meter setback was used at the Foote Creek Rim wind project in Wyoming to avoid the rim edge area heavily used by raptors, and raptor fatality rates have been low at that project (Johnson et al. 2000a, 2000b, 2000c). However, there is no general "rule" for setback distances at present; site-specific field studies recording flight paths of raptors could be analyzed to identify areas where raptors fly repeatedly and where turbines should not be located.

Based on recent analysis of limited data by Strickland and Johnson (2006), high raptor use (above 2 birds per 30-minute survey) is correlated with high raptor fatality rates; areas with this high level of

raptor use should be studied more intensively to better identify the level of risk to raptors, or the site should be avoided. The bird use data necessary to determine this metric should be obtained from standardized point counts. The relationship between use by other groups of birds, or all birds, and post-construction fatality rates has not yet been analyzed.

Post-construction monitoring at wind energy facilities typically includes standardized carcass searches designed to correct for loss of carcasses to scavengers, and for carcasses not located by searchers. In addition, other monitoring activities at some wind energy projects have included continuation of pre-construction avian surveys and pre-construction raptor nesting surveys. The purpose of these monitoring surveys is to determine actual impacts and to use the information to design additional mitigation measures and to guide the siting of future projects.

Mitigation actions designed to avoid or reduce impacts can be implemented at every phase of the development of a wind energy project, and should be an integral part of initial project site selection and evaluation.

Mitigation actions designed to avoid or reduce impacts can be implemented at every phase of the development of a wind energy project, and should be an integral part of initial project site selection and evaluation. Incorporating mitigation measures during the earliest phases of a project will be the least costly alternative, as post-construction "fixes" of problems that could have been avoided or minimized during project siting or design are often expensive and long-term. The science of monitoring the effectiveness of various mitigation measures is relatively new for wind energy projects, and few measures have been scientifically evaluated.

Landscape-scale habitat enhancement and restoration to benefit certain sensitive species and rare or degraded habitats may be considered by wind developers where cumulative impacts of wind project impacts are significant or could become significant over time. This type of mitigation through conservation banking could be implemented by non-governmental or government entities whose mission is habitat protection and restoration, such as The Nature Conservancy, the Audubon Society, and other non-governmental wildlife organizations, as well as state and federal wildlife agencies and park departments.

One method for minimizing habitat impacts from wind energy facilities would be to site projects in lower-quality habitats when feasible. Examples of such habitat include:

- Active agriculture, row crops (e.g., wheat, corn, soybeans)
- Managed pasture (non-native grassland)

- Brownfield or otherwise industrial sites (e.g., mines, landfills)
- Landscapes already fragmented in ways that reduce bird use
- Low-quality, disturbed rangelands

There are instances, however, when agricultural cropland supports high use by species of concern, such as cranes during their fall migration, and this should be researched in the early stages of the site selection process.

Avoidance of specific habitat features known to be attractive to threatened, endangered, or species of concern is the best way to minimize habitat impacts. Developers can mitigate potential impacts by obtaining baseline data that show the pattern of bird use. Ideal sites are those that do not include high activity within the elevation zone of the rotor swept area or in locations where turbines would be sited. These data can include point counts that include mapping of flight paths, and day- and night-time radar studies. Financial contribution to research the interactions of birds and wind projects and their prevention, minimization and mitigation is another possible mitigation measure.

Resource

The NWCC recently published the first draft of a Mitigation Toolbox for wind power projects. This Toolbox provides a comprehensive review of the status and effectiveness of various mitigation actions ranging from site selection and layout to specific habitat management actions. The Toolbox also summarizes state, federal, and other countries' guidance related to wind power development and identifies mitigation measures incorporated into these guidance documents. The Toolbox was designed to be regularly revised as more information from monitoring of current projects and other research becomes available.

5.1.2 Bats

The known impact to bats from wind energy projects is collision mortality. Fragmentation and displacement impacts may be occurring, but information is not currently available.

5.1.2.1 Impact Analysis

Collisions

Until 2003, the bat fatalities recorded at wind energy projects during post-construction monitoring were relatively low in number (0 to 6 bats per MW per year) and dominated by a few species (migratory, solitary tree bats such as the hoary, silver-haired, and red bat). The fatalities appeared to occur mostly during the fall migration season (NWCC 2004). The discovery of 458 bat carcasses at a 44- turbine wind project on a forested ridge in West Virginia was unanticipated (NWCC 2004). As a result, the Bat Wind Energy Cooperative (BWEC), a joint effort between AWEA and its member companies, Bat Conservation International, the FWS, and the Department of Energy's National Renewable Energy Laboratory, was formed. BWEC's purpose is to investigate the cause of bat collisions with turbines and to assist the wind industry in avoiding or minimizing the number of collisions. BWEC is currently involved in studies to determine whether high bat fatalities can be reliably predicted

based on pre-construction bat activity, as well as other questions relating to bats and wind projects.

In 2005, post-construction fatality monitoring at a wind project in Alberta, Canada found 532 bat carcasses (approximately 13 per turbine; Baerwald 2006). Additionally, there is some evidence that some bat species may be attracted to turbines or changes in the landscape after construction, based on recent studies of bat fatalities at wind projects at eastern forested ridges by BWEC (Arnett 2006). These results indicate that the rate of bat fatalities that will occur cannot be reliably predicted using the methods that have been historically used for baseline studies at wind energy project sites, especially in new geographic regions or habitats where there are no wind developments.

Small brown bat.

The NWCC also has a subgroup (which includes BWEC staff) on nocturnal methods and metrics that developed the nocturnal companion document to the "Metrics and Methods for Determining or Monitoring Potential Impacts on Birds at Existing and Proposed Wind Energy Sites" (Anderson et al. 1999). This document, "Assessing Impacts of Wind Energy Development on Nocturnally Active Birds and Bats: A Guidance Document" has been published by Kunz et al. (2007).

The following table lists studies that can be used to evaluate collision impacts to bats on wind energy project sites.

Habitat Loss/Alteration

This issue has not been studied in sufficient details to be summarized in this handbook. Developers should stay apprised of new studies and research in this area.

Pre– and Post-construction Studies for Assessing Collision Impacts to Bats

Brief Description of Methodology	Purpose	Limitations
Acoustic Surveys (pre– and post-construction)		
▪ use ultrasonic detectors to record bat calls and software to identify the calls	▪ can be used to derive an approximate index of bat use in the vicinity of the detector at a number of wind projects for pre- and post-construction surveys ▪ provides some species composition data	▪ the utility of pre-construction call rates in predicting post-construction mortality has not been proven ▪ provides only an approximate index of bat use within the detection range of the detector, but not number of individuals ▪ may not permit the identification of all bats to species depending on method used ▪ does not provide call rate data in all cases ▪ limited by season for migrating bats
Carcass Searches (post-construction)		
▪ observers conduct standardized searches for dead and injured bats ▪ scavenging rates and observer detection efficiency is calculated and used to estimate the number of fatalities occurring, since not all carcasses are found by searches	▪ used to obtain empirical estimates of fatality rates resulting from the turbines	▪ finding carcasses often difficult ▪ expensive and requires searcher efficiency and scavenging trials to provide correction factors for estimating actual fatalities ▪ in areas where turbines are located in active agricultural areas often developers must regularly mow areas to improve searcher efficiency, and when this occurs, developers may have to pay for crop losses ▪ difficult in forest or shrubland habitats due to vegetation density ▪ error estimates can be very large
Genetic (DNA) Testing of Carcasses (post-construction)		
▪ bat carcasses are subjected to DNA testing to improve species identification	▪ can identify species that are difficult to identify by traditional means, such as certain endangered species	▪ relatively expensive and require salvage permits and skilled collaborators
Mist Netting (pre-construction)		
▪ fine, black mesh nets are strung across areas frequented by feeding or commuting bats ▪ captured bats are identified to species, sometimes marked, and then released	▪ used to capture and identify bats to species where species composition is a requirement	▪ not useful for providing an index of use or populations at a site ▪ only samples areas where nets can be safely used; does not sample bats flying within the elevation range of the rotor swept area of a turbine ▪ labor intensive and permits are required to capture and handle bats
Night Vision/Thermal Imaging		
▪ visually documents the behavior of bats in the vicinity of wind turbines ▪ can be used in combination with acoustic and/or radar surveys	▪ provide real time behavioral data on how bats interact with turbines. ▪ this type of data may help the scientific community to understand bat mortality, which could in turn support development of successful bat deterrents	▪ relatively expensive and do not provide enough information to identify species of observed bats
Portable Marine Radar Surveys		
▪ use portable marine radars on trailers or mounted on vehicles ▪ cover portions of the wind project area from very close to ground level to several thousand feet aloft	▪ provide information on passage rates and heights above ground of bats during the day and night ▪ these data are available for sites throughout the US for comparison	▪ reliable radar data cannot be obtained on nights when insects are abundant or during heavy rains ▪ cannot be used to identify species of observed bats ▪ bats cannot always be distinguished from birds

5.1.2.2 Mitigation and Monitoring

This section presents many of the current bat mitigation and monitoring techniques that are being used within the wind industry. Appropriate mitigation and monitoring methods vary depending on the specific species of concern, the project location and the regulatory agencies' responsible for review. It is very important that, before making decisions on biological mitigation and monitoring measures for any project, developers educate themselves on the most recent advances and consider engaging a biologist with expertise in the field to guide decision making.

As is the case with birds, wind project siting is crucial to minimizing impacts to bats. It is thought that avoiding siting wind power projects near caves or other sites used by large numbers of bats (such as roosting, hibernation, nursery colonies) can minimize fatalities. Another mitigation measure to minimize potential impacts to bats is to avoid the siting of projects near open water. Open water is particularly important to bats, especially in arid areas as it not only provides drinking water but is a significant source of insect prey.

Aside from siting turbines to minimize collisions, other mitigation methods are currently being studied in relation to minimizing migratory tree bat fatalities. For example, during operation, shutting down turbines on Appalachian ridges (and possibly other eastern sites) on nights with low winds after the passage of frontal systems during the bat migration season appears to be a potentially effective means of minimizing fatalities. This conclusion is supported by findings of a BWEC study (Arnett 2005). However, the effectiveness of this method needs further investigation, and careful consideration must be given to the impact on the project's viability. The BWEC is also testing a system that may deter bats from frequenting wind farms by broadcasting sounds at a frequency and volume that cause bats to avoid the area. This deterrent system is in the preliminary development and testing stage and is unlikely to be available in the near future.

Developers may also consider a financial contribution to research on the interactions of bats and wind turbines in the areas where there is concern about the number of migratory tree bat fatalities. In areas where colonial bats may be at risk, protection of hibernacula and nursery colonies is an additional option to consider as mitigation. Other habitat important to bats also may be preserved or enhanced as form of mitigation.

5.1.3 Other Wildlife

5.1.3.1 Impact Analysis

Collisions

New or upgraded roads and increased traffic may increase vehicle collision risk to other wildlife, including reptiles, amphibians, and mammals. After construction, the warmth of new roads may attract snakes and increase their risk of being struck by vehicles. Smaller, less mobile reptiles, amphibians, and small mammals may cross roads slowly and be at higher risk of being struck by vehicles. Vehicle collisions with big game and carnivores are also possible. These impacts could affect listed species at some sites. These impacts are expected to be minor unless a listed species, such as desert tortoise, is present. If collision impacts to wildlife are a concern for a project, developers may consider conducting standardized searches for dead and injured wildlife within a specified distance of a turbine can be performed.

Habitat Loss/Alteration

Other wildlife species may be reluctant to cross roads, which could have adverse effects such as decreasing reproduction within the local population, causing difficulty finding mates and sufficient food, and interruption of migration routes. After construction, roads may be used as travel lanes by some predators, which could increase predation on prey species such as small mammals and herpetofauna (i.e., reptiles and amphibians).

Potential avoidance of wind projects by big game such as deer and elk has been a concern of state and federal wildlife agencies. In theory, wind farms may disrupt wildlife movements, particularly during migrations. For example, it is possible that herd animals such as elk, deer and pronghorn could be affected if rows of turbines were placed along migration paths between winter and summer ranges or in calving areas.

Studies conducted at Foote Creek Rim in Wyoming documented no measured displacement effects of pronghorn that use the site year round (Johnson et al. 2000), and a study of elk in Oklahoma indicated no adverse effect (Walter et al. 2006). The effects of wind energy on mule deer and elk have not been investigated in detail. Studies at oil and gas facilities in Wyoming have documented displacement and local population declines of mule deer (Sawyer et al. 2006a, b). The Oregon Department of Fish and Wildlife is conducting a radio-tracking study of

Example

An Oklahoma study that evaluated the response of Rocky Mountain elk to wind energy development found that "although disturbance and loss of some grassland habitat was apparent, elk were not adversely affected by wind-power development as determined by home range and dietary quality" (Walter et. al., 2006).

elk in Wasco County, Oregon, in part to document pre- and post-construction use of the area of a proposed wind energy project.

Potential adverse effects to big game should be considered when important big game habitat is present in a project area; including winter range, calving/fawning areas, migration corridors, summer, or year-round range. On the other hand, big game may use roads as travel lanes if the human disturbance level is low after construction, and habituation may occur over time.

Other animals also could be affected by the direct habitat loss that may occur at a wind project. Such impacts are expected to be relatively small, except in the case of elimination or isolation of a habitat patch or feature that is important to the continued wildlife occupancy of the site. These impacts are to be noteworthy if a state- or federally-listed species is affected.

Indirect impacts can also induce wildlife population changes; invasion by weeds in native or agricultural communities could displace vegetation with higher wildlife food or cover value and cause wildlife population declines. Increased fire hazard can result from more human activity in the area that results in accidental fire from smoking or sparks from equipment and vehicles driving across dry vegetation. Increased frequency of fire in forest and range habitats may result from invasion by fire-associated species such as cheatgrass and could eliminate forest or shrub-steppe habitat. Agencies may require indirect impacts to be evaluated to determine the level of significance, depending on the characteristics of the site.

In areas subject to development pressure, wind projects can have a positive impact on wildlife by pre-serving open space and habitat that would otherwise be occupied by suburban housing and commercial development. The projects also may be fully compatible with management objectives for protected species remaining in the area during wind project operation.

Water quality and fish and amphibian habitat can be adversely affected by increased sediment deposition and loading if wind project development increases runoff or soil erosion from the site. These impacts are temporary and short-term during the construction phase of the wind project and can be avoided or minimized by following an erosion and sediment control plan. Spills of toxic substances, which can also adversely affect wildlife, can be avoided through observance of a Spill Prevention Control and Countermeasures (SPCC) plan.

Species sensitive to disturbance are likely to avoid the site during construction, but may return during the operation phase after a habituation period. The length of time for habituation would vary among species, but it may be more than 2 years after construction, and longer-term monitoring in some form should be considered if this is a concern of the permitting agency for a particular species.

The following table lists studies that can be used to evaluate habitat loss or alteration on wind energy project sites.

Studies for Assessing Habitat Loss/Alteration Impacts to Wildlife

Brief Description of Methodology	Purpose	Limitations
Habitat surveys - Mammals, reptiles		
▪ maps are prepared from a desktop analysis of aerial photos, existing literature, and available GIS data and then field verified	▪ can identify particular habitats or areas of the project site that are attractive to these animals ▪ information can be used to avoid siting wind turbines and other project components in close proximity to sensitive habitats	▪ presence of a specific wildlife species is not guaranteed by the presence of potentially suitable habitat ▪ additional information is necessary to evaluate wildlife use of the habitat
Displacement mapping - Birds, mammals		
▪ map with turbines and associated facilities maps is superimposed with habitat map that includes a buffer around turbine and facilities for displacement distances	▪ quantifies amount of habitat displaced by project	▪ displacement studies are few and in some cases disagree ▪ additional studies are needed to define displacement distances
Remote cameras triggered by motion detectors - Large and medium sized mammals, reptiles, amphibians		
▪ cameras controlled by motion detectors are placed in remote areas and photos are examined periodically ▪ documents presence of rare species without conducting surveys requiring extensive survey time	▪ these can be used to document use by larger species ▪ may possibly be used near raptor nests or other perches to document species and use	▪ haven't been tested or frequently used for wind projects ▪ applicability may be limited
Radio tracking - Mammals, reptiles		
▪ individuals are captured and radio transmitters are attached ▪ movements are tracked either by observers with antennae or by satellites ▪ usually extend for at least a year	▪ assesses potential impacts in cases where a specific species is of high concern ▪ pre- and post-construction data can be compared to determine whether displacement is occurring	▪ relatively expensive in terms of labor and equipment ▪ inferences are limited by the number of individuals monitored

5.1.3.2 Mitigation and Monitoring

Mitigation and monitoring of potential impacts to other species should be developed in consultation with state and federal wildlife and land management agencies and will depend on the individual project and issues.

For big game species, funding of radio-tracking studies by state or federal agencies is often not only effective, but demonstrates the industry's interest in minimizing impacts and properly siting projects.

Strict enforcement of speed limits and training of construction and maintenance staff to avoid collisions with wildlife are also effective. Weed control and fire prevention programs, including on-site fire fighting equipment, can minimize these potential impacts.

5.1.4 Vegetation

5.1.4.1 Impact Analysis

The significance of vegetation loss associated with a wind project usually depends on the size of the area disturbed and whether rare or sensitive native plants or plant communities are affected. Site topography and the layout of access roads will affect the extent of vegetation disturbance and loss. Construction in steep areas can produce greater disturbance because these facilities require more extensive "cut and fill" as well as longer, more complex road systems. The growth of invasive, weedy plant species that thrive in disturbed areas may compound these losses and must be controlled to allow native vegetation to be re-established. Some wind projects include agreements or requirements to remove or prevent the re-growth of trees that disrupt wind flow and reduce available energy. The extent of the clearing typically depends on the wind speed, duration, and direction; topography; and the relative height and placement of the turbines. In forested areas, selective clearing may be necessary for turbine siting and operation. When applicable, the need for and effects of tree trimming and removal should be evaluated for impacts on biological resources. To determine whether listed or sensitive plant species are present within a project area and to identify locations to be avoided, rare plant field surveys may be conducted by a qualified botanist prior to construction.

5.1.4.2 Mitigation and Monitoring

Permanent disturbance of the smallest possible amount of surface area minimizes direct habitat losses. Impacts to native vegetation can be minimized by configuring a wind project to result in the loss of the smallest amount of native vegetation as feasible. In most cases, impacts on protected plant species or small and unique plant communities can be avoided or minimized by carefully planning and constructing the project. Mitigation measures such as segregation and storage of topsoil, soil decompaction, and topsoil replacement, will minimize loss of native vegetation and habitat. New populations can also be established through seed collection and planting, or careful

relocation of existing plants, followed by monitoring of the survival of relocated or new plant populations.

5.2 Water Resources

5.2.1 Surface Waters & Wetlands

Surface Waters include rivers, stream, lakes, ponds and other bodies of water easily seen or accessed above ground. Wetlands are areas of the land surface where soils are saturated for extended periods during the growing season or flooded during all or part of most years. They also are characterized by plant growth that has adapted to these saturated or flooded conditions. Many wetlands are seasonal, meaning that standing water is present only during a portion of every year. Wetlands provide important wildlife habitat (see Section 5.1). State and federal agencies have specific definitions for wetlands. While these definitions differ slightly, they often reference one or some combination of the following three parameters, which are described in the impacts section: vegetation, hydrology, and soils. They are generally distinguished from deepwater habitats by the depth of standing water. Wetlands are those areas inundated by less than six feet of water.

The USACE definition of "waters of the United States" includes surface waters that are navigable and their tributaries, all interstate waters and their tributaries, natural lakes, all wetlands adjacent to these waters, and all impoundments of these waters.

Wetlands are often associated with surface waters. The U.S. Army Corps of Engineers (USACE) definition of waters of the United States includes surface waters that are navigable and their tributaries, all interstate waters and their tributaries, natural lakes, all wetlands adjacent to these waters, and all impoundments of these waters. *Section 4.1.4.3* provides additional information on the USACE and the regulations and legal considerations that apply to water resources, including recent court cases that have addressed USACE wetland jurisdiction. Similarly many states also recognize the importance of surface waters and protect not only interstate waters but also local waters occurring wholly within their states.

Because of their importance, surface waters and wetlands are subject to special federal, state, and local protections as described in *Section 4.1.4*. As with development projects in general, wind energy facilities may result in unavoidable impacts to regulated surface waters and wetlands and will need specific approvals and special conditions to minimize environmental impacts. Unavoidable impacts may also require creation of new wetlands as compensation, which is discussed further under mitigation.

5.2.1.1 Impact Analysis

Prior to siting a wind energy project, a developer should determine what wetland and surface water resources exist in the proposed project area. The density and size of wetlands can affect the viability of a project not only from a design perspective, but also from economic and regulatory perspectives. If wetlands are abundant at a particular location, the costs of design, construction, restoration, and mitigation could mean the difference between an economically feasible project and a cost-prohibitive one. In addition, large-acreage impacts on wetlands can be a significant permitting obstacle, particularly if other sensitive resources, such as large or unusual concentrations of animals or a threatened or endangered species, are associated with wetlands on the project site. Depending upon the intended use and level of accuracy required, wetlands can be identified either by desktop or field delineation methods. Map review and desktop delineation generally suffice for the early planning stages of a project. However, once the project is beyond conceptual layouts, a more accurate determination of wetlands is necessary, and field delineation is required.

Resource

For desktop wetland identifications, resources include the FWS National Wetlands Inventory, state wetland inventories, and the NRCS Soils Survey hydric soils data. For field delineation, resources include the USACE 1987 Wetlands Delineation Manual and regional supplements, as well as state delineation manuals.

Numerous desktop resources can help a developer conduct a preliminary screening to determine the presence of wetlands within an area of interest. The National Wetlands Inventory (NWI) Program produces information on the characteristics, distribution, and trends of wetlands in the United States. A good source of information under this program is the NWI map service, which includes the types, locations, and extent of mapped wetlands in the contiguous United States. The service also provides basic characteristics of the mapped wetlands. The NWI maps are produced mostly by photo interpretation with some field verification. The accuracy of the NWI mapped wetland information, especially relating to wetland size and location, is related to the time of year photographs were taken, the density of trees, and other obstacles to photo-interpretation. Therefore, NWI maps do not substitute for site-specific field investigations and wetland boundary delineations usually required by federal and state agencies.

Also useful in a desktop screening of potential wetlands at proposed wind energy sites are National Resources Conservation Service (NRCS) soils maps, which show the location and extent of soils, including **hydric soils** or upland soils that include smaller islands or units of hydric soils. Recent aerial photographs (black and white, color, and color infrared) are also useful in determining the potential presence of wetlands within areas of interest.

Field verification of wetlands can utilize one or more of several methods to delineate the boundary between wetlands and uplands. It is important to apply those methods accepted by the regulatory programs (federal, state, and/or local) with jurisdictional authority. The most stringent regulations generally apply. Federal and some state agencies have developed specific methods to delineate wetlands. The 1987 Federal Manual for Identifying and Delineating Jurisdictional Wetlands is the guidance used by the USACE. Most methods involve the evaluation of the three parameters: vegetation, soils, and hydrology.

Generally, field identification of wetlands is contingent on the presence of the following criteria:

Hydrophytic vegetation consists of plants that have become tolerant to prolonged saturation or flooding and are able to survive and propagate under these conditions. About 5,000 to 7,000 types of hydrophytic plants are found in wetlands within the United States.

Hydric soils are soils that have been subjected to extended saturation, often resulting in reduced oxygen levels in the soil. Several site-specific observations can determine the presence of hydric soils: organic deposits, mottling, rotten-egg odor, and/or sandy soils that are black or discolored from accumulated organic material. The NRCS provides a detailed list of soil surveys by state, indicating soils considered to be hydric.

Wetland hydrology refers to the presence of water at or above the soil surface for a sufficient period of the year that significantly influences the plant types and soils that occur in the area. On-site field observations can be used to confirm hydrology indicators. Observations such as the presence of flowing or standing water or heavily saturated soil during the growing season, water marks, drift lines, or oxidized root channels are all indicators of wetland hydrology.

Field delineation of wetlands should be conducted during the growing season as required by many agencies. Wetland delineation should be conducted by a qualified, experienced wetland biologist.

Surface water resources are generally easier to identify than wetlands. U.S. Geological Survey (USGS) maps and various state databases provide information on the location of these resources. Delineating the mean high water mark of these features generally requires field surveys.

5.2.1.2 Mitigation

Mitigation for impacts to surface waters and wetlands may be required for both the temporary and permanent impacts of the project.

Temporary impacts include those that occur during construction, but are restored once construction is complete. For example, impacts associated with clearing of underground interconnect routes and overhead transmission lines are considered temporary impacts on wetland resources if the cleared wetland areas are restored after construction. Placement of turbines, access roads, and poles for overhead transmission lines in wetlands or water bodies is considered a permanent impact. However, access roads may be temporarily wider during construction to accommodate larger construction equipment and vehicles and then reduced in width for the operational phase. Restoration of wetland vegetation and contours helps to mitigate for the temporary impacts of construction access roads.

Mitigation for temporary impacts is also conducted through Best Management Practices (BMPs) implemented during construction. Typical best management practices include, but not limited to, the following mitigation measures:

- Use of silt fences between construction area and waterbodies and/or wetlands
- Installation of temporary water diversions at water channel crossings
- Use of erosion control blankets or mats on slopes near waterbodies and/or wetlands
- Construction of temporary bridges and culverts
- Restoration of vegetative cover to the greatest extent practicable at the site

Other guidance on preparing the required Stormwater Pollution Prevention Plan (SWPPP) and identifying appropriate construction-related BMPs to minimize or reduce soil erosion and water quality impacts can be found on EPA's stormwater construction permit website.

Permanent impacts to surface waters and wetlands are often addressed through compensatory mitigation measures intended to replace unavoidable losses to aquatic resources. Compensatory mitigation may take the form of establishment (creation), restoration, enhancement, or protection (preservation) or some combination of these measures.

Traditionally, the standard measure for determining impacts on these resources and compensatory mitigation requirements has been expressed I

n the number of acres affected by an activity. For example if one acre of a wetland is permanently impacted by the proposed project, one acre of replacement wetlands may be created. There is a recent trend, however, to use a functional assessment or acreage surrogates for determining mitigation. To compensate for wetlands losses, the objective is to provide, at a minimum, one-to-one functional replacement, i.e., no net loss of functions (such as flood control), with an appropriate margin of safety to account for uncertainties. In the absence of information on the functions of a specific wetland site, a minimum one-to-one acreage replacement may be used as a reasonable surrogate for no net loss of functions. Mitigation projects for streams generally replace linear feet of stream on a one-to-one basis. Mitigation measures are ideally completed on the project site. In the case of wind energy projects, a combination of on-site and off-site mitigation may be more useful and should be acceptable as long as the mitigation site is located within the affected watershed.

5.2.2 Groundwater Resources

Groundwater is water that infiltrates into the earth and resides in the soil and rock below the earth's surface. Groundwater is a source of potable water and is usually cleaner and more pure than surface waters. Contamination of groundwater or disruption of the hydrologic cycle can have consequences to public health.

Underground areas (i.e., soil and rock) with water-bearing zones are termed **aquifers**. In many regions of the country, individual aquifers may be separated by layers of low-permeability soil or sediment through which little or no groundwater flows. These layers are termed **aquitards**. They are often composed of layers of clay, silt, and/or other fine-grained materials that may extend over long distances and can completely isolate an aquifer. Thus, beneath a particular site it, is possible to have multiple aquifers or have groundwater connected to other aquifers located some distance away.

5.2.2.1 Impact Analysis

A desktop hydrogeologic study can help developers site wind energy facilities. Available sources of data for any hydrogeologic studies include USGS resources (including hydrologic atlases, surficial and bedrock quadrangle maps, water resources investigations, and open file reports), State Geological Survey publications and maps, university or college

earth sciences and geology departments (including faculty publications and graduate student theses and dissertations), the regional U.S. Environmental Protection Agency office, state environmental and/or health departments (for water quality investigations and delineation of public water supplies), state engineers' offices (i.e., the agency regulating wells and water rights in many western states), and local boards of health (for private water supplies). During the due diligence process, Phase I environmental site assessments (ESAs) (*Chapter 6*) may attempt to address groundwater at least in a preliminary manner, but this is more typically an "add-on" to the usual scope of a Phase I ESA. These studies can provide a good starting point for a baseline hydrogeologic investigation.

Wind energy developers may be limited in their ability to site and operate a wind energy facility near sources of groundwater. Some aquifers may have federally protected status as "sole-source aquifers" or state and regional protected status as "well head protection areas." Such status can limit property usage and activities over large geographic areas including not only the general location of the groundwater withdrawal point(s) but also the recharge area or "zone of contribution." Typically state environmental agency websites have maps or other documents that list and locate these protected areas.

One major concern for groundwater users during construction is blasting and its potential impacts to water supplies.

If a wind energy project is proposed for a site that is within a groundwater recharge area, any contaminants released at the site have the potential to be carried downward with the infiltrating stormwater, leading to contamination of the aquifer. Groundwater discharge points occur as seepage into wetlands, lakes, and streams. If a site is proposed in a groundwater discharge area, surface disturbances (such as construction or the building of stormwater retention facilities) that disrupt the local hydrology can lead to such consequences as draining the wetland or causing stream flow to become intermittent, even if the activity does not occur directly in the wetland or surface water.

During construction blasting can have an adverse impact on water supplies. Groundwater yields (including both wells and springs) are influenced by the flow of groundwater through the aquifer materials. Any disruption to these materials can potentially affect both groundwater flow and water quality. In some cases, vibrations from blasting can cause aquifer materials to collapse and compact, thereby limiting flow. In addition, bedrock fractures may be created that draw in flow from other portions of bedrock with poorer water quality, and the use of blasting agents that contain perchlorate may result in groundwater contamination.

Other potential impacts during construction include dewatering operations (which may affect well yields or spring flow); slope alteration, storm water routing, or increases in the net amount of impervious surfaces (which may affect recharge areas by adding more particulates or by diverting water so that it flows to a surface water or drainage ditch rather than recharging the underlying aquifer); and excavations that break through aquitards (which may affect flow and/or water quality by decreasing aquifer pressures or creating conduits for recharge from undesirable areas).

Baseline Hydrogeologic Studies to Consider

- ✓ delineation of aquifers and recharge areas (including both overburden and bedrock aquifers)
- ✓ groundwater contour map (often called a potentiometric surface map)
- ✓ quantification of aquifer properties (including estimates of porosity, hydraulic conductivity, saturated thickness)
- ✓ calculation of groundwater velocity and flow direction
- ✓ groundwater quality sampling results (geochemistry)
- ✓ listing of current groundwater users with delineation of withdrawal areas and estimates of usage (for public and private water supplies including domestic and industrial uses)

5.2.2.2 Mitigation

Developers who obtain a solid understanding of local hydrogeology and engage in proactive monitoring (particularly near recharge areas) can avoid many of the potential impacts associated with groundwater.

If blasting is planned as a part of wind facility construction, it may be prudent to evaluate the potential impacts on nearby groundwater users. If feasible, developers should consider using blasting agents that do not contain perchlorate. Pre- and post-blasting well surveys are generally not required; however, such surveys can demonstrate use of extra-cautionary measures and help to avoid lawsuits and minimize liability. When performing a blasting survey, it is useful to document individual well (or spring) construction details (including but not limited to well depths, borehole diameter, geologic formations, and pump size and placement), yield (or flow), and water quality both before and after blasting to provide quantifiable data on any potential impacts. Careful documentation of blasting operations (charge size, delays, etc.) and vibration monitoring are also useful in avoiding potential impacts and settling any related disputes.

Spill prevention and waste management programs such as a Spill Prevention, Control and Countermeasure (SPCC) Plan (*Section 5.11*) and other construction compliance plans are essential if regulatory threshold triggers (such as quantity of oil used or stored on a site) are surpassed. These programs may be helpful in avoiding and/or minimizing impacts to groundwater resources. If the wind energy facility exceeds the regulatory thresholds for contaminants on site drainage patterns, potential impact of a spill and containment measures must be identified prior to operation. Proper implementation of an SPCC plan

should protect surface and ground water quality in and around a wind energy project.

5.2.3 Soil Erosion and Water Quality

5.2.3.1 Impact Analysis

Soil erosion is a natural process in which soil particles are detached and moved by wind or water. This process can be exacerbated during the construction of wind projects when soil is disturbed due to vegetation removal, excavation, and vehicular traffic.

The federal Clean Water Act (CWA) and the laws and regulations of individual states have been promulgated to protect the integrity and aquatic resources. Without proper erosion controls in place, soil particles can be carried by water runoff into nearby waterbodies and wetlands. The deposition of this material into waterbodies and wetlands is called sedimentation. Sedimentation can degrade water quality by creating excess turbidity that can harm aquatic life and habitats, increase water-treatment costs, and impact recreational uses. If severe, it can obstruct drainage ditches and other waterways. Additionally, uncontrolled erosion can adversely impact water quality by depositing in waterbodies and wetlands metals and other contaminants naturally occurring in the soil. Water quality can also be impacted as a result of runoff that picks up contaminants from spills of oil and/or other potentially hazardous fluids required during construction and operation of a wind project. For these reasons, increasing the natural turbidity of surface waters is a violation of a state's water quality standards, and degrading water quality through excessive erosion is a violation of the CWA and state regulations.

Soil disturbance and the resulting erosion due to construction and operation activities of a wind project may also impact the existing drainage characteristics and runoff patterns in the surrounding area. If left uncontrolled, this could lead to increased turbidity and/or saline levels in nearby waterbodies and wetlands, contribute to potential flooding and stream bank erosion, and alter downstream flow patterns.

5.2.3.2 Mitigation

The mitigation measures described below can be cost-effective practices when undertaken before or during site development related construction activities. Further discussion regarding the permitting process required to comply with water quality standards is provided in *Section 4.1.4*.

Impacts on water quality due to soil erosion and runoff can be managed through early and thorough project planning and diligence during construction.

Impacts on water quality due to soil erosion and runoff can be managed through early and thorough project planning and diligence during construction. To determine the potential soil erosion and water quality impacts for a proposed wind project, a developer would identify the existing soil conditions of the site as well as the locations of the waterbodies and wetlands and drainage areas within the site.

Once potential impacts are identified, they can be mitigated through a number of planning and erosion control techniques. Prior to construction, as a part of the project's SWPPP required under the Construction General Permit (*Section 4.1.4.2*), a sediment and erosion control plan should be developed. In the SWPPP, all construction contractors must sign statements indicating their agreement to implement the SWPPP's relevant best management practices during construction. Most state environmental regulatory agencies have SWPPPs guidelines on their websites, which should be consulted early in the development process. Best management practices can include, but are not limited to, the following:

- Use of silt fences between construction area and waterbodies and/or wetlands
- Installation of temporary water diversions at water channel crossings
- Use of erosion control blanket on slopes near waterbodies and/or wetlands
- Construction of temporary bridges and culverts
- Restoration of vegetative cover to the greatest extent practicable at the site

5.3 Visual/Aesthetics

Visual and aesthetic impacts are among the most commonly expressed concerns about the development of wind energy projects. Determination of what constitutes an adverse visual impact is highly subjective because it depends on the values, beliefs, and experiences of individual viewers. Opinions about the aesthetic qualities of wind energy facilities can vary greatly among different segments of the population and from one location to another.

An adverse visual impact can be defined as an unwelcome visual intrusion that diminishes the visual quality of an existing landscape. Changes that can be perceived as visual intrusions generally result from

the introduction of visual contrast to the existing scene, based on differences in form, line, color, and/or texture. How much a new facility could decrease the visual quality of a landscape (and thereby create an adverse visual impact) depends in part on the degree of visual contrast it introduces. The other part of the visual impact equation involves viewer perception of the visual contrast introduced by the facility. If viewers regard the facility as a modification that does not harmonize with the existing landscape, the resulting contrast will be considered undesirable and will be perceived as an adverse impact.

Wind turbines typically become the focal point of visual and aesthetic concerns on the basis of the visual patterns created by the wind turbines, such as their spacing and uniformity of appearance, as well as the physical markings or lighting on the turbines, such as lighting required for aviation safety. In most cases, however, it is the simple size of the wind turbines that is the predominant source of visual contrast created by a wind energy facility. As wind generating technology has advanced, so has the physical size of the structures, with the maximum turbine height (at the tip of a fully extended rotor) often usually well over 300 feet. At this scale, and in a setting that is typically free of structures, trees, or intervening terrain and vegetation, the wind turbines will be visible.

5.3.1 Impact Analysis

Federal, state, and local government agencies with approval authority over siting and development of wind farms often require a formal assessment of the visual compatibility of the wind farm. Those requirements typically involve one or more of the following topics:

- The extent to which the proposed wind farm would introduce visual contrast in the landscape and/or result in adverse visual impacts.
- The extent to which the proposed wind farm would be consistent with applicable laws, regulations, plans, and policies, especially those addressing aesthetic characteristics or visual impacts.
- The extent to which the proposed wind farm adversely affects the aesthetics of historic properties or vistas designated, or known to be, important to the community.

Whether a project is consistent with laws, regulations, plans, and policies applicable to aesthetic characteristics varies widely among jurisdictions. Often, there are no specific guidelines or rules, just general

Example

Various methodologies are available to assess the visual impacts from a wind project. For projects on federal land managed by the Bureau of Land Management (BLM), the BLM has developed the Visual Resource Management system that identifies and evaluates scenic values in order to determine the appropriate level of management.

requirements that there be no "undue adverse aesthetic impacts." If the proposed project is to be located on public lands, particularly federal lands administered by the BLM or the Forest Service, the project review likely will involve consideration of formal management designations and objectives related to visual quality. Some state and local regulations may require turbine setbacks from adjacent property lines that are based, at least in part, on aesthetic considerations. Height limits on structures are common features of local zoning regulations that need to be identified early and addressed in consistency evaluations involving aesthetic factors.

In some cases, the permitting authority may prescribe specific aesthetic factors to be considered or analytical tools to be used. More commonly, however, the requirement is more general: to conduct a formal visual assessment of the project and its setting. Some standard aspects of such visual assessments are discussed below.

Visual Impact Assessment

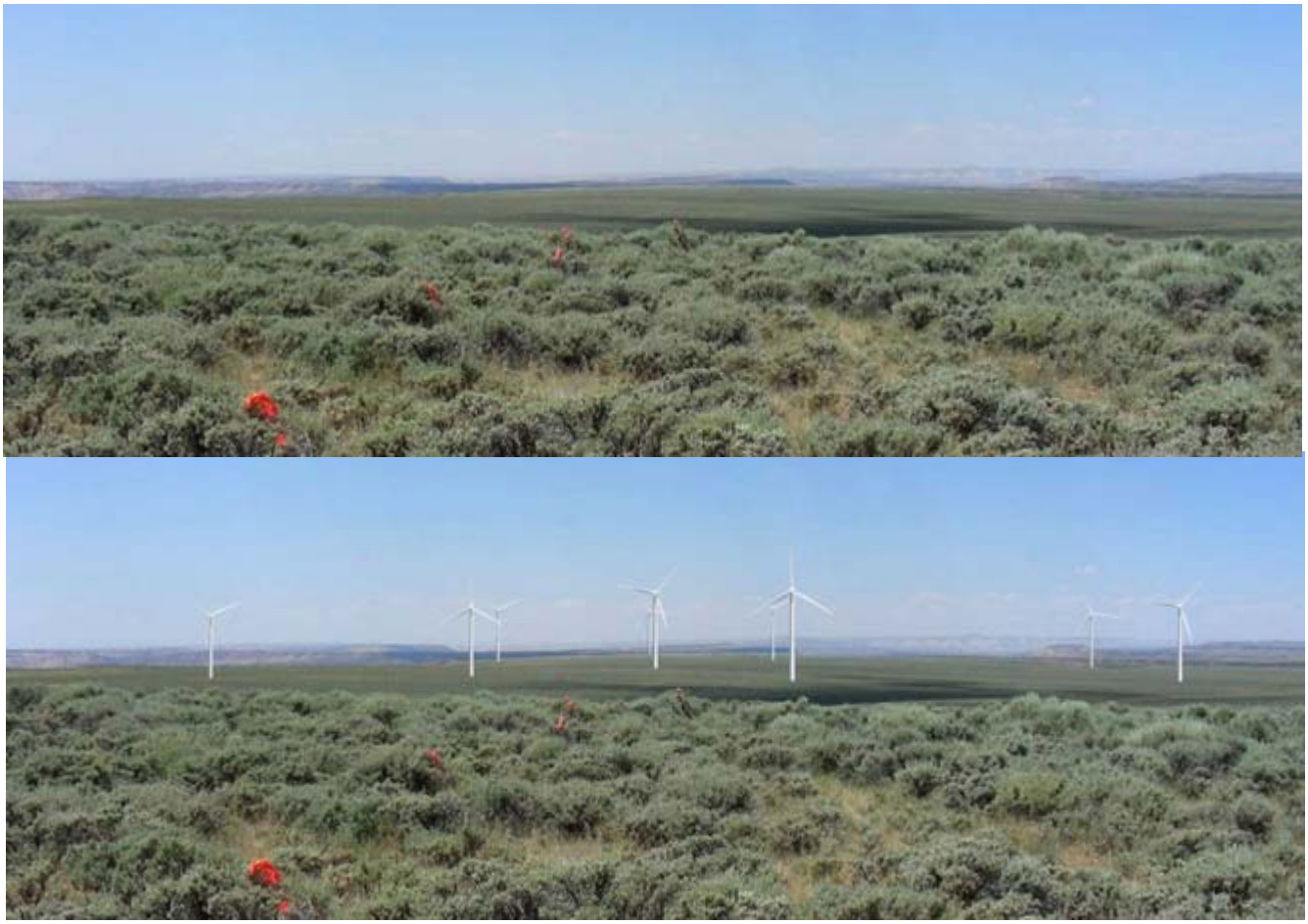
An aesthetic or visual resource assessment that supports the siting and development of a wind farm should contain the fundamental components needed to determine and evaluate the potential for visual impacts. Those basic components include:

- Characterization of the baseline or existing conditions. This usually requires a thorough, representative sampling of "before" photographs. It is suggested that these be from all directions and include near range, moderate range, and far range views of the project site.
- Photo simulations and "after" views superimposed into the "before" photographs, to the extent project elements will be visible after construction. Using precise three-dimensional data and digital photography, the simulations superimpose the proposed facilities on the existing landscape conditions. Visual simulations can offer an accurate depiction of the existing landscape with the addition of the project features, and provide a basis for characterizing the degree of visual contrast that would be created by the project.
- Specific investigation and documentation of the potential visual impacts of the project, based on identified changes from the baseline condition.

Visual receptors typically included in the assessment are residential and recreational areas, as well as sites of historic or cultural significance.

The characterization of the existing conditions should address both the existing landscape in the vicinity of the project and key variables applicable to viewers of that landscape. In some cases, the visual assessment approach includes defining the existing visual quality of the landscape, based on the form, line, color, and texture of the landscape and the evidence of human modification. Important information on viewer attributes includes the types and numbers of viewers (e.g., residents, workers, recreational, or highway travelers), their expected sensitivity to visual change, and typical viewing distances and durations. The study area is often divided into zones or units, based on landscape similarity conditions, and specific viewpoints or viewing locations are selected to represent typical or important views in each area.

Visual analysts typically determine the visibility of project facilities through three-dimensional analysis of the study area terrain and the physical dimensions of the project facilities (primarily the wind turbines). This allows identification of the areas in which viewers might respond to visual contrast created by the project, and the areas in which terrain and vegetation would block or screen views of project facilities. Using pre-



Simulation of a hypothetical wind project at a typical location in the Intermountain West. Simulated turbines are at distances of approximately 1.75 to 3 miles from the observer. Simulation courtesy of Tetra Tech EC, Inc.

and post-project conditions for key viewpoints, the analysts define as precisely as possible the degree of visual contrast that would occur in those areas where project facilities would be visible. One or more visual simulations are typically employed as an important tool for this step of the assessment.

Once the visual contrast of the project has been determined, the impact analysis then relates that information to the applicable viewer characteristics. For example, the analysis might indicate that project wind turbines would be prominent and introduce considerable visual contrast from some reference viewpoints, but that those views would be at a long distance and/or would be experienced by few viewers. In such a case, the analysis would likely characterize the potential visual impact as relatively minor. Conversely, a case of pronounced visual contrast in relatively near views experienced by a large number of viewers would indicate the potential for widespread local concern over project visual impacts.

The electrical facilities needed to transfer power from a wind farm to a local or regional electrical system also represent potential sources of visual impact from a wind farm. These facilities expand the area of project visibility and also are a potential source of visual impact. The visibility analysis for a proposed wind farm should include the project transmission line(s) (and any other overhead electrical lines proposed as part of the project) and substation(s). Wind project substations are relatively low in profile and modest in size, and therefore are less prominent visually than wind turbines. Unless the visibility analysis indicates that these ancillary facilities would have limited or no visibility, the visual simulations for a project usually includes representative views of the project transmission line(s) and substation(s).

Large-scale wind energy facilities generally require rather extensive project road systems to provide construction and operation access to the locations of the turbines and support facilities. Because roads can also contribute substantially to the visual impact of a project, they should be addressed in the visual impact analysis. The analysis should pay particular attention to visually sensitive location relative to slopes.

As described in *Section 4.1.5*, the FAA requires specific lighting depending upon the project location. The requirement to install safety lighting (on both turbines and meteorological towers) adds to the visibility of a wind project and can contribute to its visual impact. Most wind farms currently in operation have flashing white lights that add to the daytime visibility of the project. For new projects developed under the current FAA guidelines, the visual impact of safety lighting is limited

to nighttime. The flashing red lights can be conspicuous at long distances when viewed against dark skies, and the practice of synchronous flashing of the lights tends to better define the areal extent of the wind farm. The appearance of a wind farm at night, particularly with synchronized flashing of red lights, is difficult to simulate photographically. Nevertheless, the visual impact analysis should acknowledge and try to characterize this aspect of project visibility.

5.3.2 Mitigation

Micro-siting to minimize visual impacts may be possible but must be balanced with a myriad other site constraints, such as cultural resources, wetlands, wildlife habitat, constructability, microwave beam paths, wake loss considerations, property setbacks, landowner preferences, and proximity to residences and public roads.

Visual contrast with the existing landscape is often unavoidable because of the size and typical location of wind farms. Nevertheless, there are some measures that can be incorporated into the design of the project facilities to limit the degree of visual contrast and reduce the prospect that the contrast would be widely perceived as an adverse visual effect, or at least reduce the degree of the effect.

It is critical to recognize that wind turbines cannot be adjusted to meet visual criteria alone. The turbines must be located in the areas with appropriate wind resources in order for the project to be viable. Micro-siting to minimize visual impacts may be possible but must be balanced with a myriad other site constraints, such as cultural resources, wetlands, wildlife habitat, constructability, microwave beam paths, wake loss considerations, property setbacks, landowner preferences, and proximity to residences and public roads. Visual issues are by necessity the last criteria by which turbines can be sited.

Several published works include comprehensive discussions of such design measures; among the most helpful are the chapter "Design as if People Matter: Aesthetic Guidelines for a Wind Power Future," in Paul Gipe's 2002 book *Wind Power in View*, and the discussion of visual resource mitigation measures in the BLM's 2005 programmatic EIS on wind energy.

Mitigation options for the impacts associated with marking and lighting are limited because the FAA designs the markings and lighting to be visible to pilots. The need for red flashing safety lights on some portion of the turbines and met towers can be avoided only by using structures that are less than 200 feet in height; that approach may not be feasible in current wind energy practice. The visibility and potential visual impact of safety lighting can be reduced only through siting actions that would reduce the overall visibility of the wind turbines, such as locating turbines in areas where there are few or no viewers, and/or in areas where natural features (terrain and vegetation) would block or limit

views of the turbines. However, mitigating in this fashion may compete with the location constraints of a viable wind farm, as noted above.

Some options for key aesthetic design, construction, and operation measures for consideration

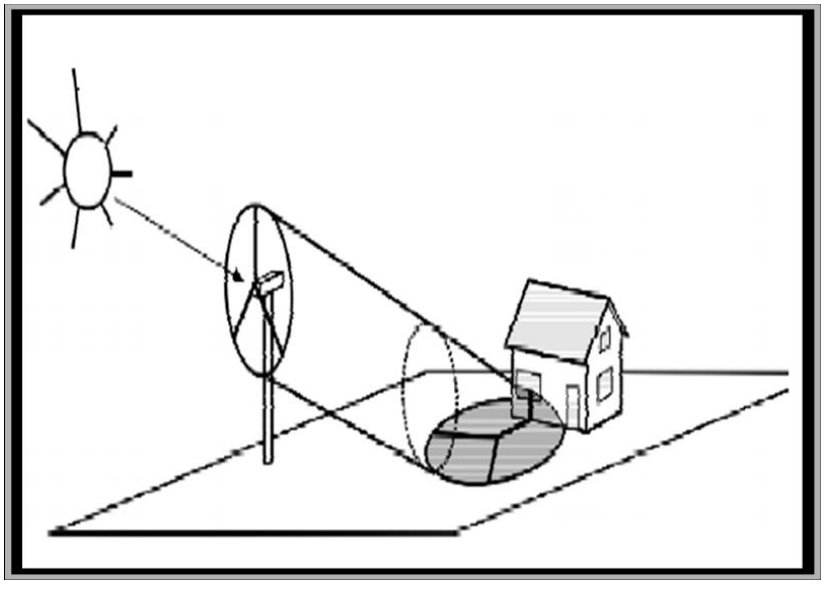
- ✓ Employ turbine units (towers, nacelles, and rotors) that are uniform and balanced in shape, color, and size.
- ✓ Prohibit the use of commercial markings or messages on the turbines.
- ✓ Limit markings and lighting on the turbines to the minimum required for safety purposes, and synchronize flashing warning lights.
- ✓ Where possible, limit the amount of security lighting, or use lights activated by motion sensors.
- ✓ Install power collection cables underground wherever feasible.
- ✓ To the extent practicable, site substations, service buildings, and other project support facilities in locations where they will be less visible, and design the structures to harmonize with their visual setting.
- ✓ Locate project access roads to limit their visibility and potential to create erosion.
- ✓ Maintain project facilities regularly during operation (including repair or replacement of inoperable turbines or parts, regular painting, and cleaning), minimize outside storage of materials or equipment, promptly remove any debris or defective equipment, and keep the site orderly.

5.4 Shadow Flicker

5.4.1 Impact Analysis

Shadow flicker is the term used to describe the effect caused by the shadows cast by moving wind turbine blades when the sun is visible. This can result in alternating changes in light intensity perceived by viewers. Since wind turbines are usually located relatively far from potential shadow receptors, shadow flicker typically occurs only at times and locations of low sun angles; this is most common just after sunrise and just before sunset, and in relatively higher latitudes (e.g., more northerly areas in the Northern Hemisphere). Shadow flicker does not occur when the sun is obscured by clouds or fog, or when wind turbines are not operating, or when the blades are at a 90° angle to the receptor. While shadow flicker can be perceived outdoors, it tends to be more noticeable in rooms with windows oriented to the shadows. A wind turbine's shadow flicker impact area does not generally extend beyond 2 kilometers, and high-impact durations (>200 hours per year) are generally located within approximately 300 meters of the turbine. Shadow flicker typically lasts less than 20 minutes.

The potential for shadow flicker has been raised as a visual issue by close neighbors of wind farm projects. Shadow flicker analysis for a wind farm is typically performed through computer-based mapping and modeling. The software packages that wind energy developers commonly use to locate wind farms and evaluate feasibility contain modules that perform shadow flicker analysis. The analysis is based on a digital terrain model, turbine locations and elevations, density and location of trees, receptor locations and elevations, and data relating to sun exposure and turbine



Representation of shadow flicker impact.

operating times. Through the model analysis, it is possible to calculate the specific frequency, timing, and duration of shadow flicker at a specific receptor location. When such an analysis is performed for a wind farm, the focus is usually on the number of affected receptors and the numbers of hours per year in which they may experience shadow flicker. Thus this analysis often requires the early identification of the location(s) of all residences or other sensitive receptors within the project vicinity.

5.4.2 Mitigation

Mitigation options for potential shadow flicker impacts can attempt to address shadow flicker at the receptor location or at the source (the wind turbine). A common practice with projects for which shadow flicker has been raised as a concern has been to conduct more detailed investigation of site-specific conditions at individual receptor locations highlighted in the impact modeling analysis. On-site investigation of factors such as tree screening and building and window orientation can usually determine whether potential impacts indicated in the modeling would in fact occur, and to what extent. If such existing mitigating factors are not present, agreements between the project developer and landowners can provide for landscape screening or window treatments (such as curtains, blinds, or shutters) to reduce or eliminate exposure to shadow flicker.

If shadow flicker impacts are unavoidable through site selection, the developer may work closely with the landowners or other receptors to come to agreement on other potential mitigation measures specific to the project.

5.5 Sound

Wind turbine manufacturers have made significant strides since the early days of the industry in reducing turbine noise. Most people's reaction to turbines, even up close, is that they are much quieter than they expected. However, because wind projects are typically located in rural areas where pre-existing background sound levels are low, an assessment of potential impacts to neighbors and other sensitive receptors is often prudent.

Wind turbine manufacturers have made significant strides since the early days of the industry in reducing turbine noise. Most people's reaction to turbines, even up close, is that they are much quieter than they expected.

5.5.1 Impact Analysis

The sounds that most turbines emit are caused by the passage of the blades through the air – the aero-acoustic "swoosh." This sound is not dissimilar to the sound made by the wind itself passing through trees or

across the ears of a listener. It is, however, distinct from such sounds in that it can occur in pulses corresponding to the passage of the turbine's blades as the rotor turns. It tends to be most noticeable in the middle range of turbine operating wind speeds, when the masking sounds of the wind are not at their highest level.

Some turbines also emit tonal sounds, caused by mechanical components. While tonal sounds may not result in a higher overall level of sound emissions (in terms of loudness), they are more noticeable. Most states and localities establish noise limits at property boundaries based on specific sound pressure levels measured in **decibels**.

Oregon assesses sound emissions with respect to frequency (in terms of one-third octave band noise levels). This approach also attributes greater sound impacts to sounds with tonal components.

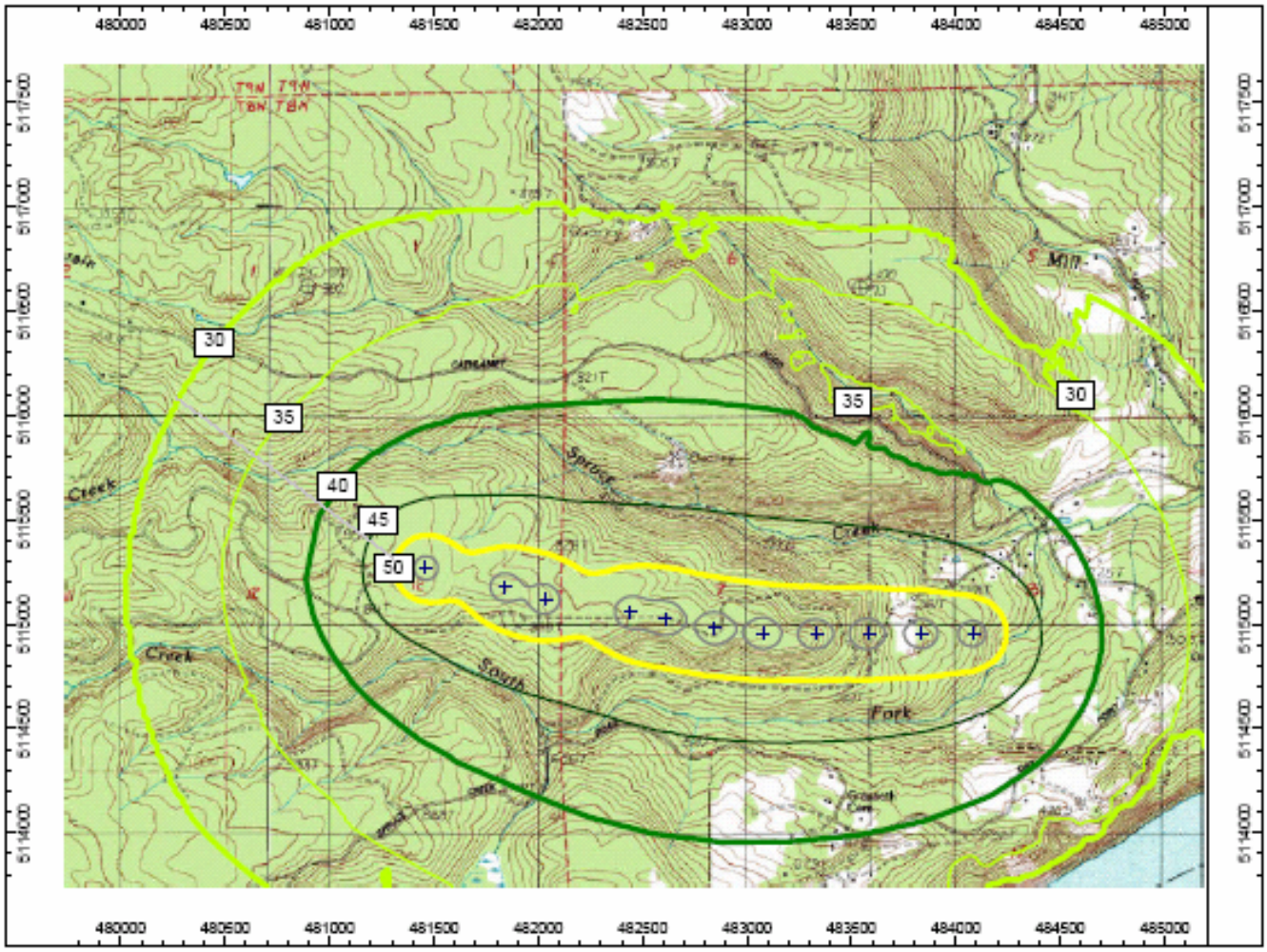
Example

Most if not all turbine manufacturers provide sound power level data determined in accordance with the International Electrotechnical Commission's (IEC) international standards. The IEC method establishes the acoustic reference wind speed of 8 m/s at 10-meter height. Although often misunderstood, this does not require that a measurement be made with 8 m/s winds at a height of 10 meters above the ground. Typically, the measurement is made using a microphone at ground level at a given distance from the turbine base, and then a series of mathematical calculations, defined by the IEC and using the manufacturer's power curve for the turbine, are applied to the results to standardize them for the reference wind speed and location. The purpose of this standardization is to allow comparison of different turbines and different hub heights. The sound power levels are then used to predict overall project sound emission levels. Commercial sound emission modeling software utilizes a variety of national and international algorithms (sound propagation standards, for example ISO 9613-2) with varying degrees of sophistication.

One representative example of such a model, as applied to a development project, appears on the next page. This example uses 1.5-MW machines (generic) on 80-meter towers spaced 220 meters apart (or more). The rings around the turbines represent sound level iso contour lines in decibels, and the scale along the side of the drawing is in meters.

While such computer models are useful, and often reflect conservative assumptions, they may not be able to account for all of the nuances of particular situations. For example:

- They may not take into account differences in upwind and downwind propagation; rather, some form of downwind propagation in all directions may be presumed.



Example results from sound contour line model.

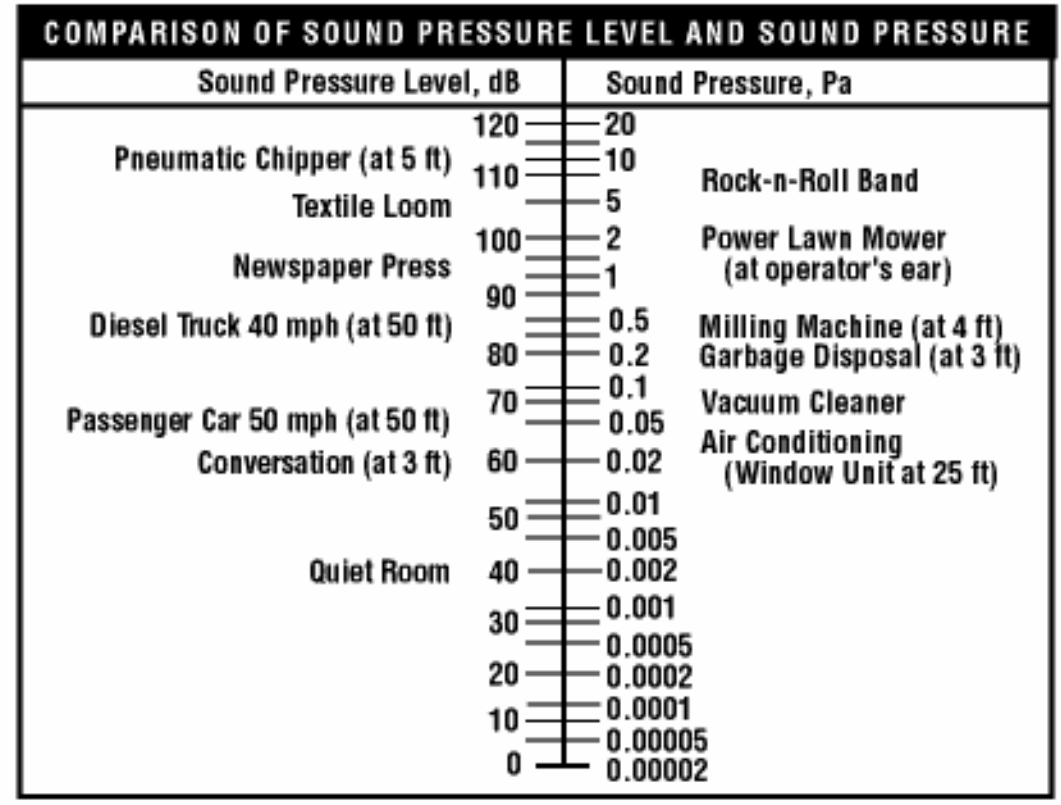
- They may or may not be programmed to take into account the relative elevation difference between the turbine and a particular sound receptor. This would affect the straight-line distance between those two points over which sound is assumed by the model to travel.
- Models will typically not predict the sound levels created by the wind itself, which often has a masking effect. For this, it is necessary to measure the background sounds at a particular location with the proper equipment, typically prior to installation of the turbine or turbines. The relative increase in sound from the project may be as important, or more important, than the absolute sound levels of the project itself.
- Attention should also be paid, and appropriate comparisons made, to other sound-emitting uses permitted under an

ordinance, to ensure that wind turbines are not being singled out on this basis.

- There are many other factors that may need to be taken into consideration to thoroughly assess sound impacts from wind turbines.

Therefore, it is important to have an experienced acoustical consultant evaluate projected sound emissions from each proposed wind farm site and help develop appropriate sound mitigation measures when necessary. Applicable environmental impact review and local land use laws often require that such studies be conducted.

While human perception of sound levels is substantially subjective, it is possible to accurately compare various sound levels with commonly experienced sounds.



Source: Canadian Centre for Occupational Health and Safety.

Finally, it is important not to overlook the subjective nature of noise. Each individual may have a different sensitivity to various types of noise. In some situations, those who are opposed to or not part of the wind project may be more annoyed by the same sound than those who are in favor of, or directly involved in the project.

Ultimately, local planning or zoning approvals for a wind farm usually require acceptance by local officials of the sound levels from turbines at certain receptors (*Section 4.3*). Many communities have specific noise limits at property boundaries in the nuisance provisions of their local ordinances. It is important to work with a qualified acoustical consultant to demonstrate that the project will meet any required sound levels. Alternatively, if a combination of mitigation measures such as those discussed below is not sufficient to meet noise limits at specific sites, then a zoning variance or special approval might be negotiated with local officials, typically involving some form of compensation for affected neighbors.

Models will typically not predict the sound levels created by the wind itself, which often has a masking effect. For this, it is necessary to measure the background sounds at a particular location with the proper equipment, typically prior to installation of the turbine or turbines. The relative increase in sound from the project may be as important, or more important, than the absolute sound levels of the project itself.

5.5.2 Mitigation

Although sound impacts at most wind farm sites are anticipated to be minor, depending on the specific location, the following mitigation measures could be considered to help meet any local sound limits and to address the concerns of sensitive nearby receptors.

Sound mitigation techniques to consider:

- ✓ Siting turbines beyond a minimum setback distance to all residential structures (such setbacks may be prescribed by local ordinance or negotiated with local officials).
- ✓ Implementing best management practices for noise abatement during construction, including use of appropriate mufflers and limiting hours of construction.
- ✓ Limiting the cutting/clearing of vegetation surrounding the proposed substation.
- ✓ Adding landscape features to help screen specific receptors.
- ✓ Keeping turbines in good running order throughout the operational life of the project.
- ✓ Notifying landowners of certain construction noise impacts in advance (e.g., if temporary blasting becomes necessary).
- ✓ Pursuing development agreements with neighbors whose residence is located within a certain distance of a project turbine.
- ✓ Implementing a complaint resolution procedure to assure that any complaints regarding construction or operational noise are promptly and adequately investigated and resolved.

5.6 Cultural and Historical Resources

Cultural resources at or near proposed wind farm sites may be archaeological, architectural, or other resources that include, but are not limited to, objects, sites, buildings, structures, and traditional cultural places. In general, archaeological and architectural cultural resources may be related to either the prehistoric (before written records) or the historic (starting with written records) time periods. Traditional cultural places are generally areas that are material to an aspect of cultural

heritage, including natural features that may have cultural associations important to a particular ethnographic or ethnic population.

Cultural resources that meet the criteria for eligibility on the National Register of Historic Places (NRHP) are considered significant and are referred to as historic properties (*Section 4.1.3*).

5.6.1 Impact Analysis

The construction and operation of wind energy projects may interfere directly or indirectly with cultural resources. Some examples of direct impacts on cultural resources include alteration of an archaeological site or an architectural structure due to construction activities, or alteration of locales where traditional cultural activities occur or have occurred due to project construction and operation. Indirect impacts include changes that may occur in or near a significant archaeological site, architectural resource, or traditional cultural place. Examples of potential causes of these indirect impacts can include:

- The location of the project within a significant cultural resource's viewshed.
- The introduction of noise or flicker shadow within a historic property setting.
- The reduction of access to historic properties as a result of project construction and operation.

Any direct or indirect impact that alters a significant cultural resource's location, setting, design, materials, workmanship, feeling, or association may be considered an adverse effect under the laws protecting cultural resources.

When a project is proposed for location near cultural resources, wind developers are usually required to conduct studies to provide information that will allow agencies to understand if the proposed project may affect such resources. Studies in support of Section 106 of the National Historic Protection Act (NHPA) and in support of state-specific requirements should be performed by qualified cultural resources professionals, as defined by federal regulation (36 CFR 61). The local State Historic Preservation Officers (SHPOs) sometimes maintain lists of qualified professionals who conduct such cultural studies within the area of the proposed project. The regulatory framework for cultural and historical resources is summarized in *Section 4.1.3*.

If historic properties are located within the project's area of potential effects (APE) (i.e., the geographic area within which a project may cause physical, visual, or audible effects on the character or use of historic properties), the wind developer may want to identify them early in the siting process and/or develop a plan that outlines steps to mitigate any potential adverse effects. The geographic extent of the APE can vary from state to state and project to project. Developers should consult with the SHPO and relevant permitting agencies to establish a project specific APE for cultural impact analysis.

The geographic extent of the APE can vary from state to state and project to project. Developers should consult with the SHPO and relevant permitting agencies to establish a project specific APE for cultural impact analysis.

In the early planning stages, a wind developer should consult available information to ascertain whether a potential project area may contain significant cultural resources. For purposes of this background review, the wind developer may choose to assess an area larger than the actual area defined for the project itself.

Wind developers can take the following steps to address cultural resources:

- Review NRHP list to determine if the project area contains NRHP-listed cultural resources, including sites classified as Historic Districts and/or National Historic Landmarks.
- Review archaeological site files maintained by the relevant SHPO, State Archaeologist, or other relevant state office, to view the number and types of previously recorded sites that are known within the project area. In some states, these sites are not available for review by the general public but are made accessible only to cultural resources professionals.
- Review architectural site files maintained by the relevant SHPO to determine the number and distribution of structures previously inventoried and recommended as potentially eligible to the NRHP.
- Review historic cartographic sources and compare these to current property maps of the project area to assess the number of structures currently located within the project area that may date back 50 years or more or to estimate the number of potential historic period archaeological sites that may be present within the project area.
- Review histories of the local areas in the vicinity of the project to identify significant events, famous individuals or groups,

special technological achievements, etc., which may suggest the potential for associated cultural resources of significance.

- Review maps of the project area to ascertain the presence of federally owned, state-owned, or Native American federal reservation property with the potential to contain significant cultural resources.
- Develop a site sensitivity model using appropriate region-specific variables to assess the potential for various sub-areas within the project area to contain cultural resources that may be potentially eligible as historic properties.
- Prior to implementing studies, identify any potential regulating drivers and/or required permits (*Section 4.1.3*).
- Consult with the SHPO and other reviewing agencies to identify any potentially significant sites and to understand required or acceptable field strategies prior to implementing studies of the project area.
- Perform archaeological field studies, architectural historical inventories, and other data gathering (possibly involving interviews with local tribes or other ethnic groups) to identify potentially NRHP-eligible cultural resources located within the project area.

Through such review of available information and subsequent identification, testing, and evaluation studies, the wind developer can determine the cultural resources that may be present within a proposed project area.

5.6.2 Mitigation

If potentially significant cultural resources are identified early in the site layout process, a wind developer can consider minor redesign of project elements to avoid or minimize adverse impacts.

If potentially significant cultural resources are identified early in the site layout process, a wind developer can consider minor redesign of project elements to avoid or minimize adverse impacts. If potentially significant resources cannot be avoided by the project, a wind developer should consult with the SHPO, other reviewing agencies, and any relevant Native American tribes or other appropriate local cultural organizations to provide an assessment of the impact on such resources and to develop appropriate mitigation for the project's adverse effects. If NHPA Section 106 applies to the project, a wind developer should follow the process outlined at 36 CFR 800 (*Section 4.1.3*). If state regulations and guidelines apply, a wind developer should follow SHPO or other state agency guidance to fully

identify, test, and evaluate potential impacts, thereby determining how to avoid or mitigate impacts.

5.7 Socioeconomics

Understanding the socioeconomic conditions of the community in which a project is proposed is important to the facility siting process. To understand the effect that a wind project would have on socioeconomic conditions, it is essential to understand the demographics (e.g., labor force, population, and housing) and economy (e.g., employment rates and opportunities, municipal budgets and taxes, and local school budgets and taxes) of the community and region. In addition, local residents may express concern over the unknown impact to local property values as a result of proposed wind power projects, while other residents may be concerned about tourism.

Example

The African nation of Eritrea is working with scientists at the Lawrence Berkeley National Laboratory to reach a goal of producing 50% of its electricity from wind energy. The nation's wind energy initiative has the potential to pay for itself in 5 years, as Eritrea creates revenue by producing an internal energy source and reducing its dependence on foreign oil. Eritrea has a population of 4.5 million and an average annual income of $250 per person.

5.7.1 Impact Analysis

The construction and operation of a wind farm can have socioeconomic impacts on a region or community. The extent of the potential impacts depends on the location and the size of project with respect to the local economy and industry. This section focuses on potential impacts of a wind project to the local economy and property values.

5.7.1.1 Local Economy

A wind project typically has a mixture of construction workers and operation and maintenance workers. Most wind farm projects tend to be located in rural and semi-rural areas, which may be more significantly impacted by the additional inhabitants than urban areas that typically have the capacity to accommodate this type of increase to the population. For wind farm projects in rural areas, the influx of non-local labor may put pressure on the local community to provide additional services and may impact short-term housing availability. These impacts are usually minimized because wind farm project construction lasts only an average of six months to one year, and local personnel can frequently fill ongoing operations and maintenance jobs. For projects located in remote areas, the project developer may need to provide temporary or permanent housing for construction workers. Typically, long-term housing for permanent employees does not present a problem because the permanent project staff is smaller than the construction workforce.

A wind project may increase the workload for police, fire, medical, and other similar services. Although major events such as fires (e.g., grass fires) are rare in the construction and operation of a wind project, industrial accidents may happen and therefore warrant development of

emergency response plans. Wind developers may work with local and surrounding communities to educate and train local emergency response staff to handle potential events and to implement mitigation measures as necessary.

Construction personnel trenching for an underground collector cable. Photo courtesy of PPM Energy.

A wind project also will increase the temporary need for construction vehicles and equipment. This can create impacts on local communities, with a greater effect in rural areas, where availability of these vehicles may be limited, than in urban areas. Advanced planning by the wind farm developer should alleviate this problem. Construction equipment may be procured and transported from other areas.

Any road development or widening and paving would result in permanent infrastructure changes to the local community, which are generally, but not always, viewed as positive. For example, paving a dirt road would allow for future development, and widening a road may make general travel along the road safer. However, some people living along an access road may not want the road paved and widened, fearing a general increase in traffic and traffic speed, and eventually more development. These concerns regarding traffic are usually addressed in a traffic study, completed as a part of the project development process, with the developer offering mitigation measures if necessary. *Section 5.10* provides more information regarding traffic and transportation.

Studies have been conducted over the past few years to analyze the economic impacts of wind facilities. The Renewable Northwest Project (RNP) conducted a study on the 24-MW Klondike Wind Project in Sherman County, Oregon. The study examined the economic impact on a rural community resulting from construction and operation of a wind farm. The study examined local business activity, employment, landowner revenue, and tax revenue for the county. This study reported that the benefits of the wind project were widespread throughout the county and the surrounding region. The study concluded that "employment from development, construction, and operations stimulated regional businesses and continue to provide personal income in the county. Sherman County as a whole receives substantial

tax revenues, while individual farmers receive additional income from royalty payments while continuing farming operations."

Another study initiated by NWCC found similar results. This study involved three wind energy projects, ranging in size from 25 MW to 107 MW (the Lake Benton I Project in Minnesota, the Vansycle Wind Project in Oregon, and the Delaware Mountain Project in Texas) The study found in all three cases a modest to moderate boost in economic activity attributed to the construction phase. All of the case study areas also benefited economically from continuing operation and maintenance activities, dependent on the size of the wind development, previous wind developments, and planned future wind developments. Additionally, the study found that the annual revenue from royalty payments received by households was a significant source of income and had a significant total effect on the local economies.

To help assess local impacts on the economy from a proposed wind farm, the Job and Economic Development Impact (JEDI) or Regional Input-Output (RIMS) models can be used to analyze the economic impacts of construction and operation. Users enter basic information about a wind project (e.g., state location, year of construction, size of the facility) to determine project cost (i.e., specific expenditures) and the income (i.e., wages and salary), economic activity, and number of jobs that will accrue to the state or local region from the project.

Research has shown that tourism due to wind power can be promoted in certain areas, thereby impacting the local economy. Some wind developers and local communities are incorporating tourism with wind projects through such means as offering daily tours and constructing observation areas and informational kiosks. In Atlantic City, the Atlantic County Utility Authority (ACUA) hopes to establish a user-friendly control room at a wind farm offering a number of video displays for visitors. In addition, eco-tourism of wind farms is becoming popular. For example, Windmill Tours in Palm Springs, California offers daily tours marketed as the "Ultimate Power Trip" in which tour guides discuss the international history of wind energy, current utilization of wind power, and the future of electric industry.

Example

ACUA Wind Farm offers a Live Web Cam on its website with real time video of the wind turbines.

5.7.1.2 Property Values

Individuals faced with a new wind development near their property may question its effect on their real estate value. This issue has come up during the siting and review of wind power projects throughout the nation. There is currently limited documentation on the impact of wind turbines on property values. It is difficult to quantify the impact of wind projects on property values due to the variables that affect property

values other than wind turbines. No study identified by AWEA concludes that projects negatively impact property values.

Variables that can affect property values in the vicinity of a wind farm include proximity to the wind farm, size of the wind farm, and type of community, such as farming communities or communities that are based on scenic natural assets such as ridgelines, shorelines, and unique/sensitive habitats.

The Renewable Energy Policy Project (REPP) conducted a quantitative study of property values in 2003 based on examination of over 25,000 property transactions. The REPP evaluated residential property values at 10 wind power projects (10 MW and larger) throughout the nation built between 1998 and 2001. For this study, data were gathered within 5 miles of the wind projects, which was determined to be the potential area of visual impact. In general, the REPP report concluded that commercial-scale wind turbines do not appear to harm "viewshed" property values. Specifically, the report found that for the majority of projects the property values increased more quickly in the viewshed than in the surrounding community.

ECONorthwest (2002) conducted another study for Kittitas County, Washington, located just north of Yakima County. The purpose of this study was to analyze and help quantify impacts in three key areas of interest: property values, economic impacts, and tax revenues. The study found that views of wind turbines would not negatively impact property values, wind plant construction would have significant economic benefits, wind plant operation would provide additional annual economic benefits, property tax revenues would increase, and tax revenues to the county would also increase.

As wind farms become more familiar to the general population, the proximity of wind farms may not be a major factor affecting property values. Nevertheless, concerns regarding property values should not be underestimated or dismissed. Public outreach can be a critical component in identifying the potential socioeconomic impact of the wind project and addressing the concerns of the local community (*Chapter 7*).

5.7.2 Mitigation

5.7.2.1 Local Economy

Socioeconomic impacts are difficult to assess, as they will vary by community and region. Therefore, the developer and local surrounding communities should work together and come to agreements on project specific mitigation for each proposed wind project. It is important that the nature and extent of socioeconomic

The developer and local surrounding communities should work together and come to agreements on project specific mitigation for each proposed wind project.

impacts be understood locally. Researching and developing information on the type and extent of such potential impacts would assist the wind developer to develop appropriate mitigation measures to incorporate in the local permitting process. In most cases, developers can reach out to the local community early in the process to discuss mitigation measures.

The potential for the host community to be compensated in some manner by the developer is often an important factor in reaching agreement with local officials. Virtually all wind project facilities will be subject to property taxes. Alternatively, developers may seek to negotiate an agreement with the local taxing entities, often called a PILOT agreement (*Section 4.3.6*). By establishing a fixed set of payments over a specified period of time, the developer (and the project financers) will be able to better forecast long-term expenses, and the taxing authority will have a guaranteed level of income.

Many factors contribute to changes in the local economy. Employment from development, construction, and operations can stimulate local businesses and provide personal income in the county. Local cities and governments may receive additional tax revenues, while individual landowners may receive additional income from royalty/lease payments. In either case, the community benefits from the increased income.

Agreements between the wind developer and the local community, including police, fire, medical, and other, similar services, not only promote good will, but also establish protocols to handle potential events and maintain the lines of communication between the wind project and the host community.

5.7.2.2 Property Values

Many variables can affect property values in the vicinity of a wind farm, and these must be reviewed on a case-by-case basis. Typically, wind farms do not impact properties in a uniform manner, and the circumstances of each development can be different. Developers should work with individual landowners to discuss mitigation measures, if any, to protect property values and preserve the integrity of the property. Public outreach is a key component in addressing and mitigating any impacts to socioeconomic resources. *Chapter 7* provides more information regarding public outreach.

5.8 Public Health and Safety

Potential risks to public health and safety should be identified and addressed early in the development process. This section describes key health and safety issues and mitigation techniques to be considered.

These risks and associated mitigation techniques may be incorporated into an overall emergency action plan to be used throughout construction and operation by project personnel in coordination with local emergency management officials. This coordination should be initiated early in the development process to ensure a sound emergency action plan to be carried through construction and operation.

Public health and safety risks and associated mitigation techniques may be incorporated into an overall emergency action plan to be used throughout construction and operation by project personnel in coordination with local emergency management officials.

5.8.1 Ice Shedding

Wind turbines can experience periods when the weather conditions will result in ice build-up on the exposed parts of the turbine. In addition, it has been observed that the moving turbine rotor is liable to accrete heavier quantities of ice than the stationary components of the wind turbine. It has also been observed that the rotor ice can break off, and if the rotor is moving, be cast some distance.

Field observations indicate that most ice shedding occurs as temperatures rise and ice thaws from the rotor. A typical scenario is that ice builds up on the rotor and on the wind sensors, which are mounted on the nacelle. Sensor malfunction normally causes automatic turbine shutdown in most modern wind turbines. In this situation, most turbines will restart only when the ice has thawed and fallen from the stationary turbine and the operator has reset the sensors. However, in certain situations the operator will accelerate the process by thawing the sensors and restarting the turbine with ice still on the rotor. This may lead to shedding of ice. Operations staff is more likely to be affected than the public.

Studies have been conducted to try to characterize how ice fragments are shed from the rotor blades. While limited information is available, evidence does suggest that there is a tendency for ice fragments to be dropped off, rather than thrown off, the rotor. Also, ice tends to shed more from the blade tips, and larger pieces of ice debris tend to fragment in flight.

5.8.1.1 Mitigation

Key steps to reduce the risk to the public or operational staff of injury due to ice shedding are provided. This should also be detailed in the facility's emergency action plan.

Possible Mitigation Measures to Reduce Threat of Personal Injury from Ice

- ✓ Design of turbine layout with appropriate setbacks from sensitive receptors and areas of regular public use to minimize risk of ice shedding injury.
- ✓ Education of operational staff about the conditions likely to lead to ice accretion on the turbine, the risk of ice falling from the rotor, and the areas of risk.
- ✓ Use of warning signs alerting anyone in the area of risk.
- ✓ Implementation of special turbine features that prevent ice accretion or operation during periods of ice accretion.
- ✓ Curtailment of operation of turbines during periods of severe ice accretion.

5.8.2 Blade Drop/Throw

During normal operation, wind turbine rotor blades are exposed to centripetal, gravitational, and aerodynamic forces. In the course of each revolution, these forces create a cyclical combination of axial, bending, and torsional stress at each part of the blade. If all or any part of a blade detaches from the rotor, its trajectory will be dependent upon the loading and stress state at the time of failure, and on the type and progression of failure before separation. Acts of vandalism could conceivably damage rotor blades and cause a blade fragment to be thrown, although no such case has been documented. While cases of blade drop/throw have occurred, these incidents are rare and have generally been linked to improper assembly or exceedance of design limits. Today's improved wind turbine design and engineering make the likelihood of such an occurrence extremely remote.

5.8.2.1 Mitigation

Sound engineering design and quality control in the manufacture, construction, and operation of wind turbines are the most appropriate and effective means for reducing the potential for blade throw. Modern turbine braking systems, pitch controls, and other speed controls should prevent exceedance of design limits. Many permitting agencies have also established minimum required setbacks from residences, public roads, and adjacent property lines to provide safety buffers from potential blade throw. In instances where no required setbacks have been established, developers may consider voluntarily incorporating such setbacks into the siting and design phase.

Example

Since its inception in 1974, AWEA has worked to develop wind industry consensus standards in partnership with the U.S. Department of Energy and other organizations that have a stake in the development of wind energy technology.

5.8.3 Fire

During the construction period of a wind farm project, construction activities and personnel could increase the risk for fire hazard. Possible contributors to an increased risk include: increased number of workers in an area, operation of powered machinery, and storage and handling of fuel.

Historically, a small number of fires have been directly or indirectly attributed to operating wind turbines. The suspected causes of such fires include sparks or flames resulting from substandard machine maintenance, improper welding practices, electrical shorts, equipment striking power lines, and lightning. Instances of electromechanical failures in wind turbine generators that resulted in fire have also been documented. For the most part, they have been traced to the electrical systems of the turbines, but mechanical malfunctions such as overheated bearings could conceivably cause a fire. The nacelle of many

turbine generators includes combustible materials such as oil. It is conceivable, though unlikely, that a fire could penetrate the nacelle, allowing burning materials to fall to the ground. Similarly, ground-level equipment or maintenance activities could be a source of ignition.

5.8.3.1 Mitigation

Fire hazards associated with the operation of wind farms can be minimized through a variety of measures that are typically incorporated within modern wind project designs and operating procedures. Probably the single most effective fire hazard avoidance measure is to place electrical wiring between turbines and the project substation underground. Other typical mitigation measures include fire prevention plans, special training programs for local firefighters, regular maintenance and monitoring of equipment, and adherence to proper operation and maintenance procedures. A fire protection and emergency response plan should be provided to all on-site personnel. Strong relationships and communication with local fire departments, many of which are voluntary, should be maintained throughout the operation of the project. Members of the fire department should be educated on the equipment and facility layout and may need access keys to some areas of the project site.

Strong relationships and communication with local fire departments, many of which are voluntary, should be maintained throughout the operation of the project.

5.8.4 Stray Voltage

The grounding of electrical systems results in some current flow through the earth. A small voltage develops at each point where the system is grounded. Stray voltage is measured between two points that can be simultaneously accessed by a person or animal. Stray voltages can arise from unbalanced neutral currents flowing into the earth through ground rods, pipes, or other conducting objects, or from faulty wiring or faulty grounding of conducting objects in a facility. Thus, stray voltage is generally associated with the distribution system that conducts electric power to and from an area.

5.8.4.1 Mitigation

Electric power from a wind turbine project should normally be balanced three-phase power that is fed directly into the electric transmission system. In the balanced three-phase system there should be very little or no unbalanced current to return through the earth. In addition, the power collection and interconnection system should be separate from the distribution system serving the local area, and should not contribute to currents associated with that system. Consequently, stray voltage effects from a wind farm installation would not be anticipated and no mitigation would be required if standard industry practices are followed.

5.8.5 Electromagnetic Fields

Electromagnetic Fields (EMF) emanate from any wire carrying electricity. Members of the general public are routinely exposed to these fields in their everyday lives. Possible effects associated with the electric and magnetic fields from transmission lines (or similar electrical sources) fall into two categories:

- short-term effects that can be perceived and may represent a nuisance
- possible long-term health effects.

The issue of whether there are long-term health effects associated with exposure to fields from transmission lines and other sources has been investigated for several decades. There is little evidence that electric fields cause long-term health effects. Estimates of magnetic-field exposures have been associated with certain health effects in studies of residential and occupational populations. Research in this area is continuing to determine whether such associations might reflect a causal relationship. National and international organizations, such as IEEE, formerly known as the Institute of Electrical and Electronics Engineers, have established public and occupational EMF exposure guidelines on the basis of short-term stimulation effects, rather than long-term health effects. In so doing, these organizations did not find data sufficient to justify the setting of a standard to restrict long-term exposures to electric or magnetic fields. From what is known about short-term effects, EMF levels generally decrease exponentially as one moves away from the electrical wires.

Example

The U.S. Department of Energy prepared a booklet in 2002 on EMF entitled "Questions and Answers: Electric and Magnetic Fields Associated with the Use of Electric Power."

5.8.5.1 Mitigation

The electromagnetic fields produced by the generation and export of electricity from a wind farm do not pose a threat to public health. Typically, electric cabling between wind turbines is buried in the ground, effectively eliminating EMF exposure to the public. Grid connection is normally made at no more than 132 kilovolts (kV), similar to the voltages used by utilities in existing residential distribution networks. In addition, project developers generally design the entire electrical system to adhere to applicable state guidelines and industry standards to minimize EMF exposure from any new overhead transmission lines.

5.8.6 Lightning Strikes

Lightning strike frequency varies depending on location, ranging from the relatively high rate of occurrence in Florida (8 to 16 flashes per sq. km per year), to the near average rate in Texas (1 to 8 flashes per sq.

km per year), to a negligible rate of occurrence on the west coast. Without lightning protection systems, wind towers or blades might attract lightning and pose a threat to nearby persons or dwellings.

5.8.6.1 Mitigation

Protection against lightning strikes is built into the electrical systems of all wind energy projects.

Protection against lightning strikes is built into the electrical systems of all wind energy projects. All wind turbines have a lightning protection system that includes grounding of each tower. The grounding system installed as part of the foundation is also used for lightning protection. These lightning protection systems act to dissipate lightning strokes into the ground. Consequently, a person standing next to a turbine when a lightning strike occurred would be at some risk that a ground potential rise could result in a voltage between the ground and the tower or between two spots on the ground. Project operations workers are probably at highest risk. This risk should be counteracted by safety procedures instructing workers (or others) not to stand near turbines during lightning activity.

A wind project would not increase long-term lightning hazards for residents in the project vicinity. In addition, the electrical system of a wind turbine project is normally completely independent of the residential distribution system in the project vicinity. Therefore, any faults or surges on the project's electrical system due to lightning strike or other causes would not extend to the local distribution system that provides power to residences in the area.

5.9 Communications

Wind projects may impact communications signals in two ways. Wind turbines and their associated transmission lines can generate electromagnetic noise, which can interfere with telecommunications services, or, more commonly, wind turbines create physical obstructions that distort communications signals. The types of communications systems that may be affected include microwave systems, off-air TV broadcast signals, land mobile radio (LMR) operations, and mobile telephone services.

5.9.1 Impact Analysis

5.9.1.1 Microwave and Radar Systems

Microwave telecommunication systems are wireless point-to-point links that communicate between two sites (antennas) and require clear line-of-site conditions between each antenna. Obstructions between transmitters reduce the reliability of the transmission.

A Licensed Microwave Search and Worst Case Fresnel Zone (WCFZ) Analysis can be carried out to identify microwave paths within a project area. The results of this analysis provide a map that shows the location of the microwave paths and the WCFZ around each path. Structures within a WCFZ could obstruct microwave transmission.

Consultation with federal agencies such as the National Telecommunications Information Administration (NTIA) and the National Weather Service is necessary to identify federal government microwave communication systems (*Section 4.1.6*). NTIA maintains a classified database, the Government Master File (GMF), that contains all of the government telecommunications systems. The NTIA notifies federal agencies operating telecommunication systems in areas near wind project sites. This notification method consists of sending site maps and a letter that describes the wind energy project and the turbines to be used, including turbine locations if known. The NTIA distributes the letter to the Interdepartmental Radio Advisory Committee (IRAC), which is made up of government agencies that operate telecommunication or radar systems. These agencies typically include the FAA, the DOD, the Department of Justice, and the Department of Homeland Security. The NTIA normally responds to a consultation request within approximately thirty days. The response either will state that government telecommunications concerns within the project area have not been identified or will identify potential impacts that will have to be addressed in coordination with the relevant federal agencies. However, the IRAC consultation process may not reach all relevant federal entities and does not eliminate the possibility that a federal agency may raise concerns about impacts to radar systems.

Although the FAA receives the NTIA letter, the FAA primarily depends on its FAA Form 7460-1 (*Section 4.1.5*) to analyze air safety issues and any potential degradation or obstruction of communication, navigation, or radar operations, including secondary radar relied upon by the military but operated by the FAA. The FAA has created a Long Range Radar Tool for preliminary radar clearance analyses. Project site coordinates can be entered to determine whether the site is in a no problem area (green zone), a possible problem area (yellow zone) or a definite problem area (red zone). Placement of turbines in yellow or red zones would require further consultation with the FAA and other relevant federal agencies to determine the proper mitigation measures to accommodate their radar and communication requirements.

As described in *Section 4.1.6*, the Long Range Radar Tool allows for a preliminary screening of only Air Defense and Homeland Security long range radar systems. A number of agencies have jurisdiction over other

radar facilities that may be of concern at a particular wind project. Consultants that are familiar with FAA regulations, DOD radar concerns, and other radar systems can conduct screening analyses to examine the potential for interference with federal radar. Consultation with agencies such as the FAA and NTIA early in the development process may also identify potential impacts to radar systems.

5.9.1.2 Off-Air TV Broadcast Signal Distortion

Off-air stations are television broadcasters that transmit signals that can be received from terrestrially located broadcast facilities on a television receiver. Off-air television signals are subject to distortion by the reflections from the turbine blades and by the attenuation of the signal passing through the wind turbines. The reflections may cause multipath distortion and ghosting. Blade motion may cause the contrast and brightness of the signal to vary. These effects apply to Analog modulated television signals and do not affect digital signals in the same way.

The off-air television signal environment will change as of February 2009 when broadcast TV will be required to switch to digital format . This change should lessen the potential for wind projects to impact off-air television signals.

A TV Broadcast Off-Air Reception Analysis can be done prior to development of a project to characterize the baseline signal strength and reception conditions within the project area. The study is used to identify the potential impacts from project development. The extent of the impacts would vary based on factors identified by the study, such as the pre-existing signal strength and the use of cable and satellite television in the area. If this baseline study is performed, problems or changes in signal quality can be compared with the baseline measurements to evaluate whether the wind project may be causing or contributing to reception problems.

5.9.1.3 AM/FM Broadcast Signals

Wind turbines generally do not affect AM/FM radio broadcast signals as they affect microwave and television signals. Radio transmitters are often omni-directional, which means that the signal spreads out in several directions. The spreading prevents a structure such as a wind turbine from obstructing the signal. Wind turbines could obstruct radio signals if located in close proximity to a broadcast antenna.

5.9.1.4 LMR Operations

A LMR system is a collection of portable and stationary radio units designed to communicate with each other over predefined frequencies. LMR operations in the vicinity of wind projects include public safety organizations, such as police departments, fire departments, and medical responders, as well as private sector activities such as construction, building maintenance, and site security. In typical LMR systems, a central dispatch console or base station controls

communications to the disparate handheld or mobile units in the field. These communications are usually between vehicles or people on the move using walking and fixed stations. The range of the communications coverage is extended by using repeaters located on towers and other tall structures.

5.9.2 Mitigation

Identification of communication systems near a wind project can avoid interference with signal transmission. Moving turbines outside of microwave paths and away from antennas would avoid obstructing microwave transmissions and radio broadcasts. The following mitigation measures are available when turbines cannot be moved to accommodate communication systems.

- Adding transmitters and receivers to the communication system
- Installing satellite TV service
- Installing cable television services when available
- Installing directive reception television antenna with amplifier
- Setting up wireless television distribution system for a cluster of homes affected by a wind project
- Repositioning LMR repeaters or adding repeaters to the LMR system

Studies in the United Kingdom and elsewhere show that while wind turbines can cause "clutter" on radars, there are engineering solutions that can be implemented and explored further. For example, the British Wind Energy Association conducted a study in 2003 entitled "Feasibility of Mitigating the Effects of Windfarms on Primary Radar."

Example

5.10 Ground Transportation and Traffic

Ground transportation and traffic impacts associated with wind energy projects typically include impacts on the transportation system itself (e.g., the physical properties of the road system) and impacts on traffic that uses the transportation system. Such impacts arise almost entirely during the construction period.

5.10.1 Transportation Impacts Analysis

The means for transporting the components of a wind energy project to the project site should be determined early in the development process to accurately identify risks, potential impacts, and applicable regulatory requirements. This includes identifying the origin of the components and the most efficient route to the location of the site. Knowing the origin of the components helps to identify an appropriate delivery port (if coming from an international location) as well as the nearest major artery or

Some counties have developed comprehensive transportation and capital improvement plans that should be considered in transportation planning and impact assessment. State and local travel restrictions should also be considered when developing transportation routes for oversize or overweight vehicles.

Interstate highway from which to begin the analysis. The design criteria for Interstate highways and ramps will likely accommodate the type of oversized construction vehicles required for wind projects. With the major access point identified, the focus of the analysis can then be directed to the location of the site. A site location map is necessary to identify the primary access routes to the site, which would receive the greatest impact from construction vehicles. With this basic information, the most logical and direct route for the delivery of equipment can be identified.

A desktop assessment should then be conducted utilizing available GIS, roadway, and other information to identify the network of available state, county, and local roads. This assessment is necessary to determine, at the desktop level, where modifications to existing roadways and intersections may be required and to consider possible alternatives to the delivery route. The physical characteristic assessment should include a review of the general condition of the roadway, roadway widths, horizontal curvature, vertical curves, intersection geometry, drainage structures, height restrictions, load restrictions of existing bridges and culverts, and any locally significant features such as wetlands/waterways, roadside cemeteries, monuments, or historic markers.

After the desktop-level analysis is complete, a site visit is performed to evaluate the anticipated delivery paths during construction. The scope of the visit would include evaluating the condition of the roadway pavement, lateral clearances, vertical clearances, intersecting roadway control, speed limits, posted truck size and weight restrictions, major roadway intersection configurations, primary route selection, determination of alternate or secondary routes, and development of preliminary mitigation measures. The evaluation should include a review of available design and construction drawings for each of the structures along the route; field observations of the condition of each structure; measurement of the wall thickness, height, width, length, and soil cover depth for culverts; and comparison of the proposed loadings with the design loadings for each structure. Where drawings or previous inspection reports are not available for existing bridges, a detailed survey of the bridges should be performed to determine safe load-carrying capacity based on Load Factor Design methods.

5.10.2 Transportation Mitigation

The proposed mitigation of the transportation routes can vary from minor modifications to the existing roadway to major reconstruction, depending on the specific situation. Wherever possible, rerouting

construction traffic to wider, less-restrictive roadways is preferred. Where roadway widths are insufficient, either temporary widening of the roadway with gravel or full depth widening of the pavement structure would be necessary. Efforts also should be made to avoid or minimize impacts to significant features such as wetland/ waterways (including associated culverts) and cultural or historic structures as additional laws and regulations may apply (*Section 4.1.3* and *Section 4.1.4*).

Developers should make efforts to avoid or minimize impacts to significant features such as wetland/ waterways (including associated culverts) and cultural or historic structures when planning transportation routes.

At intersections that cannot accommodate construction vehicles, reconfiguring of intersection geometry with wider, larger turning radii will be required. Utility poles, traffic signs, or other features adjacent to the roadway may need to be relocated. Culverts may need to be extended and drainage swales shifted to accommodate the required geometric modifications. In locations where the roadway profile consists of a sharp vertical curve, reconstruction of the roadway to remove the crest may be required to accommodate construction vehicles. Adjustments to the horizontal or vertical geometry of the roadway should meet design criteria established by the American Association of State Highway and Transportation Officials (AASHTO) in "A Policy on Geometric Design of Highways and Streets."

Where existing drainage structures and cross culverts have insufficient strength or cover to accommodate construction vehicles, additional cover, reinforcement, steel plates, bridge jumpers, or other mitigation measures can be used. These structures can be replaced prior to construction or replaced after construction if damaged. Where existing bridge structures are insufficient to support overweight construction vehicles, the bridge could be reinforced with additional longitudinal or lateral support beams or other components to bring the structure up to standards for the anticipated loading. Some bridge structures may need to be replaced prior to construction or after construction if damaged.

Prior to construction, it is desirable to document the existing roadways on video to verify the pre-construction roadway conditions. Upon completion of the construction activities, road owners typically require that all roadways be returned to their pre-construction conditions and video documented.

5.10.3 Traffic Impacts Analysis

Traffic data for the network of existing roadways must be reviewed to determine the potential traffic impacts that may occur as a result of equipment delivery and construction vehicles entering and exiting the project site during construction. In addition, traffic data should be

analyzed to determine whether alteration of access roads may be necessary for the operation of the project after construction is complete.

In analyzing traffic data, one important measure often used is the "Level of Service." Level of Service is a measure of operational conditions along any given stretch of road. It describes traffic conditions in terms of speed and travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. It is based on a grading system ranging from Level of Service A (free flow) to Level of Service F (forced flow). During construction it is typically anticipated that local traffic may experience minor delays due to the slower-moving equipment delivery and construction vehicles. Determining the existing Level of Service, average daily traffic, and design capacity can assist in the assessment of impacts during construction. Although the impacts on traffic during construction are temporary, the existing Level of Service establishes a baseline condition that helps in determining the degree of mitigation measures required.

Accident data also are important in the analysis of potential impacts. Locations with high accident rates can be identified and targeted for improvement in the mitigation process.

Analysis of the operating conditions of the intersections along the route also is required to determine impacts at these locations. The existing traffic control devices such as yield signs, stop signs, or traffic signal systems need to be assessed for Level of Service. Intersections that are over capacity or are operating poorly will need to be singled out for improvement. Many intersections used by oversized construction vehicles will require radius improvements to accommodate these vehicles. The degree of improvement should be determined on an intersection-by-intersection basis. Some intersections may require only geometric improvements while others will require a combination of geometric improvements and upgraded traffic control devices.

Traffic volume data on state, county, and local roads in and around a proposed wind energy project site should be available from the state or county. Subsequent to the on-site traffic evaluation, a transportation engineer visits the proposed wind energy project site to confirm the analysis. In addition, after completion of the on-site traffic evaluation, the transportation engineer meets with local and state regulatory agencies to begin consultation about the proposed project.

5.10.4 Traffic Mitigation

The primary mitigation measure for traffic-related issues is avoidance. At locations with substandard traffic conditions, congested intersections,

The primary mitigation measure for traffic-related issues is avoidance. Where avoidance is not possible, a traffic management plan should be developed to assure the safe flow of traffic during construction operations.

over-capacity roadways, or roadways with geometric conditions that can create dangerous conditions, construction vehicles should be rerouted wherever possible. Where avoidance is not possible, a traffic management plan (TMP) should be developed to assure the safe flow of traffic during construction operations. The TMP can be reviewed by federal, state, and local officials for informational purposes and to allow comments and input into the plan. It is desirable that TMPs have some built-in flexibility to accommodate unforeseen changes in the work schedule or traffic patterns of construction vehicles. The goal of a TMP is to allow the safe routing of traffic at controlled speeds during construction operations. Specific procedures can be designed to minimize the potential for accidents. For example, all construction vehicles would be directed to drive through a municipality only when children are in school.

A major part of a TMP is provision of proper roadside guide signs. For example, signs that warn about "Oversized Vehicles," "Equipment on Road," "Truck Access," or "Road Crossings" inform the public of the ongoing construction operations. TMPs can also include Arrow Boards, warning lights, flashers, barrels, cones, temporary pavement markings, or other traffic control devices appropriate to assure safe interaction between construction vehicles and the general public. Certain permits must be obtained from state, county, and local officials for the transportation of oversized, overweight, or overlength vehicles. Compliance may include the use of a pilot car, police escort, flaggers, and advanced signs. These measures are used to warn and direct traffic when large equipment is on the roadway. Regardless of what measures are required for the conditions encountered on any specific project, maintenance of at least one lane of traffic open and operational at all times is the optimal situation.

5.11 Solid and Hazardous Wastes

This section describes the potential impacts of solid and hazardous wastes and waste oil during the construction and operation phase of a wind project and identifies mitigation measures to manage wastes and avoid environmental impacts during project construction and operation.

5.11.1 Impact Analysis

Construction Wastes - Wastes generated during the construction of a wind energy facility will be non-hazardous solid wastes such as packing and crating materials. Some wastes with special management and/or disposal requirements, such as oil wastes, may be generated.

Where sites have pre-existing structures, there could be demolition wastes that must be managed appropriately. Examples of demolition-related wastes that may require special handling include asbestos-containing materials, debris coated with lead-based paint, PCB-contaminated materials, oil and other liquids removed from old equipment, and fluorescent light bulbs. Special requirements may apply to construction and demolition debris.

Similar to other construction projects involving earthmoving activities or assembly of industrial structures, construction of a wind energy facility could entail the use of heavy-equipment fuels, gearbox oils, hydraulic fluids, lubricants, cleaning fluids, paints, degreasers and other similar substances. Some of these types of fluids could be considered hazardous wastes regulated by federal and/or state agencies.

Operational Wastes - Operation of the wind energy facility could generate waste fluids that must be properly managed and disposed. Waste fluids could also leak from facility components, triggering clean up and reporting obligations. Release of fluid may trigger a duty to notify government authorities if the spilled amount is in excess of the "reportable quantity" established under federal, state or local laws.

5.11.2 Mitigation

Construction Wastes - All wastes generated during construction must be managed and disposed of in accordance with applicable regulations and permit requirements. Recycling and waste reduction can decrease waste disposal and associated costs.

Construction plans and/or design specifications often include a Waste Management Plan to ensure compliance with applicable requirements. The plan may require the construction contractor to remove all construction-phase wastes upon project completion and to document proper disposal in accordance with the contract, plan, regulations, and any permit requirements.

To minimize the occurrence of spills and to respond quickly and appropriately in the event of a spill, construction plans and/or design specifications also should require a containment and response plan pertaining to fluids and fuels used on site during construction. Such plans may be required by law.

Operational Wastes - Operational wastes associated with routine maintenance, repair, upgrades, and/or decommissioning must be properly handled, stored, transported, and disposed of at a licensed facility that complies with applicable regulations.

Underground or above-ground storage tanks associated with a wind energy facility must be constructed and operated in accordance with applicable regulations, including requirements addressing leaks or discharges, testing, and secondary containment.

Because a wind energy project may be spread over a wide area it may be more efficient to manage non-hazardous wastes at a few centralized service facilities and control centers, except when individual units are being serviced.

Storage of hazardous wastes for extended time periods (e.g., more than 90 days) can trigger additional requirements and permits. Advanced planning to reduce the amount of waste generated and/or stored on-site can often eliminate the need to comply with such requirements.

Regulatory spill programs are typically implemented by state environmental agencies under the authority of the U.S. EPA, and some states have additional programs and requirements. The Oil Program within U.S. EPA's Office of Solid Waste and Emergency Response provides guidance for reporting, preparing for and responding to oil spills. If sufficient oil is stored on-site, the SPCC Rule may require development of an SPCC Plan. SPCC Plans ensure that facilities put in place containment and other countermeasures to prevent oil spills. Amendments proposed to the SPCC rule in October 2007 include specific provisions applicable to wind energy facilities. Developers using this handbook should confirm the status of the proposed amendments prior to preparing an SPCC Plan.

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The following list contains examples of other mitigation approaches or best management practices to reduce the potential of and liability from spills and releases.

Management Practices to Prevent and/or Minimize the Consequences of Hazardous Material Spills

- ✓ Developing and implementing a Hazardous Materials Management Plan, which establishes standard procedures for reporting, handling, disposal, and cleanup of hazardous material spills and releases
- ✓ Designing engineering controls such as catch basins into turbine foundations or transformer pads
- ✓ Installing oil pans to catch oil leaks
- ✓ Using bio-degradable lubricants
- ✓ Using non-hazardous fluids wherever feasible
- ✓ Performing off-site maintenance and repair of turbine components and vehicles

5.12 Air Quality and Climate Impacts

Wind energy benefits the local ambient air quality and long-term health of the atmosphere because it produces electricity without emitting pollutants. Unlike conventional fossil fuel-fired electric power plants, no pollutant emissions are associated with wind power generation. To the extent that electricity produced by wind energy displaces electricity produced by fossil fuel-fired power plants, pollutant emissions are reduced and air quality is improved.

Pollutants that may be reduced from this energy displacement include "criteria pollutants" regulated by the Clean Air Act, such as nitrogen oxides, sulfur dioxide, carbon monoxide, particulate matter, and volatile organic carbon, as well as "non-criteria pollutants," such as hazardous air pollutants (HAPs) including metals and other toxic compounds. In addition, unlike fossil fuel-fired energy generation, wind power does not result in greenhouse gas emissions (such as carbon dioxide), generally considered the major factor in global warming. Wind energy developers should emphasize the zero carbon dioxide emissions, particularly in light of the creation of regional and state cap-and-trade systems for carbon dioxide such as the Regional Greenhouse Gas Initiative and California's Global Warming Solutions Act of 2006, as well as multiple bills in the U.S. Congress to create a federal cap-and-trade system. Wind energy projects can calculate the extent of such pollutant and greenhouse gas emission displacement using average emissions data for the power generators in the region. Such estimates should consider the fuel mix (coal, natural gas, oil, nuclear, etc.) and the power generators that normally supply the electricity to be displaced by the wind farm project or use the dispatch model to identify which units would likely be supplanted.

Wind energy developers should emphasize the zero carbon dioxide emissions, particularly in light of the creation of regional and state cap-and-trade systems for carbon dioxide such as the Regional Greenhouse Gas Initiative and California's Global Warming Solutions Act of 2006, as well as multiple bills in the U.S. Congress to create a federal cap-and-trade system.

The only air pollutants generated as a result of a wind energy facility occurs during construction of the facility. The primary pollutant generated is particulate matter (PM), which may occur from excavation activities and fugitive wind-blown dirt/dust. Pollutants (NOx, CO, VOCs, SO2, PM) are also emitted in the engine exhaust of the construction equipment. However, because all of these emissions are associated only with construction, they are temporary in nature.

These construction emissions are not typically regulated on the project level other than to be quantified if an EA or EIS is required for the project and included in mitigation measures. However, many states do have nuisance regulations for dust, visible emissions, and odors. Mitigation usually entails minimization of disturbed surface area and possible use

of watering or other dust suppressant to reduce fugitive dust. Construction equipment engines must be manufactured in accordance with non-road engine emission standards, and the equipment should be operated in accordance with the manufacturer's recommended procedures.

Construction-related PM emissions can be estimated by multiplying the EPA emission factor by the amount of area being excavated. While potential project emissions probably will not exceed any air quality permitting thresholds, local concerns may require a wind energy developer to implement dust mitigation measures. These measures may include dust suppression or temporary suspension of excavation activities during high wind conditions. Any special project requirements can be addressed during the siting and/or permitting process.

CHAPTER 6

ASTM Environmental Site Assessment (ESA)

6.1 Purpose of Environmental Screening and Site Assessments

Even if a proposed site appears relatively pristine (e.g., agricultural or vegetated lands), there may be historical contamination of soil, surface water, and groundwater from prior uses such as application of pesticides, polychlorinated biphenyls (PCBs) from transformers, leaking oil tanks, or illegal dumping. Additionally, wind developers are increasingly exploring opportunities to construct wind energy projects on or near previously industrialized properties. Such sites may be impacted by environmental contamination due to prior industrial practices.

Federal and state laws may hold a landowner or operator of a wind project liable for the costs to remediate environmental contamination – regardless of culpability. These cleanup costs can exceed the cost of the property or the value of the investment, and can attach to anyone in the chain of title (unless a liability exemption applies). Even as a lease holder, wind project developers could be held liable for pre-existing contamination on the property leased in certain scenarios, particularly if their construction or operation activities contribute to, or exacerbate, existing conditions.

Federal and state laws may hold a landowner or operator of a wind project liable for the costs to remediate environmental contamination – regardless of culpability. For protection against such liability, a developer may choose to perform a screening level assessment and/or an environmental site assessment prior to acquisition of the property to identify any pre-existing environmental contamination.

For protection against such liability, a developer may choose to perform a screening level assessment and/or an environmental site assessment prior to acquisition of the property to identify any pre-existing environmental contamination. Also, if the project is being financed, such assessments are almost always required by the lender or investors. Lenders are particularly sensitive to liability associated with environmental contamination and typically require a minimum level of assessment prior to providing financing.

In addition to minimizing liability, there is a practical value to understanding the environmental conditions at a site. For example:

- If questionable areas are identified, a developer may be able to eliminate them from the property to be acquired or to include provisions in the acquisition agreement that allocate costs and responsibility for cleanup.

- The project can be designed so as to avoid disturbing contaminated areas, reducing the risk of exacerbating the problem or causing harm to the environment, workers, or the public.
- If environmental conditions cannot be avoided during construction, best management practices can be implemented to eliminate or reduce exposure risks, and, if necessary, mitigation measures can be implemented.
- Proper planning and realistic schedules should minimize the possibility of costly delays due to discovery of unrecognized environmental conditions during construction.

6.2 Screening Level Assessments

As developers begin to piece together the parcels that will comprise the project site, they typically perform a screening-level assessment of the potential for environmental contamination to impact each of the properties that will comprise the final site for development.

An example of such a screening tool is American Society for Testing and Materials (ASTM) International Standard E 1528-06, "Practice for Environmental Site Assessments: Transaction Screen Process." This type of limited inquiry is a useful tool for identifying potential risks and can be performed at minimal cost. The screening process consists of a questionnaire designed to establish whether there are historical uses which raise the possibility of environmental conditions existing on the property.

As the developer gets closer to acquiring the property, a more detailed environmental site assessment should be considered in compliance with specific regulatory standards to minimize liability for pre-existing contamination and to satisfy any financing requirements.

Several major federal statues impose liability with respect to contaminated lands and waters, including the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), and the Oil Pollution Act (OPA).

Example

6.3 Phase I Environmental Site Assessment

To minimize liability under federal or state law, or if the results of the screening tool mentioned above demonstrate a need to do so, the developer may consider performing a Phase I Environmental Site Assessment consistent with ASTM Standard E 1527-05 - "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process."

The ASTM Phase I ESA standard is a voluntary, non-intrusive investigation into historical uses of the site and visible evidence of environmental conditions based on publicly available records and sources of information.

The ASTM Phase I Environmental Site Assessment (ESA) standard is a voluntary, non-intrusive investigation into historical uses of the site and visible evidence of environmental conditions based on publicly available records and sources of information. A Phase I ESA involves no physical testing of environmental media at the site. Generally, it consists of a site inspection, interviews of the site owner(s), review of available documents and databases (including prior ESA reports), and some consideration of potential impacts from adjacent properties. ASTM Phase I ESAs must be performed by an Environmental Professional meeting the qualifications of the ASTM standard.

The objective of the ASTM Phase I ESA is to determine if an actual or potential "recognized environmental condition" (REC) exists at the property. A REC is the (non-de minimis) presence or likely presence of any hazardous substances or petroleum on a property under conditions that indicate an existing release, a past release, or a material threat of release has occurred. Such release may be into the structures on the property, onto the ground or into the groundwater or surface water of the property. A REC may even involve events or circumstances that were in compliance with then-current laws. Any report meeting the ASTM Phase I standard will contain the opinion of the assessor as to whether there is evidence of a REC at the site.

The ASTM Phase I ESA standard satisfies a federal regulation to perform "all appropriate inquiries" (AAI) into the prior ownership and use of a property to be eligible for certain defenses from liability. Even if a developer makes a business decision not to perform a detailed site assessment prior to property acquisition, such an assessment will typically be required by lenders prior to financing. *Section 6.6* provides a more detailed discussion of issues relating to liability for contaminated property.

Also, the scope of the ASTM Phase I ESA is limited. It does not, for example, address matters such as whether a site complies with applicable environmental or health and safety laws, nor does it cover whether asbestos or lead paint may exist in older buildings, establish whether radon may exist at the property, whether there are wetlands within the site boundaries that may affect where structures can be placed, whether there are ecological resources or endangered species which could affect site approvals and development objectives, or the presence of mycotoxins (molds). If a developer wishes to have these non-scope items included in a Phase I site assessment, the developer must specifically contract with the consultant performing such work to include these elements.

The scope of the ASTM Phase I ESA is limited. If a developer wishes to have non-scope items included in a Phase I site assessment, the developer must specifically contract with the consultant performing such work to include these elements.

6.4 Phase II Environmental Site Assessments

If the non-intrusive Phase I ESA establishes that there is an actual or potential REC at the site, in order to be eligible for defenses from liability, the developer must continue the inquiry, using additional methods to confirm the existence of the REC and to evaluate the potential impacts for the transaction. Such additional investigations are typically known as "Phase II ESAs" and typically include intrusive sampling and analysis of environmental media (e.g., groundwater, surface water, sediments, air). The scope of Phase II ESAs, the analytical methods to use, what they might cost, and who bears the cost for such investigations are driven by site-specific and transaction-specific considerations which go beyond the scope of this handbook. ASTM has a Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process (ASTM Designation E 1903).

Waste management issues and potential contaminant types that can be associated with rural areas or other locations typical for wind energy development:

- ✓ Landfills and open dumping sites, including "social dumps," uncontrolled or unpermitted landfills, construction and demolition debris disposal areas, and illegal waste storage and disposal sites
- ✓ Agricultural and ranching-related uses (e.g., pesticide mixing and storage sites, livestock dip vats and pesticide applicator sites, and herbicide/insecticide application areas)
- ✓ Commercial properties associated with service industries (e.g., service stations and fuel distributors, underground storage tanks, above-ground storage tanks, vehicle/equipment maintenance and repair shops, and salvage yards)
- ✓ Food and animal feed processing plants
- ✓ Manufacturing (especially light industry)
- ✓ Mining areas (metal, coal, and industrial mineral mines where issues such as subsidence from underground workings, tailings, waste rock dumps, mill and smelter wastes, and acid mine discharge can occur)
- ✓ Oil and gas fields and oil and gas transmission and processing facilities
- ✓ Military land uses (e.g., munitions and explosives of concern)
- ✓ Electrical transmission and distribution infrastructure (e.g., PCB transformers or former transformer sites)
- ✓ Wood preservative treatment sites and sawmills

6.5 Contracting for Environmental Site Assessments

When commissioning an ESA, it is important to pay attention to contracting considerations and to discuss the developer's objectives for the ESA with the consultant. The consultant that will perform the ESA can provide essential scoping advice to the developer, including whether to include additional items beyond the scope of the ASTM Phase I standard. Also, provision for site access will need to be made if the property being assessed is not owned or under lease agreement by the developer. Timing considerations can be crucial in obtaining and reviewing government documents or securing permission to conduct site assessments and interviews.

The consultant should be asked to confirm that it has an assessor who meets the requirements of an Environmental Professional (as defined in the ASTM Phase I standard) to oversee the assessment process. These requirements relate to education, training, certification or licensing, and experience.

Further, the ASTM Phase I standard specifies certain tasks that are "user responsibilities," including conducting a review of title and judicial records relating to liens and recorded use limitations, as well as information relating to adjustments to the purchase price due to contamination and specialized knowledge of the user. These should be discussed with the ESA consultant and a decision made as to whether other professionals supporting the project development are covering these tasks.

Whoever commissions the ESA should also carefully consider any limitations a consultant may impose on who may use or rely on the report and explicitly provide for reliance by investors, lenders or others, if necessary. This may be discussed in the Phase I report itself, or, if the report has been prepared before the entities who may rely on it are fully known, it can be identified through a "reliance letter" signed by the consultant and consenting to reliance by third parties to whom the report was not originally directed.

Finally, the standard terms and conditions of the consultant should be carefully reviewed so that any limitations on liability and insurance coverage is ascertained and acceptable to the user of the ESA.

6.6 CERCLA – Satisfying the Requirement for Conducting "All Appropriate Inquiries"

Persons conducting "all appropriate inquiry" are not entitled to the CERCLA liability protections unless they also comply with additional continuing obligations established under the statute. Legal counsel should be consulted for a more detailed understanding of these requirements.

The Comprehensive Environmental Response, Compensation, and Liability Act (42 USC §§ 9601 to 9675), more commonly known as CERCLA or Superfund, is the principal federal statute that governs liability with respect to contaminated properties. In general, CERCLA imposes strict, joint, and several liability for costs incurred in responding to the release of hazardous substances. It imposes liability on current owners and operators, owners and operators at the time of disposal or release, those who arranged for disposal or treatment of the substance released, and transporters of the substance released. Many, but not all, states follow the federal Superfund law for their state programs, and some states impose such liability on anyone in the chain of title. State laws applicable to the state in which the project will be sited and developed should be reviewed.

In legal terms, "strict liability" means liability imposed even in the absence of fault. The terms "owner" and "operator" are not well defined by the statute. In general, the courts have construed these terms broadly, finding liable not only active owners or operators of a site, but also owners having less direct involvement with sites, such as absentee

owners, and trustees of a trust owning a site. Courts have also considered lessees to be liable where they are actively involved in supervision or management of a site and those activities result in impacts to the site.

Under certain circumstances, parties may be eligible for one of several defenses to liability under CERCLA. The defenses most likely to be applicable to the developer of a wind project are those available to "innocent landowners," "bona fide prospective purchasers" and "contiguous property owners."

- An *innocent landowner* is one who buys a property and despite having conducted all appropriate inquiry into the current and historical uses of the property, acquires the property on which an environmental condition is subsequently discovered. In other words, the owner acquired title to the property not knowing about the environmental condition.
- A *bona fide prospective purchaser* is one who buys property after conducting all appropriate inquiry into the current and historical uses of the property knowing that there are environmental conditions present on the property.
- A *contiguous property owner* is one who owns property that is contiguous to, and may be impacted by, hazardous substances migrating from property they do not own.

In any of these cases, federal law provides an exemption to the liability that would normally pass to the owner with title, if certain statutory requirements are met. The most significant of these requirements is that the buyer conducted "all appropriate inquiry" ("AAI") into the current and former uses of the property.

The United States Environmental Protection Agency (EPA) promulgated standards for conducting all appropriate inquiries in a rulemaking effective November 1, 2006. EPA specifically recognizes the 2005 version of ASTM International Standard E 1527-05 as meeting the requirements of AAI. Some developers may be familiar with prior iterations or variations of the above ASTM standard. Although using other standards may be satisfactory for certain business purposes, ASTM E 1527-05 is the only standard that EPA has determined to be consistent with its regulations and compliant with the statutory criteria for all appropriate inquiries.

It is important to recognize that not every state Superfund law counterpart recognizes these defenses. Moreover, a number of states

have adopted "environmental transfer acts" that specifically regulate the disclosures a seller is required to make to buyers of real property, and some of these laws require certification to the state regulators regarding the condition of the property. A developer should ask its counsel to investigate these requirements as part of the site assessment and property transfer process.

Certain components of the report must be completed less than 180 days prior to the date of property acquisition. If reports are older than one year, updating may be necessary to document conditions that may have changed since the site assessment was conducted. If the report was prepared more than a year prior to transfer of title, a new report may be required.

Developers should consult with legal counsel to ensure compliance with applicable standards for conducting environmental site assessment and to ensure that appropriate steps are taken to minimize liability.

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CHAPTER 7

Public Outreach

The public acceptability of a wind project can often be a critical component of the success of wind development in the site area. Some important considerations include:

- Apparent disposition of local citizens and officials
- State or local renewable energy policy statements or goals
- Local economic climate
- Residential density
- Compatibility of surrounding land uses
- Proximity to recreational and tourism uses
- Proximity to important viewsheds, historical sites, or other culturally sensitive locations
- Proximity to rare, threatened, or endangered wildlife

After identifying the considerations most relevant to a particular community, the developer may prepare an outreach plan to address community concerns and build project support.

After identifying the considerations most relevant to a particular community, the developer may prepare an outreach plan to address community concerns and build project support. It is important to communicate the potential benefits of the project to the local community and larger region, such as economic and environmental benefits, and improved homeland security. It is also critical to understand and address a community's concerns, which often include impacts on the viewshed and property values, potential for noise or shadow flicker, and avian/bat mortality. The developer should plan for adequate public relations efforts throughout the development process.

Sheep grazing near the Shiloh Wind Project in Solano County, California. Photo courtesy of PPM Energy.

7.1 Planning Public Outreach

Planning public outreach is a crucial aspect of the siting process and should be commenced in the initial planning stages. To the extent members of the public

have concerns about a wind project, those concerns usually focus on one or more environmental or land use issues. This section discusses the role of the developer in communicating with various audiences, how to convey a message, and when and where to conduct public outreach activities.

"Know your audience" is the key to any phase of siting and permitting. Whether the developer is facing a regulator, a neighborhood, or the media, it is important to communicate effectively with those interested in the project. The most successful wind energy projects are those in which all stakeholders feel a sense of ownership and empowerment. The challenge is to promote this inclusiveness to gain allies without losing control over the process and the developer's message. During the siting process, the developer will get to know the local, regional, and state political issues and players. The developer may pick a spokesperson who is knowledgeable about the details of the proposed project and who will be available to answer questions.

Some developers find it helpful to consult with a public relations specialist to create a public outreach plan and schedule. Factors to be weighed in deciding whether or not to hire such a consultant include the location, complexity, and schedule of the proposed project, as well as any particular concerns about wind energy projects or positions held by regulators and permitting authorities, the community, abutters, and the media.

Wind turbine at the Red Canyon wind energy facility in Texas. Photo courtesy of FPL Energy.

Where possible, the developer should forge positive relationships with government officials. Public officials usually want to know about proposed developments before the general public. Public officials often can alert the developer to more obscure obstacles or concerns that might be addressed before the project is announced. Minor project adjustments may be made in response to concerns voiced by public officials. Although officials may not agree with every aspect of the project, gaining their respect through proactive communication is worthwhile.

The developer should explain how the project will promote the positive impacts of wind power, such as energy generation with no air or water pollution, utilization of domestic sources of energy rather than reliance on foreign imports, increased energy security and independence, benefits for the municipality including an increased tax base and modest increases in local jobs, and creation of a potential tourist attraction. The socioeconomics discussion in *Section 5.7* provides additional information regarding increased tax base and local job creation.

Wind turbines at the Highwinds wind project in California. Photo courtesy of FPL Energy.

Many local officials want to be identified with local development projects and can become valuable allies in presenting the project to the community. It is usually easiest to develop such relationships with local officials, although the developer should approach state and federal officials as well. The developer may coordinate with government officials early in the process to communicate with the public during the development of a proposed project.

After local officials and regulators have been briefed on the project, the developer might offer to meet with neighborhood and community leaders. The best way for people to hear about a project is directly from the developer, before any opposition can spread misinformation about the project and its potential impacts. The developer may consider distributing leaflets in an area or sending bulk mailings from the local post office. Once the community knows the developer's plans, the developer may consider consulting with neighbors and abutters to give them an opportunity to comment before formal proposals are submitted for review by regulators or permitting agencies.

Most permitting agencies will hold public meetings or hearings at the beginning of the permitting process to educate the public about the project, the permitting process, potential issues, and opportunities for public involvement. Some agencies may hold meetings or workshops in the community to allow meaningful public involvement. Permitting statutes and regulations usually provide an opportunity for written comment.

Kaheawa Wind Power turbines in Hawaii. Photo courtesy of UPC Wind.

The developer may also consider hosting a series of public meetings to educate the public, government officials, and the media regarding the project before and during the more formal permitting agency process. Some regulatory requirements may include a public meeting or hearing. These meetings could be small focus groups, facilitated planning sessions, or open houses. The developer may also want to consider hosting educational programs and other community-based functions.

Following are suggested guidelines for spokespersons conducting meetings and presentations:

Guidelines for developer's spokesperson in conducting public meetings:

- ✓ Start with the most important points first. These may include the environmental benefits due to the displacement of fossil-fuel fired resources.
- ✓ Listen carefully to issues and potential concerns. First impressions count, so be attentive and thoughtful.
- ✓ Answer each question to the extent possible. Don't be evasive. Remember that most communities don't have experience with wind energy developments and may carry misperceptions about the impacts of a wind energy project.
- ✓ When it is time to respond, speak clearly and honestly.
- ✓ Maintain a calm disposition at all times.
- ✓ Responses should be brief (1-2 minutes). Additional information can be provided in a side discussion after the meeting or in response to a follow-up question.
- ✓ Don't read from a script. If you don't have the answer or a task requires consideration, say "I don't know but I'll look into it and get back to you" or "we will consider that." Then follow through on this commitment in a timely manner.
- ✓ Ask people for their contact information so that you can respond to their inquiries and do so promptly.

Meetings held at times that are convenient for the audience (weeknights or weekends) are usually the most inclusive. The location should be suitable – with enough seats and acoustics that allow everyone to be heard. To convey important information, the developer could use a PowerPoint™ presentation or large boards displayed on tripods.

It is often useful to prepare fact sheets, frequently asked questions, and other handouts. The developer may consider issuing press releases to the media at key points during the process. A simple website can be a useful communication tool. If used, the website should be kept up-to-date, and could include links to public documents and a calendar with meetings, events, comment periods, and deadlines. The website should also include an email address or telephone number of the developer or the public relations representative for members of the public to ask questions and provide feedback.

Creating project websites and telephone hotlines can be useful communication tools.

The developer may consider taping public meetings (announcing at the beginning that the meeting is being taped). Formal transcription services involving stenographers often set a more aggressive tone, although having an exact transcript can be helpful later in the permitting process. The developer will often maintain a database of attendees at public meetings, questions and issues raised, and responses to questions and issues.

Once the developer has received approval for the project, public outreach should continue throughout the life of the project. A telephone number should be available to members of the public who wish to call with questions or concerns. The developer should consider developing a complaint resolution system and designating an independent ombudsman to hear complaints. This will avoid, or at least narrow, unnecessary hearings before permitting agencies over alleged non-compliance with permit terms and conditions.

While unlikely to appease everyone's concerns and issues, the developer will likely have more success with an approach that is proactive, prepared, credible, and resourceful. The developer must know the audiences, educate them about the project, listen to their concerns, and solve problems creatively. The process won't always be smooth, but the developer will decrease permitting time and effort by commencing public outreach early in the process and continuing throughout the life of the project.

Twin Groves Wind Farm in McLean County, Illinois. Photo courtesy of Horizon Wind Energy.

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CHAPTER 8

Glossary of Key Terms

Access roads - Provide construction and service access to each wind turbine.

Adverse visual impact - An unwelcome visual intrusion that diminishes the visual quality of an existing landscape.

All Appropriate Inquiries (AAI) - Part of the Phase I Environmental Site Assessment under CERCLA relative to contaminated properties, AAI involves research to determine prior ownership and use of a property.

Anemometer - One of the components of a meteorological tower, the anemometer is a sensor that measures wind speed and direction.

Aquifers - Underground areas (i.e., dirt and rock) with water-bearing zones.

Aquitards - Individual aquifers separated by layers of low-permeability soil or sediment through which little or no groundwater flows.

Area of potential effects (APE) - A geographic area within which a project may cause physical, visual, or audible effects on the character or use of historic properties.

Data logger - One of the components of a meteorological tower, the data logger records the measurements.

Decibel - A logarithmic unit of measurement that expresses the magnitude of a physical quantity relative to a specified or implied reference level.

Determination of Hazard (DOH) - If after the extended study there remains an operational impact, the FAA will attempt to negotiate a height that will be acceptable for a DNH. If no agreement is reached with the proponent, FAA will issue a DOH. A DOH can be appealed to FAA Washington Headquarters; if the appeal fails to secure a DNH, the proponent can bring the issue before a federal court.

Determination of No Hazard (DNH) - The FAA determines that the proposed structure(s) will not interfere with the navigable airspace or communications technology of aviation operations, and the project is allowed to proceed.

Electrical collection system - Consists of underground and overhead cables that carry electricity from and within groups of wind turbines and transmits it to a collection substation and point of interconnection switchyard, which transfers the electricity generated by the project to the regional power grid.

Electromagnetic fields (EMF) - A combination of invisible electric and magnetic fields of force. They can occur both naturally or due to human constructs.

Electromagnetic radiation (EMR) - A wavelike pattern of electric and magnetic energy moving together through space.

Fresnel zone - The pattern of electromagnetic radiation that is created by a transmitting station from its antenna to receiving antennas; the concept of Fresnel zones may be used to analyze interference by obstacles near the path of a radio beam. The first Fresnel zone must be kept largely free from obstructions to avoid interfering with the radio reception.

General or nationwide, and individual - Under Section 404, regulated activities in wetlands are authorized under these two types of permits.

GIS – (Geographic Information System) A system of hardware and software used for storage, retrieval, mapping, and analysis of geographic data.

Global warming - Refers to forms of climatic inconsistency, but is more properly used to imply a significant change from one climatic condition to another. Climate change has also been used synonymously with the term global warming.

Hydric soils - Soils that have been subjected to extended saturation, often resulting in reduced oxygen levels in the soil.

Hydrophytic vegetation - Plants that have become tolerant to prolonged saturation or flooding and are able to survive and propagate under these conditions.

Incidental take - Unintentional removal that may occur during otherwise lawful activities. If a project may result in "incidental take" of a listed species, an incidental take permit is required. An incidental take permit allows the permittee to proceed with an activity that is legal in all other respects, but that results in "incidental taking" of a listed species.

Long Range Surveillance Radar, often called Air Defense Radar - Wind farms located within radar line-of-sight of an air defense radar facility may degrade the ability of the radar to perform its intended function and assure military readiness.

Megawatt - A unit used to measure power, equal to one million watts.

Meteorological mast - One of the components of a meteorological tower, the meteorological mast supports the anemometers and data logger.

Meteorological towers - Wind measurement systems that can be of steel tube or lattice construction, and can be free-standing or guyed; they are equipped with sensors to measure wind speed and direction, temperature and pressure.

Non-criteria pollutants - Hazardous air pollutants (HAPs), including metals and other toxic compounds.

Notice of Presumed Hazard (NPH) - If an NPH is issued because the proposal exceeds an obstruction standard or impacts an operational procedure, the FAA then initiates an in-depth technical analysis (commonly called an extended study) and the document explains the basis for the NPH.

Operations and maintenance facilities (O&M) - For storing equipment and supplies required during operation. Some maintenance facilities include control functions such as the supervisory control and data acquisition (SCADA) to provide two-way communication with each wind turbine.

PCBs - Any of a family of industrial compounds produced by chlorination of biphenyl, noted primarily as an environmental pollutant that accumulates in animal tissue with resultant pathogenic and teratogenic effects.

Radio frequency (RF) EMR - Emitted by artificial sources such as mobile phones, broadcast towers, radar facilities, remote controls, and electrical and electronic equipment.

Rime icing - Occurs when the structure is at a sub-zero temperature and is subject to incident flow with significant velocity and liquid water content.

Satellite accumulation area - An area in an individual laboratory, shop, or other facility designated by the generator for the accumulation of waste.

Sedimentation - Deposition of sediment into waterbodies and wetlands.

Shadow flicker - The effect caused by the sun's casting shadows from moving wind turbine blades.

Soil erosion - A natural process in which soil particles are detached and removed by wind or water.

Sole-source aquifer - Aquifer with federally protected status.

Television - The transmission, reception, and reproduction of moving pictures and audio.

Traffic management plan (TMP) - A plan to manage traffic during the construction of projects to reduce congestion.

Transmission/interconnection facilities - A collection substation terminates collection feeder cables and steps up the voltage to that of the transmission system to which the project ultimately connects.

Viewshed - The landscape or topography visible from a geographic point, especially those that have an aesthetic value.

Waters of the United States - Includes surface waters that are navigable and their tributaries, all interstate waters and their tributaries, natural lakes, all wetlands adjacent to these waters, and all impoundments of these waters.

Wetland hydrology - The presence of water at or above the soil surface for a sufficient period of the year to significantly influence the plant types and soils that occur in the area.

Wetlands - Lands on which water covers the soil or is present either at or near the surface of the soil or within the root zone, all year or for varying periods of time during the year, including during the growing season.

Wind project - Wind projects vary in size, from small projects of one to a few turbines (known as "behind the meter" or "distributed wind systems") serving individual customers, to large projects ("utility" or "commercial-scale" or "wind farms") designed to provide wholesale electricity to utilities or an electricity market.

Wind turbine - Consists of three major mechanical components: tower, nacelle, and rotor.

CHAPTER 9

Resources

Typical Federal Permitting Requirements for Wind Energy Projects

Regulatory Authority	Statute	Permit/Approval	Description	Triggers
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
■ CEQ NEPA Website http://www.nepa.gov/nepa/nepanet.htm ■ EPA NEPA Webpage http://www.epa.gov/compliance/nepa/index.html				
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
■ FWS Endangered Species Program Website: http://www.fws.gov/endangered/ ■ FWS Endangered Species Endangered Species Act of 1973 http://www.fws.gov/endangered/pdfs/ESAall.pdf ■ FWS 1998 Endangered Species Act Section 7 Consultation Handbook. Available online at http://www.fws.gov/endangered/consultations/s7hndbk/s7hndbk.htmhttp://www.fws.gov/endangered/consultations/s7hndbk/toc-glos.pdf. ■ FWS 1996 and 2000 Habitat Conservation Planning Handbook. Available online at http://www.fws.gov/endangered/hcp/hcpbook.html. ■ FWS 2003 Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines. Available online at http://www.fws.gov/habitatconservation/wind.pdf.				
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 statute.	■ Potential impact to migratory bird species protected by the act
■ FWS Division of Migratory Bird Management: http://www.fws.gov/migratorybirds/ ■ FWS 2003 Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines. Available online at http://www.fws.gov/habitatconservation/wind.pdf.				

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

Regulatory Authority	Statute	Permit/Approval	Description	Triggers
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 statute	▪ Potential impact to bald or golden eagle ▪ Necessity for moving golden eagle nest
▪ FWS Bald Eagle Website: http://www.fws.gov/migratorybirds/BaldEagle.htm ▪ Note: The Bald Eagle was removed from the list of threatened and endangered species by a rule published in July 2007 but continues to be protected under the Bald and Golden Eagle Protection Act (http://www.fws.gov/migratorybirds/issues/BaldEagle/FINALEagle%20release.pdf) ▪ FWS 2007 National Bald Eagle Management Guidelines. Available online at http://www.fws.gov/migratorybirds/issues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf. ▪ FWS 2003 Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines. Available online at http://www.fws.gov/habitatconservation/wind.pdf.				
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 ▪ 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
▪ National Park Service History and Culture Website http://www.nps.gov/history				
U.S. Army Corps of Engineers (33 CFR 320-331 and 40 CFR 230)	Clean Water Act (CWA) (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
▪ EPA Clean Water Act http://www.epa.gov/region5/water/cwa.htm ▪ U.S. Army Corps of Engineers Nationwide Permits http://www.usace.army.mil/cw/cecwo/reg/nationwide_permits.htm				
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
▪ U.S. Army Corps of Engineers Website http://www.usace.army.mil/				
Environmental Protection Agency and state agencies (40 CFR 122 and 123)	Clean Water Act (CWA) (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
▪ EPA Clean Water Act http://www.epa.gov/region5/water/cwa.htm ▪ EPA NPDES Program http://cfpub.epa.gov/npdes/index.cfm				

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

Regulatory Authority	Statute	Permit/Approval	Description	Triggers
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
▪ FAA Order 7400.2F Procedures for Handling Airspace Matters http://www.faa.gov/airports_airtraffic/air_traffic/publications/atpubs/AIR/index.htm ▪ FAA Obstruction Evaluation/Airport Airspace Analysis Office https://oeaaa.faa.gov/oeaaa/external/portal.jsp ▪ FAA OEAAA Advisory Circular AC 70/7460-1K Obstruction Marking and Lighting https://oeaaa.faa.gov/oeaaa/external/content/AC70_7460_1K.pdf				
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
▪ EPA SPCC Rule http://www.epa.gov/emergencies/content/spcc/index.htm				
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
▪ EPA Superfund http://www.epa.gov/superfund/ ▪ EPA All Appropriate Inquiries http://www.epa.gov/brownfields/regneg.htm ▪ American Society for Testing and Materials (ASTM http://www.astm.org ▪ American Society for Testing and Materials (ASTM) International Standard E 1528-06 "Practice for Environmental Site Assessments: Transaction Screen Process" ▪ American Society for Testing and Materials (ASTM) International Standard E 1527-05 "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process				

North American ISOs and RTOs

North American ISOs	North American RTOs
■ Alberta Electric System Operator (AESO) ■ California ISO (CAISO) ■ Electric Reliability Council of Texas (ERCOT), also a Regional Reliability Council ■ Florida Reliability Coordinating Council (FRCC), also a Regional Reliability Council ■ Independent Electricity System Operator (IESO), operates the Ontario Hydro system ■ Midwest ISO (MISO) ■ New York ISO (NYISO)	■ Midwest Independent Tranmission System Operator (MISO) ■ ISO New England (ISONE), an RTO despite the ISO in its name ■ PJM Interconnection (PJM) ■ Southwest Power Pool (SPP), also a Regional Reliability Council

State Model Ordinances and Guidelines for Wind Energy

The following table provides a sampling of model ordinances and guidelines. Many of the guidelines relate to smaller-scale wind projects and may not apply to the utility-scale projects that are the focus of this handbook.

State	Guidelines
Alaska	Small Wind Electric Systems: A Alaska Consumer's Guide http://www.nrel.gov/docs/fy07osti/41212.pdf
Arizona	Wind Energy Development Guidelines Arizona Game and Fish Department, Habitat Branch, July 2006 http://www.azgfd.gov/hgis/pdfs/WindEnergyGuidelines.pdf Small Wind Electric Systems: A Arkansas Consumer's Guide http://www.nrel.gov/docs/fy04osti/34935.pdf
Arkansas	Consumer's Guide to Renewable Energy in Arkansas http://www.arkansasrenewablenergy.org/consumers_guide.pdf
Colorado	Small Wind Electric Systems: A Colorado Consumer's Guide http://www.nrel/gov/docs/fy04osti/31254.pdf
Delaware	Small Wind Electric Systems: A Delaware Consumer's Guide http://www.nrel.gov/docs/fy03osti/34339.pdf
Hawaii	Small Wind Electric Systems: A Hawaii Consumer's Guide http://www.nrel.gov/docs/fy05osti/37629.pdf
Idaho	Small Wind Electric Systems: An Idaho Consumer's Guide http://www.nrel.gov/docs/fy04osti/36432.pdf Permitting of Small and Medium sized Wind Turbine Projects in Idaho, A Handbook Guide with specific examples for counties of Bonneville, Cassia, Elmore, Jerome and Twin Falls Idaho Energy Division, November 2005 http://www.idwr.state.id.us/energy/wind/idwindpermitguide.pdf
Illinois	Harvest the Wind: A Wind Energy Handbook http://www.iira.org/pubsnew/publications/IVARDC_Reports_614.pdf Small Wind Electric Systems: An Illinois Consumer's Guide http://www.nrel.gov/docs/fy07osti/41208.pdf
Indiana	Small Wind Electric Systems: An Indiana Consumer's Guide http://www.nrel.gov/docs/fy05osti/37710.pdf
Iowa	Wind Energy Manual Iowa Energy Center http://www.energy.iastate.edu/renewable/windwem-index.html Small Wind Electric Systems: A Iowa Consumer's Guide http://www.nrel.gov/docs/fy03osti/32583.pdf
Kansas	Wind Energy Siting Handbook: Guideline Options for Kansas Cities and Towns., Kansas Energy Council, April 2005. http://kec.kansas.gov/reports/wind_siting_handbook.pdf http://www.kansasenergy.org/Kansas_Siting_Guidelines.PDF Small Wind Electric Systems: A Kansas Consumer's Guide http://www.nrel.gov/docs/fy04osti/36249.pdf Siting Guidelines for Windpower Projects in Kansas http://www.naseo.org/energy_sectors/wind/kansas_siting_guidelines.pdf
Maine	Maine Wind Energy Act http://janus.state.me.us/legis/statutes/35-A/title35-Ach34sec0.html Small Wind Electric Systems: A Maine Consumer's Guide http://www.nrel.gov/docs/fy03osti/34342.pdf
Maryland	Small Wind Systems: A Maryland Consumer's Guide http://www.nrel.gov/docs/fy04/36411.pdf
Massachusetts	Renewable Energy & Distributed Energy Handbook A Developer's Guide to Regulations, Policies and Programs that Affect Renewable Energy and Distributed Generation Facilities in Massachusetts http://www.mass.gov/Eoca/docs/doer/pub_infor/guidebook.pdf Small Wind Electric Systems: A Massachusetts Consumer's Guide http://www.nrel.gov/docs/fy03osti/34341.pdf
Michigan	Michigan: HTTP://WWW.MICHIGAN.GOV/DOCUMENTS/WIND_AND_SOLAR_SITING_GUIDLINES_DRAFT_5_96872_7.PDF Small Wind Electric Systems: A Michigan Consumer's Guide http://www.nrel.gov/docs/fy07osti/40925.pdf

State Model Ordinances and Guidelines for Wind Energy (Cont'd)

State	Guidelines
Minnesota	Small Wind Electric Systems: A Minnesota Consumer's Guide http://www.nrel.gov/docs/fy07osti/41228.pdf Minnesota Statutes 2006 Chapter 216F. Wind Energy Conversion Systems http://ros.leg.mn/bin/getpub.php?pubtype=STAT_CHAP&year=2006&section=216F Wind Rules as Adopted: Chapter 4401, February 7, 2002 http://www.eqb.state.mn.us/pdf/FileRegister/01-16-WIND-RULES/windruleslastversion.pdf
Missouri	Small Wind Electric Systems: A Missouri Consumer's Guide http://www.nrel.gov/docs/fy05osti/37711.pdf
Montana	Small Wind Electric Systems: A Montana Consumer's Guide http://www.nrel.gov/docs/fy02osti/31255.pdf
Nevada	Small Wind Electric Systems: A Nevada Consumers Guide http://www.nrel.gov/docs/fy05osti/37630.pdf
New Hampshire	Small Wind Electric Systems: A New Hampshire Consumer's Guide http://www.nrel.gov/docs/fy03osti/34343.pdf
New Jersey	Small Wind Electric Systems: A New Jersey Consumer's Guide http://www.nrel.gov/docs/fy03osti/29948.pdf
New Mexico	Guidelines for Developers and Investors interested in the Wind Energy Sector in New Mexico http://www.emnrd.state.nm..us/ecmd/Wind/documents/GuidelinesforDeveloperandInvestors.doc Sistemas Eólicos Pequeños para Generación de Electricidad: Una Guia para Consumidores en Nuevo México http://www.nrel.gov/docs/fy06osti/38816.pdf Small Wind Electric Systems: A New Mexico Consumer's Guide http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/small_wind/small_wind_nm.pdf
New York	http://www.agmkt.state.ny.us/AP/agservices/constructWind.html Wind Energy Model Ordinance Options http://www.powernaturally.org/Programs/Wind/toolkit//2_windenergymodel.pdf Small Wind Electric Systems: A New York Consumer's Guide http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/small_wind/small_wind_ny.pdf
North Carolina	Small Wind Electric Systems: A North Carolina Consumer's Guide http://www.nrel.gov/docs/fy05osti/37708.pdf
North Dakota	Small Wind Electric Systems: A North Dakota Consumer's Guide http://www.nrel.gov/docs/02osti/31256.pdf The North Dakota Wind Energy Handbook http://www.nd.gov/dcs/energy/pubs/renewable/winden.pdf
Ohio	Small Wind Electric Systems: A Ohio Consumer's Guide http://www.nrel.gov/docs/fy05osti/37631.pdf
Oklahoma	Small Wind Electric Systems: A Oklahoma Consumer's Guide http://www.nrel.gov/docs/fy05osti/37713.pdf
Oregon	Small Wind Electric Systems: A Oregon Consumer's Guide http://www.nrel.gov/docs/fy05osti/37632.pdf Oregon: Energy Facility Siting Standards http://www.oregon.gov/energy/siting/standards.shtml
Pennsylvania	Wind Farm Model Ordinance Draft 12-08-06 Model Ordinance for Wind Energy Facilities in PA www.depweb.state.pa.us/energy/lib/energy/docs/wind_model_ordinance_draft_(12-8-06).doc Pennsylvania Guide to Wind Energy Sources http://www.pawindmap.org Small Wind Electric Systems: A Pennsylvania Consumer's Guide http://www.nrel.gov/docs/fy03osti/34338.pdf

State Model Ordinances and Guidelines for Wind Energy (Cont'd)

State	Guidelines
Puerto Rico	Energia Del Viento The Puerto Rico Energy Office, December 2003 http://www.aae.gobierno.pr/Folletos/windPower.pdf
Rhode Island	Small Wind Electric Systems: A Rhode Island Consumer's Guide http://www.nrel.gov/docs/fy03osti/34340.pdf
South Dakota	Small Wind Energy Systems: A South Dakota Consumer's Guide http://www.nrel.gov/docs/fy07osti/41226.pdf
Tennessee	Small Wind Electric Systems: A Tennessee Consumer's Guide http://www.nrel.gov/docs/fy04osti/35818.pdf
Utah	Small Wind Electric Systems: A Utah Consumer's Guide http://www.nrel.gov/docs/fy05osti/37712.pdf
Vermont	Impacts of Wind Energy Development to Wildlife, Rare Plant Species, and Natural Communities on State Lands http://www.anr.state.vt.us/fpr/wind/workingpapers/wildlife impact.pdf Small Wind Electric Systems: A Vermont Consumer's Guide http://www.nrel.gov/docs/fy07osti/41219.pdf
Virginia	Small Wind Electric Systems: A Consumer's Guide http://www.nrel.gov/docs/fy03osti/34337.pdf
Washington	Wind Power Guidelines August 2003 http://www.wdfw.wa.gov/hab/engineer/windpower/index.htm Small Wind Electric Systems: A Washington Consumer's Guide http://www.nrel.gov/docsfy02osti/31872.pdf
Wisconsin	Considering Natural Resource Issues in Windfarm Siting in Wisconsin http://www.dnr.state.wi.us/org/es/science/energy/wind/guidelines.pdf Small Wind Electric Systems: A Wisconsin Consumer's Guide http://www.nrel.gov/docs/fy04osti/35120.pdf Wisconsin Model Wind Ordinance Reference Guide (Draft) http://www.doa.state.wi.us/docs_view.asp?docid=2870

States with Environmental Impact Review/Environmental Planning Requirements Similar to NEPA

State	Statute	Agency Web Link
California	CAL. PUB. RES. CODE §§ 21000 - 21177	http://www.opr.ca.gov/clearinghouse/Environmental.html
Connecticut	CONN. GEN. STAT. §§ 22a-1 to -1h	http://www.opm.state.ct.us/cepa/overview.htm
District of Columbia	D.C. CODE §§ 8-109.01 to -109.11	http://dcra.dc.gov/dcra/site/default.asp http://dcra.dc.gov/dcra/cwp/view,a,1342,q,600463,dcraNav,|33408|.asp http://www.grc.dc.gov/grc/site/default.asp
Georgia	GA. CODE ANN. §§ 12-16-1 to -8	http://hpd.dnr.state.ga.us/
Guam	1996 Guam Laws Exec. Ord. No. 96-26	http://www.guamepa.govguam.net/programs/epr/index.html
Hawaii	HAW. REV. STAT. §§ 343-1 to -8	http://www.state.hi.us/health/oeqc/index.html
Indiana	IND. CODE §§ 13-12-4-1 to -10	http://www.in.gov/idem
Maryland	Md. Code Ann., Nat. Res. §§ 1-301 to -305	http://www.mdp.state.md.us/index.html
Massachusetts	MASS. GEN. LAWS Ch. 30, §§ 61 - 62H	http://www.mass.gov/envir/mepa/index.htm
Minnesota	MINN. STAT. §§ 116D.01 to -.11	http://www.eqb.state.mn.us/
Montana	MONT. CODE ANN. §§ 75-1-201 to -220	http://www.deq.state.mt.us/index.asp
Nevada/ California - Tahoe	Article VII, Tahoe Regional Planning Compact (NEV. REV. STAT. §§ 277.190 to .220)	http://www.trpa.org/
New Jersey	N.J. Exec. Order No. 215 (1989)	http://www.nj.gov/dep/opppc/index.html http://www.state.nj.us/dep/opppc/permitcoor.htm http://www.state.nj.us/infobank/circular/eok215.htm
New York	N.Y. ENVTL. CONSERV. LAW §§ 8-0101 to 0117	http://www.dec.state.ny.us/website/dcs/seqr/index.html
North Carolina	N.C. GEN. STAT. §§ 113A-1 to -13	http://www.enr.state.nc.us/html/laws___regulations.html
Puerto Rico	12 P.R. LAWS ANN. §§ 1121-1127	http://www.jca.gobierno.pr/
South Dakota	S.D. CODIFIED LAWS §§ 34A-9-1 to -13	http://www.state.sd.us/denr
Virginia	VA. CODE ANN. §§ 10.1-1188 to -1192	http://www.deq.state.va.us/eir
Washington	WASH. REV. CODE §§ 43.21C.010 to .914	http://www.ecy.wa.gov/programs/sea/sepa/e-review.html
Wisconsin	Wis. Stat. Ann. §1.11; Wis. Admin. Code NR §150.01-.40	http://www.dnr.state.wi.us/org/es/science/eis

List of State Agencies

State	State Environmental Agencies	State Energy Agencies	State Wildlife Agencies	State Cultural Resources Agencies
Alabama	AL Dept. of Environmental Management	AL Public Service Commission – Energy Division	AL Dept. of Conservation and Natural Resources	AL Historical Commission
Alaska	AK Dept. of Environmental Conservation	AK Energy Authority	AK Dept. of Fish & Game	AK Dept. of Natural Resources, Division of Parks and Outdoor Recreation - Office of History and Archaeology
Arizona	AZ Dept. of Environmental Quality	AZ Corporation Commission-Utilities Division	AZ Game & Fish Dept.	AZ State Historic Preservation Office
Akansas	Dept. of Environmental Quality	AR Public Service Commission	AR Game & Fish Commission	AR Historic Preservation Program
California	CA Dept. of Conservation CA Environmental Protection Agency	CA Energy Commission	CA Dept. of Fish & Game	CA Dept. of Parks and Recreation - Office of Historic Preservation
Colorado	CO Dept. of Public Health and Environment	CO Public Utilities Commission Governor's Energy Office	CO Division of Wildlife	CO Historical Society – Office of Archaeology & Historic Preservation
Connecticut	CT Dept. of Environmental Protection	CT Dept. of Public Utility Control	CT Dept. of Environmental Protection - Wildlife	CT Commission on Culture & Tourism – History Division
Delaware	DE Dept. of Natural Resources and Environmental Control	DE Dept. of Natural Resources & Environmental Control – DE Energy Office	DE Dept. of Natural Resources & Environmental Control - Division of Fish & Wildlife	Dept. of State - Division of Historical & Cultural Affairs
District of Columbia	District Dept. of the Environment	DC Public Service Commission District Dept. of Environment Energy Office		
Florida	FL Dept. of Environmental Protection	FL Public Service Commission	FL Public Service Commission	FL Office of Cultural, Historical, and Information Programs
Georgia	GA Dept. of Natural Resources	GA Public Service Commission	GA Dept. of Natural Resources - Wildlife Resources Division	GA Historic Preservation Division
Hawaii	HI Dept. of Land and Natural Resources	HI Public Utilities Commission	HI Dept. of Land and Natural Resources - Division of Forestry & Wildlife	HI Dept. of Land and Natural Resources - State Historic Preservation Division
Idaho	ID Dept. of Environmental Quality	ID Public Utilities Commission	ID Fish & Game	ID State Historical Society
Illinois	IL Environmental Protection Agency IL Pollution Control Board	IL Dept. of Commerce and Economic Opportunity-Energy & Recycling IL Commerce Commission	IL Dept. of Natural Resources	IL Historic Preservation Agency

List of State Agencies (Cont'd)

State	State Environmental Agencies	State Energy Agencies	State Wildlife Agencies	State Cultural Resources Agencies
Indiana	IN Dept. of Environmental Management Dept. of Natural Resources	IN Utility Regulatory Commission	IN Division of Fish & Wildlife	IN Dept. of Natural Resources – Division of Historic Preservation & Archaeology
Iowa	IA Dept. of Natural Resources	IA Utilities Board	IA Dept. of Natural Resources – Division of Fish & Wildlife	State Historical Society of Iowa
Kansas	KS Dept. of Health and Environment	KS Corporation Commission-Energy Office	KS Dept. of Wildlife & Parks	KS State Historical Society
Kentucky	KY Dept. for Environmental Protection KY Dept. for Natural Resources	KY Governor's Office of Energy Policy	KY Dept. of Fish & Wildlife Resources	KY Heritage Council
Louisiana	LA Dept. of Environmental Quality	LA Public Service Commission	LA Dept. of Wildlife & Fisheries	LA Division of Historic Preservation
Maine	ME Department of Environmental Protection ME Natural Areas Program	ME Public Utilities Commission	ME Dept. of Inland Fisheries & Wildlife ME Dept. of Marine Resources	ME Historic Preservation Commission
Maryland	MD Dept. of the Environment	MD Energy Administration	MD Dept. of Natural Resources	MD Historical Trust
Massachusetts	Dept. of Environmental Protection MA Dept. of Conservation and Recreation	Executive Office of Energy & Environmental Affairs-Division of Energy Resources	MA Dept. of Fish & Game	MA Historical Commission
Michigan	MI Dept. of Environmental Quality	MI Public Service Commission MI Dept. of Labor & Economic Growth-Energy Division	MI Dept. of Natural Resources	MI History, Arts and Libraries – State Historic Preservation Office
Minnesota	MN Pollution Control Agency MN Board of Soil & Water Resources	MN Public Utilities Commission MN Dept of Commerce	MN Dept. of Natural Resources	MN State Historic Preservation Office
Mississippi	Dept. of Environmental Quality	MS Public Service Commission	MS Wildlife, Fisheries & Parks	MS Dept. of Archives & History
Missouri	MO Dept. of Natural Resources	MO Public Service Commission	MO Dept. of Conservation	MO Dept. of Natural Resources – State Historic Preservation Office
Montana	Dept. of Environmental Quality http://dnrc.mt.gov/ MT Dept. of Natural Resources & Conservation MT Natural Resource Information System	MT Public Service Commission	MT Fish, Wildlife & Parks	MT Historical Society
Nebraska	NE Dept. of Environmental Quality NE Dept. of Natural Resources	NE Public Service Commission NE Energy Office	NE Game & Parks Commission	NE State Historical Society
Nevada	NV Dept. of Conservation and Natural Resources NV Division of Forestry	Public Utilities Commission of Nevada NV Office of the Governor – NV State Office of Energy	NV Dept. of Wildlife	NV Dept. of Cultural Affairs

List of State Agencies (Cont'd)

State	State Environmental Agencies	State Energy Agencies	State Wildlife Agencies	State Cultural Resources Agencies
New Hampshire	NH Dept. of Environmental Services	NH Public Utilities Commission NH Office of Energy & Planning	NH Fish & Game Dept.	NH Division of Historical Resources
New Jersey	NJ Dept. of Environmental Protection	NJ Board of Public Utilities-Energy Division	NJ Division of Fish & Wildlife	NJ Historic Preservation Office
New Mexico	NM Environment Dept.	NM Energy, Minerals & Natural Resources Dept. NM Energy Conservation & Management Division	NM Dept. game & Fish - Wildlife	NM Historic Preservation Division
New York	NY State Dept. of Environmental Conservation	NY State Public Service Commission	NY State Division of Fish, Wildlife and Marine Resources	NY State Office of Parks, Recreation & Historic Preservation
North Carolina	NC Dept. of Environment and Natural Resources	NC Utilities Commission NC State Energy Office	NC Wildlife Resources Commission	NC State Historic Preservation Office
North Dakota	ND Dept. of Health – Environmental Health ND State Water Commission	ND Public Service Commission	ND Game & Fish Dept.	ND State Historical Society of ND
Ohio	OH Environmental Protection Agency OH Dept. of Natural Resources	Public Utilities Commission of Ohio	OH Dept. of Natural Resources - Division of Wildlife	OH Historical Society – OH Historic Preservation Office
Oklahoma	OK Dept. of Environmental Quality OK Conservation Commission	OK Corporation Commission	OK Dept. of Wildlife Conservation	OK Historical Society - State Historic Preservation Office
Oregon	OR Dept. of Environmental Quality	OR Dept. of Energy	OR Dept. of Fish & Wildlife	OR Parks & Recreation Department
Pennsylvania	PA Dept. of Environmental Protection PA Dept. of Conservation and Natural Resources	PA Public Utility Commission	PA Game Commission PA Fish & Boat Commission	PA Historical & Museum Commission
Puerto Rico	Puerto Rico Dept. of Natural Resources	PR Electrical Energy Authority	Southeast Region-US Fish & Wildlife	PR State Historic Preservation Office
Rhode Island	RI Dept. of Environmental Management	RI Public Utilities Commission and Division of Public Utilities and	RI Department of Environmental Management – Division of Fish & Wildlife	RI Historical Preservation & Heritage Commission
South Carolina	Dept. of Health and Environmental Control	Public Service Commission of South Carolina	SC Dept. of Natural Resources-Wildlife Division	SC State Historic Preservation Office
South Dakota	SD Dept. of Environment & Natural Resources	SD Public Utilities Commission	SD Game, Fish & Parks	SD State Historical Society – Historic Preservation Office
Tennessee	TN Dept. of Environment and Conservation	TN Regulatory Authority	TN Wildlife Resources Agency	TN Dept. of Environment & Conservation – TN Historical Commission

List of State Agencies (Cont'd)

State	State Environmental Agencies	State Energy Agencies	State Wildlife Agencies	State Cultural Resources Agencies
Texas	TX Commission on Environmental Quality	Public Utility Commission of Texas TX State Energy Conservation Office	TX Parks & Wildlife	TX Historical Commission - State Agency for Historic Preservation
Utah	UT Dept. of Environmental Quality	Public Service Commission of Utah	UT Division of Wildlife Resources	UT State History
Vermont	VT Agency of Natural Resources	VT Dept. of Public Service	VT Fish & Wildlife Dept.	VT Division for Historic Preservation
Virginia	VA Dept. of Environmental Quality	VA State Corporation Commission	VA Division of Game & Inland Fisheries VA Dept. of Conservation & Recreation	VA Dept. of Historic Resources
Washington	WA Dept. of Ecology WA Dept. of Natural Resources	WA Energy Facility Site Evaluation Council	Dept. of Fish & Wildlife	WA Dept. of Archaeology & Historic Preservation
West Virginia	WV Dept. of Environmental Protection	Public Service Commission of WV	WV Division of Natural Resources	WV Division of Culture and History – State Historic Preservation Office
Wisconsin	Dept. of Natural Resources	The Public Service Commission of Wisconsin	WI Dept. of Natural Resources	WI Historical Society
Wyoming	WY Dept. of Environmental Quality	WY Public Service Commission	WY Game & Fish	WY State Historic Preservation Office

Wind Energy Associations

- American Wind Energy Association http://www.awea.org/
- World Wind Energy Association http://www.wwindea.org
- European Wind Energy Association http://www.ewea.org/
- African Wind Energy Association http://www.afriwea.org/
- Australian Wind Energy Association http:www.auswind.org/index.html
- Austrian Wind Power Association http:www.igwindkraft.at/
- Avel Pen Ar Bed (France) http://www.apab.org/
- British Wind Energy Association http://www.bwea.com
- Canadian Wind Energy Association http://www.canwea.ca/
- Danish Wind Industry Association http://www.windpower.org/en/core.htm
- Estonia Wind Energy Association http://www.tuuleenergia.ee/
- Finnish Wind Power Association http:www.tuulivoimayhdistys.fi/index_en.htm
- German Wind Energy Association http://www.wind-energie.de/
- Indian Wind Energy Association (InWEA) http://www.inwea.org/
- Irish Wind Energy Association http:www.iwea.com/
- Latin American Wind Energy Association http:www.lawea.org/ing/
- Les Compagnons d'Ele (Belgium) http://users.swing.be/compagnons-eole/
- New Zealand Wind Energy Association http:www.windenergy.org.nz/
- Norwegian Wind Power Association http://www.vindkraft.no/
- Polish Wind Energy Association http://www.elektrownie-wiatrowe.org.pl/
- Suisse-Eole (Switzerland) http://www.suisse-eole.ch/default-f.htm
- Swedish Wind Energy Association http:www.svensk-vindkraft.org/

Renewable Energy Research

- California Wind Energy Collaborative, A Partnership of the University of California and the California Energy Commission http://cwec.ucdavis.edu/
- Center for Energy Efficiency and Renewable Energy – UMASS Amherst http://www.ceere.org/
- National Renewable Energy Laboratory (NREL) http://www.nrel.gov/

Organizations

- American Association of State Highway and Transportation Officials (AASHTO) http://www.transportation.org
- American Bird Conservancy (ABC) http://www.abcbirds.org/
- American Land Title Association (ALTA) http://www.alta.org
- Audubon Society http://www.audubon.org/
- Australian Windmill Contractors Association http://www.awca.asn.au/
- Bat Conservation International http://www.batcon.org
- Bat Conservation International Bat Wind Energy Cooperative http://www.batcon.org/home/index.asp?idPage=55
- Interstate Renewable Energy Council http://www.irecusa.org/
- Interwest Energy Alliance http://www.interwestenergy.org/
- National Wind Coordinating Collaborative http://www.nationalwind.org
- Union of Concerned Scientists http://www.ucsusa.org
- Utility Wind Interest Group http:www.uwig.org/
- Western Resource Advocate http://www.westernresourceadvocates.org/energy/index.php
- Windustry http://www.windustry.org/community/default.htm

CHAPTER 10

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CHAPTER 11

Acronym List

AAI	all appropriate inquiries
AASHTO	American Association of State Highway and Transportation Officials
ACHP	Advisory Council on Historic Preservation
ACUA	Atlantic County Utility Authority
APE	area of potential effects
APLIC	Avian Power Line Interaction Committee
ARPA	Archaeological Resources Protection Act of 1979
ASTM	American Society for Testing and Materials
AWEA	American Wind Energy Association
BACI	before-after-control-impact
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BLM Wind Policy	Wind Energy Development Policy
BMP	best management practices
BOR	Bureau of Reclamation
BWEA	British Wind Energy Association
BWEC	Bat Wind Energy Cooperative
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CGP	Construction General Permit
CONUS	continental United States
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CWA	Clean Water Act

CX	Categorical Exclusions
DHS	Department of Homeland Security
DNH	Determination of No Hazard
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOH	Determination of Hazard
DOI	U.S. Department of the Interior
DSIRE	Database of State Incentives for Renewables & Efficiency
EA	Environmental Assessment
Eagle Protection Act	Bald and Golden Eagle Protection Act
ECIP	Energy Conservation Investment Program
EIS	Environmental Impact Statement
EMF	electromagnetic fields
EMR	electromagnetic radiation
EPA	U.S. Environmental Protection Agency
EPAct	Energy Policy Act
EPC	Engineering Procurement Construction
ESA (ASTM)	environmental site assessment
ESA	Endangered Species Act
ESPC	Energy Savings Performance Contracting
FAA	Federal Aviation Administration
FACA	Federal Advisory Committee
FCC	Federal Communications Commission
FONSI	Finding of No Significant Impact
FSA	Farm Service Agency
FWS	U.S. Fish and Wildlife Service
GMF	Government Master File
GSA	U.S. General Services Administration

HAP	hazardous air pollutants
HCP	habitat conservation plan
IEC	International Electrotechnical Commission
IRAC	Interdepartmental Radio Advisory Committee
ISO	independent system operator
ITP	Incidental Take Permit
JEDI	Job and Economic Development Impact
kV	kilovolts
Little-NEPAs	State Environmental Impact Review Laws
LMR	land mobile radio
MBTA	Migratory Bird Treaty Act
MW	Megawatts
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NFS	National Forest System
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NPC	Notice of Proposed Construction
NPDES	National Pollutant Discharge Elimination System
NPH	Notice of Presumed Hazard
NPS	National Parks Service
NRCS	Natural Resource Conservation Service
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NTIA	National Telecommunications Information Administration
NWCC	National Wind Coordinating Collaborative

NWI	National Wetlands Inventory
NWP	Nationwide Permit
NYSERDA	New York State Energy Research and Development Authority
O&M	operations and maintenance
PCBs	polychlorinated biphenyls
PCN	Preconstruction Notification
PEIS	Programmatic Environmental Impact Statement
PGP	programmatic general permit
PILOT	payment-in-lieu-of-taxes
PM	particulate matter
PPA	power purchase agreement
REC	recognized environmental condition
REPP	Renewable Energy Policy Project
RF	radio frequency
RIMS	Regional Input-Output
RNP	Renewable Northwest Project
ROD	Record of Decision
ROW	right-of-way
RSA	rotor swept area
RTO	regional transmission operator
SCADA	supervisory control and data acquisition system
SEQR	State Environmental Quality Review Act
SHPO	State Historic Preservation Officer
SPCC	Spill Prevention, Control and Countermeasure
SWPPP	Stormwater Pollution Prevention Plan
TERA	Tribal Energy Resource Agreements
THPO	Tribal Historic Preservation Office
TMP	traffic management plan

NRCS	USDA Natural Resources Conservation Service
USDA	U.S. Department of Agriculture
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WCFZ	Worst Case Fresnel Zone
WECS	Wind Energy Conversion Systems
WQC	Water Quality Certification

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