Wind Turbine Guidelines Advisory Committee

Established under the Federal Advisory Committee Act October 26, 2007

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March 4, 2010

To: Secretary of the Interior

Through: Acting Director, U.S. Fish and Wildlife Service

From: Chairman, Wind Turbine Guidelines Advisory Committee

Attached please find the Wind Turbine Guidelines Advisory Committee (Committee) recommendations. In 2007, the Committee was established under the Federal Advisory Committee Act, to provide advice and recommendations on developing effective measures to avoid or minimize impacts to wildlife and their habitats related to land-based wind energy facilities. Our Committee is comprised of 22 members representing the federal, state, and tribal governments, wildlife conservation organizations, and the wind industry.

We are pleased to provide these recommendations. We have divided our report into two sections: policy recommendations, and recommended voluntary guidelines for wind siting and operations to avoid or minimize potential impacts to wildlife and habitat from wind energy development. We appreciate your consideration of these recommendations.

The Committee has worked diligently to understand each other's interests and believes this product is highly professional and scientifically credible. The members remain committed to further assist in implementing guidelines that will achieve minimal impacts to wildlife and habitats, while providing the flexibility to develop the nation's wind energy resources. Please contact Dave Stout, Committee Chairperson, at 703-358-2161, if you require any additional information about the Committee's recommendations.

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U.S. Fish and Wildlife Service
Wind Turbine Guidelines Advisory Committee

Preamble to the Committee Recommendations

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Committee Policy Recommendations

❖

Committee Recommended Guidelines

Submitted to the Secretary of the Interior
March 4, 2010

By the Wind Turbine Guidelines Advisory Committee

Andy Linehan, formerly with Iberdrola Renewables, was a Committee Member from October 2007 to December 2009. The Committee recognizes Andy's contributions to the Committee's Guidelines and his tireless efforts to build agreement on many issues related to wind and wildlife. In honor of Andy's leadership and inspiration, this agreement is dedicated in his memory.

U.S. Fish and Wildlife Service
Wind Turbine Guidelines Advisory Committee

Overview Table of Contents

Executive Summary i

Section I. Preamble to the Committee Recommendations vii

Section II. Committee Policy Recommendations xi

Section III. Committee Recommended Guidelines.....1

This document is a recommendation to the Secretary of the Interior. As such, any legal conclusions in these recommendations or its attachments do not necessarily reflect the legal position of the United States.

Executive Summary

The Wind Turbine Guidelines Advisory Committee (Committee) was established in 2007 under the Federal Advisory Committee Act to provide advice and recommendations to the Secretary of the Interior (Secretary) on developing effective measures to avoid or minimize impacts to wildlife and their habitats related to land-based wind energy projects. The USFWS chairs the Committee, which includes 22 members representing governments, wildlife conservation organizations, and the wind industry.

This Committee's recommendations to the Secretary (Guidelines) contain the Committee's advice regarding policy issues, as well as science-based technical advice on how best to assess and prevent adverse impacts to wildlife and their habitats while allowing for the development of the Nation's wind energy resources. The Committee recognizes that the environmentally-friendly development of wind energy and the protection of the Nation's natural resources are priorities for both the Administration and the American people. For example, on March 11, 2009, the Secretary issued Executive Order 3285, making the production and delivery of renewable energy a priority for the Department of the Interior. The Committee therefore developed a set of premises and principles that recognize the delicate balance between wind resource development and the protection of wildlife and habitats. Those principles guided the Committee's discussions and are the basis upon which its advice is founded.

The Committee recognizes that these Guidelines require new activities and increased effort by the USFWS. The Committee urges that the necessary resources to fulfill these responsibilities be made available to the USFWS. In addition to these new USFWS activities, the Committee recognizes that wind energy developers who voluntarily adhere to these Guidelines will be undertaking a robust level of wildlife impact analysis, and a shared responsibility with USFWS to ensure that the scientific standards of the Guidelines are upheld and used to make wise development decisions. To further demonstrate a commitment to wildlife conservation, the Committee recognizes and encourages the wind energy industry's participation and support of partnerships such as the American Wind Wildlife Institute, National Wind Coordinating Collaborative, Grassland Shrub-Steppe Species Collaborative, and the Bats and Wind Energy Cooperative to promote needed research about wildlife and wind energy interactions. The Committee encourages USFWS to seek partnerships among the wind energy industry, federal, state, and tribal governments, and conservation organizations, to continue the relationships formed and strengthened through this process, and to assist in fulfilling new and existing responsibilities.

The Committee's Guidelines are founded upon a "tiered approach" for assessing potential impacts to wildlife and their habitats. The tiered approach is an iterative decision-making process for collecting information in increasing detail, quantifying the possible risks of proposed wind energy projects to wildlife and habitats, and evaluating those risks to make siting, construction, and operation decisions. Subsequent tiers refine and build upon issues

raised and efforts undertaken in previous tiers. At each tier, a set of questions is provided to help the developer identify potential problems associated with each phase of a project, and to guide its decision process. The tiered approach is designed to assess the risks of project development by formulating questions that relate to site-specific conditions regarding potential species and habitat impacts. The tiers are outlined briefly as:

- Tier 1 – Preliminary evaluation or screening of sites (landscape-level screening of possible project sites)
- Tier 2 – Site characterization (broad characterization of one or more potential project sites)
- Tier 3 – Field studies to document site wildlife conditions and predict project impacts (site-specific assessments at the proposed project site)
- Tier 4 – Post-construction fatality studies (to evaluate direct fatality impacts)
- Tier 5 – Other post-construction studies (to evaluate direct and indirect effects of adverse habitat impacts, and assess how they may be addressed)

This framework allows the developer to determine whether he or she has sufficient information, whether and/or how to proceed with development of a project, or whether additional information gathered at a subsequent tier is necessary to make those decisions. The Committee agrees that incentives should be available to those developers who demonstrate due care by voluntarily implementing the tiered approach and through coordination with USFWS early and throughout the tiered process.

The Guidelines provide best-available methods and metrics to help answer the questions posed at each tier. The Committee recognizes that substantial variability exists among project sites and recommends methods and metrics that should be applied with the flexibility to address the varied issues that may occur on a site-by-site basis, while maintaining consistency in the overall tiered process. As research expands and provides new information, these methods and metrics will be updated to reflect current science.

Other elements in the Guidelines include a full discussion of mitigation policies and principles; the applicability of adaptive management, including the potential use of operational modifications; and considerations related to cumulative impacts, habitat fragmentation, and landscape-level analysis. Finally, the Guidelines discuss the need for additional research and collaboration related to potential wind energy-wildlife impacts, and offer some alternatives for accomplishing the needed research.

The Committee also wishes to present policy advice germane to its Charter but separate from its recommended Guidelines. First, the Committee unanimously recommends that the Secretary adopt the Committee's Guidelines to evaluate and minimize the potential risk of

wind energy projects to wildlife and habitats. Additional policy recommendations support the implementation of the Guidelines, including that the Secretary:

- Develop landscape-level tools and provide analysis to assist in implementation of the Guidelines.
- Provide and/or support adequate, meaningful incentives for industry's voluntary adoption of the Guidelines.
- Advance the use, cooperation, and effective implementation of the Guidelines.
- Assure that the USFWS has an adequate budget and staff resources to implement the Guidelines as necessary, including training of Regional and Field staff and other interested stakeholders.
- When making policy decisions, address both the threat to birds and other wildlife from climate change, and the effects of other stressors.
- Work with other federal and tribal agencies, stakeholders, and states to develop a national research plan that identifies and implements research priorities to reduce impacts to wildlife resources while allowing wind energy development.
- Revise the Guidelines regularly.
- Improve DOI's capability to assess cumulative impacts by developing data that can be used to conduct regional or landscape level analysis.

The Committee believes that the recommended Guidelines reflect a comprehensive and user-friendly wildlife and habitat risk assessment and decision-making tool that supports DOI priorities related to renewable energy development, federal, state and tribal trust responsibilities, developer cost and confidentiality concerns, and the needs of federal- or state-listed wildlife and habitats, without creating new regulations. The policy recommendations outlined above are offered to promote and support the successful voluntary adoption and implementation of the recommended Guidelines.

U.S. Fish and Wildlife Service
Wind Turbine Guidelines Advisory Committee

Preamble and Policy Recommendations

March 4, 2010

I. Preamble to the Committee Recommendations

A. Establishment of Wind Turbine Guidelines Advisory Committee

In response to interest in the development of wind energy in the United States, the U.S. Fish and Wildlife Service (USFWS) in July 2003 released for public comment a set of voluntary, interim guidelines for developing wind energy projects. After USFWS reviewed the public comments, the Secretary of the Interior (Secretary) established a Federal Advisory Committee to provide recommendations to avoid or minimize impacts to wildlife and their habitats related to land-based wind energy facilities. In March of 2007, USFWS announced the establishment of the Wind Turbine Guidelines Advisory Committee (the Committee) in the *Federal Register*.

Pursuant to the requirements of the Federal Advisory Committee Act, the Committee Charter was signed by the Secretary on October 26, 2007, and was renewed on October 26, 2009, effective for two years. The Charter states the Committee's scope and objective:

> *"The Committee will provide advice and recommendations to the Secretary of the Interior (Secretary) on developing effective measures to avoid or minimize impacts to wildlife and their habitats related to land-based wind energy facilities."*

The attached Recommended Guidelines (Guidelines) are the result of more than two years of deliberation by the Committee.

Committee Members

Committee Members were carefully selected by the Secretary from a large pool of candidates to represent a balance of stakeholder groups with the necessary policy, technical, and scientific expertise to address minimization of wildlife impacts associated with the development of the Nation's wind energy potential:

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Michael Azeka, AES Wind Generation
G. Thomas Bancroft, National Audubon Society
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Mark Sinclair, Clean Energy Group
Dave Stout, U.S. Fish & Wildlife Service
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B. Background on Context and Need for the Recommended Guidelines

Wind development in the United States broke all previous records in 2009, with close to 10,000 megawatts (MW) of new generating capacity installed.[1] This rate of development is expected to continue, and perhaps accelerate, as United States energy policy emphasizes independence from foreign oil and reduction of carbon emissions. USFWS and the Committee Members recognize that wind-generated electrical energy is renewable, and is considered to be a generally environmentally-friendly technology.

Wind energy produces electricity without air pollution, greenhouse gas emissions, water consumption, mining, drilling, refining, waste storage and other problems associated with many traditional forms of energy generation. Wind energy has recently received increased attention because it is a domestic source of energy, and because carbon dioxide emissions from fossil fuel combustion is the leading cause of anthropogenic climate change, which is likely to have serious negative impacts on ecosystems and wildlife.[2] The U.S. Department of Energy (DOE) reports that a single 1.5 MW wind turbine displaces 2700 metric tons of CO_2 per year compared with the current U.S. average utility fuel mix.[3] In some locations, wind prevents urban and suburban encroachment into traditional greenbelts. Given these advantages, wind is expected to play an increasingly important role in meeting the nation's energy goals in the coming years.

Nevertheless, as the United States moves to expand wind energy production, it also must maintain and protect the nation's wildlife and habitats, which wind energy production can negatively affect. As with all responsible energy development, wind energy projects should adhere to high standards for environmental protection. With proper diligence paid to siting, operations, and management of projects, it is possible to mitigate for significant adverse impacts to wildlife and their habitats. Mitigation is defined in this document as avoiding or

[1] http://www.awea.org/publications/reports/4Q09.pdf
[2] Intergovernmental Panel on Climate Change 2007
[3] 20% Wind Energy by 2030 (2008).

minimizing significant adverse impacts, and when appropriate, compensating for unavoidable significant adverse impacts, as determined through the tiered approach described in the recommended Guidelines (Section III attached).

C. Committee Premises and Guiding Principles

Committee Premises

1. The Committee acknowledges the USFWS definition of wildlife (see Appendix A: Glossary). The Committee recognizes that different species and species groups have different levels of protection under tribal authority and federal and state wildlife statutes (see Appendix B: Legal White Paper).

   It is the Committee's intention to identify, evaluate and recommend approaches to assessing risk and impacts to wildlife associated with wind energy development that are useful regardless of the regulatory status of any particular species, and that are particularly focused on those species most likely to be affected by wind energy development.

2. The Committee recognizes that, among different wind energy projects, there will be varying degrees of potential impact to wildlife as well as varying degrees of certainty associated with the assessments of that potential impact. Thus, varying levels of effort will be appropriate in assessing the risk of potential projects and determining how or whether the projects are developed.

3. The Committee recognizes that it is possible and essential to mitigate negative impacts on wildlife populations and habitats while balancing expected impacts with the costs of undertaking necessary studies and monitoring.

Committee Guiding Principles

The Guidelines should:

1. Provide a consistent methodology for conducting pre-construction risk assessments and post-construction impact assessments to guide siting decisions by developers and agencies.

2. Encourage communication and coordination between the developer and relevant state and federal agencies during all phases of wind energy project development.

3. Provide mechanisms to encourage the adoption and use of the Guidelines by all federal agencies, as well as the wind energy industry, while recognizing the primary role of the lead agency in coordinating specific project assessments.

4. Complement state and tribal efforts to address wind/wildlife interactions and provide a voluntary means for these entities to coordinate and standardize review of wind projects with the USFWS.

5. Provide a clear and consistent approach that increases predictability and reduces the risk of liability exposure under federal wildlife laws.

6. Provide sufficient flexibility to accommodate the diverse geographic and habitat features of different wind development sites.

7. Present mechanisms for determining compensatory mitigation, when appropriate, in the event of unforeseen impacts to wildlife during construction or operation of a wind energy project.

8. Define scientifically rigorous and cost-effective study designs that improve the ability to predict direct and indirect wildlife impacts locally and regionally.

9. Include a formal mechanism for revision in order to incorporate experience, technological improvements, and scientific advances that reduce uncertainty in the interactions between wind energy and wildlife.

II. Committee Policy Recommendations

A. Adoption and Use of the Guidelines

Adopt and consistently implement the voluntary Guidelines recommended in this document. The Committee gave considerable attention to the production of a suggested protocol for wildlife assessment and siting decisions at wind energy projects. This protocol, described in detail in Chapter Three of this document, uses a tiered approach to evaluate, predict, and minimize the risk of potential wind energy projects to wildlife and habitat, and to assess and, as appropriate, provide compensatory mitigation for significant adverse post-construction impacts. The Committee believes that the final product reflects a comprehensive and user-friendly risk assessment and decision-making tool that supports Department of the Interior (DOI) priorities with respect to renewable energy development, federal and state trust responsibilities, developer cost and confidentiality concerns, and the needs of federal or state listed wildlife and habitats, without creating new regulations. The Committee recommends that the Secretary of the Interior (Secretary) direct the U.S. Fish and Wildlife Service (USFWS) to promptly adopt the recommended voluntary Guidelines developed by the Committee.

In adopting and implementing the Guidelines, use the premises and principles adopted by the Committee, as set forth in the Preamble.

B. Tools and Support for Implementation

Develop landscape tools and provide analysis to assist in implementation of the Guidelines. The Committee recommends that the Secretary instruct USFWS, in consultation with the U.S. Geological Survey and state agencies, to assemble and maintain a comprehensive national scale landscape database based on scientifically credible sources. This database will assist in identifying and assessing development risks to ecosystems, large-scale habitats, and migratory and resident species that rely on large-landscape or specialized habitats. In developing this database, the USFWS should consult and assess existing and on-going landscape analysis and mapping efforts focused on renewable energy, including, but not limited to: the California Renewable Energy Transmission Initiative, Western Governors' Association Wildlife Habitat Council, The Nature Conservancy, National Audubon Society, and American Wind and Wildlife Institute activities. Such a database should have broad applicability to help guide decisions regarding other types of development, including other energy sources. However, the Committee stresses that the lack of landscape-level tools should not in any way delay the use and application of the recommended Guidelines.

Provide and/or support adequate, meaningful incentives for industry's voluntary adoption of the Guidelines. The Committee has explored a suite of incentives to encourage universal adoption of the recommended voluntary Guidelines. The Committee recommends that DOI implement incentives within DOI's purview simultaneously with adoption and implementation of the Guidelines. The Committee also recommends that DOI engage

constructively to support potential incentives that are outside the purview of DOI (for instance, those that would require statutory changes) and encourage their timely adoption and implementation.

Advance the use, cooperation, and effective implementation of the Guidelines. Coordinate with DOI and other federal agencies, Tribes, states, wind developers and stakeholders to maximize the use and effectiveness of the Guidelines. To do this, the Committee recommends the Secretary consider the following:

- Encourage collaboration and coordination with other federal and state agencies and Tribes to ensure timely and consistent review of wind energy projects and resolve conflicts among and within agencies.
- Develop best management practices based on the Guidelines.
- Promote use of the Guidelines by federal and state agencies, as well as by the private sector.
- Provide training to USFWS and other federal or tribal agency field personnel on effective use of the Guidelines.
- Advance the involvement and cooperation of non-governmental organizations with an interest in improving siting and compensatory mitigation for wind energy projects.

Assure that the USFWS has an adequate budget and staff resources to implement the Guidelines as necessary, including training of Regional and Field staff and other interested stakeholders.

When making policy decisions, address both the threat to birds and other wildlife from climate change, and the effects of other stressors. When conducting its review of wind energy development pursuant to the Guidelines, the Secretary is encouraged to make management, policy, project-specific assessment, siting, and mitigation decisions with appropriate consideration of wind energy's air pollution, greenhouse gas, water consumption, and other benefits. According to the USFWS Climate Change Strategic Plan (Strategic Plan), climate change is the greatest challenge USFWS has ever faced in conserving fish, wildlife and their habitats. The Strategic Plan outlines a joint commitment to *mitigation*[4] (reducing the sources or enhancing the sinks of carbon dioxide) and *adaptation*[4] (management to reduce the impacts of climate change on fish, wildlife and habitats). The Committee urges the Secretary to keep both of the following commitments in mind when making management decisions related to wind development: recognizing both the important role that wind energy, as a carbon-free energy source, will play in climate change *mitigation*[4], while also delivering wind energy projects on the landscape in a manner that supports wildlife *adaptation*[4] to climate change, namely by minimizing wind energy development's potential to itself be a non-climate stressor.

[4] As defined by the Intergovernmental Panel on Climate Change (IPCC).

C. Future Application

Work with other federal and tribal agencies, stakeholders, and states to develop a national research plan that identifies and implements research priorities to reduce impacts to wildlife resources while allowing wind energy development. Research should be conducted collaboratively, wherever possible, and should include appropriate stakeholders and peer review.

Revise the Guidelines. Review and revise the Guidelines, as justified, at least once every five years to incorporate new knowledge on wildlife interactions with wind energy and the rapidly advancing technology of commercialized wind energy production. The Secretary should use the Committee's premises and principles to assist in revisions of the Guidelines.

DOI should improve its capability to assess cumulative impacts by working with the USFWS Regions to:

- Review the range of development-related significant adverse impacts.
- Review species of concern and/or their habitats within the landscape at the most risk of significant impacts from wind development, in conjunction with other reasonably foreseeable significant adverse impacts.
- Develop data that can be used to conduct regional or landscape level analysis.

The product of regional analyses of cumulative impacts should be available to inform Tier 1 preliminary site assessment or Tier 2 site characterization and may be useful for designing Tier 3 wildlife surveys. However, the Committee stresses that the lack of tools for cumulative impact analysis should not in any way delay the use and application of the recommended Guidelines.[5]

[5] The Committee also recommends that in developing the scope of this cumulative effects analysis, the USFWS review the conclusions of the white paper on cumulative effects analysis developed by the USFWS, Oregon Department of Fish and Wildlife, and other stakeholders during the development of the Oregon Columbia Ecoregion Wind Energy Siting and Permitting Guidelines (September 29, 2008). The white paper reviewed multistate cumulative effects analyses prepared by WEST, Inc. in the Pacific Northwest and made recommendations on how such analyses could be more effective. Recommendations included:

- Collaborative funding and management of regional cumulative effects analysis
- Focus on a limited number of key regional indicator species and habitats most likely to be affected by wind energy
- Studies to better understand the population dynamics of the key indicator species and to develop "impact levels of concern"
- Development of an action plan for impacts to key species and habitats that are above "threshold of concern" levels

U.S. Fish and Wildlife Service
Wind Turbine Guidelines Advisory Committee

III. Recommended Guidelines

Recommendations on developing effective measures to mitigate impacts to wildlife and their habitats related to land-based wind energy facilities

Submitted to the Secretary of the Interior
March 4, 2010

By the Wind Turbine Guidelines Advisory Committee

This document is a recommendation to the Secretary of the Interior. As such, any legal conclusions in these recommendations or its attachments do not necessarily reflect the legal position of the United States.

Acknowledgments

The Chairman would like to note the following individuals who offered their assistance to the Committee. With an impressively broad range in expertise and interests, their hard work and dedication contributed to and ensured the success of this process and the quality of the final report:

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USFWS Regional Offices that provided comments

U.S. Fish and Wildlife Service
Wind Turbine Guidelines Advisory Committee
Recommended Guidelines

Table of Contents

Committee Members and Alternates

List of Acronyms

Chapter One: Introduction 1
- A. Background 1
- B. Premises and Guiding Principles 1
  - Premises 1
  - Principles 2
- C. Purpose of the Guidelines 3
- D. Benefits of Using the Guidelines 3

Chapter Two: Summary of the Guidelines and General Considerations 7
- A. Intended Use of the Guidelines 7
  - Project Scale and Location 7
  - Project Interconnection Lines 7
- B. Introduction to the Decision Framework Using a Tiered Approach 8
  - Application of the Tiered Approach and Possible Outcomes 8
  - Application of the Tiered Approach and Risk Assessment 9
  - Applicability of Adaptive Management 11
- C. Other Elements of the Guidelines 12
  - Use of Mitigation Policies and Principles 12
  - Confidentiality of Site Evaluation Process as Appropriate 12
  - Cumulative Impacts of Project Development 12
  - Landscape Considerations 13
- D. Research 14

Chapter Three: The Tiered Approach for Wildlife Assessment and Siting Decisions 15
- A. Tier 1: Preliminary Evaluation or Screening of Potential Sites 15
  - Tier 1 Questions 17
  - Tier 1 Methods and Metrics 17
  - Use of Tier 1 Information 18
- B. Tier 2: Site Characterization 19
  - Tier 2 Questions 19
  - Tier 2 Methods and Metrics 20
  - Tier 2 Decision Process 24

C. Tier 3: Field Studies to Document Site Wildlife Conditions and Predict Project Impacts 25
Tier 3 Questions 25
Tier 3 Study Design Issues 26
Tier 3 Methods and Metrics....27
Bird distribution, abundance, behavior and site use 32
Bat survey methods 36
Other bat survey techniques 38
Other wildlife 39
Tier 3 Decision Point 42
D. Site Construction: Site Development and Construction Best Management Practices 44
E. Tier 4: Post-Construction Fatality Studies 47
Tier 4 Questions 48
Tier 4 Protocol Design Issues 49
Frequency of carcass searches.... 49
Number of turbines to monitor.... 50
Delineation of carcass search plots, transects, and habitat mapping 50
General search protocol guidance 51
Field bias and error assessment....52
Estimators of fatality 52
Tier 4 Methods and Metrics 54
F. Tier 5: Other Post-construction Studies.... 56
Tier 5 Questions 56
Tier 5 Study Design Issues 58
Tier 5 Examples 59
Tier 5 Studies and Research 61
G. Retrofitting, Repowering, and Decommissioning Best Management Practices 64
Retrofitting.... 64
Repowering Existing Wind Projects 64
Decommissioning.... 65

Chapter Four: Mitigation 67

Chapter Five: Advancing Use, Cooperation, and Effective Implementation of the Guidelines.... 69
A. USFWS Adoption and Implementation of Guidelines 69
Process and Timeline for Developing Final USFWS Guidelines.... 69
General Considerations 70
Phase-in for using Committee's Recommended Guidelines 71
B. Project Development and Coordination with the USFWS 72
Coordination and/or Consultation with USFWS....72
Ensuring Timely Project Review....72

Conflict Resolution....73
Consideration of the Guidelines in MBTA and BGEPA Enforcement....73
Optional Use of Avian and Bat Protection Plan (ABPP)....74
C. Federal Interagency Coordination and Cooperation....74
D. USFWS-State Coordination and Cooperation....75
E. USFWS-Tribal Coordination and Cooperation....76
Authorities for Federal-Tribal Coordination....77
Tribal Coordination....77
F. NGO Actions....80
NGO Conservation Lands....81

Appendices....83
Appendix A: Glossary....A1-8
Appendix B: Legal White Paper (*presented and adopted at October 21-23, 2008 Committee Meeting*)....B1-24
Appendix C: Landscape-Level Mapping Tools for Assessing Wildlife and Habitat Impacts, *from the Landscape/Habitat Subcommittee* (presented at *October 21-23, 2008 Committee Meeting*)....C1-4
Appendix D: Literature Cited....D1-10

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The Committee would like to acknowledge the contributions of former Committee Members Michael Daulton, National Audubon Society, Karen Douglas, California Energy Commission, and Andrew Linehan, Iberdrola Renewables, to this process.

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Acronyms:

ABPP – Avian and Bat Protection Plan
APLIC – Avian Power Line Interaction Committee
APWRA – Altamont Pass Wind Resource Area
BA – Before-After analysis
BACI – Before-After Control-Impact study design
BGEPA – Bald and Golden Eagle Protection Act
BLM – Bureau of Land Management
BMP – Best Management Practice
CRP – Conservation Reserve Program
CWA – Clean Water Act
ESA – Endangered Species Act
FAA – Federal Aviation Administration
FACA – Federal Advisory Committee Act
FRPP – Farm and Ranchlands Protection Program
DOE – U.S. Department of Energy
DOI – U.S. Department of the Interior
GIS – Geographic Information System
GRP – Grasslands Reserve Program
GS3C – Grassland Shrub-Steppe Species Collaborative
MBTA – Migratory Bird Treaty Act
NEPA – National Environmental Policy Act
NWCC – National Wind Coordinating Collaborative
RETI – Renewable Energy Transmission Initiative
RSF – Resource Selection Function
USDA FSA – U.S. Department of Agriculture Farm Services Agency
USDA-NRCS U.S. Department of Agriculture – Natural Resource Conservation Service
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey
WRP – Wetlands Reserve Program

Chapter One: Introduction

A. Background

In response to the United States' growing demand for production of electricity by wind energy and in recognition of the U.S. Fish and Wildlife Service (USFWS) mission "Working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people," the Secretary of the Interior (Secretary) authorized the Wind Turbine Guidelines Advisory Committee (Committee), chaired by USFWS, to recommend effective measures to avoid or minimize impacts to wildlife and their habitats related to land-based wind energy facilities.

Herein are the Committee's Recommended Guidelines (Guidelines). They are based on more than two years of deliberations and judgments regarding the siting and operation of large wind energy developments while minimizing adverse impacts to wildlife and their habitats. The Committee is composed of a broad array of representatives, among the most informed in the country, selected for their outstanding experience on these issues. These Guidelines are the Committee's best attempt to present the most effective, feasible, practicable, and appropriate approaches available to the Department of the Interior (DOI), Tribes, states, local jurisdictions, and the wind industry to address their respective responsibilities to protect wildlife resources while encouraging responsible siting and operation of wind energy projects.

B. Premises and Guiding Principles

In its development of these Guidelines, the Committee accepted by consensus[6] the following premises and principles and recommends these be incorporated into the final guidance published by the USFWS.

Premises

1. The Committee acknowledges the USFWS definition of wildlife (see Appendix A: Glossary). The Committee recognizes that different species and species groups have different levels of protection under tribal authority and federal and state wildlife statutes (see Appendix B: Legal White Paper).

   It is the Committee's intention to identify, evaluate and recommend approaches to assessing risk and impacts to wildlife associated with wind energy development that are useful regardless of the regulatory status of any particular species, and that are particularly focused on those species most likely to be affected by wind energy development.

[6] March 26, 2009

2. The Committee recognizes that, among different wind energy projects, there will be varying degrees of potential impact to wildlife as well as varying degrees of certainty associated with the assessments of that potential impact. Thus varying levels of effort will be appropriate in assessing the risk of potential projects and determining how or whether the projects are developed.

3. The Committee recognizes that it is possible and essential to mitigate negative impacts on wildlife populations and habitats while balancing expected impacts with the costs of undertaking necessary studies and monitoring.

Principles

The Guidelines should:

1. Provide a consistent methodology for conducting pre-construction risk assessments and post-construction impact assessments to guide siting decisions by developers and agencies.

2. Encourage communication and coordination between the developer and relevant state and federal agencies during all phases of wind energy project development.

3. Provide mechanisms to encourage the adoption and use of the Guidelines by all federal agencies, as well as the wind energy industry, while recognizing the primary role of the lead agency in coordinating specific project assessments.

4. Complement state and tribal efforts to address wind/wildlife interactions and provide a voluntary means for these entities to coordinate and standardize review of wind projects with the USFWS.

5. Provide a clear and consistent approach that increases predictability and reduces the risk of liability exposure under federal wildlife laws.

6. Provide sufficient flexibility to accommodate the diverse geographic and habitat features of different wind development sites.

7. Present mechanisms for determining compensatory mitigation, when appropriate, in the event of unforeseen impacts to wildlife during construction or operation of a wind energy project.

8. Define scientifically rigorous and cost-effective study designs that improve the ability to predict direct and indirect wildlife impacts locally and regionally.

9. Include a formal mechanism for revision in order to incorporate experience, technological improvements, and scientific advances that reduce uncertainty in the interactions between wind energy and wildlife.

C. Purpose of the Guidelines

The primary purpose of these Guidelines is to describe the information typically needed to identify, assess, and monitor the potentially adverse impacts of wind energy projects on wildlife and their habitats, especially migratory birds and bats, to:

- Guide the wind energy industry to make the best possible choices on the location, design and operation of projects to avoid or minimize the risks to wildlife and their habitats.
- Ensure that the responsible federal action agency for any wind energy installation is aware of and considers the appropriate factors that present risks to wildlife and their habitats and the full range of options to avoid, minimize and, as appropriate, provide compensation for unavoidable significant adverse impacts.
- Specify the types and amount of baseline information required for adequate review of a project, and describe the likely extent of follow-up that would be necessary after construction.

Additional purposes of the Guidelines are to:

- Promote responsible development of wind energy facilities across the country.
- Enable states, Tribes, USFWS, developers and stakeholders to share information and data regarding avian and bat studies, avoidance, minimization, and, as appropriate, compensatory mitigation, siting practices, and monitoring of habitat/species impacts, to increase understanding of risks and the effectiveness of siting and operating decision-making.
- Develop effective, consistent and cost-effective methods and protocols to guide project-specific studies, to improve assessment of risk and impacts by producing comparable data.
- Allow for comparison among field studies from around the country.

D. Benefits of Using the Guidelines

As the United States moves to achieve its renewable energy commitments, it must also maintain and protect its wildlife resources. The Committee's recommended Guidelines will facilitate wind energy development while protecting wildlife and their habitats. The Guidelines provide best management practices to address wind energy-wildlife interactions and, although voluntary, will result in greater regulatory certainty for the wind energy developer (developer), resulting in the following four types of benefits.

1. Reduced Ecological Impacts

The Guidelines offer a science-based reference for use by industry, federal, state, tribal and local agencies, and other stakeholders in the siting and permitting of wind energy projects. The Guidelines describe the kind of information needed to adequately identify, assess, mitigate, and monitor wind energy-wildlife impacts when developing new projects and repowering existing facilities. The Guidelines will promote scientifically sound and cost-effective study designs, produce comparable data among studies throughout the country, allow for analyses of trends and patterns of impacts at multiple sites, and ultimately improve the ability to estimate and resolve impacts to wildlife and habitats both locally and regionally.

2. Increased Compliance and Reduced Regulatory Risk

The Guidelines are a tool for facilitating compliance with relevant laws and regulations by recommending methods for conducting site-specific, scientifically sound biological evaluations. Following the Guidelines is consistent with the National Environmental Policy Act (NEPA), namely, to provide full and fair discussion of significant adverse impacts of wind energy development upon wildlife arising from potential federal actions. The Guidelines are also consistent with the intent of NEPA to ensure full disclosure and consideration of any damage to the environment. The Guidelines facilitate achieving the NEPA objective of ensuring that environmental resources are given appropriate consideration in planning and decision-making processes. Using the methods described in the Guidelines will provide information for impact assessment and mitigation. Mitigation is defined in this document as avoiding or minimizing significant adverse impacts, and when appropriate, compensating for unavoidable significant adverse impacts, as determined through the tiered approach recommended in the Guidelines. When used hereafter in this document, the term "mitigation" includes, collectively, the concepts of avoidance, minimization, and, as appropriate, compensatory mitigation (see Chapter Four). Using the Guidelines also demonstrates a good faith effort to develop and operate projects consistent with the intent of local, state, and federal laws. Using the Guidelines, however, does not by itself provide authorization to take wildlife under any applicable statute. If take were to occur, and if appropriate authorization is available under the applicable wildlife statute, the developer should obtain that authorization.

3. Improved Predictability of Wildlife and Habitat Impact

The goal of the Guidelines is to provide a consistent, predictable approach to assessing impacts to wildlife and habitats from projects, while providing flexibility to accommodate the unique circumstances of each project. As comparable information using consistent and common methods and protocols becomes available from projects around the nation, meta-analysis will continue to provide information that allows better predictive modeling. The growing body of information will assist in providing valuable information on "use" of wind energy sites by and potential impacts to wildlife. Over time, the growing knowledge base should decrease the need for some monitoring studies.

4. Cost Savings

The Guidelines will promote scientifically sound, cost-effective study designs proportionate to the risk to wildlife and their habitats, produce comparable data among studies within the nation, allow for analyses of trends and patterns of impacts at multiple sites, and ultimately improve the ability to predict and resolve impacts locally, regionally and nationally. This will reduce the need for some studies, thereby reducing project costs. Initiating pre-construction surveys early will help avoid unnecessary and costly delays during permitting. The Guidelines advise that the costs and the resulting benefits be considered when developing the monitoring efforts needed for each project site. Some monitoring methods and/or technologies are expensive and should be recommended only when necessary.

Chapter Two:

Summary of the Guidelines and General Considerations

A. Intended Use of the Guidelines

These Guidelines are intended to be voluntary. Although voluntary, the Guidelines described in this report are designed to be used by all prospective developers of wind energy projects and by USFWS field staff reviewing such projects. The Guidelines also are intended to suggest a useful approach for local, state and tribal officials, and other interested stakeholders.

The Committee wrote the Guidelines to be as specific as possible with regard to the expectations, recommendations, and appropriate assessments for developing a project. They must, however, apply to a large diversity of projects in many different habitats. The Guidelines are intended to provide flexibility in their application and in consideration of project-specific factors, and are not to be rigidly applied in every situation. The Guidelines are designed to address current commercial technology.

Project Scale and Location

The tiered approach is designed to lead to the appropriate amount of evaluation in proportion to the anticipated level of risk that a project may pose to wildlife and their habitats. Study plans and the duration and intensity of study efforts should be tailored specifically to the unique characteristics of each site and the corresponding potential for significant adverse impacts on wildlife and their habitats as determined through the tiered approach. In particular, the risk of adverse impacts to wildlife and their habitats tends to be a function of site location, not necessarily the size of the project. A small project may pose greater risk to wildlife than a larger site in a less sensitive location, and would therefore require more pre- and post-construction studies than the larger site. This is why the tiered approach begins with an examination of the potential location of the project, not the size of the project. In all cases, study plans and selection of appropriate study methods and techniques should be tailored to the relative scale, location and potential for significant adverse impacts of the proposed site.

Project Interconnection Lines

The Guidelines are designed to address all elements of a wind energy facility, including the turbine string or array, access roads, ancillary buildings, and the above- and below-ground electrical lines which connect a project to the transmission system. It is recommended that the project evaluation include consideration of the wildlife- and habitat-related impacts of these electrical lines, and that the developer include measures to reduce impacts of these lines, such as those outlined in the Avian Power Line Interaction Committee (APLIC)

Suggested Practices for Avian Protection on Power Lines (2006). The Guidelines are not designed to address transmission beyond the point of interconnection to the transmission system. The national grid and proposed smart grid system are beyond the scope of these Guidelines.

B. Introduction to the Decision Framework Using a Tiered Approach

The Committee recommends using a tiered approach, an iterative process for evaluating the risks and minimizing the impacts to wildlife of a wind energy project. The tiered approach provides a decision framework for collecting information in increasing detail to evaluate risk and make siting and operational decisions. It provides the opportunity for evaluation and decision-making at each tier, enabling a developer to abandon or proceed with project development, or to collect additional information if required. This approach does not require that every tier, or every element within each tier, be implemented for every project. Instead, it allows efficient use of developer and wildlife agency resources with increasing levels of effort until sufficient information and the desired precision is acquired for the risk assessment.

Application of the Tiered Approach and Possible Outcomes

The flow chart on page 10 ("General Framework for Minimizing Impacts of Wind Development on Wildlife in the Context of the Siting and Development of Wind Energy Projects") illustrates the tiered approach, which consists of up to five iterative stages, or tiers:

Tier 1 – Preliminary evaluation or screening of potential sites

Tier 2 – Site characterization

Tier 3 – Field studies to document site wildlife conditions and predict project impacts

Tier 4 – Post-construction fatality studies

Tier 5 – Other post-construction studies

At each tier, potential issues associated with developing or operating a project are identified and questions formulated to guide the decision process. Chapter Three outlines the questions to be posed at each tier, and describes recommended methods and metrics for gathering the data needed to answer those questions.

If sufficient data are available at a particular tier, the following outcomes are possible based on analysis of the information gathered:

1. The project is abandoned because the risk is considered unacceptable.
2. The project proceeds in the development process without additional data collection.

3. An action or combination of actions, such as project modification, mitigation, or specific post-construction monitoring, is indicated.

If data are deemed insufficient at a tier, more intensive study is conducted in the subsequent tier until sufficient data are available to make a decision to abandon the project, modify the project, or proceed with and expand the project.

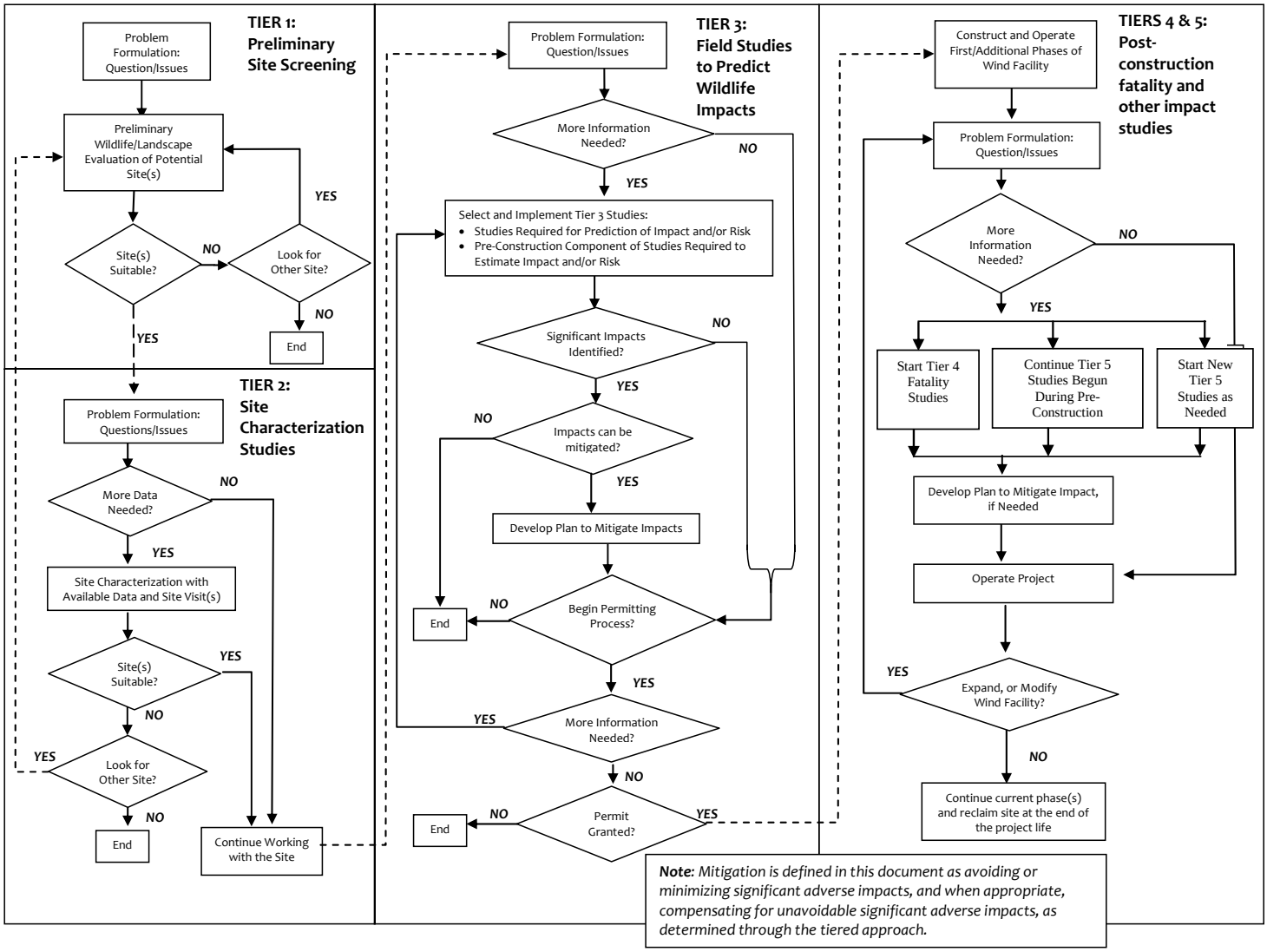
Application of the Tiered Approach and Risk Assessment

Risk is defined as the likelihood that adverse impacts will occur to individuals or populations of species of concern as a result of wind energy development and operation. In this context, collision risk can be defined for individuals of a species or groups of species (such as raptors) as the estimated number of collision fatalities (impact), divided by the number of individuals in the zone of risk (exposure). Estimates of fatality risk can be used in a relative sense, allowing comparisons among projects, alternative development designs, and in the evaluation of potential risk to populations. Because there are relatively few methods available for direct estimation of risk, a weight-of-evidence approach is often used (Anderson et al. 1999). Until such time that reliable risk predictive models are developed, estimates of risk would typically be qualitative, but would be based upon quantitative site information.

Risk can also be defined in the context of populations, but the calculation is more complicated as it could involve estimating the reduction in population viability as indicated by demographic metrics such as growth rate, size of the population, or survivorship, either for local populations, metapopulations, or entire species. For most populations, risk cannot easily be reduced to a strict metric, especially in the absence of population viability models for most species. Consequently, estimating the quantitative risk to populations is usually beyond the scope of project studies due to the difficulties in evaluating these metrics, and therefore risk assessment will be qualitative. Risk to habitat is a component of the evaluation of population risk. In this context, the estimated loss of habitat is evaluated in terms of the potential for population level effects (e.g., reduced survival or reproduction).

The assessment of risk should synthesize sufficient data collected at a project to estimate exposure and predict impact for individuals and their habitats for the species of concern, with what is known about the population status of these species, and in communication with the relevant wildlife agency and industry wildlife experts. Predicted risk of these impacts could provide useful information for determining appropriate mitigation measures if determined to be necessary. In practice in the tiered approach, risk assessments conducted in Tiers 1 and 2 require less information to reach a risk-based decision than those conducted at higher tiers.

General Framework for Minimizing Impacts of Wind Development on Wildlife in the Context of the Siting and Development of Wind Energy Projects



Applicability of Adaptive Management

Adaptive management (AM) can be categorized into two types: "passive" and "active" (Walters and Holling 1990, Murray and Marmorek 2003). In passive AM, alternatives are assessed and the management action deemed best is designed and implemented. Monitoring and evaluation then lead to adjustments, as necessary. In active AM, managers explicitly recognize that they do not know which management approaches are best, so they select several alternative management approaches to design and implement.[7] Active AM, if necessary, should be explored and applied only when substantial uncertainty exists regarding the approaches to avoiding or minimizing significant adverse impacts. With the possible exception of evaluating project-specific mitigation measures, these Guidelines do not recommend that active AM be implemented at projects. Active AM may be appropriate if there is a specific research objective that is probably applicable to multiple projects; however, these Guidelines recognize that accomplishing such objectives is outside this decision framework, and would involve multiple stakeholders and funding sources.

Adaptive management, whether active or passive, is not typically applied to projects because in the majority of instances, the impacts and the level of uncertainty do not warrant its use. Nevertheless, the tiered approach is designed to accommodate AM if warranted. In the pre-construction environment, analysis and interpretation of information gathered at a particular tier influence the decision to proceed further with the project or the project assessment. If the project is constructed, information gathered in the pre-construction assessment guides possible project modifications, mitigation or the need for and design of post-construction studies. Analysis of the results of post construction studies can test design modifications and operational activities to determine their effectiveness in avoiding or minimizing significant adverse impacts. When there is considerable uncertainty over the appropriate mitigation for a project, active AM is the preferred approach to testing the effectiveness of alternative approaches.

For AM to work, there must be agreement to adjust management and/or mitigation measures if monitoring indicates that goals are not being met. The agreement should include a timeline for periodic reviews and adjustments as well as a mechanism to consider and implement additional mitigation measures as necessary after the project is developed.

Passive and active AM as described above are similar to the process described in the DOI Adaptive Management Technical Guide (Williams et al 2007). As described in the Technical Guide, application of AM includes five key elements: stakeholder involvement, management objectives, management alternatives, predictions of the effects of potential management actions, and monitoring protocols and plans. These elements are folded into the structured process of decision-making, monitoring, and assessment. Passive AM, and its use in the tiered approach, is consistent with the technique outlined in the Technical Guide.

[7] In active adaptive management, monitoring and evaluation of each alternative helps in deciding which alternative is more effective in meeting objectives, and adjustments to the next round of management decisions can be based on those lessons.

C. Other Elements of the Guidelines

Use of Mitigation Policies and Principles

These Guidelines contain valid, economic, technically feasible and effective methods and metrics intended to evaluate risk and estimate impacts to wildlife, inform permitting decisions, and satisfy environmental assessment processes. The objective is to avoid or minimize significant adverse impacts and when appropriate, to provide compensatory mitigation for unavoidable significant adverse impacts, as identified in the tiered approach recommended in the Guidelines. When used alone in this document, the term "mitigation" includes avoiding or minimizing significant adverse impacts, and when appropriate, compensating for unavoidable significant adverse impacts. Several tools are available to determine appropriate mitigation, including the USFWS Mitigation Policy (USFWS Mitigation Policy, 46 FR 7656 (1981)). The USFWS policy provides a common basis for determining how and when to use different mitigation strategies, and facilitates earlier consideration of wildlife values in wind energy project planning. While the USFWS uses the Mitigation Policy for project reviews, developers may also use other tools to determine appropriate mitigation. Chapter Four includes additional information regarding the use of mitigation and elements considered by the USFWS during mitigation development. Wind energy developers also should consult with appropriate state agencies to ensure compliance with state mitigation requirements.

Confidentiality of Site Evaluation Process as Appropriate

Some aspects of the initial pre-construction risk assessment, including preliminary screening and site characterization, occur early in the development process, when land or other competitive issues limit developers' willingness to share information on projects with the public and competitors. Any consultation or coordination with agencies at this stage may include confidentiality agreements.

Cumulative Impacts of Project Development

Cumulative impacts are the comprehensive effect on the environment that results from the incremental impact of a project when added to other past, present, and reasonably foreseeable future actions. Consideration of cumulative impacts should be incorporated into the wind energy planning process as early as possible to improve decisions. To achieve that goal, it is important that agencies and organizations take the following actions to improve cumulative impacts analysis: review the range of development-related significant adverse impacts, determine which species of concern or their habitats within the landscape are most at risk of significant adverse impacts from wind development in conjunction with other reasonably foreseeable significant adverse impacts, and make that data available for regional or landscape level analysis. The magnitude and extent of the impact on a resource depends on whether the cumulative impacts exceed the capacity for resource sustainability and productivity.

Federal agencies are required to include a cumulative impacts analysis in their NEPA review, including any energy projects that require a federal permit or have any other federal nexus. The federal action agency coordinates with the developer to obtain the necessary information for the NEPA review and cumulative impacts analysis. To avoid project delays, federal and state agencies are encouraged to use existing wildlife data for the cumulative impacts analysis until improved data are available.

Where there is no federal nexus, individual developers are not expected to conduct their own cumulative impacts analysis. However, a cumulative impacts analysis would help developers and other stakeholders better understand the significance of potential impacts on wildlife and habitats. Developers are encouraged to coordinate with federal and state agencies early in the project planning process to access any existing information on the cumulative impacts of individual projects on species and habitats at risk, and to incorporate it into project development and any necessary wildlife studies.

Landscape Considerations

One important component of the comprehensive landscape database is the identification of large blocks of intact habitat for species of habitat fragmentation concern (see Glossary). Development of this database and identification of these intact habitats is the shared responsibility of the various stakeholders (not developers), with a key leadership role to be played by USFWS.

The Secretary of the Interior recently directed USFWS, in cooperation with other DOI agencies, to stimulate the development of a network of collaborative "Landscape Conservation Cooperatives." These cooperatives are one approach to identifying large, intact habitats for species of habitat fragmentation concern.

Within identified intact habitats for species of habitat fragmentation concern, it is essential that the anthropogenic factors that may lead to harmful loss and fragmentation be identified. Where possible, best management practices (BMPs) should be developed to avoid or minimize the effects of habitat loss and fragmentation. It may be possible to develop other mitigation measures to offset unavoidable significant adverse impacts.

The identification of intact habitats for species of habitat fragmentation concern, and development of mitigation measures, should be accomplished through a collaborative process, beginning after the USFWS publishes final guidelines and continuing as more is learned about the potential habitat impacts of wind energy development. Through the implementation of these Guidelines, individual companies can provide valuable information that will assist in the collaborative landscape analysis. However, the lack of a landscape database and BMPs should not in any way delay the use and application of these Guidelines.

D. Research

Much uncertainty remains about predicting risk and estimating impacts of wind energy development on wildlife. Thus there is a need for additional research to improve scientifically based decision-making when siting wind energy facilities, evaluating impacts on wildlife and habitats, and testing the efficacy of mitigation measures. More extensive studies are needed to further elucidate patterns and test hypotheses regarding possible solutions to wildlife and wind energy impacts.

It is in the interests of wind developers and wildlife agencies to improve these assessments to better avoid or minimize the impacts of wind energy development on wildlife and their habitats. The Committee recommends that research to improve predictions of pre-construction risk and estimates of post-construction impacts be a high priority. Research can provide data on operational factors (e.g. wind speed, weather conditions) that are likely to result in fatalities. It could also include studies of cumulative impacts of multiple wind energy projects, or comparisons of different methods for assessing avian and bat activity relevant to predicting risk. Monitoring and research should be designed and conducted to ensure unbiased data collection that meets technical standards such as those used in peer review. Research projects may occur at the same time as project-specific Tier 4 and Tier 5 studies.

Research would usually result from collaborative efforts involving appropriate stakeholders, and is not the sole or primary responsibility of any developer. Research partnerships (e.g., Bats and Wind Energy Cooperative (BWEC)[8], Grassland and Shrub Steppe Species Collaborative (GS3C)[9]) involving diverse players will be helpful for generating common goals and objectives and adequate funding to conduct studies (Arnett and Haufler 2003). The National Wind Coordinating Collaborative (NWCC)[10], the American Wind Wildlife Institute (AWWI)[11], and the California Energy Commission (CEC)'s Public Interest Energy Research Program[12] all support research in this area.

Study sites and access will be required to design and implement research, and developers are encouraged to participate in these research efforts when possible. Subject to appropriations, the USFWS also should fund priority research and promote collaboration and information sharing among research efforts to advance science on wind energy-wildlife interactions, and to improve these Guidelines.

[8] www.batsandwind.org
[9] www.nationalwind.org
[10] www.nationalwind.org
[11] http://www.awwi.org
[12] http://www.energy.ca.gov/research

Chapter Three:

The Tiered Approach for Wildlife Assessment and Siting Decisions

This chapter describes in detail the suggested process for each stage of the tiered approach, with additional sections outlining BMPs during site construction, retrofitting, repowering and decommissioning phases of a project.

The first three tiers correspond to the pre-construction evaluation phase of wind energy development. At each of the three tiers, the Guidelines provide a set of questions that the Committee recommends developers attempt to answer, followed by recommended methods and metrics to use in answering the questions. Some questions are repeated at each tier, with successive tiers requiring a greater investment in data collection to answer certain questions. For example, while Tier 2 investigations may discover some existing information on federal or state-listed species and their use of the proposed development site, it may be necessary to collect empirical data in Tier 3 studies to determine the presence of federal or state-listed species.

The decision to proceed to the next tier is made by the developer. The decision is based on whether all questions identified in the tier have been adequately answered and whether the methods for arriving at the answers were appropriate for the site selected and the risk posed to species of concern and their habitats. Answers indicating little or no risk for all questions in a tier may lead the developer to conclude that the tiered approach may end in that tier, without the necessity to proceed to the next tier. The developer is encouraged to communicate early in the tiered approach with relevant agencies and stakeholders.

A. Tier 1: Preliminary Evaluation or Screening of Potential Sites

Tier 1

For developers taking a first look at a broad geographic area, a preliminary evaluation of the general ecological context of a potential site or sites can serve as useful preparation for coordination with the federal, state, tribal, and/or local agencies. USFWS is available to assist wind energy project developers to identify potential wildlife and habitat issues and should be contacted as early as possible in the company's planning process. The Committee encourages the USFWS to respond expeditiously and substantively. With this internal screening process, the developer can begin to identify broad geographic areas of high sensitivity due to the presence of: 1) large blocks of intact native landscapes, 2) intact ecological communities, 3) fragmentation-sensitive species' habitats, or 4) other important landscape-scale wildlife values.
Tier 1 may be used in any of the following three ways:

1. To identify regions where wind energy development poses substantial risks to species of concern or their habitats, including the fragmentation of large-scale habitats and threats to regional populations of federal- or state-listed species.
2. To "screen" a landscape or set of multiple potential sites to avoid those with the highest habitat values.
3. To begin to determine if a single identified potential site poses serious risk to species of concern or their habitats.

Tier 1 can offer early guidance about the sensitivity of the site within a larger landscape context; it can help direct development away from sites that will be associated with higher study, mitigation costs, and uncertainty; or it can identify those sensitive resources that will need to be studied further to determine if the site can be developed without significant adverse impacts to the species of concern or local population(s). This may facilitate discussions with the federal, state, tribal, and/or local agencies in a region being considered for development. In some cases, Tier 1 studies could reveal serious concerns indicating that a site should not be developed.

Development in some areas may be precluded by federal law. This designation is separate from a determination through the tiered approach that an area is not appropriate for development due to feasibility, ecological reasons, or other issues. Developers are encouraged to visit USFWS databases or other available information during Tier 1 or Tier 2 to see if a potential wind energy area is precluded from development by federal law. Some areas may be protected from development through state or local laws or ordinances, and the appropriate agency should be contacted accordingly. It may be appropriate to coordinate with the local USFWS office if there are questions regarding the designation and how it may apply to wind energy development.

It should be noted that some areas may be inappropriate for large scale development because they have been recognized according to scientifically credible information as having high wildlife value, based solely on their ecological rarity and intactness (e.g., Audubon Important Bird Areas, The Nature Conservancy portfolio sites, state wildlife action plan priority habitats). It is important to identify such areas through the tiered approach, as reflected in Tier 1, Question 2 below; evaluating the potential to mitigate for significant adverse impacts is the key facet of a Tier 1 evaluation. Many of North America's native landscapes are greatly diminished, with some existing at less than 10 percent of their pre-settlement occurrence. Herbaceous sub-shrub steppe in the Pacific Northwest and old growth forest in the Northeast are representative of such diminished native resources. Important remnants of these landscapes are identified and documented in various databases held by private conservation organizations, state wildlife agencies, and, in some cases, by USFWS. Developers should collaborate with such entities specifically about such areas in the vicinity of a prospective project site.

Tier 1 Questions

Suggested questions to be considered in Tier 1 include:

1. Are there species of concern present on the proposed site, or is habitat (including designated critical habitat) present for these species?
2. Does the landscape contain areas where development is precluded by law or areas designated as sensitive according to scientifically credible information? Examples of designated areas include, but are not limited to: "areas of scientific importance;" "areas of significant value;" federally-designated critical habitat; high-priority conservation areas for non-government organizations (NGOs); or other local, state, regional, federal, tribal, or international categorizations.
3. Are there known critical areas of wildlife congregation, including, but not limited to: maternity roosts, hibernacula, staging areas, winter ranges, nesting sites, migration stopovers or corridors, leks, or other areas of seasonal importance?
4. Are there large areas of intact habitat with the potential for fragmentation, with respect to species of habitat fragmentation concern needing large contiguous blocks of habitat?

Tier 1 Methods and Metrics

Developers who choose to conduct Tier 1 investigations would generally be able to utilize existing public or other readily available landscape-level maps and databases from sources such as federal, state, or tribal wildlife or natural heritage programs, the academic community, conservation organizations, or the developers' or consultants' own information. It is recommended that developers conduct a review of the publicly available data. The analysis of available sites in the region of interest will be based on a blend of the information available in published and unpublished reports, wildlife range distribution maps, and other such sources. Currently available data sources useful for this analysis are listed in Appendix C. It is recommended that the developer check with the USFWS Field Office for data specific to wind energy development and wildlife.

Use of Tier 1 Information

The objective of the Tier 1 process is to help the developer identify a site or sites to consider further for wind energy development. Possible outcomes of this internal screening process include the following:

1. One or more sites are found within the area of investigation where the answer to each of the above Tier 1 questions is "no," indicating a low probability of significant adverse impact to wildlife. The developer proceeds to Tier 2 investigations and characterization of the site or sites, answering the Tier 2 questions with site-specific data to confirm the validity of the preliminary indications of low potential for significant adverse impact.
2. A "Yes" answer to one or more of the Tier 1 questions indicates a higher probability of significant adverse impacts to wildlife. Consideration of the area may be abandoned, or effort may be devoted to identifying possible means by which the project can be modified to avoid or minimize significant adverse impacts.
3. The data available in the sources described above are insufficient to answer one or more of the Tier 1 questions. The developer proceeds to Tier 2, with a specific emphasis on collecting the data necessary to answer the Tier 2 questions, which are inclusive of those asked at Tier 1.

B. Tier 2: Site Characterization

Tier 2

At this stage, the developer has narrowed consideration down to specific sites, and additional data may be necessary to systematically and comprehensively characterize a potential site in terms of the risk wind energy development would pose to species of concern and their habitats. In the case where a site or sites have been selected without the Tier 1 preliminary evaluation of the general ecological context, Tier 2 becomes the first stage in the site selection process. The developer will address the questions asked in Tier 1; if addressing the Tier 1 questions here, the developer will evaluate the site within a landscape context. However, a distinguishing feature of Tier 2 studies is that they focus on site-specific information and should include at least one visit to each of the prospective site(s). Because Tier 2 studies are preliminary, normally one reconnaissance level site visit will be adequate as a "ground-truth" of available information. Notwithstanding, if key issues are identified that relate to varying conditions and/or seasons, Tier 2 studies should include enough site visits during the appropriate times of the year to adequately assess these issues for the prospective site(s).

Tier 2 Questions

Questions suggested for Tier 2 can be answered using credible, publicly available information that includes published studies, technical reports, databases, and information from agencies, local conservation organizations, and/or local experts. Developers or consultants working on their behalf should contact the federal, state, tribal, and local agencies that have jurisdiction or management authority and responsibility over the potential project.

1. Are there known species of concern present on the proposed site, or is habitat (including designated critical habitat) present for these species?
2. Does the landscape contain areas where development is precluded by law or designated as sensitive according to scientifically credible information? Examples of designated areas include, but are not limited to: "areas of scientific importance;" "areas of significant value;" federally-designated critical habitat; high-priority conservation areas for NGOs; or other local, state, regional, federal, tribal, or international categorizations.
3. Are there plant communities of concern present or likely to be present at the site(s)?
4. Are there known critical areas of congregation of species of concern, including, but not limited to: maternity roosts, hibernacula, staging areas, winter ranges, nesting sites, migration stopovers or corridors, leks, or other areas of seasonal importance?
5. Using best available scientific information, has the relevant federal, state, tribal, and/or local agency independently demonstrated the potential presence of a population of a species of habitat fragmentation concern? If not, the developer need not assess impacts of the proposed project on habitat fragmentation.

6. Which species of birds and bats, especially those known to be at risk by wind energy facilities, are likely to use the proposed site based on an assessment of site attributes?

Tier 2 Methods and Metrics

Obtaining answers to Tier 2 questions will involve a more thorough review of the existing site-specific information than in Tier 1. Tier 2 site characterizations studies will generally contain three elements:

1. A review of existing information, including existing published or available literature and databases and maps of topography, land use and land cover, potential wetlands, wildlife, habitat, and sensitive plant distribution. If agencies have documented potential habitat for species of habitat fragmentation concern, this information can help with the analysis.
2. Contact with agencies and organizations that have relevant scientific information to further help identify if there are bird, bat or other wildlife issues. It is recommended that the developer make contact with federal, state, tribal, and local agencies that have jurisdiction or management authority over the project or information about the potentially affected resources. In addition, because key NGOs and relevant local groups are often valuable sources of relevant local environmental information, it is recommended that developers contact key NGOs, even if confidentiality concerns preclude the developer from identifying specific project location information at this stage. These contacts also provide an opportunity to identify other potential issues and data not already identified by the developer.
3. One or more reconnaissance level site visits by a wildlife biologist to evaluate current vegetation/habitat coverage and land management/use. Current habitat and land use practices will be noted to help in determining the baseline against which potential impacts from the project would be evaluated. The vegetation/habitat will be used for identifying potential bird and bat resources occurring at the site and the potential presence of, or suitable habitat for, species of concern. Vegetation types or habitats will be noted and evaluated against available information such as land use/land cover mapping. Any sensitive resources located during the site visit will be noted and mapped or digital location data recorded for future reference. Any individuals or signs of species of concern observed during the site visit will be noted. If land access agreements are not in place, access to the site will be limited to public roads.

Specific resources that can help answer each Tier 2 question include:

1. **Are there known species of concern present on the proposed site, or is habitat (including designated critical habitat) present for these species?**

   Information review and agency contact: locations of state and federally listed, proposed and candidate species and species of concern are frequently documented in state and federal wildlife databases. Examples include published literature such as:

Natural Heritage Databases, State Wildlife Action Plans, NGOs publications, and developer and consultant information, or can be obtained by contacting these entities.

Site Visit: to the extent practicable, the site visit(s) should evaluate the suitability of habitat at the site for species identified and the likelihood of the project to adversely affect the species of concern that may be present.

2. **Does the landscape contain areas where development is precluded by law or designated as sensitive according to scientifically credible information?** Examples of designated areas include, but are not limited to: "areas of scientific importance;" "areas of significant value;" federally-designated critical habitat; high-priority conservation areas for NGOs; or other local, state, regional, federal, tribal, or international categorizations.

   Information review and agency contact such as: maps of political and administrative boundaries; National Wetland Inventory data files; USGS National Land Cover data maps; state, federal and tribal agency data on areas that have been designated to preclude development, including wind energy development; State Wildlife Action Plans; State Land and Water Resource Plans; Natural Heritage databases; scientifically credible information provided by NGO and local resources; and the additional resources listed in Appendix C of this document, or through contact of agencies and NGOs, to determine the presence of high priority habitats for species of concern or conservation areas.

   Site Visit: to the extent practicable, the site visit(s) should characterize and evaluate the uniqueness of the site vegetation relative to surrounding areas.

3. **Are plant communities of concern present or likely to be present at the site(s)?**

   Information review and agency contact such as: Natural Heritage Data of state rankings (S1, S2, S3) or globally (G1, G2, G3) ranked rare plant communities.

   Site Visit: to the extent practicable, the site visit should evaluate the topography, physiographic features and uniqueness of the site vegetation in relation to the surrounding region.

4. **Are there known critical areas of wildlife congregation, including, but not limited to, maternity roosts, hibernacula, staging areas, winter ranges, nesting sites, migration stopovers or corridors, leks, or other areas of seasonal importance?**

   Information review and agency contact such as: existing databases, State Wildlife Action Plan, Natural Heritage Data, and NGO and agency information regarding the presence of Important Bird Areas, migration corridors or stopovers, leks, bat hibernacula or maternity roosts, or game winter ranges at the site and in the surrounding area.

   Site Visit: to the extent practicable, the site visit should evaluate the topography, physiographic features and uniqueness of the site in relation to the surrounding

region to assess the potential for the project area to concentrate resident or migratory birds and bats.

5. **Using best available scientific information, has the relevant federal, state, tribal, and/or local agency independently demonstrated the potential presence of a population of a species of habitat fragmentation concern?** If not, the developer need not assess impacts of the proposed project on habitat fragmentation.

   Habitat fragmentation is defined as the separation of a block of habitat for a species into segments, such that the genetic or demographic viability of the populations surviving in the remaining habitat segments is reduced; and risk, in this case, is defined as the probability that this fragmentation will occur as a result of the project. Site clearing, access roads, transmission lines and turbine tower arrays remove habitat and displace some species of wildlife, and may fragment continuous habitat areas into smaller, isolated tracts. Habitat fragmentation is of particular concern when species require large expanses of habitat for activities such as breeding and foraging.

   Consequences of isolating local populations of some species include decreased reproductive success, reduced genetic diversity, and increased susceptibility to chance events (e.g. disease and natural disasters), which may lead to extirpation or local extinctions. In addition to displacement, development of wind energy infrastructure may result in additional loss of habitat for some species due to "edge effects" resulting from the break-up of continuous stands of similar vegetation resulting in an interface (edge) between two or more types of vegetation. The extent of edge effects will vary by species and may result in adverse impacts from such effects as a greater susceptibility to colonization by invasive species, increased risk of predation, and competing species favoring landscapes with a mosaic of vegetation.

   If the answer to Tier 2 Question 5 is yes, it is recommended the developer use the general framework for evaluating habitat fragmentation at a project site in Tier 2 outlined below. Developers and USFWS may use this method to analyze the impacts of habitat fragmentation at wind development project sites on species of habitat fragmentation concern. USFWS offices can provide the available information on habitat types, quality and intactness. Developers may use this information in combination with site-specific information on the potential habitats to be impacted by a potential development and how they will be impacted.

General Framework for Evaluating Habitat Fragmentation at a Project Site (Tier 2)

A. The developer should define the study area. The study area should include the Project Site (see Glossary) for the proposed project. The extent of the study area should be based on the distribution of habitat for the local population of the species of habitat fragmentation concern.

B. The developer should analyze the current habitat quality and spatial configuration of the study area for the species of habitat fragmentation concern.

   i. Use recent aerial and remote imagery to determine distinct habitat patches, or boundaries, within the study area, and the extent of existing habitat fragmenting features (e.g., highways).
   ii. Assess the level of fragmentation of the existing habitat for the species of habitat fragmentation concern and categorize into three classes:
      - High quality: little or no apparent fragmentation of intact habitat
      - Medium quality: intact habitat exhibiting some recent disturbance activity (e.g., off-road vehicle (ORV) trails, roadways)
      - Low quality: Extensive fragmentation of habitat (e.g., row-cropped agricultural lands, active surface mining areas)

C. The developer should determine potential changes in quality and spatial configuration of the habitat in the study area if development were to proceed as proposed using existing site information.

D. The USFWS should use the collective information from steps A-C for all potential developments to assess whether the habitat impacts, including habitat fragmentation, are likely to affect population viability of the potentially affected species of habitat fragmentation concern.

6. Which species of birds and bats, especially those known to be at risk by wind energy facilities, are likely to use the proposed site based on an assessment of site attributes?

Information review and agency contact: existing published information and databases from NGOs and federal and state resource agencies regarding the potential presence of:

- Raptors: species potentially present by season
- Prairie grouse and sage grouse: species potentially present by season and location of known leks
- Other birds: species potentially present by season that may be at risk of collision or adverse impacts to habitat, including loss, displacement and fragmentation

- Bats: species likely to be impacted by wind energy facilities and likely to occur on or migrate through the site

Site Visit: To the extent practicable, the site visit(s) should identify landscape features or habitats that could be important to raptors, prairie grouse, other birds that may be at risk of adverse impacts, and bats, including nesting and brood-rearing habitats, areas of high prey density, movement corridors and features such as ridges that may concentrate raptors. Raptors, prairie grouse, and other presence or sign of species of concern seen during the site visit should be noted, with species identification if possible.

Tier 2 Decision Process

Possible outcomes of Tier 2 include the following:

1. The most likely outcome of Tier 2 is that the answer to one or more Tier 2 questions is inconclusive to address wildlife risk, either due to insufficient data to answer the question or because of uncertainty about what the answers indicate (for example, Tier 2 site characterization may capture the presence of features indicating wildlife congregation, but may not capture seasonality and spatial variation of wildlife use). The developer proceeds to Tier 3, formulating questions, methods, and assessment of potential mitigation measures based on issues raised in Tier 2 results.
2. Sufficient information is available to answer all Tier 2 questions, and the answer to each Tier 2 question indicates a low probability of significant adverse impact to wildlife (for example, infill or expansion of an existing facility where impacts have been low and Tier 2 results indicate that conditions are similar, therefore wildlife risk is low). The developer may then decide to proceed to permitting (if required), design, and construction following best management practices (see Chapter Three, section D).
3. The answers to one or more Tier 2 questions indicate a high probability of significant adverse impacts to species of concern or their habitats that cannot be mitigated. The proposed site should be abandoned.

C. Tier 3: Field Studies to Document Site Wildlife Conditions and Predict Project Impacts

Tier 3

Tier 3 is the first tier in which quantitative and scientifically rigorous studies would be conducted to assess the potential risk of the proposed project. Specifically, these studies provide pre-construction information to:

- Further evaluate a site for determining whether the wind energy project should be developed or abandoned
- Design and operate a site to avoid or minimize significant adverse impacts if a decision is made to develop
- Design compensatory mitigation measures if significant adverse habitat impacts cannot acceptably be avoided or minimized
- Determine if post-construction studies are necessary
- If warranted, provide the pre-construction component of Tier 5 studies necessary to estimate impacts

Not all Tier 3 studies will continue into Tiers 4 or 5. For example, surveys conducted in Tier 3 for species of concern may indicate one or more species are not present at the proposed project site, or siting decisions could be made in Tier 3 that remove identified concerns, thus removing the need for continued efforts in later tiers. Additional detail on the design of Tier 5 studies that begin in Tier 3 is provided in the discussion of methods and metrics in Tier 5.

Tier 3 Questions

Tier 3 begins as the other tiers begin, with problem formulation: what additional studies are required to enable a decision as to whether the proposed project can proceed to construction or operation or should be abandoned? This step includes an evaluation of data gaps identified by Tier 2 studies as well as the gathering of data necessary to:

- Design a project to avoid or minimize predicted risk
- Evaluate predictions of impact and risk through post-construction comparisons of estimated impacts (i.e., Tier 4 and 5 studies)
- Identify compensatory mitigation measures, if appropriate, to offset unavoidable significant adverse impacts

The decision to conduct a Tier 3 study depends on whether additional data are necessary to answer the questions listed below. The duration, seasonality, and level of effort required to answer each Tier 3 question depends on several factors, including but not limited to: the question being addressed; site sensitivity; amount and quality of existing data from nearby comparable sites with similar species and their habitats; seasons of occupancy; variability within and between seasons and years where such variability is likely to substantially affect

answers to the Tier 3 questions; and affected species of concern. Existing state and federal agency protocols will have established study duration and level of effort for some species. When such established protocols are not available, or the developer believes it has good cause not to apply them, the developer should communicate with federal or state natural resource agencies, or other credible experts as appropriate, on project-specific conditions, and design studies that collect sufficient data to answer Tier 3 questions.

If, for example, adequate data are available from nearby sources or from studies of the site being evaluated, then additional studies may be unnecessary. A reduced level of survey effort may be warranted for certain projects, such as infill development, projects with low potential risk for significant adverse impacts, some repowering projects, or projects contiguous to existing low-impact wind energy facilities – provided these projects have sufficient credible information regarding impacts. More effort and longer duration may be needed for uncommon or rare species of concern, when there is little existing information, or when deviation from normal environmental conditions (e.g., drought years) or variability in the metric(s) of interest (e.g., bat activity) is considered so high that it is not otherwise possible to categorize risk as high, moderate or low.

The problem formulation stage for Tier 3 also will include an assessment of which species identified in Tier 1 and/or Tier 2 will be studied further in the site risk assessment. This determination is based on analysis of existing data from Tier 1 and existing site-specific data and Project Site (see Glossary) visit(s) in Tier 2, and on the likelihood of presence and the degree of adverse impact to species or their habitat. If the habitat is suitable for a species needing further study and the site occurs within the historical range of the species, or is near the existing range of the species but presence has not been documented, additional field studies may be appropriate. Additional analyses should not be necessary if a species is unlikely to be present or is present but adverse impact is unlikely or of minor significance.

Tier 3 studies address many of the questions identified for Tiers 1 and 2, but Tier 3 studies differ because they attempt to quantify the distribution, relative abundance, behavior, and site use of species of concern. Tier 3 data also attempt to estimate the extent that these factors expose these species to risk from the proposed wind energy facility. Therefore, in answering Tier 3 questions 1-3, developers should collect data sufficient to analyze and answer Tier 3 questions 4-6.

Tier 3 Study Design Issues

Tier 3 studies should be designed to answer the following questions:

1. Do field studies indicate that species of concern are present on or likely to use the proposed site?
2. Do field studies indicate the potential for significant adverse impacts on the affected population of the species of habitat fragmentation concern?

3. What is the distribution, relative abundance, behavior, and site use of species of concern identified in Tiers 1 or 2, and to what extent do these factors expose these species to risk from the proposed project?
4. What are the potential risks of adverse impacts of the proposed project to individuals and local populations of species of concern and their habitats? (In the case of rare or endangered species, what are the possible adverse impacts to entire species and their habitats?)
5. If significant adverse impacts are predicted to species of concern, can these impacts be mitigated?
6. Are there studies that should be initiated at this stage that would be continued in either Tier 4 or Tier 5?

Tier 3 Methods and Metrics

If Tier 3 studies are warranted, the Committee encourages the use of methods and metrics that are common to all similar Tier 3 studies for measuring wildlife activity and habitat features. Common methods and metrics provide great benefit over the long-term, allowing for comparisons among projects and for greater certainty regarding what will be asked of the developer for a specific project. Deviation from commonly used methods should be carefully considered, scientifically justifiable and discussed with federal, tribal, or state natural resource agencies, or other credible experts, as appropriate. It may be useful to consult other scientifically credible information sources.

Tier 3 studies will be designed to accommodate local and regional characteristics. The specific protocols by which common methods and metrics are implemented in Tier 3 studies depend on the question being addressed, the species or ecological communities being studied and the characteristics of the study sites. Federally-listed threatened and endangered species, and some other species of concern and their habitats, may have specific protocols required by local, state or federal agencies. The need for special surveys and mapping that address these species and situations should be discussed with the appropriate stakeholders.

In some instances, a single method will not adequately assess potential collision risk or habitat impact. For example, when there are moderate to high levels of concern about risk to nocturnally active species, such as migrating passerines and local and migrating bats, a combination of remote sensing tools such as radar, and acoustic monitoring for bats and indirect inference from diurnal bird surveys during the migration period may be necessary. Answering questions about habitat use by songbirds may be accomplished by relatively small-scale observational studies, while answering the same question related to wide-ranging species such as prairie grouse and sage grouse may require more time-consuming surveys, perhaps including telemetry.

Because of the points raised above and the need for flexibility in application, the Committee does not make specific recommendations on protocol elements for Tier 3 studies. The peer-reviewed scientific literature (such as the articles cited throughout this section) contains numerous recently published reviews of methods for assessing bird and bat activity, and tools for assessing habitat and landscape level risk. Details on specific methods and protocols for recommended studies are or will be widely available and should be consulted by industry and agency professionals.

Many methods for assessing risk are components of active research involving collaborative efforts of public-private research partnerships with federal, state and tribal agencies, wind energy developers and NGOs interested in wind energy-wildlife interactions (e.g., Bats and Wind Energy Cooperative and the Grassland Shrub Steppe Species Cooperative). Thus, while acknowledging the value of utilizing common methods, the Committee also recognizes the need to integrate the results of research that improves existing methods or describes new methodological developments.

The remainder of this section outlines the methods and metrics that may be appropriate for gathering data to answer Tier 3 questions. Each question is considered in turn, followed by a discussion of the methods and their applicability.

1. **Do field studies indicate that species of concern are present on or likely to use the proposed site?**

In many situations, this question can be answered based on information accumulated in Tier 2. Specific presence/absence studies may not be required, and protocol development will focus on answering the remaining Tier 3 questions. Nevertheless, it may be necessary to conduct field studies to determine the presence, or likelihood of presence, when little information is available for a particular site. The level of effort normally contemplated for Tier 3 studies should detect common species and species that are relatively rare, but which visit a site regularly (e.g., every year). In the event a species of concern is very rare and only occasionally visits a site, a determination of "likely to occur" would be inferred from the habitat at the site and historical records of occurrence on or near the site.

State, federal and tribal agencies often require specific protocols be followed when species of concern are potentially present on a site. The methods and protocols for determining presence of species of concern at a site are normally established for each species and required by federal, state and tribal resource agencies. Surveys should sample the wind turbine sites and applicable disturbance area during seasons when species are most likely present. Normally, the methods and protocols by which they are applied also will include an estimate of relative abundance. Most presence/absence surveys should be done following a probabilistic sampling protocol to allow statistical extrapolation to the area and time of interest.

Acoustic monitoring can be a practical method for determining the presence of threatened, endangered or otherwise rare species of bats throughout a proposed project (Kunz et al. 2007). There are two general types of acoustic detectors used for collection of information on bat activity and species identification: the full-spectrum, time-expansion and the zero-crossing techniques for ultrasound bat detection (see Kunz et al. 2007 for detailed discussion). Full-spectrum time expansion detectors provide nearly complete species discrimination, while zero-crossing detectors provide reliable and cost-effective estimates of total bat use at a site and some species discrimination. *Myotis* species can be especially difficult to discriminate with zero-crossing detectors (Kunz et al. 2007). Kunz et al. (2007) describe the strengths and weaknesses of each technique for ultrasonic bat detection, and either type of detector may be useful in most situations except where species identification is especially important and zero-crossing methods are inadequate to provide the necessary data. Bat acoustics technology is evolving rapidly and study objectives are an important consideration when selecting detectors. When rare or endangered species of bats are suspected, sampling should occur during different seasons and at multiple sampling stations to account for temporal and spatial variability.

Mist-netting for bats is required in some situations by state agencies, Tribes, and the USFWS to determine the presence of threatened, endangered or otherwise rare species. Mist-netting is best used in combination with acoustic monitoring to inventory the species of bats present at a site, especially to detect the presence of threatened or endangered species. Efforts should concentrate on potential commuting, foraging, drinking, and roosting sites (Kuenzi and Morrison 1998, O'Farrell et al. 1999). Mist-netting and other activities that involve capturing and handling threatened or endangered species of bats will require permits from state and/or federal agencies.

Determining the presence of diurnally or nocturnally active mammals, reptiles, amphibians, and other species of concern will typically be accomplished by following agency-required protocols. Most listed species have required protocols for detection (e.g., the black-footed ferret). State, tribal and federal agencies should be contacted regarding survey protocols for those species of concern. See Corn and Bury 1990, Olson et al. 1997, Bailey et al. 2004, Graeter et al. 2008 for examples of reptile and amphibian protocols, survey and analytical methods.

2. Do field studies indicate significant adverse impacts on species of habitat fragmentation concern?

If the answer to Tier 2 Question 5 was yes, but existing information did not allow for a complete analysis of potential impacts and decision-making, then additional studies and analyses should take place in Tier 3.

As in Tier 2, the particulars of the analysis will depend on the species of habitat fragmentation concern and how habitat block size and fragmentation are defined for the life

cycles of that species, the likelihood that the project will adversely affect a local population of the species and the significance of these impacts to the viability of that population.

To assess habitat fragmentation in the project vicinity, developers should evaluate landscape characteristics of the proposed site prior to construction and determine the degree to which habitat for species of habitat fragmentation concern will be significantly altered by the presence of a wind energy facility.

A general framework for evaluating habitat fragmentation at a project site, following that described in Tier 2, is outlined below. This framework should be used in those circumstances when the USFWS, or a relevant federal, state, tribal and/or other local agency demonstrates the potential presence of a population of a species of habitat fragmentation concern that may be adversely affected by the project. Otherwise, the developer need not assess the impacts of the proposed project on habitat fragmentation. This method for analysis of habitat fragmentation at project sites must be adapted to the local population of the species of habitat fragmentation concern potentially affected by the proposed development.

The developer should:

1. Define the study area. The study area for the site should include the "footprint" for the proposed facility plus an appropriate surrounding area. The extent of the study area should be based on the area where there is potential for significant adverse habitat impacts, including displacement, within the distribution of habitat for the species of habitat fragmentation concern.

2. Determine the potential for occupancy of the study area based on the guidance provided for the species of habitat fragmentation concern described above in Question 1.

3. Analyze current habitat quality and spatial configuration of the study area for the species of habitat fragmentation concern.
    a. Use recent aerial or remote imagery to determine distinct habitat patches or boundaries within the study area, and the extent of existing habitat fragmenting features.
        i. Assess the level of fragmentation of the existing habitat for the species of habitat fragmentation concern and categorize into three classes:
            - High quality: little or no apparent fragmentation of intact habitat
            - Medium quality: intact habitat exhibiting some recent disturbance activity (e.g., timber clearing, ORV trails, roadways)
            - Low quality: extensive fragmentation of habitat (e.g., row-cropped agricultural lands, active surface mining areas)

ii. Determine edge and interior habitat metrics of the study area:
- Identify habitat, non-habitat landscape features and existing fragmenting features relative to the species of habitat fragmentation concern, to estimate existing edge
- Calculate area and acres of edge
- Calculate area of intact patches of habitat and compare to needs of species of habitat fragmentation concern

b. Determine potential changes in quality and spatial configuration of the habitat in the study area if development proceeds as proposed using existing site information and the best available spatial data regarding placement of wind turbines and ancillary infrastructure:
   i. Identify, delineate and classify all additional features added by the development that potentially fragment habitat for the species of habitat fragmentation concern (e.g., roads, transmission lines, maintenance structures, etc.)
   ii. Assess the expected future size and quality of habitat patches for the species of habitat fragmentation concern and the additional fragmenting features, and categorize into three classes as described above
   iii. Determine expected future acreages of edge and interior habitats
   iv. Calculate the area of the remaining patches of intact habitat

c. Compare pre-construction and expected post-construction fragmentation metrics:
   i. Determine the area of intact habitat lost (to the displacement footprint or by alteration due to the edge effect)
   ii. Identify habitat patches that are expected to be moved to a lower habitat quality classification as a result of the development

4. Assess the likelihood of a significant reduction in the demographic and genetic viability of the local population of the species of habitat fragmentation concern using the habitat fragmentation information collected under item 3 above and any currently available demographic and genetic data. Based on this assessment, the developer makes the finding whether or not there is significant reduction. The developer is encouraged to share the finding with the relevant agencies. If the developer finds the likelihood of a significant reduction, the developer should consider items a, b or c below:

   a. Consider alternative locations and development configurations to minimize fragmentation of habitat in communication with species experts, for all species of habitat fragmentation concern in the area of interest.

b. Identify high quality habitat parcels that may be protected as part of a plan to limit future loss of habitat for the impacted population of the species of habitat fragmentation concern in the area.

c. Identify areas of medium or low quality habitat within the range of the impacted population that may be restored or improved to compensate for losses of habitat that result from the project (e.g., management of unpaved roads and ORV trails).

This protocol for analysis of habitat fragmentation at project sites should be adapted to the species of habitat fragmentation concern as identified in response to Question 5 in Tier 2 and to the landscape in which development is contemplated.

3. What is the distribution, relative abundance, behavior, and site use of species of concern identified in Tiers 1 or 2, and to what extent do these factors expose these species to risk from the proposed wind energy project?

For those species of concern that are considered at risk of collisions or habitat impacts, the questions to be answered in Tier 3 include: where are they likely to occur (i.e., where is their habitat) within a project site or vicinity, when might they occur, and in what abundance. The spatial distribution of species at risk of collision can influence how a site is developed. This distribution should include the airspace for flying species with respect to the rotor-swept zone. The abundance of a species and the spatial distribution of its habitat can be used to determine the relative risk of impact to species using the sites, and the absolute risk when compared to existing projects where similar information exists. Species abundance and habitat distribution can also be used in modeling risk factors.

Surveys for spatial distribution and relative abundance require coverage of the wind turbine sites and applicable site disturbance area, or a sample of the area using observational methods for the species of concern during the seasons of interest. As with presence/absence (see Tier 3, question 1, above) the methods used to determine distribution, abundance, and behavior may vary with the species and its ecology. Spatial distribution is determined by applying presence/absence or using surveys in a probabilistic manner over the entire area of interest.

Bird distribution, abundance, behavior and site use

Diurnal Avian Activity Surveys

The commonly used data collection methods for estimating the spatial distribution and relative abundance of diurnal birds includes counts of birds seen or heard at specific survey points (point count) or along transects (transect surveys). Both methods result in estimates of bird use, which are assumed to be indices of abundance in the area surveyed. Absolute abundance is difficult to determine for most species and is not necessary to evaluate species risk. Surveys for raptor and other large bird use should be

done using point counts. Depending on the characteristics of the area of interest and the bird species potentially affected by the project, additional pre-construction study methods may be necessary. Point counts or line transects should collect vertical as well as horizontal data to identify levels of activity within the rotor-swept zone.

Avian point counts should follow the general methodology described by Reynolds et al. (1980) for point counts within a fixed area, or the line transect survey similar to Schaffer and Johnson (2008), where all birds seen within a fixed distance of a line are counted. These methods are most useful for pre- and post-construction studies to quantify avian use of the project site by habitat, determine the presence of species of concern, and to provide a baseline for assessing displacement effects and habitat loss. Point counts for large birds (e.g., raptors) follow the same point count method described by Reynolds et al. (1980).

Point count plots or transects should allow for statistical extrapolation of data and be distributed throughout the area of interest using a probability sampling approach (e.g., systematic sample with a random start). For most projects, the area of interest is the area where wind turbines and permanent meteorological (met) towers are proposed or expected to be sited. Alternatively, the centers of the larger plots can be located at vantage points throughout the potential area being considered with the objective of covering most of the area of interest. Flight height should also be collected to focus estimates of use on activity occurring in the rotor-swept zone.

Sampling duration and frequency will be determined on a project-by-project basis and by the questions being addressed. The most important consideration for sampling frequency when estimating abundance is the amount of variation expected among survey dates and locations and the species of concern.

The use of comparable methods and metrics should allow data comparison from plot to plot within the area of interest and from site to site where similar data exist. The data should be collected so that avian activity can be estimated within the rotor-swept zone. Relating use to site characteristics requires that samples of use also measure site characteristics thought to influence use (i.e., covariates such as vegetation and topography) in relation to the location of use. The statistical relationship of use to these covariates can be used to predict occurrence in unsurveyed areas during the survey period and for the same areas in the future.

Surveys should be conducted at different intervals during the year to account for variation in expected bird activity with lower frequency during winter months if avian activity is low. Sampling frequency should also consider the episodic nature of activity during fall and spring migration. Standardized protocols for estimating avian abundance are well-established and should be consulted (e.g., Dettmers et al. 1999). If a more precise estimate of density is required for a particular species (e.g., when the goal is to

determine densities of a special-status breeding bird species), the researcher will need more sophisticated sampling procedures, including estimates of detection probability.

Raptor Nest Searches

An estimate of raptor use of the project site is obtained through the point counts, but if potential impacts to breeding raptors are a concern on a project, raptor nest searches are also recommended. These surveys provide information to predict risk to the local breeding population of raptors, for micro-siting decisions, and for developing an appropriate-sized non-disturbance buffer around nests. Surveys also provide baseline data for estimating impacts and determining mitigation requirements.

Searches for raptor nests or raptor breeding territories on projects with potential for impacts to raptors should be conducted in suitable habitat during the breeding season. While there is no consensus on the recommended buffer zones around nest sites to avoid disturbance of most species (Sutter and Jones 1981), a nest search within at least one mile of the wind turbines and transmission lines should locate most raptor nests potentially affected by the development.

Methods for these surveys are fairly common and will vary with the species, terrain, and vegetation within the survey area. It is recommended that draft protocols be discussed with biologists from the lead agency, USFWS, state wildlife agency, and Tribes where they have jurisdiction. It may be useful to consult other scientifically credible information sources. At minimum, the protocols should contain the list of target raptor species for nest surveys and the appropriate search protocol for each site, including timing and number of surveys needed, search area, and search techniques.

Prairie Grouse and Sage Grouse Population Assessments

Sage grouse and prairie grouse merit special attention in this context for three reasons:

1. The scale and biotic nature of their habitat requirements uniquely position them as reliable indicators of impacts on, and needs of, a suite of species that depend on sage and grassland habitats, which are among the nation's most diminished ecological communities (Vodehnal and Haufler 2007).
2. Their ranges and habitats are highly congruent with the nation's richest inland wind resources.
3. They are species for which some known impacts of anthropogenic features (e.g., tall structures, buildings, roads, transmission lines, wind energy facilities, etc.) have been documented.

Populations of prairie grouse and sage grouse generally are assessed by either lek counts (a count of the maximum number of males attending a lek) or lek surveys (classification of known leks as active or inactive) during the breeding season (e.g., Connelly et al. 2000). Methods for lek counts vary slightly by species but in general require repeated

visits to known sites and a systematic search of all suitable habitat for leks, followed by repeated visits to active leks to estimate the number of grouse using them.

Recent research indicates that viable prairie grouse and sage grouse populations are dependent on suitable nesting and brood-rearing habitat (Connelly et al. 2000, Hagen et al. 2009). These habitats generally are associated with leks. Leks are the approximate centers of nesting and brood-rearing habitats (Connelly et al. 2000, but see Connelly et al. 1988; Becker et al. 2009,). High quality nesting and brood rearing habitats surrounding leks are critical to sustaining viable prairie grouse and sage grouse populations (Giesen and Connelly 1993, Hagen et al. 2004, Connelly et al. 2000). A population assessment study area should include nesting and brood rearing habitats that may extend several miles from leks. For example, greater and lesser prairie-chickens generally nest in suitable habitats within one to two miles of active leks (Hagen et al. 2004), whereas the average distances from nests to active leks of non-migratory sage grouse range from 0.7 to four miles (Connelly et al. 2000), and potentially much more for migratory populations (Connelly et al. 1988).

While surveying leks during the spring breeding season is the most common and convenient tool for monitoring population trends of prairie grouse and sage grouse, documenting available nesting and brood rearing habitat within and adjacent to the potentially affected area is recommended. Suitable nesting and brood rearing habitats can be mapped based on habitat requirements of individual species. The distribution and abundance of nesting and brood rearing habitats can be used to help in the assessment of adverse impacts of the proposed project to prairie grouse and sage grouse.

Mist-Netting for Birds

Mist-netting is not recommended as a method for assessing risk of wind development for birds. Mist-netting cannot generally be used to develop indices of relative bird abundance, nor does it provide an estimate of collision risk as mist-netting is not feasible at the heights of the rotor-swept zone and captures below that zone may not adequately reflect risk. Operating mist-nets is expensive and requires considerable experience, as well as state and federal permits.

Occasionally mist-netting can help confirm the presence of rare species at documented fallout or migrant stopover sites near a proposed project. If mist-netting is to be used, it is recommended that procedures for operating nets and collecting data be followed in accordance with Ralph et al. (1993).

Nocturnal Bird Survey Methods

Additional studies using different methods will be required if characteristics of the project site and surrounding areas potentially pose a high risk of collision to night migrating songbirds and other nocturnally active species. For most of their flight, songbirds and other nocturnal migrants are above the reach of wind turbines, but they

pass through the altitudinal range of wind turbines during ascents and descents and may also fly closer to the ground during inclement weather (Able, 1970; Richardson, 2000). Factors affecting flight path, behavior, and "fall-out" locations of nocturnal migrants are reviewed elsewhere (e.g., Williams et al., 2001; Gauthreaux and Belser, 2003; Richardson, 2000; Mabee et al., 2006).

In general, pre-construction nocturnal studies are not recommended unless the site has features that might strongly concentrate nocturnal birds, such as along coastlines that are known to be migratory songbird corridors. Biologists knowledgeable about nocturnal bird migration and familiar with patterns of migratory stopovers in the region should assess the potential risks to nocturnal migrants at a proposed project site. No single method can adequately assess the spatial and temporal variation in nocturnal bird populations or the potential collision risk. Following nocturnal study methods in Kunz et al. (2007) is recommended to determine relative abundance, flight direction and flight altitude for assessing risk to migrating birds, if warranted. If areas of interest are within the range of nocturnal species of concern (e.g., marbled murrelet, northern spotted owl, Hawaiian petrel, Newell's shearwater), surveyors should use species-specific protocols recommended by state wildlife agencies, Tribes or USFWS to assess the species' potential presence in the area of interest.

In contrast to the diurnal avian survey techniques previously described, considerable variation and uncertainty exist on the optimal protocols for using acoustic monitoring devices, radar, and other techniques to evaluate species composition, relative abundance, flight height, and trajectory of nocturnal migrating birds. While an active area of research, the use of radar for determining passage rates, flight heights and flight directions of nocturnal migrating animals has yet to be shown as a good indicator of collision risk. Pre- and post-construction studies comparing radar monitoring results to estimates of bird and bat fatalities will be required to evaluate radar as a tool for predicting collision risk. Additional studies are also needed before making recommendations on the number of nights per season or the number of hours per night that are appropriate for radar studies of nocturnal bird migration (Mabee et al., 2006).

Bat survey methods

It is recommended that all techniques discussed below be conducted by biologists trained in bat identification, equipment use, and the analysis and interpretation of data resulting from the design and conduct of the studies. Activities that involve capturing and handling bats may require permits from state and/or federal agencies.

Acoustic Monitoring

Acoustic monitoring provides information about bat presence and activity, as well as seasonal changes in species occurrence and use, but does not measure the number of individual bats or population density. The goal of acoustic monitoring is to provide a prediction of the potential risk of bat fatalities resulting from the construction and

operation of a project. Our current state of knowledge about bat-wind turbine interactions, however, does not allow a quantitative link between pre-construction acoustic assessments of bat activity and operations fatalities. Discussions with experts, state wildlife trustee agencies, Tribes, and USFWS will be needed to determine whether acoustic monitoring is warranted at a proposed project site.

The predominance of bat fatalities detected to date are migratory species and acoustic monitoring should adequately cover periods of migration and periods of known high activity for other (i.e., non-migratory) species. Monitoring for a full year is recommended in areas where there is year round bat activity. Data on environmental variables such as temperature and wind speed should be collected concurrently with acoustic monitoring so these weather data can be used in the analysis of bat activity levels.

The number and distribution of sampling stations necessary to adequately estimate bat activity have not been well established but will depend, at least in part, on the size of the project area, variability within the project area, and a Tier 2 assessment of potential bat occurrence.

The number of detectors needed to achieve the desired level of precision will vary depending on the within-site variation (e.g., Arnett et al. 2006, Weller 2007, E.B. Arnett, Bat Conservation International, unpublished data). The Committee recommends placing acoustic detectors on existing met towers, approximately every two kilometers across the site where turbines are expected to be sited. Acoustic detectors should be placed at high positions (as high as practicable, based on tower height) on each met tower included in the sample to record bat activity at or near the rotor swept zone, the area of presumed greatest risk for bats. Developers should evaluate whether it would be cost effective to install detectors when met towers are first established on a site. Doing so might reduce the cost of installation later and might alleviate time delays to conduct such studies.

If sampling at met towers does not adequately cover the study area or provide sufficient replication, the Committee recommends that additional sampling stations be established at low positions (~1.5-2 meters) at a sample of existing met towers and one or more mobile units (i.e., units that are moved to different locations throughout the study period) to increase coverage of the proposed project area. When practical, the Committee recommends some acoustic monitoring of features identified as potentially high bat use areas within the study area (e.g., bat roosts and caves) to determine use of such features.

There is growing interest in determining whether "low" position samples (~1.5-2 meters) can provide equal or greater correlation with bat fatalities than "high" position samples (described above) because this would substantially lower cost of this work. Developers could then install a greater number of detectors at lower cost resulting in improved

estimates of bat activity and, potentially, improved qualitative estimates of risk to bats. This is a research question that is not expected to be addressed at a project.

Other bat survey techniques

Occasionally, other techniques may be needed to answer Tier 3 questions and complement the information from acoustic surveys. Kunz et al. (2007), NAS (2007), Kunz and Parsons (2009) provide comprehensive descriptions of bat survey techniques, including those identified below that are relevant for Tier 3 studies at wind energy facilities.

Roost Searches and Exit Counts

Pre-construction survey efforts may be recommended to determine whether known or likely bat roosts in mines, caves, bridges, buildings, or other potential roost sites occur within the project vicinity, and to confirm whether known or likely bat roosts are present and occupied by bats. If active roosts are detected, it may be appropriate to address questions about colony size and species composition of roosts. Exit counts and roost searches are two approaches to answering these questions, and Rainey (1995), Kunz and Parsons (2009), and Sherwin et al. (2009) are resources that describe options and approaches for these techniques. Roost searches should be performed cautiously because roosting bats are sensitive to human disturbance (Kunz et al. 1996). Known maternity and hibernation roosts should not be entered or otherwise disturbed unless authorized by state and/or federal wildlife agencies. Internal searches of abandoned mines or caves can be dangerous and should only be conducted by trained researchers. For mine survey protocol and guidelines for protection of bat roosts, see the appendices in Pierson et al. (1999). Exit surveys at known roosts generally should be limited to non-invasive observation using low-light binoculars and infrared video cameras.

Multiple surveys will be required to determine the presence or absence of bats in caves and mines, and the number of surveys needed will vary by species of bats, sex (maternity or bachelor colony) of bats, seasonality of use, and type of roost structure (e.g., caves or mines). For example, Sherwin et al. (2003) demonstrated that a minimum of three surveys are needed to determine the absence of large hibernating colonies of Townsend's big-eared bats (*Corynorhinus townsendii*) in mines (90 percent probability), while a minimum of nine surveys (during a single warm season) are necessary before a mine could be eliminated as a bachelor roost for this species (90 percent probability). An average of three surveys was needed before surveyed caves could be eliminated as bachelor roosts (90 percent probability). It is recommended that decisions on level of effort follow discussion with relevant agencies and bat experts.

Activity Patterns

If active roosts are detected, it may be necessary to answer questions about behavior, movement patterns, and patterns of roost use for bat species of concern, or to further investigate habitat features that might attract bats and pose fatality risk. For some bat

species, typically threatened, endangered, or state-listed species, radio telemetry or radar may be recommended to assess both the direction of movement as bats leave roosts, and the bats' use of the area being considered for development. Kunz et al. (2007) describe the use of telemetry, radar and other tools to evaluate use of roosts, activity patterns, and flight direction from roosts.

Mist-Netting for Bats

While mist-netting for bats is required in some situations by state agencies, Tribes, and the USFWS to determine the presence of threatened, endangered or other bat species of concern, mist-netting is not generally recommended for determining levels of activity or assessing risk of wind energy development to bats for the following reasons: 1) not all proposed or operational wind energy facilities offer conditions conducive to capturing bats, and often the number of suitable sampling points is minimal or not closely associated with the project location; 2) capture efforts often occur at water sources offsite or at nearby roosts and the results may not reflect species presence or use on the site where turbines are to be erected; and 3) mist-netting isn't feasible at the height of the rotor-swept zone, and captures below that zone may not adequately reflect risk of fatality. If mist-netting is employed, it is best used in combination with acoustic monitoring to inventory the species of bats present at a site.

Other wildlife

While the above guidance emphasizes the evaluation of potential impacts to birds and bats, Tier 1 and 2 evaluations may identify other species of concern. Developers are encouraged to assess adverse impacts potentially caused by development for those species most likely to be negatively affected by such development. Impacts to other species are primarily derived from potential habitat loss or displacement. The general guidance on the study design and methods for estimation of the distribution, relative abundance, and habitat use for birds is applicable to the study of other wildlife. Nevertheless, most methods and metrics will be species-specific and developers are advised to work with the state, tribal, or federal agencies, or other credible experts, as appropriate, during problem formulation for Tier 3.

4. What are the potential risks of adverse impacts of the proposed wind energy project to individuals and local populations of species of concern and their habitats? (In the case of rare or endangered species, what are the possible impacts to entire species and their habitats?)

Methods used for estimating risk will vary with the species of concern. For example, estimating potential bird fatalities in Tier 3 may be accomplished by comparing exposure estimates (described earlier in estimates of bird use) at the proposed site with exposure estimates and fatalities at existing projects with similar characteristics (e.g., similar technology, landscape, and weather conditions). If models are used, they may provide an additional tool for estimating fatalities, and have been used in Australia (Organ and

Meredith 2004), Europe (Chamberlin et al. 2006), and the United States (Madders and Whitfield 2006). As with other prediction tools, model predictions should be evaluated and compared with post-construction fatality data to validate the models. Models should be used as a subcomponent of a risk assessment based on the best available empirical data. A statistical model based on the relationship of pre-construction estimates of raptor abundance and post-construction raptor fatalities is described in Strickland et al. (in review) and promises to be a useful tool for risk assessment.

Collision risk to individual birds and bats at a particular wind energy facility may be the result of complex interactions among species distribution, relative abundance, behavior, weather conditions (e.g., wind, temperature) and site characteristics. Collision risk for an individual may be low regardless of abundance if its behavior does not place it within the rotor-swept zone. If individuals frequently occupy the rotor-swept zone but effectively avoid collisions, they are also at low risk of collision with a turbine (e.g. ravens). Alternatively, if the behavior of individuals frequently places them in the rotor-swept zone, and they do not actively avoid turbine blade strikes, they are at higher risk of collisions with turbines regardless of abundance. For a given species (e.g., red-tailed hawk), increased abundance increases the likelihood that individuals will be killed by turbine strikes, although the risk to individuals will remain about the same. The risk to a population increases as the proportion of individuals in the population at risk to collision increases.

At some projects, bat fatalities are higher than bird fatalities, but the exposure risk of bats at these facilities is not fully understood (National Research Council (NRC) 2007). Horn et al. (2008) and Cryan (2008) hypothesize that bats are attracted to turbines, which, if true, would further complicate estimation of exposure. Further research is required to determine if bats are attracted to turbines and if so, to evaluate 1) the influence on Tier 2 methods and predictions, and 2) if this increased individual risk translates into higher population-level impacts for bats.

The estimation of displacement risk requires an understanding of animal behavior in response to a project and its infrastructure, and a pre-construction estimate of presence/absence of species whose behavior would cause them to avoid areas in proximity to turbines, roads and other components of the project. The amount of habitat that is lost to indirect impacts will be a function of the sensitivity of individuals to the project and to the activity levels associated with the project's operations. The population-level significance of this habitat loss will depend on the amount of habitat available to the affected population. If the loss of habitat results in habitat fragmentation, then the risk to the demographic and genetic viability of the isolated animals is increased. Quantifying cause and effect may be very difficult, however.

5. If significant adverse impacts are predicted to species of concern, can these impacts be mitigated?

Results of Tier 3 studies should provide a basis for identifying measures to mitigate significant adverse impacts predicted for species of concern. Information on wildlife use of the proposed area is most useful when designing a project to avoid or minimize significant adverse impacts. In cases of uncertainty with regard to impacts to species of concern, additional studies may be necessary to quantify significant adverse impacts and determine the need for mitigation of those impacts.

The following discussion of prairie grouse and sage grouse as species of concern describes the present state of scientific knowledge relative to these species, which should be considered when designing mitigation measures. The extent of the impact of wind energy development on prairie grouse and sage grouse leking activity (e.g., social structure, mating success, persistence, etc.) and the associated impacts on productivity (e.g., nesting, nest success, chick survival, etc.) is poorly understood (Arnett et al. 2007, NRC 2007, Manville 2004). However, recent published research documents that anthropogenic features (e.g., tall structures, buildings, roads, transmission lines, etc.) can adversely impact vital rates (e.g., nesting, nest success, leking behavior, etc.) of lesser prairie-chickens (Pruett et al. 2009, Pitman et al. 2005, Hagen et al. 2009, Hagen et al. In press) and greater prairie-chickens (Robel, Pers Comm.) over long distances. Pitman et al. (2005) found that transmission lines reduced nesting of lesser prairie chicken by 90 percent out to a distance of 0.25 miles, improved roads at a distance of 0.25 miles, a house at 0.3 miles, and a power plant at >0.6 miles. Reduced nesting activity of lesser prairie chickens may extend farther, but Pitman et al. (2005) did not analyze their data for lower impacts (less than 90 percent reduction in nesting) of those anthropogenic features on lesser prairie chicken nesting activities at greater distances. Hagen et al. (In press) suggested that development within 1 to 1 ½ miles of active leks of prairie grouse may have significant adverse impacts on the affected grouse population. It is not unreasonable to infer that impacts from wind energy facilities may be similar to those from these other anthropogenic structures. Kansas State University, as part of the NWCC GS3C, is undertaking a multi-year telemetry study to evaluate the effects of a proposed wind-energy facility on displacement and demographic parameters (survival, nest success, brood success, fecundity) of greater prairie-chickens in Kansas.[13]

The distances over which anthropogenic activities impact sage grouse are greater than for prairie grouse. Based primarily on data documenting reduced fecundity (a combination of nesting, clutch size, nest success, juvenile survival, and other factors) in sage grouse populations near roads, transmissions lines, and areas of oil and gas development/production (Holloran 2005, Connelly et al. 2000), development within three to five miles (or more) of active sage grouse leks may have significant adverse impacts on the affected grouse population. Lyon and Anderson (2003) found that in habitats fragmented by natural gas development, only 26 percent of hens captured on disturbed leks nested within 1.8 miles of the lek of capture, whereas 91 percent of hens from undisturbed areas nested within the same area. Holloran (2005) found that active drilling within 3.1 miles of sage

[13] www.nationalwind.org

grouse lek reduced the number of breeding males by displacing adult males and reducing recruitment of juvenile males. The magnitudes and proximal causes (e.g., noise, height of structures, movement, human activity, etc.) of those impacts on vital rates in grouse populations are areas of much needed research (Becker et al. 2009). Data accumulated through such research may improve our understanding of the buffer distances necessary to avoid or minimize significant adverse impacts to prairie grouse and sage grouse populations.

When significant adverse impacts cannot be fully avoided or adequately minimized, some form of compensatory mitigation may be appropriate to address the loss of habitat value. For example, it may be possible to mitigate habitat loss or degradation for a species of concern by enhancing or restoring nearby habitat value comparable to that potentially influenced by the project. More detail is provided on this topic in Chapter Four.

6. Are there studies that should be initiated at this stage that would be continued in either Tier 4 or Tier 5?

During Tier 3 problem formulation, it is necessary to identify the studies needed to address the Tier 3 questions. Consideration of how the resulting data may be used in conjunction with post-construction Tier 4 and 5 studies is also recommended. The design of post-construction impact or mitigation assessment studies will depend on the specific impact questions being addressed. Tier 3 predictions of fatalities will be evaluated using data from Tier 4 studies designed to estimate fatalities. Tier 3 studies may demonstrate the need for compensatory mitigation of significant adverse habitat impacts or for measures to avoid or minimize fatalities. Where significant adverse habitat impacts are of major concern, Tier 5 studies will provide data that evaluate the predicted impacts and the effectiveness of avoidance, minimization and mitigation measures. Evaluation of the impact of a project on demographic parameters of local populations, habitat use, or some other parameter(s), typically will require data on these parameters prior to and after construction of the project.

Tier 3 Decision Point

At the end of Tier 3, the developer and potentially the permitting authority will make a decision regarding whether and how to develop the project. The decision point at the end of Tier 3 involves three potential outcomes:

1. Development of the site has a high probability of acceptable environmental impact based on existing and new information.

   There is little uncertainty regarding when and how development should proceed, and adequate information exists to satisfy any required permitting. The decision process proceeds to permitting, when required, and/or development, and pre-construction surveys are terminated.

2. Development of the site has a relatively high probability of unacceptable significant adverse impacts without proper measures being taken to mitigate those impacts. This outcome may be subdivided into two possible scenarios:

   a. There is certainty regarding how to develop the site to adequately mitigate significant adverse impacts. A decision to develop the site is made, conditional on the proper mitigation measures being adopted, with appropriate follow-up fatality studies (Tier 4) and habitat studies, if necessary (Tier 5).
   b. There is uncertainty regarding how to develop the site to adequately mitigate significant adverse impacts, or a permitting process requires additional information on potential significant adverse wildlife impacts before permitting future phases of the project. A decision to develop the site is made conditional on the proper mitigation measures being taken and with appropriate follow up post-construction studies (Tier 4 and 5).

3. Development of the site has a high probability of unacceptable environmental impact that cannot be satisfactorily mitigated.

Site development is delayed until plans can be developed that satisfactorily avoid, minimize or provide compensatory mitigation for the significant adverse impacts. Alternatively, the site is abandoned in favor of known sites with less potential for environmental impact, or the developer begins an evaluation of other sites or landscapes for more acceptable sites to develop.

D. Site Construction: Site Development and Construction Best Management Practices

During site planning and development, careful attention to reducing risk of adverse impacts to species of concern from wind energy projects, through careful site selection and facility design, is recommended. The following BMPs can assist a developer in the planning process to reduce potential impacts to species of concern. Use of these BMPs should ensure that the potentially adverse impacts to most species of concern and their habitats present at many project sites would be reduced, although compensatory mitigation may be appropriate at a project level to address significant site-specific concerns and pre-construction study results.

These BMPs will evolve over time as additional experience, learning, monitoring and research becomes available on how to best minimize wildlife and habitat impacts from wind energy projects. USFWS should work with the industry, stakeholders and states to evaluate, revise and update these BMPs on a periodic basis, and the USFWS should maintain a readily available publication of recommended, generally accepted best practices.

1. Minimize, to the extent practicable, the area disturbed by pre-construction site monitoring and testing activities and installations.
2. Avoid locating wind energy facilities in areas identified as having a demonstrated and unmitigatable high risk to birds and bats.
3. Use available data from state and federal agencies, and other sources (which could include maps or databases), that show the location of sensitive resources and the results of Tier 2 and/or 3 studies to establish the layout of roads, power lines, fences, and other infrastructure.
4. Use native species when seeding or planting during restoration.
5. To reduce avian collisions, place low and medium voltage connecting power lines associated with the wind energy development underground to the extent possible, unless burial of the lines is prohibitively expensive (e.g., where shallow bedrock exists) or where greater adverse impacts to biological resources would result:
    a. Overhead lines may be acceptable if sited away from high bird crossing locations, to the extent practicable, such as between roosting and feeding areas or between lakes, rivers, prairie grouse and sage grouse leks, and nesting habitats. To the extent practicable, the lines should be marked in accordance with Avian Power Line Interaction Committee (APLIC) collision guidelines.
    b. Overhead lines may be used when the lines parallel tree lines, employ bird flight diverters, or are otherwise screened so that collision risk is reduced.
    c. Above-ground low and medium voltage lines, transformers and conductors should follow the 2006 or most recent APLIC "Suggested Practices for Avian Protection on Power Lines."

6. Avoid guyed communication towers and permanent met towers at wind energy project sites. If guy wires are necessary, bird flight diverters or high visibility marking devices should be used.
7. Use construction and management practices to minimize activities that may attract prey and predators to the wind energy facility.
8. Employ only red, or dual red and white strobe, strobe-like, or flashing lights, not steady burning lights, to meet Federal Aviation Administration (FAA) requirements for visibility lighting of wind turbines, permanent met towers, and communication towers. Only a portion of the turbines within the wind project should be lighted, and all pilot warning lights should fire synchronously.
9. Keep lighting at both operation and maintenance facilities and substations located within half a mile of the turbines to the minimum required:
    a. Use lights with motion or heat sensors and switches to keep lights off when not required.
    b. Lights should be hooded downward and directed to minimize horizontal and skyward illumination.
    c. Minimize use of high-intensity lighting, steady-burning, or bright lights such as sodium vapor, quartz, halogen, or other bright spotlights.
10. Establish non-disturbance buffer zones to protect sensitive habitats or areas of high risk for species of concern identified in pre-construction studies. Determine the extent of the buffer zone in consultation with USFWS and state, local and tribal wildlife biologists, and land management agencies (e.g., U.S. Bureau of Land Management (BLM) and U.S. Forest Service (USFS)), or other credible experts as appropriate.
11. Locate turbines to avoid separating bird and bat species of concern from their daily roosting, feeding, or nesting sites if documented that the turbines' presence poses a risk to species.
12. Avoid impacts to hydrology and stream morphology, especially where federal or state-listed aquatic or riparian species may be involved.
13. Although it is unclear whether tubular or lattice towers reduce risk of collision, when practical use tubular towers or best available technology to reduce ability of birds to perch and to reduce risk of collision.
14. Minimize the number and length of access roads; use existing roads when feasible.
15. Minimize impacts to wetlands and water resources by following all applicable provisions of the Clean Water Act (33 USC 1251-1387) and the Rivers and Harbors Act (33 USC 301 et seq.); for instance, by developing and implementing a storm water management plan and taking measures to reduce erosion.

16. Reduce vehicle collision risk to wildlife by instructing project personnel to drive at appropriate speeds, be alert for wildlife, and use additional caution in low visibility conditions.
17. Instruct employees, contractors, and site visitors to avoid harassing or disturbing wildlife, particularly during reproductive seasons.
18. Reduce fire hazard from vehicles and human activities (instruct employees to use spark arrestors on power equipment, ensure that no metal parts are dragging from vehicles, use caution with open flame, cigarettes, etc.).
19. Follow federal and state measures for handling toxic substances to minimize danger to water and wildlife resources from spills.
20. Reduce the introduction and spread of invasive species by following applicable local policies for noxious weed control, cleaning vehicles and equipment arriving from areas with known invasive species issues, using locally sourced topsoil, and monitoring for and rapidly removing noxious weeds at least annually.
21. Utilize pest and weed control measures as specified by county or state requirements, or by applicable federal agency requirements (such as Integrated Pest Management) when federal policies apply.

E. Tier 4: Post-Construction Fatality Studies

Tier 4

Following the tiered decision process, the outcome of Tier 1 to 3 studies will determine the need for Tier 4 studies.

Tier 4 studies focus specifically on post-construction fatality monitoring. Activities involve searching for bird and bat carcasses beneath turbines to estimate the number and species composition of fatalities. This information may be useful in answering other questions such as relationships with site characteristics, comparison of fatalities among facilities, and comparison of actual and predicted fatality rates estimated in previous tiers.

Fatality studies should be considered for all wind energy projects. Fatality studies should occur over all seasons of occupancy for the species being monitored, based on information produced in previous tiers. The number of seasons and total length of the study may be determined separately for bats and birds, depending on the pre-construction risk assessment, results of Tier 3 and Tier 4 studies from comparable sites (see Glossary), and the results of first year fatality studies. It may be appropriate to conduct studies using different durations and intervals depending on the species of concern. For example, if raptors occupy an area year-round, it may be appropriate to monitor for raptors throughout the year (12 months). It may be warranted to monitor for bats when they are active (spring, summer and fall or approximately eight months). It may be appropriate to increase the search frequency during the months bats are active and decrease the frequency during periods of inactivity. All fatality studies should include estimates of carcass removal and carcass detection bias likely to influence those rates.

The developer's decision about the number of years of study should follow discussions with relevant agencies. The decision should be based on the table below. The number of years of monitoring is indicated by outcomes of both Tier 3 and Tier 4 analysis as indicated in the table below:

Number of years of monitoring	Outcomes of Tier 3	AND	Outcomes of Tier 4
0	• Tier 3 studies conducted at Project Site per Guidelines and predict risk is low • Comparable Tier 3 studies indicate low risk • No ESA species likely to be at risk	→	• Comparable Tier 4 studies indicate low fatalities and uncertainty is low
1	• No ESA species likely to be at risk • Tier 3 studies conducted at the site per Guidelines • Tier 3 studies at Project Site predict risk is **medium** • No comparable Tier 3 studies indicate high risk	→	• Tier 4 study conducted per Guidelines • Tier 4 study indicates **low** fatalities • No comparable Tier 4 studies indicate high fatalities • No ESA fatalities at the Project Site
1	• No ESA species likely to be at risk • Tier 3 studies conducted at the site per Guidelines • Tier 3 studies at Project Site predict risk is **low** • No comparable Tier 3 studies indicate high risk	→	• Tier 4 study conducted per Guidelines • Tier 4 study indicates **low or medium** fatalities • No comparable Tier 4 studies indicate high fatalities • No ESA fatalities at the Project Site
2 or more	• Did not meet all conditions above	→	• Did not meet all conditions above

Tier 4 Questions

Post-construction fatality monitoring activities are designed to answer the following questions as appropriate for the individual project:

1. What are the bird and bat fatality rates for the project?
2. What are the fatality rates of species of concern?
3. How do the estimated fatality rates compare to the predicted fatality rates?
4. Do bird and bat fatalities vary within the project site in relation to site characteristics?
5. How do the fatality rates compare to the fatality rates from existing projects in similar landscapes with similar species composition and use?
6. What is the composition of fatalities in relation to migrating and resident birds and bats at the site?
7. Do fatality data suggest the need for measures to reduce impacts?

Fatality monitoring results should be of sufficient statistical validity to answer Tier 4 questions, allow comparisons with pre-construction impact predictions and comparisons with other sites, and provide a basis for determining if corrective management or mitigation measures at the site are appropriate.

Tier 4 Protocol Design Issues

The basic method of measuring fatality rates is the carcass search. Search protocols should be standardized to the greatest extent possible, especially for common objectives and species of concern, and they should include methods for adequately accounting for sampling biases (searcher efficiency and scavenger removal). However, some situations warrant exceptions to standardized protocol, and the responsibility of demonstrating that an exception is appropriate and applicable should be on the stakeholder attempting to justify increasing or decreasing the duration or intensity of operations monitoring.

Some general guidance is given below with regard to the following fatality search protocol design issues:

- Duration and frequency of monitoring
- Number of turbines to monitor
- Delineation of carcass search plots, transects, and habitat mapping
- General search protocol
- Field bias and error assessment
- Estimators of fatality

More detailed descriptions and methods of fatality search protocols can be found in the California (California Energy Commission 2007) and Pennsylvania (Pennsylvania Game Commission 2007) state guidelines and in Kunz et al. (2007) and Smallwood (2007).

Frequency of carcass searches

Frequency of carcass searches (search interval) may vary for birds and bats, and will vary depending on the questions to be answered, the species of concern, and their seasonal abundance at the project site. The carcass searching protocol should be adequate to answer applicable Tier 4 questions at an appropriate level of precision to make general conclusions about the project, and is not intended to provide highly precise measurements of fatalities. Except during low use times (e.g. winter months in northern states), it is recommended that protocols be designed such that carcass searches occur at some turbines within the project area most days each week of the study.

The search interval is the interval between carcass searches at individual turbines, and this interval may be lengthened or shortened depending on the carcass removal rates. If the primary focus is on fatalities of large raptors, where carcass removal is typically low, then a longer interval between searches (e.g., 14-28 days) is sufficient. However, if the focus is on fatalities of bats and small birds and carcass removal is high, then a shorter search interval will be necessary.

There are situations in which studies of higher intensity (e.g., daily searches at individual turbines within the sample) may be appropriate. These would be considered only in Tier 5 studies or in research programs because the greater complexity and level of effort goes beyond that recommended for typical Tier 4 post construction monitoring. Tier 5 and research studies could include evaluation of specific measures that have been implemented to mitigate potential significant adverse impacts to species of concern identified during pre-construction studies.

Number of turbines to monitor

If available, data on variability among turbines from existing projects in similar conditions within the same region are recommended as a basis for determining needed sample size (see Morrison et al., 2008). If data are not available, it is recommended that a sufficient number of turbines be selected via a systematic sample with a random start point. Sampling plans can be varied (e.g., rotating panels [McDonald 2003, Fuller 1999, Breidt and Fuller 1999, and Urquhart et al. 1998]) to increase efficiency as long as a probability sampling approach is used. If the project contains fewer than 10 turbines, it is recommended that all turbines in the area of interest be searched unless otherwise agreed to by the permitting or wildlife resource agencies. When selecting turbines, it is recommended that a systematic sample with a random start be used when selecting search plots to ensure interspersion among turbines. Stratification among different habitat types also is recommended to account for differences in fatality rates among different habitats (e.g., grass versus cropland or forest); a sufficient number of turbines should be sampled in each strata.

Delineation of carcass search plots, transects, and habitat mapping

Evidence suggests that greater than 80 percent of bat fatalities fall within half the maximum distance of turbine height to ground (Erickson 2003 a, b), and a minimum plot width of 120 meters from the turbine should be established at sample turbines. Plots will need to be larger for birds, with a width twice the turbine height to ground. Decisions regarding search plot size should be made in discussions with the USFWS, state wildlife agency, permitting agency and Tribes. It may be useful to consult other scientifically credible information sources.

It is recommended that each search plot should be divided into oblong subplots or belt transects and that each subplot be searched. The objective is to find as many carcasses as possible so the width of the belt will vary depending on the ground cover and its influence on carcass visibility. In most situations, a search width of 6 meters should be adequate, but this may vary from 3-10 meters depending on ground cover.

Searchable area within the theoretical maximum plot size varies, and heavily vegetated areas (e.g., eastern mountains) often do not allow surveys to consistently extend to the maximum plot width. In other cases it may be preferable to search a portion of the maximum plot instead of the entire plot. For example, in some landscapes it may be

impractical to search the entire plot because of the time required to do an effective search, even if it is accessible (e.g., croplands), and data from a probability sample of subplots within the maximum plot size can provide a reasonable estimate of fatalities. It is important to accurately delineate and map the area searched for each turbine to adjust fatality estimates based on the actual area searched. It may be advisable to establish habitat visibility classes in each plot to account for differential detectability, and to develop visibility classes for different landscapes (e.g., rocks, vegetation) within each search plot. For example, the Pennsylvania Game Commission (2007) identified four classes based on the percentage of bare ground.

The use of visibility classes requires that detection and removal biases be estimated for each class. Fatality estimates should be made for each class and summed for the total area sampled. Global positioning systems (GPS) are useful for accurately mapping the actual total area searched and area searched in each habitat visibility class, which can be used to adjust fatality estimates. The width of the belt or subplot searched may vary depending on the habitat and species of concern; the key is to determine actual searched area and area searched in each visibility class regardless of transect width. An adjustment may also be needed to take into account the density of fatalities as a function of the width of the search plot.

General search protocol guidance

Personnel trained in proper search techniques should look for bird and bat carcasses along transects or subplots within each plot and record and collect all carcasses located in the searchable areas. A complete search of the area should be accomplished and subplot size (e.g., transect width) should be adjusted to compensate for detectability differences in the search area. Subplots should be smaller when vegetation makes it difficult to detect carcasses; subplots can be wider in open terrain. Subplot width also can vary depending on the size of the species being looked for. For example, small species such as bats may require smaller subplots than larger species such as raptors.

Data to be recorded include date, start time, end time, observer, which turbine area was searched (including GPS coordinates) and weather data for each search. When a dead bat or bird is found, the searcher should place a flag near the carcass and continue the search. After searching the entire plot, the searcher returns to each carcass and records information on a fatality data sheet, including date, species, sex and age (when possible), observer name, turbine number, distance from turbine, azimuth from turbine (including GPS coordinates), habitat surrounding carcass, condition of carcass (entire, partial, scavenged), and estimated time of death (e.g., $\leq$1 day, 2 days). A digital photograph of the carcass should be taken. Rubber gloves should be used to handle all carcasses to eliminate possible transmission of rabies or other diseases and to reduce possible human scent bias for carcasses later used in scavenger removal trials. Carcasses should be placed in a plastic bag and labeled. Fresh carcasses (those determined to have

been killed the night immediately before a search) should be redistributed at random points on the same day for scavenging trials.

Field bias and error assessment

It has long been recognized that during searches conducted at wind turbines, actual fatalities are incompletely observed and that therefore carcass counts must be adjusted by some factor that accounts for imperfect detectability. Important sources of bias and error include: 1) fatalities that occur on a highly periodic basis; 2) carcass removal by scavengers; 3) differences in searcher efficiency; 4) failure to account for the influence of site (e.g. vegetation) conditions in relation to carcass removal and searcher efficiency; and 5) fatalities or injured birds and bats that may land or move outside search plots.

Some fatalities may occur on a highly periodic basis creating a potential sampling error (number 1 above). It is recommended that sampling be scheduled so that some turbines are searched most days and episodic events are more likely detected, regardless of the search interval. To address bias sources 2-4 above, it is strongly recommended that all fatality studies conduct carcass removal and searcher efficiency trials using accepted methods (Anderson 1999, Kunz et al. 2007, Arnett et al. 2007, NRC 2007). Bias trials should be conducted throughout the entire study period and searchers should be unaware of which turbines are to be used or the number of carcasses placed beneath those turbines during trials. Carcasses or injured individuals may land or move outside the search plots (number 5 above). With respect to Tier 4 fatality estimates, this potential sampling error is considered to be small and can be ignored.

Prior to a study's inception, a list of random turbine numbers and random azimuths and distances (in meters) from turbines should be generated for placement of each bat or bird used in bias trials. Data recorded for each trial carcass prior to placement should include date of placement, species, turbine number, distance and direction from turbine, and visibility class surrounding the carcass. Trial carcasses should be distributed as equally as possible among the different visibility classes throughout the study period and study area. Studies should attempt to avoid "over-seeding" any one turbine with carcasses by placing no more than one or two carcasses at any one time at a given turbine. Before placement, each carcass must be uniquely marked in a manner that does not cause additional attraction, and its location should be recorded. There is no agreed upon sample size for bias trials, though some state guidelines recommend from 50 - 200 carcasses.

Estimators of fatality

If there were a direct relationship between the number of carcasses observed and the number killed, there would be no need to develop a complex estimator that adjusts observed counts for detectability, and observed counts could be used as a simple index of fatality. But the relationship is not direct and raw carcass counts recorded using

different search intervals and under different carcass removal rates and searcher efficiency rates are not directly comparable. It is strongly recommended that only the most contemporary equations for estimating fatality be used, as some original versions are now known to be extremely biased under many commonly encountered field conditions (Strickland et al. In review, Erickson et al. 2000b, Erickson et al. 2004, Johnson et al. 2003, Kerns and Kerlinger 2004, Fiedler et al. 2007, Kronner et al. 2007, Smallwood 2007).

Tier 4 Methods and Metrics

In addition to the monitoring protocol, the metrics used to estimate fatality rates must be selected with the Tier 4 questions and objectives in mind. Metrics considerations for each of the Tier 4 questions are discussed briefly below. Not all questions will be relevant for each project, and which questions apply would depend on Tier 3 outcomes.

1. What are the bird and bat fatality rates for the project?

The primary objective of fatality searches is to determine the overall estimated fatality rates for birds and bats for the project. These rates serve as the fundamental basis for all comparisons of fatalities, and if studies are designed appropriately they allow researchers to relate fatalities to site characteristics and environmental variables, and to evaluate mitigation measures. Several metrics are available for expressing fatality rates. Early studies reported fatality rates per turbine. However, this metric is somewhat misleading as turbine sizes and their risks to birds vary significantly (NRC 2007). Fatalities are frequently reported per nameplate capacity (i.e. MW), a metric that is easily calculated and better for comparing fatality rates among different sized turbines. Even with turbines of the same name plate capacity, the size of the rotor swept area may vary among manufacturers, and turbines at various sites may operate for different lengths of time and during different times of the day and seasons. With these considerations in mind, it is recommended that fatality rates be expressed on a per turbine and per nameplate MW basis until a better metric becomes available.

2. What are the fatality rates of species of concern?

This analysis simply involves calculating fatalities per turbine of all species of concern at a site when sample sizes are sufficient to do so. These fatalities should be expressed on a per nameplate MW basis if comparing species fatality rates among projects.

3. How do the estimated fatality rates compare to the predicted fatality rates?

There are a several ways that predictions can be assigned and later evaluated with actual fatality data. During the planning stages in Tier 2, predicted fatalities may be based on existing data at similar facilities in similar landscapes used by similar species. In this case, the assumption is that use is similar, and therefore that fatalities may be similar at the proposed facility. Alternatively, metrics derived from pre-construction assessments for an individual species or group of species – usually an index of activity or abundance at a proposed project

– could be used in conjunction with use and fatality estimates from existing projects to develop a model for predicting fatalities at the proposed project site. Finally, physical models can be used to predict the probability of a bird of a particular size striking a turbine, and this probability, in conjunction with estimates of use and avoidance behavior, can be used to predict fatalities.

The most current equations for estimating fatality should be used to evaluate fatality predictions. Several statistical methods can be found in the revised Strickland et al. (in review) and used to evaluate fatality predictions. Metrics derived from Tier 3 pre-construction assessments may be correlated with fatality rates, and (using the project as the experimental unit), in Tier 5 studies it should be possible to determine if different preconstruction metrics can in fact accurately predict fatalities and, thus, risk.

4. How do the fatality rates compare to the fatality rates from existing facilities in similar landscapes with similar species composition and use?

Comparing fatality rates among facilities with similar characteristics is useful to determine patterns and broader landscape relationships, as is discussed in some detail above for predicting fatalities at a proposed project site. Fatality rates should be expressed on a per nameplate MW or some other standardized metric basis for comparison with other projects, and may be correlated with site characteristics – such as proximity to wetlands, riparian corridors, mountain-foothill interface, or other broader landscape features – using regression analysis. Comparing fatality rates from one project to fatality rates of other projects provides insight into whether a project has relatively high, moderate or low fatalities.

5. Do bird and bat fatalities vary within the project site in relation to site characteristics?

Turbine-specific fatality rates may be related to site characteristics such as proximity to water, forest edge, staging and roosting sites, known stop-over sites, or other key resources, and this relationship may be estimated using regression analysis. This information is particularly useful for evaluating micro-siting options when planning a future facility or, on a broader scale, in determining the location of the entire project.

6. What is the composition of fatalities in relation to migrating and resident birds and bats at the site?

The simplest way to address this question is to separate fatalities per turbine of known resident species (e.g., big brown bat, prairie horned lark) and those known to migrate long distances (e.g. hoary bat, red-eyed vireo). These data are useful in determining patterns of species composition of fatalities and possible mitigation measures directed at residents, migrants, or perhaps both, and can be used in assessing potential population effects.

7. Do fatality data suggest the need for measures to reduce impacts?

It is recommended that the wind project operator and the relevant agencies discuss the results from Tier 4 studies to determine whether these impacts are significant. If fatalities are considered significant the wind project operator and the relevant agencies develop a plan to mitigate these impacts.

F. Tier 5: Other Post-construction Studies

Tier 5

Tier 5 studies will not be necessary for most wind energy projects. Tier 5 studies can be costly, complex and time consuming, and the Committee anticipates that the tiered approach will steer projects away from sites where Tier 5 studies would be necessary.

When Tier 5 studies are conducted, they will be site-specific and intended to: 1) evaluate the direct and indirect effects (e.g., displacement) of significant adverse habitat impacts on species of concern; 2) analyze factors associated with impacts, particularly direct impacts, in those cases in which impacts significantly exceed pre-construction predictions; 3) identify additional actions as warranted when mitigation measures implemented for a project are not adequate; and 4) assess demographic effects on local populations of species of concern.

Tier 5 Questions

Tier 5 studies are intended to answer questions that fall in three major categories; answering yes to any of these questions might indicate a Tier 5 study is needed:

1. Are post-construction impacts significantly higher than pre-construction estimates for direct and indirect impacts on species of concern and their habitat determined to be of interest in Tier 3?

   For example, in the Tier 3 risk assessment, predictions of collision fatalities and habitat impacts (direct and indirect) are developed. Post-construction studies in Tiers 4 and 5 evaluate the accuracy of those predictions by estimating impacts. If post-construction studies demonstrate an unacceptably high level of adverse impact, Tier 5 studies may also be warranted. Such Tier 5 studies will be unusual and will not apply to most projects.

2. Have habitat mitigation measures implemented (other than fee in lieu) been effective? If habitat restoration is conducted, it may be desirable to monitor the restoration efforts to determine if there is replacement of habitat conditions. Have measures undertaken to reduce collision fatalities been significantly less effective than anticipated?

   One objective of Tier 4 studies is to assess the effectiveness of measures undertaken to reduce fatalities as part of the project and to identify such alternative or additional measures as are necessary. If Tier 4 studies indicate that collision fatalities and adverse habitat impacts are unacceptably high, there may be additional or alternative mitigation measures which should be explored. The effectiveness of these additional measures would be evaluated using Tier 5 studies.

3. Are the estimated impacts of the proposed project likely to lead to population declines in the species of concern?

   Impacts of a project will have population level effects if the project causes a population decline in the species of concern (lambda (λ) is significantly less than 1).

   For non-listed species, this assessment will apply only to the local population. For listed species, the assessment may include impact assessments for the local or regional population, or the entire species.

Circumstances in which Tier 5 studies may be conducted include:

1) When realized fatality levels for individual species of concern reach a level at which they are considered significant adverse impacts by the relevant agencies.

   For example, if Tier 4 fatality studies document that a particular turbine or set of turbines exhibits unacceptably higher bird or bat collision fatality than predicted, adaptive management (as defined in Chapter Two-B) may be useful in evaluating alternative measures to avoid or minimize future fatalities at that turbine/turbine string.

2) There is the potential for significant fatality impacts or significant adverse impacts to habitat for species of concern, there is a need to assess the impacts more closely, and there is uncertainty over how these impacts will be mitigated.

3) The rare occasion when fatality and/or significant adverse habitat impacts suggest the potential for a reduction in the viability of an affected population, in which case studies on the potential for population impacts may be warranted.

4) When a developer evaluates the effectiveness of a risk reduction measure before deciding to continue the measure permanently or whether to use the measure when implementing future phases of a project.

   In the event additional turbines are proposed as an expansion of an existing project, results from Tier 4 and Tier 5 studies and the decision-making framework contained in the tiered approach can be used to determine whether the project should be expanded and whether additional information should be collected. It may also be necessary to evaluate whether additional measures are warranted to reduce significant adverse impacts to species.

Tier 5 Study Design Issues

Because Tier 5 studies will be highly variable and unique to the circumstances of the individual project, these Guidelines do not provide specific guidance on all potential approaches, but make some general statements about study design. Specific Tier 5 study designs will depend on the types of questions, the specific project, and practical considerations. The most common practical considerations include the area being studied, the time period of interest, the species of concern, potentially confounding variables, time available to conduct studies, project budget, and the magnitude of the anticipated impacts.

In the context of wind energy development, when it is possible to collect data both pre- and post-construction in the areas of interest and reference areas are available, then the Before-After-Control-Impact (BACI) is the most statistically robust design. The BACI design is most like the classic manipulative experiment.[14] In the absence of a suitable reference area, the design is reduced to a Before-After (BA) analysis of effect where the differences between pre- and post-construction parameters of interest are assumed to be the result of the project, independent of other potential factors affecting the assessment area. With respect to BA studies, the key question is whether the observations taken immediately after the incident can reasonably be expected within the expected range for the system (Manly 2009). Reliable quantification of impact usually will include additional study components to limit variation and the confounding effects of natural factors that may change with time.

In most situations, the timeline for the development of a wind energy facility does not allow for the collection of pre-construction data and suitable reference areas are lacking. Furthermore, alterations in land use or disturbance over the course of a multi-year BACI or BA study may complicate the analysis of study results.

When pre-construction data are unavailable and/or a suitable reference area is lacking, the reference Control Impact Design (Morrison et al. 2008) is the recommended design. The lack of a suitable reference area also can be addressed using the Impact Gradient Design, when habitat and species use are homogenous in the assessment area prior to development. When applied both pre- and post-construction, the Impact Gradient Design is a suitable replacement for the classic BACI (Morrison et al. 2008).

In the study of habitat impacts, the resource selection function (RSF) study design (see Anderson et al 1999; Morrison et al. 2008; Manly et al. 2002) is a statistically robust design, either with or without pre-construction and reference data. Habitat selection is modeled as a function of characteristics measured on resource units and the use of those units by the animals of interest. The RSF allows the estimation of the probability of use as a function of the distance to various environmental features, including wind energy facilities, and thus

[14] In this context, such designs are not true experiments in that the treatments (project development and control) are not randomly assigned to an experimental unit, and there is often no true replication. Such constraints are not fatal flaws, but do limit statistical inferences of the results.

provides a direct quantification of the magnitude of the displacement effect. RSF could be improved with pre-construction and reference area data. Nevertheless, it is a relatively powerful approach to documenting displacement or the effect of mitigation measures designed to reduce displacement even without those additional data.

Tier 5 Examples

As described earlier, Tier 5 studies will not be conducted at most projects, and the specific Tier 5 questions and methods for addressing these questions will depend on the individual project and the concerns raised during pre-construction studies and during operational phases. Rather than provide specific guidance on all potential approaches, these Guidelines offer the following case studies as examples of studies that have attempted to answer Tier 5 questions.

1. Habitat impacts - displacement and demographic impact studies

Studies to assess impacts may include quantifying species' habitat loss (e.g., acres of lost grassland habitat for grassland songbirds) and habitat modification. For example, an increase in edge may result in greater nest parasitism and nest predation. Assessing indirect impacts may include two important components: 1) indirect effects on wildlife resulting from displacement, due to disturbance, habitat fragmentation, loss, and alteration and 2) demographic effects that may occur at the local, regional or population-wide levels due to reduced nesting and breeding densities, increased isolation between habitat patches, and effects on behavior (e.g., stress, interruption, and modification). These factors can individually or cumulatively affect wildlife, although some species may be able to habituate to some or perhaps all habitat changes. Indirect impacts may be difficult to quantify but their effects may be significant (e.g., Stewart et al. 2007, Pearce-Higgins et al. 2008, Bright et al. 2008, Drewitt and Langston 2006, Robel et al. 2004, Pruett et al. 2009).

Example: in southwestern Pennsylvania, development of a project is proceeding at a site located within the range of a state-listed terrestrial species. Surveys were performed at habitat locations appropriate for use by the animal, including at control sites. Post-construction studies are planned at all locations to demonstrate any displacement effects resulting from the construction and operation of the project.

The Committee recognizes that displacement studies may not be appropriate for most individual projects. Consideration should be given to developing collaborative research efforts with industry, government agencies, and NGOs to conduct studies to address displacement as discussed in Chapter Two-D.

Displacement is considered a potentially significant adverse impact to species such as prairie grouse (prairie chickens, sharp-tailed grouse), and sage grouse, and displacement studies may be necessary to determine the extent of these impacts and the need for mitigation.

Displacement studies may use any of the study designs describe earlier. The most scientifically robust study designs to estimate displacement effects are BACI, RSF, and impact gradient. RSF and impact gradient designs may not require specialized data gathering during Tier 3.

Telemetry studies that measure impacts of the project development on displacement, nesting, nest success, and survival of prairie grouse and sage grouse in different environments (e.g., tall grass, mixed grass, sandsage, sagebrush) will require spatial and temporal replication, undisturbed reference sites, and large sample sizes covering large areas, and will be expensive. Examples of study designs and analyses used in the studies of other forms of energy development are presented in Holloran et al. (2005), Pitman et al. (2005), and Robel et al. (2004). Anderson et al. (1999) provides a thorough discussion of the design, implementation, and analysis of these kinds of field studies and should be consulted when designing the BACI study.

Studies are being initiated to evaluate effects of wind energy development on greater sage grouse in Wyoming. In addition to measuring demographic patterns, these studies will use the RSF study design (see Sawyer et al. 2006) to estimate the probability of sage grouse use as a function of the distance to environmental features, including an existing and a proposed project.

In certain situations, such as for a proposed project site that is relatively small and in a more or less homogeneous landscape, an impact gradient design may be an appropriate means to assess impacts of the wind energy facility on resident populations (Strickland et al., 2002). For example, Leddy et al. 1999 used the impact gradient design to evaluate grassland bird density as a function of the distance from wind turbines. Data were collected at various distances from turbines along transects.

This approach provides information on whether there is an effect, and may allow quantification of the gradient of the effect and the distance at which the effect no longer exists – the assumption being that the data collected at distances beyond the influence of turbines are the reference data (Erickson et al., 2007). An impact gradient analysis could also involve measuring the number of breeding grassland birds counted at point count plots as a function of distance from the wind turbines (Johnson et al. 2000).

2. Unacceptable levels of fatalities (beyond those predicted)

More intensive post-construction fatality studies may be used to determine relationships between fatalities and weather, wind speed or other covariates, which usually require daily carcass searches. Fatalities determined to have occurred the previous night can be correlated with that night's weather or turbine characteristics to establish important relationships that can then be used to evaluate the most effective times and conditions to implement measures to reduce collision fatality at the project.

3. Measures to address fatalities

The efficacy of operational modifications (e.g. changing turbine cut-in speed) of a project to reduce collision fatalities has only recently been evaluated (Arnett et al. 2009, Baerwald et al 2009). Operational modifications and other measures to address fatalities should be applied only at sites where collision fatalities are predicted or demonstrated to be high.

Tier 5 Studies and Research

The Committee recognizes that developers may be asked to conduct a study on an experimental mitigation technique, such as differences in turbine cut-in speed to reduce bat fatalities. Such techniques may show promise in mitigating the impacts of wind energy development to wildlife, but may have not been shown to have broad applicability for mitigation. Such techniques should not be routinely applied to projects, but application at appropriate sites will contribute to the breadth of knowledge regarding the efficacy of such measures in addressing collision fatalities. In addition, studies involving multiple sites and academic researchers can provide more robust research results, and such studies take more time and resources than are appropriately carried out by one developer at a single site. Examples below demonstrate collaborative research efforts to address displacement, operational modifications, and population level impacts.

1. Displacement Studies

Researchers at Kansas State University, as part of the NWCC GS3C, have begun a multi-year telemetry study to evaluate the effects of three proposed projects on displacement and demographic parameters (survival, nest success, brood success, fecundity) of greater prairie chickens (*Tympanuchus cupido*) in Kansas. Studies are intended to evaluate whether: 1) lek attendance is affected by wind energy development, 2) greater prairie-chickens avoid wind turbines and/or other anthropogenic features, and 3) wind energy development reduces nest success or chick survival.

The study combines use of data collected at three proposed projects and reference areas, and the BACI design has been used to assess impacts on demographic parameters. Several hundred birds have been radio marked on all sites combined to obtain baseline data on both the reference areas and project sites. Birds are located frequently to determine home ranges and habitat use prior to project development so that displacement can be measured once the facilities are constructed. In addition, data are collected on survival of radio-marked birds as well as nest success, fledgling success, and fecundity (the number of female offspring produced per adult female). The first year of post-construction data were collected in 2009.

Erickson et al. (2004) evaluated the displacement effect of a large wind energy facility in the Pacific Northwest. The study was conducted in a relatively homogeneous grassland landscape. Erickson et al. (2004) conducted surveys of breeding grassland birds along 300 meter transects perpendicular to strings of wind turbines. Surveys were conducted prior to construction and after commercial operation. The basic study design follows the Impact

Gradient Design (Morrison et al. 2008) and in this application, conformed to a special case of BACI where areas at the distal end of each transect were considered controls (i.e., beyond the influence of the turbines). In this study, there is no attempt to census birds in the area, and observations per survey are used as an index of abundance. Additionally, the impact-gradient study design resulted in less effort than a BACI design with offsite control areas. Erickson et al. (2004) found that grassland passerines as a group, as well as grasshopper sparrows and western meadowlarks, showed reduced use in the first 50 meter segment nearest the turbine string. About half of the area within that segment, however, had disturbed vegetation and separation of behavior avoidance from physical loss of habitat in this portion of the area was impossible. Horned larks and savannah sparrows (*Passerculus sandwichensis*) appeared unaffected. The impact gradient design is best used when the study area is relatively small and homogeneous.

2. Operational Modifications to Reduce Collision Fatality

Arnett et al. (2009) conducted studies on the effectiveness of changing turbine cut-in speed on reducing bat fatality at wind turbines at the Casselman Wind Project in Somerset County, Pennsylvania. Their objectives were to: 1) determine the difference in bat fatalities at turbines with different cut-in-speeds relative to fully operational turbines, and 2) determine the economic costs of the experiment and estimated costs for the entire area of interest under different curtailment prescriptions and timeframes. Arnett et al. (2009) reported substantial reductions in bat fatalities with relatively modest power losses.

In Kenedy County, Texas, investigators are refining and testing a real-time curtailment protocol. The projects use an avian profiling radar system to detect approaching "flying vertebrates" (birds and bats), primarily during spring and fall bird and bat migrations. The blades automatically idle when risk reaches a certain level and weather conditions are particularly risky. Based on estimates of the number and timing of migrating raptors, feathering (real-time curtailment) experiments are underway in Tehuantepec, Mexico, where raptor migration through a mountain pass is extensive.

Other tools, such as thermal imaging (Horn et al. 2008) or acoustic detectors (Kunz et al. 2007), have been used to quantify post-construction bat activity in relation to weather and turbine characteristics for improving operational mitigation efforts. For example, at the Mountaineer project in 2003, Tier 4 studies (weekly searches at every turbine) demonstrated unanticipated and high levels of bat fatalities (Kerns and Kerlinger 2004). Daily searches were instituted in 2004 and revealed that fatalities were strongly associated with low-average-wind-speed nights, thus providing a basis for testing operational modifications (Arnett 2005, Arnett et al. 2008). The program also included behavioral observations using thermal imaging that demonstrated higher bat activity at lower wind speeds (Horn et al. 2008).

Studies are currently underway to design and test the efficacy of an acoustic deterrent device to reduce bat fatalities at wind facilities (E.B. Arnett, Bat Conservation International, under the auspices of BWEC). Prototypes of the device have been tested in the laboratory

and in the field with some success. Spanjer (2006) tested the response of big brown bats (*Eptesicus fuscus*) to a prototype eight speaker deterrent emitting broadband white noise at frequencies from 12.5–112.5 kHz and found that during non-feeding trials, bats landed in the quadrant containing the device significantly less when it was broadcasting broadband noise. Spanjer (2006) also reported that during feeding trials, bats never successfully took a tethered mealworm when the device broadcast sound, but captured mealworms near the device in about 1/3 of trials when it was silent. Szewczak and Arnett (2006, 2007) tested the same acoustic deterrent in the field and found that when placed by the edge of a small pond where nightly bat activity was consistent, activity dropped significantly on nights when the deterrent was activated. Horn et al. (2007) tested the effectiveness of a larger, more powerful version of this deterrent device on reducing nightly bat activity and found mixed results. In 2009, a new prototype device was developed and tested at a project in Pennsylvania. Ten turbines were fitted with deterrent devices, daily fatality searches were conducted, and fatality estimates were compared with those from 15 turbines without deterrents (i.e., controls) to determine if bat fatalities were reduced. This experiment found that estimated bat fatalities per turbine were 20 to 53 percent lower at treatment turbines compared to controls. More experimentation is required. At the present time, there is not an operational deterrent available that has demonstrated effective reductions in bat kills (E. B. Arnett, Bat Conservation International, unpublished data).

3. Assessment of Population-level Impacts

The Altamont Pass Wind Resource Area (APWRA) has been the subject of intensive scrutiny because of avian fatalities, especially for raptors, in an area encompassing more than 5,000 wind turbines (e.g., Orloff and Flannery 1992; Smallwood and Thelander 2004, 2005). To assess population-level effects of long lived raptors, Hunt (2002) completed a four-year telemetry study of golden eagles at the APWRA and concluded that while the population is self-sustaining, fatalities resulting from wind-energy production were of concern because the population apparently depends on floaters from the local population and/or immigration of eagles from other subpopulations to fill vacant territories. Hunt conducted follow-up surveys in 2005 (Hunt and Hunt 2006) and determined that all 58 territories occupied by eagle pairs in 2000 were also occupied in 2005.

G. Retrofitting, Repowering, and Decommissioning: Best Management Practices

As with project construction, these Guidelines offer BMPs for the retrofitting, repowering, and decommissioning phases of wind energy projects.

Retrofitting

Retrofitting is defined as replacing portions of existing wind turbines or project facilities so that at least part of the original turbine, tower, electrical infrastructure or foundation is being utilized. Retrofitting BMPs include:

1. Retrofitting of turbines should use installation techniques that minimize new site disturbance, soil erosion, and removal of vegetation of habitat value.
2. Retrofits should employ shielded, separated or insulated electrical conductors that minimize electrocution risk to avian wildlife per APLIC (2006).
3. Retrofit designs should prevent nests or bird perches from being established in or on the wind turbine or tower.
4. FAA visibility lighting of wind turbines should employ only red, or dual red and white strobe, strobe-like, or flashing lights, not steady burning lights
5. Lighting at both operation and maintenance facilities and substations located within half a mile of the turbines should be kept to the minimum required:
    a. Use lights with motion or heat sensors and switches to keep lights off when not required.
    b. Lights should be hooded downward and directed to minimize horizontal and skyward illumination.
    c. Minimize use of high intensity lighting, steady-burning, or bright lights such as sodium vapor, quartz, halogen, or other bright spotlights.
6. Remove wind turbines when they are no longer cost effective to retrofit.

Repowering Existing Wind Projects

Repowering may include removal and replacement of turbines and associated infrastructure. BMPs include:

1. To the greatest extent practicable, existing roads, disturbed areas and turbine strings should be re-used in repower layouts.
2. Roads and facilities that are no longer needed should be stabilized and re-seeded with native plants appropriate for the soil conditions and adjacent habitat and of local seed sources where feasible, per landowner requirements and commitments.
3. Existing substations and ancillary facilities should be re-used in repowering projects to the extent practicable.

4. Existing overhead lines may be acceptable if located away from high bird crossing locations, such as between roosting and feeding areas, or between lakes, rivers and nesting areas. Overhead lines may be used when they parallel tree lines, employ bird flight diverters, or are otherwise screened so that collision risk is reduced.
5. Above-ground low and medium voltage lines, transformers and conductors should follow the 2006 or most recent APLIC "Suggested Practices for Avian Protection on Power Lines."
6. Guyed structures should be avoided unless guy wires are treated with bird flight diverters or high visibility marking devices, or are located where known low bird use will occur.
7. FAA visibility lighting of wind turbines should employ only red, or dual red and white strobe, strobe-like, or flashing lights, not steady burning lights.
8. Lighting at both operation and maintenance facilities and substations located within ½ mile of the turbines should be kept to the minimum required.
    a. Use lights with motion or heat sensors and switches to keep lights off when not required.
    b. Lights should be hooded downward and directed to minimize horizontal and skyward illumination.
    c. Minimize use of high intensity lighting, steady-burning, or bright lights such as sodium vapor, quartz, halogen, or other bright spotlights.

Decommissioning

Decommissioning is the cessation of wind energy operations and removal of all associated equipment, roads, and other infrastructure. The land is then used for another activity. During decommissioning, contractors and facility operators should apply BMPs for road grading and native plant re-establishment to ensure that erosion and overland flows are managed to restore pre-construction landscape conditions. The facility operator, in conjunction with the landowner and state and federal wildlife agencies, should restore the natural hydrology and plant community to the greatest extent practical.

1. Decommissioning methods should minimize new site disturbance and removal of native vegetation, to the greatest extent practicable.
2. Foundations should be removed to a depth of two feet below surrounding grade, and covered with soil to allow adequate root penetration for native plants, and so that subsurface structures do not substantially disrupt ground water movements.
3. If topsoils are removed during decommissioning, they should be stockpiled and used as topsoil when restoring plant communities. Once decommissioning activity is complete, topsoils should be restored to assist in establishing and maintaining pre-construction native plant communities to the extent possible, consistent with landowner objectives.

4. Soil should be stabilized and re-vegetated with native plants appropriate for the soil conditions and adjacent habitat, and of local seed sources where feasible, consistent with landowner objectives.
5. Surface water flows should be restored to pre-disturbance conditions, including removal of stream crossings, roads, and pads, consistent with storm water management objectives and requirements.
6. Surveys should be conducted by qualified experts to detect invasive plants, and comprehensive approaches to controlling any detected plants should be implemented and maintained as long as necessary.
7. Overhead pole lines that are no longer needed should be removed.
8. After decommissioning, erosion control measures should be installed in all disturbance areas where potential for erosion exists, consistent with storm water management objectives and requirements.
9. Fencing should be removed unless the landowner will be utilizing the fence.
10. Petroleum product leaks and chemical releases should be remediated prior to completion of decommissioning.

Chapter Four: Mitigation

During the communication process between the project developer and USFWS, USFWS, the developer, and other relevant agencies will identify important species of concern and their habitats that may occur in the area which might be impacted by project development. As noted in Chapter Two-C, the objective is to avoid or minimize significant adverse impacts to species of concern, and when appropriate, to provide compensatory mitigation for unavoidable significant adverse impacts, as identified in the tiered approach recommended in the Guidelines. All recommendations regarding avoidance, minimization and compensatory mitigation are voluntary on the part of the developer. However, it is the expectation that the developer will work with USFWS and other appropriate entities and sources of expertise to agree on mitigation strategies. It is in the best interest of all parties to cooperate early in the project design process to identify where mitigation may be necessary. This will avoid unnecessary project delays and allows for incorporation of the mitigation into the project design.

If significant adverse impacts to species of concern and their habitats cannot be avoided, then opportunities to minimize significant adverse impacts to the fullest extent practicable are pursued. For example, it may not be possible to avoid removing some forested habitat for a turbine string, but it may be possible to reduce the total amount of forest habitat removed through alternative placement of access roads and support structures. In addition, anticipated direct mortalities may be reduced by the application of operational adjustments.

In cases where significant adverse impacts cannot be avoided or minimized, it may be possible to offset all, or a portion, of these impacts through additional minimization strategies or compensatory mitigation. One tool, used by the USFWS, is the USFWS Mitigation Policy which describes steps for addressing habitat loss in detail and includes information on Resource Categories[15] to assist in considering type and amount of compensatory mitigation to offset losses of habitat.

For example, the resource goals for the following habitat resource categories are:

Resource Category 1: Avoid habitat loss
Resource Category 2: No net loss of in-kind habitat value
Resource Category 3: No net loss of out-of-kind habitat value
Resource Category 4: Minimize loss of habitat value

Other tools to determine appropriate compensatory mitigation may be used by developers and in coordination with USFWS and States. Recommended measures may include on- or off-site habitat improvement, and may consist of in-kind or out-of-kind compensatory mitigation. Compensatory measures may be project-specific or may be part of a mitigation

[15] http://www.fws.gov/policy/501fw2.html

banking scenario. It is recommended that the method for implementing compensatory mitigation (e.g. fee title acquisition, in-lieu fee, conservation easement) be determined early in the process, if possible.

It may be possible to offset direct impacts of habitat loss to individuals, but this does not apply to federally listed threatened and endangered species. If a federal nexus exists, or if a developer chooses to seek an Incidental Take Permit (ITP), then impacts to listed species should be evaluated through the processes of Section 7 or 10 of the Endangered Species Act.

Additional mitigation for significant adverse impacts from operations should be requested and implemented only if Tier 4 or Tier 5 studies determine that significant adverse impacts cannot be adequately addressed by existing mitigation measures. Because in certain circumstances a project's impacts cannot be forecast with precision, the developer and the agencies may be unable to make some mitigation decisions until post-construction data have been collected. Mitigation measures implemented post-construction, whether in addition to those implemented pre-construction or whether they are new, are appropriate elements of the tiered approach. The general terms and funding commitments for future mitigation and the triggers or thresholds for implementing such compensation should be developed prior to or upon project operation and/or construction when possible. Mitigation beyond that implemented prior to or upon project operation should be well defined, bounded, and technically feasible, and commensurate with the project impacts.

It is anticipated that developers will take steps to avoid or minimize significant adverse impacts to species of concern and their habitats to the greatest extent practicable for that project. It is generally the case that project-impact assessment is a cooperative effort involving the developer, USFWS, Tribes, and state wildlife agencies, and therefore, recommended mitigation measures will be consensus measures, and will not be additive. The state, Tribe, and the USFWS may have different species or habitats of concern, however, according to their responsibilities and statutory authorities.

Chapter Five:

Advancing Use, Cooperation, and Effective Implementation of the Guidelines

A. USFWS Adoption and Implementation of Guidelines

Process and Timeline for Developing Final USFWS Guidelines

The Secretary, through the Director of the USFWS (Director), anticipates using the Committee's recommendations as the basis of his or her guidance to the maximum extent possible, consistent with DOI's legal obligations. Following is an anticipated process and timeline for USFWS guidance development after the Committee transmits its recommended Guidelines to the Secretary. The timeline is optimistic and the USFWS intends to make every effort to meet the goals as outlined barring unforeseen delays.

1. Recommendations to Secretary of the Interior

Consistent with its Charter, the Committee is submitting to the Secretary these recommended Guidelines for "developing effective measures to avoid or minimize impacts to wildlife and their habitats related to land-based wind energy facilities." The Committee understands that the Secretary will review the recommended Guidelines and will consider how to use them in developing final guidelines, but that the recommended Guidelines are not binding on the Secretary. The Committee appointed a Legal Subcommittee to prepare a summary of the applicable wildlife laws (MBTA, BGEPA, and ESA). This summary, entitled "White Paper," describes salient aspects of those laws as of October 22, 2008. The full Committee reviewed the White Paper and voted to include it in the appendix to the Guidelines as a useful reference paper (see Appendix B).

2. Step-down to the Director of the USFWS

It is anticipated that the Secretary will transmit to the Director the full set of recommended Guidelines, together with direction for their use in developing final guidelines. While it is uncertain when this will occur, the Committee requests that the Secretary review the recommendations as soon as possible.

3. USFWS develops draft guidelines

The Committee recommends that the Secretary direct the USFWS to use the Committee's recommended Guidelines to develop its final guidelines. The Committee recommends that the Guidelines be adopted in full. The Secretary retains full discretion to alter or modify the recommended Guidelines, especially in the event that new information or public comments warrant changes.

The Committee understands that the final guidelines will be developed by a USFWS Task Force to be convened as soon as possible following the step-down from the Secretary. The Task Force will be comprised of key USFWS staff from Regional and Field Offices with knowledge, skills, and experience related to wind energy development. The Committee requests that the Task Force complete their work as soon as possible, depending on when the Secretary forwards his direction to the Director.

4. Publication/Solicitation of comments

The Committee understands that a Notice of Proposed Guidance will be published in the *Federal Register* and made available for public comment. The Committee understands that the USFWS anticipates a 90-day comment period.

5. Comment review and response

The Committee anticipates that USFWS will review and respond to all comments received during the comment period. The response time will depend upon the quantity and detail of the comments received. However, USFWS anticipates that it will require at least 60 days to respond to comments and make the necessary changes to the guidelines.

6. Publication of final guidelines

The Committee anticipates that USFWS will publish the final guidelines and response to comments in the *Federal Register* as soon as possible.

General Considerations

1. Consistent Application

The Committee recommends that USFWS inform all Regional and Field staff of the Premises and Principles from which these Guidelines were developed. USFWS should provide guidance and training to all USFWS staff involved in wind energy development for implementation of final USFWS guidelines to promote their consistent application, provide direction on how to accommodate flexibility in addressing site specific conditions, and facilitate agency and industry understanding of recommended actions. Guidance should include the need for flexibility to address diverse geographic regions, habitat types, and wind energy projects. USFWS should ensure that Regional and/or Washington Office staff is available to provide guidance to the field staff for consistent application of the guidelines. Guidance also will be provided to assist in addressing developer concerns that cannot otherwise be resolved in a timely fashion at the field level.

USFWS, environmental, and industry representatives should continue to be involved with the development of BMPs for project design, operation and compensatory mitigation, based on best available science, to minimize significant adverse impacts to species of concern and their habitats from projects. USFWS will review BMPs periodically and revise as necessary to

reflect new knowledge gained from current science, monitoring results, and experience with projects. All USFWS staff involved in review of projects should be trained in use of BMPs.

2. Training

USFWS should provide training to ensure that all Regional and Field staff have the knowledge, skill, and ability to implement the USFWS guidelines. The Committee recommends that training be provided through hands-on workshops conducted in each USFWS Region, with priority for the first workshops to be scheduled in areas of high wind energy development activity. Each workshop should be planned in consultation with and open to participants from USFWS, industry, states, Tribes, NGOs and other appropriate participants, with the goal of developing partnerships to minimize adverse impacts to species of concern and their habitat while allowing flexibility for projects.

3. Staff Support

The Committee recommends that the USFWS Chief of Division of Habitat and Resource Conservation be designated lead on development and implementation of these guidelines. The Committee recommends that the USFWS set a priority to work within its budget constraints and provide staff support to review projects in a timely and efficient manner. To supplement its staff efforts, USFWS should encourage state cooperative arrangements and participation in review of potential projects. USFWS encourages developers to communicate early in the project development process to facilitate timely involvement and feedback. USFWS should also explore the collocation of additional staff in BLM Pilot Offices for renewable energy, and the creation of new co-located renewable offices. USFWS should continue to explore new technologies and research findings to improve its ability to avoid wildlife detriments while streamlining the review process.

Phase-in for Using Committee's Recommended Guidelines

The recommended tiered approach in these Guidelines may not be immediately applicable at projects in the development or operational phase because the tiered approach requires many months or years to plan and implement. Accordingly, the recommendations contained in Tiers 1 through 5 become effective 24 months after the date USFWS publishes final guidelines (the "Effective Date"). This will allow USFWS and state wildlife-agency managers and Field Office personnel, wildlife consultants, developers, NGOs, and other government agencies time for training and adjustments.

An important incentive to voluntary adoption of the tiered approach is that after the guidelines are published, USFWS will take a developer's adherence to the guidelines and communication with USFWS fully into account as evidence of due care when exercising its enforcement discretion under the MBTA and BGEPA. A benefit of following the approach recommended in the Guidelines is that in the event of later adverse environmental impacts, the developer will be able to demonstrate that it adhered to the guidelines, communicated

with USFWS, and considered the advice of USFWS in project siting, construction and operation.

USFWS encourages use of the guidelines and adoption of the tiered approach by future and existing projects. Accordingly, all projects that commence after the Effective Date should apply the tiered approach to all phases of the project. However, projects that have already commenced are not expected to start over or return to the beginning of a specific tier. Instead, these projects should implement those portions of the guidelines relevant to the continuing phases of the project. For projects that are already operational prior to the Effective Date, they should adhere to the recommendations in Tier 4, and, if applicable, Tier 5.

For projects commencing after the Effective Date of the guidelines, "voluntary adherence and communication" shall mean that the developer has applied the guidelines, including the tiered approach, through site selection, design, construction, operation and post-operation phases of the project, and has communicated with USFWS and considered its advice. For projects commencing prior to the Effective Date of the guidelines, "voluntary adherence and communication" shall mean that the developer has communicated with USFWS early in the process and can produce records that demonstrate that they have applied recommendations of the tiered approach relevant to activities at the project which occur after the date the USFWS publishes final guidelines. In either case, USFWS will take such adherence and communication fully into account when exercising its discretion with respect to any potential referral for prosecution under the MBTA and BGEPA. USFWS retains its existing authority to inspect and assess the sufficiency of these records.

B. Project Development and Coordination with the USFWS

Coordination and/or Consultation with USFWS

The Committee recommends that the Secretary direct the USFWS to consider the varying circumstances in which a wind energy project may be developed, and provide clear explanation and expectations to users of the guidelines as to how the guidelines will be applied in each instance. Explanation should include guidance for projects developed with or without a federal nexus.

Ensuring Timely Project Review

The Committee recommends that the USFWS:

- Work within its budget constraints to provide staff support in order to review projects in a timely and efficient manner.
- Encourage state cooperative arrangements and participation in review of proposed projects to supplement its staff efforts.
- Encourage developers to communicate early in the project development process to facilitate timely involvement and feedback.

- Explore agreements with other federal agencies to help fund staff positions, such as the BLM Pilot Project Offices for oil and gas or the BLM Renewable Offices.
- Continue to explore cutting edge technology to further streamline the review process, such as the Information, Planning, and Consultation (IPaC) system.

Conflict Resolution

Conflict resolution under the provisions of the Guidelines needs to be expeditious and effective. To increase use of the guidelines, conflict resolution should be applied consistently across USFWS regions. USFWS and developers should attempt to resolve any conflicts arising from use of the guidelines at the Field Office level. Deliberations should be in the context of the intent of the Guidelines and be based on the site-specific conditions and the best available data. However, if there is an issue that cannot be resolved within a standard time frame, the developer should have the option to bring the issue to a designated individual/team in the Regional Office. The designated individual/team USFWS Regional Office representative should work with the field staff and the developer to ensure that a resolution is obtained in a timely manner. If the issue is unresolved, the Regional Office representative will facilitate resolution if it requires further elevation within USFWS. The Committee recommends that the USFWS shepherd the disputed issue(s) up the USFWS chain of command, if necessary.

Consideration of the Guidelines in MBTA and BGEPA Enforcement

The Committee recommends that DOI adopt the following statement:

> **Consideration of the Guidelines in MBTA and BGEPA Enforcement**
> "USFWS urges voluntary adherence to the guidelines and communication with USFWS when planning and operating a facility. USFWS will regard such voluntary adherence and communication as evidence of due care with respect to avoiding, minimizing, and mitigating significant adverse impacts to species protected under the MBTA and BGEPA, and will take such adherence and communication fully into account when exercising its discretion with respect to any potential referral for prosecution related to the death of or injury to any such species. Each developer will be responsible for maintaining internal records sufficient to demonstrate adherence to the guidelines. Examples of these records could include: studies performed in the implementation of the tiered approach; an internal or external review or audit process; an Avian and Bat Protection Plan; or a wildlife management plan. USFWS retains its existing authority to inspect and assess the sufficiency of those records."

Optional Use of Avian and Bat Protection Plan (ABPP)

An Avian and Bat Protection Plan (ABPP) is a company- or project-specific document that provides a description of actions to responsibly address the applicable wildlife issues associated with wind energy development; the avoidance, minimization and (as appropriate) mitigation measures; and the management activities that a company or project owner will conduct to protect birds and bats. Although the details of each company's or project's ABPP will be different, the overall goals of any ABPP include describing the actions and/or processes to implement and demonstrate adherence to the guidelines in the development, construction and operation of projects.

Corporate ABPP

A corporate ABPP documents the processes a company uses to implement the guidelines for all of its projects. Key elements usually include a corporate policy commitment to minimize adverse impacts to wildlife; specific processes to be used to reduce impacts to birds and bats during each stage of project development, construction, and operations; permit compliance systems; and implementation tools, including training, auditing, and reporting.

Project-specific ABPP

Companies that adopt corporate ABPPs may in many cases also "step down," or implement the corporate ABPP for some or all of its projects via project-specific ABPPs. In other cases, a company may develop only the project-specific ABPP.

A project-specific ABPP documents the bird and bat impact avoidance, minimization and (if applicable) mitigation measures for a specific site. Typically a project-specific ABPP will document the analyses, studies, and reasoning that have supported progressing from one tier to the next in the tiered approach laid out in the Guidelines. A project-specific ABPP will often be a plan developed in stages, over time, as the analysis and studies are undertaken for each tier.

C. Federal Interagency Coordination and Cooperation

The Committee recommends that the Chief of Division of Habitat and Resource Conservation, USFWS, employ the following strategies to ensure the timely and consistent review of wind energy projects by federal agencies:

1. USFWS, together with other federal agencies, should establish an interagency working group to optimize federal coordination and use of the USFWS national guidelines to the greatest extent possible, advance consistency, and avoid duplication in the federal review and permitting process as it relates to wind development.

2. USFWS should work with other federal agencies to provide incentives for adopting and using USFWS national guidelines, encourage early coordination for projects that may affect wildlife resources, and use interagency meetings to promote consistency.

3. USFWS should establish and maintain a readily accessible national repository of BMPs for wind/wildlife interactions to increase efficiency, interagency coordination, and state and industry use of best management practices.

4. USFWS should assist public lands management agencies in identifying landscapes that include important habitats and ecosystem components that merit special attention in considering wind energy development.

5. USFWS should cooperate with U.S. Department of Agriculture (USDA)-Natural Resource Conservation Service and USDA Farm Service Agency to ensure that agricultural conservation programs – including, but not limited to, the Conservation Reserve Program, Wetland Reserve Program, Grassland Reserve Program, and Farm and Ranchland Protection Program – are implemented and managed in a manner consistent with the guidelines.

USFWS should coordinate with other agencies that require data collection at a wind energy site to promote consistent methodology and reporting requirements, while also accommodating individual site conditions and practical limitations.

D. USFWS-State Coordination and Cooperation

USFWS should encourage states to increase compatibility between state guidelines and these voluntary guidelines, protocols, data collection methods, and recommendations relating to wildlife and wind energy. While these Guidelines contain recommendations that are generally applicable at the federal, state and local levels across the country, some specific recommendations contained herein may not be standard practice in all states. States that desire to adopt, or those that have formally adopted, wind energy siting, permitting or environmental review regulations or guidelines are encouraged to cooperate with USFWS to develop consistent state level guidelines. USFWS should confer, coordinate and share its expertise with interested states when a state lacks its own guidance or program to address wind energy-wildlife interactions. The USFWS should also use states' technical resources as much as possible and appropriate.

USFWS should establish a voluntary state/federal program to advance cooperation and compatibility between USFWS and interested state and local governments for coordinated review of projects under both federal and state wildlife laws. USFWS and interested states are encouraged to reach agreements to foster consistency in review of projects using the following tools:

- Cooperation agreements with interested state governments.

- Joint agency reviews to reduce duplication and increase coordination in project review.

- A communication mechanism:
    - To share information about prospective projects
    - To coordinate project review
    - To ensure that state and federal regulatory processes, and/or mitigation requirements are being adequately addressed
    - To ensure that species of concern and their habitats are fully addressed

- Establishing consistent and predictable joint protocols, data collection methodologies, and study requirements to satisfy project review and permitting.

- Designating a USFWS management contact within each Regional Office to assist Field Offices working with states and local agencies to resolve significant wildlife-related issues that cannot be resolved at the field level.

- Cooperative state/federal/industry research agreements relating to wind energy - wildlife interactions.

- States without their own guidelines should consider waiting for the USFWS guidelines in order to ensure compatibility with those guidelines.

USFWS Role:

- Provide training to states.
- Foster development of a national geographic data base that identifies development-sensitive ecosystems and habitats.
- Support a national database for reporting of mortality data on a consistent basis.
- Establish national BMPs for wind energy development projects.
- Develop recommended guidance on study protocols, study techniques, and measures and metrics for use by all jurisdictions.
- Assist in identifying and obtaining funding for national research priorities.

E. USFWS-Tribal Coordination and Cooperation

Tribal coordination is important not only in federal discussions. Many tribal traditional lands and tribal rights extend outside federal lands onto state regulated lands. In addition, tribal interests are impacted in even private land developments. A discussion of tribal input to all projects is important.

Authorities for Federal-Tribal Coordination

The federal government maintains a special trust relationship with Tribes pursuant to treaties, statutes, Executive Orders, regulations, and judicial decisions. The federal government and USFWS affirmed these obligations to Tribes in Executive Order 13175 "Consultation and Coordination with Indian Tribal Governments," and Presidential Memorandum "Government-to-Government Relations with Native American Tribal Governments" (April 29, 1994), Joint Secretarial Order 3206 "American Indian Tribal Rights, Federal Tribal Trust Responsibilities, and the Endangered Species Act" (updated January 16, 2008), and the USFWS Native American Policy (June 28, 1994).

Tribal Coordination

Accordingly, the USFWS shall seek to establish and maintain effective government-to-government working relationships with Tribes to achieve the common goal of promoting and protecting the fish, wildlife and their habitats. Whenever USFWS is aware that its actions and activities may impact tribal trust resources, the exercise of tribal rights, or Indian lands (both lands held in trust for Tribes and individual Indians, and lands owned by Tribes or individual Indians subject to restrictions on alienation), the USFWS shall consult and coordinate with, and seek the participation of, the affected Tribes to the maximum extent practicable. This shall include providing affected Tribes adequate opportunities to participate in data collection, consensus seeking, comment, and associated processes. To facilitate the government-to-government relationship, the USFWS may coordinate their discussions with a representative from an intertribal organization, if so designated by the affected Tribe(s).

Jurisdiction on Tribal Lands

The USFWS recognizes that Tribes value and take responsibility for the management of their lands and resources. Indian lands, whether held in trust by the United States for the use and benefit of Indians or owned exclusively by a Tribe, are not subject to the controls or restrictions set forth in federal public land laws. Indian lands are not federal public lands or part of the public domain, but are rather retained by Tribes or set aside for tribal use pursuant to treaties, statutes, court orders, executive orders, judicial decisions, or agreements. Accordingly, Tribes manage Indian lands in accordance with tribal goals and objectives, within the framework of applicable laws.

Except when determined necessary for investigative or prosecutorial law enforcement activities, or when otherwise provided in a federal/tribal agreement, the USFWS, to the maximum extent practicable, shall obtain permission from Tribes before knowingly entering Indian reservations and tribally-owned fee lands and shall communicate as necessary with the appropriate tribal officials. If a Tribe believes this section has been violated, such Tribe may file a complaint with the Secretary, who shall promptly investigate and respond to the Tribe.

Tribal Conservation and Management Plans

The USFWS acknowledges that Tribes value, and exercise responsibilities for, management of Indian lands and tribal trust resources. As such, the USFWS shall give deference to tribal conservation and management plans for tribal trust resources that: 1) govern activities on Indian lands, including, for purposes of these plans, tribally-owned fee lands, and 2) address the conservation needs of tribal resources. The USFWS shall conduct government-to-government consultations to discuss the extent to which tribal resource management plans for tribal trust resources outside Indian lands can be incorporated into actions to address the conservation needs of tribal resources.

Communication with other Agencies

USFWS will encourage and facilitate communication and cooperation among tribal governments, states, federal agencies and others to identify and delineate respective roles and responsibilities and to ensure that issues of common interest and concern are discussed. This may include such activities as taking the initiative, as lead federal agency in this process, to provide the biological or managerial expertise necessary for resolution of conflicts about fish and wildlife resource issues. This may include, but is not limited to, coordination and cooperation with other fish and wildlife management agencies, such as the National Marine Fisheries Service.

Intergovernmental Agreements for Sensitive Species

The USFWS shall, when appropriate and at the request of a Tribe, pursue intergovernmental agreements to formalize arrangements for federal candidate, proposed, and listed species such as, but not limited to, land and resource management, multi-jurisdictional partnerships, cooperative law enforcement, and guidelines to accommodate Indian access to, and traditional uses of, natural products. Such agreements shall strive to establish partnerships that harmonize the USFWS mission with the Tribe's own ecosystem management objectives.

Coordination on Cultural Resources Issues

Tribes and the USFWS both recognize the relationship between habitat resources and cultural and historic resources. USFWS and its Cultural Resources Program manage the array of cultural resources under its jurisdiction. Therefore the USFWS shall consult with appropriate Tribe(s) to identify the cultural or religious interests, the traditional practices, aboriginal use areas, historic and sacred sites, artifacts, archeological sites, and treaty rights that could be affected by USFWS actions on Indian lands held in trust by the federal government. USFWS will be guided in this respect by such legislation as the National Historic

Preservation Act, Native American Graves Protection and Repatriation Act, Archaeological Resources Protection Act, and the American Indian Religious Freedom Act.

USFWS should work with Tribes with the goal to promote compatibility between tribal and federally recommended wildlife protocols, data collection methods, and requirements relating to wildlife and wind energy. These wind energy Guidelines contain recommendations that may be generally applicable at the federal, state, tribal and local levels across the country, as well as policies, measures and incentives that are focused on USFWS policies, procedures, goals and regulations, and those of other federal agencies. Some of the specific recommendations may not be applicable at the tribal government level. Those Tribes that desire to or that have formally adopted wind energy siting, permitting or environmental review regulations or guidelines may contact USFWS for technical assistance (including consultation, as necessary, with the Office of the Solicitor) in order to minimize conflicting or unnecessary requirements resulting from different tribal versus federal practices. In addition, USFWS should confer, coordinate and share its expertise with interested Tribes when a Tribe lacks its own guidance or program to address wind and wildlife interactions.

The Committee recommends that USFWS establish a voluntary tribal/federal cooperation program to promote cooperation and compatibility between USFWS and interested tribal governments for coordinated review of projects under applicable federal wildlife laws. Formal agreements between USFWS and Tribes may be explored. Cooperation between Tribes and USFWS may include the following elements:

- Strengthening a cooperative approach to the management of fish and wildlife habitat on Indian lands through potential mutually cooperative agreements, memoranda of understanding, or memoranda of agreement with interested tribal governments to promote coordinated, consistent review of projects for compliance with applicable federal wildlife laws.

- Provision for voluntary joint agency reviews and other appropriate measures to reduce duplication and increase coordination between tribal governments and USFWS in reviewing projects.

- Fostering of communication between Tribes and USFWS to ensure that the party first obtaining the information about a prospective project will notify the other party to enable joint planning on how to coordinate review of the project.

- Identification of representatives of a Tribe who is responsible to work with the USFWS Regional Office to coordinate review of proposed wind activities under applicable wildlife laws.

- Establishment of consistent and predictable joint protocols, data collection methodology, and study requirements that can be used by USFWS and Tribes to satisfy project permitting and environmental review requirements.

- Designation of a USFWS management contact within each Regional Office who is available as a resource to the Field Offices to work with Tribes to resolve significant wildlife-related issues that may arise at projects that cannot be resolved at the Field Office.

- Establishment of cooperative tribal/federal/industry research agreements relating to wind energy-wildlife interactions.

- Tribes must have the confidence that developers are considering tribal resources that may be at risk and ensure that tribal regulatory processes or mitigation requirements are being addressed in project development.

Additional Optional Arrangements between Indian Tribes and USFWS:

- USFWS should support and promote the establishment of negotiated agreements with interested Tribes that specify additional coordination, review and compliance responsibilities for ensuring project compatibility with applicable wildlife laws.

- In administering this tribal/federal partnership program, the Committee recommends that USFWS and the Tribes provide differing but complementary services.

USFWS Services:

- Provide training to Tribes.
- Support and/or manage a national database for reporting of mortality data on a consistent basis.
- Establish and maintain national "best management practices" for project siting and operation based on project experience and learning.
- Establish and revise recommended guidance on study protocols, study techniques, and measures and metrics for use by all jurisdictions.
- Assist in identification and pursuit of funding for national research priorities.

Indian Tribes Services:

- Consider the voluntary national guidelines as the minimum foundation of a Tribe's approach to wind energy and wildlife review.
- Consider sharing information by reporting project monitoring data and results received from the project developer to national database at USFWS.

F. NGO Actions

If a specific project involves actions at the local, state, or federal level that provide opportunities for public participation, non-governmental organizations (NGOs) can provide meaningful contributions to the discussion of biological issues associated with that project, through the normal processes such as scoping, testimony at public meetings, and comment processes. In the absence of formal public process, there are many NGOs that have substantial scientific capabilities and may have resources that could contribute productively to the siting of wind energy projects. Several NGOs have made significant contributions to the understanding of the importance of particular geographic areas to wildlife in the United States. This work has benefited and continues to benefit from extensive research efforts and from associations with highly qualified biologists. NGO expertise can – as can scientific expertise in the academic or private consulting sectors – serve highly constructive purposes. These can include:

- Providing information to help identify environmentally sensitive areas, during the screening phases of site selection (Tiers 1 and 2, as described in this document)
- Providing feedback to developers and agencies with respect to specific sites and site and impact assessment efforts
- Helping developers and agencies design and implement mitigation or offset strategies
- Participating in the defining, assessing, funding, and implementation of research efforts in support of improved predictors of risk, impact assessments and effective responses
- Articulating challenges, concerns, and successes to diverse audiences

NGO Conservation Lands

Implementation of these Guidelines by USFWS and other state agencies will recognize that lands owned and managed by non-government conservation organizations represent a significant investment that generally supports the mission of state and federal wildlife agencies. Many of these lands represent an investment of federal conservation funds, through partnerships between agencies and NGOs. These considerations merit extra care in the avoidance of wind energy development impacts to these lands. In order to exercise this care, the Committee recommends that the USFWS and allied agencies coordinate and consult with NGOs that own lands or easements which might reasonably be impacted by a project under review.

U.S. Fish and Wildlife Service
Wind Turbine Guidelines Advisory Committee

Appendices

Appendices

Appendix A: Glossary.....A1-8

Appendix B: Legal White Paper (*presented and adopted at October 21-23, 2008 Committee Meeting*)..... B1-24

Appendix C: Landscape-Level Mapping Tools for Assessing Wildlife and Habitat Impacts, *from the Landscape/Habitat Subcommittee* (presented at *October 21-23, 2008 Committee Meeting*)..... C1-4

Appendix D: Literature Cited D1-10

Appendix A:
Glossary

Acceptable/unacceptable – In the tiered approach described in these Guidelines, the individuals and institutions involved in the decision process agree that risk and/or impacts are acceptable or unacceptable.

Accuracy – The agreement between a measurement and the true or correct value.

Adaptive management – An iterative decision process that promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. The term as used in the recommendations and the Guidelines specifically refers to "passive" adaptive management, in which alternative management activities are assessed, and the best option is designed, implemented, and evaluated.

Anthropogenic – Resulting from the influence of human beings on nature.

Area of interest – For most projects, the area where wind turbines and meteorological (met) towers are proposed or expected to be sited, and the area of potential impact.

Avian – Pertaining to or characteristic of birds.

Avoid – To not take an action or parts of an action to avert the potential effects of the action or parts thereof. First of three components of "mitigation," as defined in USFWS Mitigation Policy. (*See* **mitigation**.)

Before-after/control-impact (BACI) – A study design that involves comparisons of observational data, such as bird counts, before and after an environmental disturbance in a disturbed and undisturbed site. This study design allows a researcher to assess the effects of constructing and operating a wind turbine by comparing data from the "control" sites (before and undisturbed) with the "treatment" sites (after and disturbed).

Best management practices (BMPs) – Methods that have been determined by the stakeholders to be the most effective, practicable means of avoiding or minimizing significant adverse impacts to individual species, their habitats or an ecosystem, based on the best available information.

Buffer zone – A neutral zone surrounding a resource designed to protect the resource from adverse impact, and/or a zone surrounding an existing or proposed wind energy project for the purposes of data collection and/or impact estimation.

Comparable site – A site similar to the project site with respect to topography, vegetation, and the species under consideration.

Compensatory mitigation – Replacement of project-induced losses to fish and wildlife resources. Substitution or offsetting of fish and wildlife resource losses with resources considered to be of equivalent biological value.

- **In-kind –** Providing or managing substitute resources to replace the value of the resources lost, where such substitute resources are physically and biologically the same or closely approximate to those lost.
- **Out-of-kind –** Providing or managing substitute resources to replace the value of the resources lost, where such substitute resources are physically or biologically different from those lost. This may include conservation or mitigation banking, research or other options.

Cost effective – Economical in terms of tangible benefits produced by money spent.

Covariate – Uncontrolled random variables that influence a response to a treatment or impact, but do not interact with any of the treatments or impacts being tested.

Critical habitat – For listed species, consists of the specific areas designated by rule making pursuant to Section 4 of the Endangered Species Act and displayed in 50 CFR § 17.11 and 17.12.

Cumulative impacts – *See* **impact**.

Displacement – The loss of habitat as result of an animal's behavioral avoidance of otherwise suitable habitat. Displacement may be short-term, during the construction phase of a project, temporary as a result of habituation, or long-term, for the life of the project.

Ecosystem – A system formed by the interaction of a community of organisms with their physical and chemical environment. All of the biotic elements (i.e., species, populations, and communities) and abiotic elements (i.e., land, air, water, energy) interacting in a given geographic area so that a flow of energy leads to a clearly defined trophic structure, biotic diversity, and material cycles. USFWS Mitigation Policy adopted definition from E. P. Odum 1971 *Fundamentals of Ecology*.

Endangered species – *See* **listed species**.

Extirpation – The species ceases to exist in a given location; the species still exists elsewhere.

Fatality – An individual instance of death.

Fatality rate – The ratio of the number of individual deaths to some parameter of interest such as megawatts of energy produced, the number of turbines in a wind project, the number of individuals exposed, etc, within a specified unit of time.

Feathering – A form of curtailment for wind turbines that involves either reducing the angle of individual blades into the wind, thereby reducing rotor speed, or turning the whole unit out of the wind. When rotors are feathered, they are pitched parallel to the wind, essentially making them stationary.

Federal action agency – A department, bureau, agency or instrumentality of the United States which plans, constructs, operates or maintains a project, or which reviews, plans for or approves a permit, lease or license for projects, or manages federal lands.

Federally listed species – *See* **listed species**.

Footprint – The geographic area occupied by the actual infrastructure of a project such as wind turbines, access roads, substation, overhead and underground electrical lines, and buildings.

G1 (Global Conservation Status Ranking) Critically Imperiled – At very high risk of extinction due to extreme rarity (often five or fewer populations), very steep declines, or other factors.

G2 (Global Conservation Status Ranking) Imperiled – At high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors.

G3 (Global Conservation Status Ranking) Vulnerable – At moderate risk of extinction or elimination due to a restricted range, relatively few populations, recent and widespread declines, or other factors.

Guy wire – Wires used to secure wind turbines or meteorological towers that are not self-supporting.

Habitat – The area which provides direct support for a given species, including adequate food, water, space, and cover necessary for survival.

Habitat fragmentation – The separation of a block of habitat for a species into segments, such that the genetic or demographic viability of the populations surviving in the remaining habitat segments is reduced.

Impact – An effect or effects on natural resources and on the components, structures, and functioning of affected ecosystems.

- **Cumulative –** Changes in the environment caused by the aggregate of past, present and reasonably foreseeable future actions on a given resource or ecosystem.
- **Direct –** Effects on individual species and their habitats caused by the action, and occur at the same time and place.
- **Indirect impact –** Effects caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.

Infill – Add an additional phase to the existing project, or build a new project adjacent to existing projects.

In-kind compensatory mitigation – See **compensatory mitigation.**

Intact habitat – An expanse of habitat for a species or landscape scale feature, unbroken with respect to its value for the species or for society.

Intact landscape – Relatively undisturbed areas characterized by maintenance of most original ecological processes and by communities with most of their original native species still present.

Lambda (λ) – Population growth rate; a lamba of 1.0 = stable population, less than 1.0 = declining population, and greater than 1.0 = increasing population.

Lattice design – A wind turbine support structure design characterized by horizontal or diagonal lattice of bars forming a tower rather than a single tubular support for the nacelle and rotor.

Lead agency – Agency that is responsible for federal or non-federal regulatory or environmental assessment actions.

Lek – A traditional site commonly used year after year by males of certain species of birds (e.g., greater and lesser prairie-chickens, sage and sharp-tailed grouse, and buff-breasted sandpiper), within which the males display communally to attract and compete for female mates, and where breeding occurs.

Listed species – Any species of fish, wildlife or plant that has been determined to be endangered or threatened under section 4 of the Endangered Species Act (50 CFR §402.02), or similarly designated by state law or rule.

Local population – A subdivision of a population of animals or plants of a particular species that is in relative proximity to a project.

Loss – As used in this document, a change in wildlife habitat due to human activities that is considered adverse and: 1) reduces the biological value of that habitat for species of concern; 2) reduces population numbers of species of concern; 3) increases population

numbers of invasive or exotic species; or 4) reduces the human use of those species of concern.

Megawatt (MW) – A measurement of electricity-generating capacity equivalent to 1,000 kilowatts (kW), or 1,000,000 watts.

Migration – Regular movements of wildlife between their seasonal ranges necessary for completion of the species lifecycle.

Migration corridor – Migration routes and/or corridors are the relatively predictable pathways that a migratory species travel between seasonal ranges, usually breeding and wintering grounds.

Migration stopovers – Areas where congregations of birds assemble during migration, and supply high densities of food, such as wetlands and associated habitats.

Minimize – To reduce to the smallest practicable amount or degree.

Mitigation – (*Specific to these Guidelines)* Avoiding or minimizing significant adverse impacts, and when appropriate, compensating for unavoidable significant adverse impacts.

Monitoring – A process of project oversight. Also, making measurements of uncontrolled events at one or more points in space or time with space and time being the only experimental variable or treatment.

Mortality rate – Population death rate, typically expressed as the ratio of deaths per 100,000 individuals in the population per year (or some other time period).

Operational modification – Deliberate changes to wind energy project operating protocols, such as the wind speed at which turbines "cut in" or begin generating power, undertaken with the object of reducing collision fatalities.

Passerine – Describes birds that are members of the Order *Passeriformes*, typically called "songbirds."

Population – A demographically and genetically self-sustaining group of animals and/or plants of a particular species.

Practicable – Capable of being done or accomplished; feasible.

Prairie grouse – A group of gallinaceous birds, includes the greater prairie-chicken, the lesser prairie-chicken, and the sharp-tailed grouse, occurring in the Great Plains and northwestern areas of North America.

Project area – The area that includes the project site as well as contiguous land that shares relevant characteristics.

Project commencement – The point in time when a developer begins its preliminary evaluation of a broad geographic area to assess the general ecological context of a potential site or sites for wind energy project(s). For example, this may include the time at which an option is acquired to secure real estate interests, an application for federal land use has been filed, or land has been purchased.

Project Site – The land that is included in the project where development occurs or is proposed to occur.

Project transmission lines – Electrical lines built and owned by a project developer.

Raptor – As defined by the American Ornithological Union, a group of predatory birds including hawks, eagles, falcons, osprey, kites, owls, vultures and the California condor.

Relative abundance – The number of organisms of a particular kind in comparison to the total number of organisms within a given area or community.

Risk – The likelihood that adverse effects may occur to individual animals or populations of species of concern, as a result of development and operation of a wind energy project. For detailed discussion of risk and risk assessment as used in this document see Chapter Two-B.

Rotor – The part of a wind turbine that interacts with wind to produce energy. Consists of the turbine's blades and the hub to which the blades attach.

Rotor-swept area – The area of the circle or volume of the sphere swept by the turbine blades.

Rotor-swept zone – The altitude within a wind energy project which is bounded by the upper and lower limits of the rotor-swept area and the spatial extent of the project.

S1 (Subnational Conservation Status Ranking) Critically Imperiled – Critically imperiled in the jurisdiction because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the jurisdiction.

S2 (Subnational Conservation Status Ranking) Imperiled – Imperiled in the jurisdiction because of rarity due to very restricted range, very few populations, steep declines, or other factors making it very vulnerable to extirpation from jurisdiction.

S3 (Subnational Conservation Status Ranking) Vulnerable – Vulnerable in the jurisdiction due to a restricted range, relatively few populations, recent and widespread declines, or other factors making it vulnerable to extirpation.

Sage grouse – A large gallinaceous bird living in the sage steppe areas of the intermountain west, including the greater sage grouse and Gunnison's sage grouse.

Significant – (For purposes of impacts to species of concern, as used in these Guidelines; adopted from *The Council on Environmental Quality Definitions, 40 CFR 1500-1508)* Significant shall be defined to include both context and intensity. Context means that the significance of an action may consider the affected region and the locality. In the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the state or the country as a whole. Both short- and long-term effects are relevant. Intensity refers to the severity of impact, and would often include consideration of the degree to which the proposed action affects wetlands, wildlife populations, wild and scenic rivers, and ecologically critical areas. Considerations of significance include the following:

- Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment.
- The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
- Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment.

Species of concern – For a particular wind energy project, any species which 1) is listed as an endangered, threatened or candidate species under the Endangered Species Act, is subject to the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act, or is designated by law, regulation or other formal process for protection and/or management by the relevant agency or other authority, or has been shown to be significantly adversely affected by wind energy development, and 2) is determined to be possibly affected by the project.

Species of habitat fragmentation concern – Species of concern whose genetic or demographic viability is reduced by separation of their habitats into smaller blocks, thereby reducing connectivity, and for which habitat fragmentation from a wind energy project may create significant barriers to genetic or demographic viability of the affected population.

String – A number of wind turbines oriented in close proximity to one another that are usually sited in a line, such as along a ridgeline.

Strobe – Light consisting of pulses that are high in intensity and short in duration.

Threatened species – *See* **listed species**.

Tubular design – A type of wind turbine support structure for the nacelle and rotor that is cylindrical rather than lattice.

Turbine height – The distance from the ground to the highest point reached by the tip of the blades of a wind turbine.

Voltage (low and medium) – Low voltages are generally below 600 volts, medium voltages are commonly on distribution electrical lines, typically between 600 volts and 110 kV, and voltages above 110 kV are considered high voltages.

Wildlife – Birds, fishes, mammals, and all other classes of wild animals and all types of aquatic and land vegetation upon which wildlife is dependent.

Wildlife management plan – A document describing actions taken to identify resources that may be impacted by proposed development; measures to mitigate for any significant adverse impacts; any post-construction monitoring; and any other studies that may be carried out by the developer.

Wind turbine – A machine for converting the kinetic energy in wind into mechanical energy, which is then converted to electricity.

Appendix B: Legal White Paper

Department of the Interior Wind Turbine Guidelines Advisory Committee
October 22, 2008

The Charter for the U.S. Department of the Interior ("DOI") Wind Turbine Guidelines Advisory Committee (the "Committee") directs the Committee to provide advice and recommendations to the Secretary of the Interior (the "Secretary") concerning wind turbine guidelines that "avoid and minimize impacts to wildlife and their habitat related to land-based wind energy facilities." The Charter describes the authority of the Committee to act in furtherance of the Migratory Bird Treaty Act ("MBTA"),[1] the Bald and Golden Eagle Protection Act ("BGEPA"),[2] the Endangered Species Act ("ESA"),[3] and the National Environmental Policy Act ("NEPA").[4] The Charter also directs the Committee to consider wildlife impacts, costs of information acquisition, scientific approaches, and compliance with State and Federal laws. In order to assist the Committee with regard to these directives, the Legal Subcommittee has prepared and the full Committee has unanimously adopted[5] this memorandum summarizing: (1) the authority under the above-noted environmental laws to protect wildlife and habitat and regulate the impacts of land-based wind energy facilities; (2) the consequences of noncompliance with these laws; and (3) the means by which a person or entity may avoid or reduce liability and avoid, minimize, and mitigate adverse effects on wildlife or habitat under these laws.

I. SCOPE OF AUTHORITY TO PROTECT WILDLIFE AND HABITAT UNDER FEDERAL LAW AND CONSEQUENCES OF NONCOMPLIANCE

A. Endangered Species Act

By delegation of authority from the respective Secretaries of the Interior and Commerce, the ESA is administered by the U.S. Fish and Wildlife Service ("FWS") and the National Marine Fisheries Service ("NMFS"), with the former having primary responsibility for terrestrial and freshwater species and the latter having primary responsibility for marine life. The purpose of the ESA is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of [certain] treaties and conventions . . . ."[6] In furtherance of this purpose, Sections 7 and 9 of the ESA contain independent provisions that may set species- and habitat-related standards relevant to wind energy projects.

1. Section 7(a)(2) Requirements

Section 7(a)(2) requirements relate to Federal agency actions. Section 7(a)(2) requires that:

> each Federal agency shall, in consultation with . . . the Secretary, insure that any action authorized, funded or carried out by such agency . . . is not likely to jeopardize the continued

> out by such agency . . . 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 of such species.[7]

The broad statutory description of agency action means that the Section 7(a)(2) standards apply to private actions that require Federal permits, licenses, or other forms of authorization, or that receive federal grants or other forms of federal funding.

Section 7(a)(2) contains two relevant standards: the "jeopardy standard" and the "critical habitat standard." FWS has defined both standards in terms of "survival and recovery" of the endangered species or threatened species ("listed species").[8] However, several courts have described as invalid the regulatory definition of the critical habitat standard.[9] Critical habitat—as with listed species—is designated by rulemaking under Section 4 of the ESA. Section 3 defines critical habitat in terms of conservation ("features" or "areas" that are "essential to the conservation of the species").[10] Section 3 also defines "conservation" in terms of recovery of the listed species to the point that it no longer needs the protection of the ESA.[11] Based on those statutory definitions, some courts have opined that the regulatory definition of "survival" in the critical habitat standard is inappropriate. Although the courts have not provided a substitute definition for the standard, they have determined that, where a listed species' critical habitat is involved in an agency action,[12] the FWS must at least consider the effect of the action on conservation (and not just survival) of that species (even though, when designating critical habitat, the FWS can exclude all habitat for economic or other reasons up to the point that extinction would result from a failure to designate).[13] The FWS also has not adopted a new or modified definition of the critical habitat standard; instead, it has declared it will not use its existing regulatory definition of the standard and will apply the standard solely in accordance with the statutory wording (*i.e.*, "destruction or adverse modification").[14]

2. Section 9 Requirements

Section 9 sets a standard applicable to all persons, whether they are subject to any Federal agency action.[15] Section 9(a)(1)(B) prohibits the "take" of endangered species of fish and wildlife within the United States or its territorial waters.[16] A "take" is defined with extraordinary breadth to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[17] A "take" of individual members of a listed endangered or threatened species of fish or wildlife ("wildlife") constitutes a violation of the ESA.

With regard to the impacts of habitat modification on listed species covered by the Section 9 take prohibition, the FWS has by regulation defined "harm" as "an act which actually kills or injures wildlife," which "may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering."[18] Injury or death to a listed wildlife species can be the direct or indirect result of habitat modification or degradation, such that the act "impair[s] essential behavioral patterns, including breeding, feeding or sheltering."[19] To be actionable, habitat modification or degradation must be "significant,"[20] and land use activities that result in habitat modification or degradation are not sufficient in

themselves to constitute a "take" of listed wildlife under Section 9 and the "harm" regulation.[21] Instead, only a land use activity that "actually kills or injures wildlife" will constitute a "take" of a listed wildlife species.[22] Accordingly, "harm" requires proof of actual injury—the mere potential for injury to listed wildlife is not "harm."[23] Moreover, the regulation determines "harm" by reference to an individual member of a listed wildlife species.[24]

The FWS also by regulation defined "harass," but has—unlike the regulatory definition of "harm"—excluded consideration of habitat modification in the context of "harass."[25] While "harm" requires "actual" injury to wildlife, the definition of "harass" includes a "negligent act or omission which creates the likelihood of injury to wildlife by annoying it" to a significant extent. Under the regulatory intent, instead of covering physical modifications of habitat, the "harass" rule addresses the annoying effects of persistent noise, light, or motion. In promulgating the definition, the FWS stated:

> The concept of environmental damage being considered a "taking" has been retained but is now found in a new definition of the word "harm" . . . . By moving the concept of environmental degradation from the proposed definition of "harass" to the definition of "harm," potential restrictions on environmental modifications are expressly limited to those actions causing actual death or injury to a protected species of fish or wildlife.[26]

The only role that habitat modification might play in the "harass" form of take might be the *act* of habitat modification (where the presence of, and noise from, heavy equipment and construction crews are involved). However, courts have been extremely reluctant to find violations of the "harass" form of take.

There are three notable differences between the standards of Section 9 and Section 7(a)(2). Unlike the Section 7(a)(2) jeopardy standard, the Section 9 take standard only considers injuries to an individual member of a listed species. The take standard applies only to listed wildlife species, while the Section 7(a)(2) standards apply to all listed species, plants as well as wildlife. Moreover, the Section 9 standard applies to any habitat of listed wildlife species, while the Section 7(a)(2) critical habitat standard applies only to designated critical habitat of listed species.

As discussed in Section II, because most methods of compliance—or securing immunity for noncompliance—with the Section 9 take standard require at least some form of permit from, or agreement with, the FWS, and because that FWS permit or agreement itself constitutes a Federal agency action subject to Section 7(a)(2), the standards of Section 9 and Section 7(a)(2) are often applied together when private land uses or projects are involved.[27]

3. Enforcement

Three general types of enforcement actions are available under Section 11 for violations of the ESA. First, Section 11(a) authorizes the government to pursue civil penalties against violators, and Section 11(b) authorizes the government to seek criminal penalties.[28]

Second, Section 11(e)(6) authorizes the government to bring suits to enjoin violations.[29] And third, Section 11(g) authorizes private citizens to bring actions to enjoin violations of the ESA by any person and to force certain compliance with the ESA by the Secretary.[30] The ESA provides significant penalties only for "knowing" acts,[31] but it is a general intent statute which requires only that a violator knew that it was taking a particular action and not that the action was illegal.[32] Anyone who violates the ESA generally may be fined up to $25,000 for a civil violation and up to $100,000 ($200,000 for an organization) and/or imprisoned for not more than one year for a criminal violation.[33]

B. Migratory Bird Treaty Act

The MBTA is a criminal environmental law which implements four international treaties that the United States has entered into in order to protect over eight hundred species of birds that migrate across the United States and its territories.[34] The MBTA states as follows:

> Unless and except as permitted by regulations . . . it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell . . . offer to purchase, purchase . . . ship, export, import… transport or cause to be transported… any migratory bird, any part, nest, or eggs of any such bird, or any product . . . composed in whole or in part, of any such bird or any part, nest, or egg thereof.[35]

FWS regulations broadly define "take" to mean "pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect."[36] An unauthorized "take" of any one of the protected bird species constitutes a violation of the MBTA. By delegation of authority from the Secretary, the FWS administers the MBTA.

The MBTA's applicability to habitat modification and destruction is unclear. Unlike the ESA, the definition of "take" in the MBTA does not include "harm" (or "harass"). And the MBTA itself is silent in regard to habitat modification and destruction. In *Seattle Audubon Society v. Evans*,[37] which involved a claim that the MBTA prohibited the U.S. Forest Service from logging activities that may provide habitat for a protected bird, the Ninth Circuit Court of Appeals concluded that the MBTA covers only direct, though unintended, bird deaths, and that habitat destruction leading indirectly to bird deaths was not a take for purposes of the MBTA.[38] In contrast to this and similar cases involving timber activities, there are several cases which have found MBTA liability in connection with the discharge of extra-hazardous materials or the misapplication of pesticides.[39]

Reconciling these cases or determining what may constitute prohibited direct harm to migratory birds from habitat modification or destruction is not easy.[40] A case which attempted to provide some order to the evaluation of claims under the MBTA is *United States v. Moon Lake Elec. Ass'n*,[41] which is noteworthy for the wind energy industry because the court found the defendant electrical association liable under the MBTA and the BGEPA for the killing of protected birds resulting from its failure to install inexpensive protective equipment on its power poles. In *Moon Lake*, the district court disagreed with the

distinction in *Seattle Audubon* between direct and indirect take, finding that the MBTA's misdemeanor provision may apply to unintended bird deaths which are a probable consequence of a defendant's actions. The court also ruled that the MBTA is not limited simply to physical conduct associated with hunting or poaching.[42] Although *Moon Lake* did not involve habitat modification, the court's extensive analysis of incidental take under the MBTA could influence subsequent decisions. Based on the case law and other precedent,[43] it appears that incidental take of a protected bird can subject one to liability under the MBTA in some contexts, but the precise scope of the MBTA in connection with habitat modification or destruction and wind energy projects remains to be determined.

Unlike the ESA, the MBTA has no provision which expressly authorizes the issuance of permits by the FWS authorizing incidental take. The MBTA does authorize the Secretary to determine when, to what extent, if any, and by what means it is compatible with the terms of the related treaties "to allow hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any . . . [protected] bird, or any part, nest, or egg thereof" and to adopt regulations governing the same.[44] Pursuant to this authority the FWS has promulgated regulations which set forth requirements for the issuance of permits for a wide variety of specific purposes, including falconry, scientific collecting, conservation education, taxidermy, and waterfowl sale and disposal, as well as for the hunting of migratory waterfowl.[45] To date, however, the FWS has not issued rules expressly providing for a permitting program for incidental take (although the FWS, in very limited circumstances, has granted individual permits). As discussed in Section I(C), the FWS recently began—and has partially completed—a rulemaking under a similar statute, the BGEPA, which authorizes incidental takes of bald and golden eagles in certain circumstances. As discussed in Section II(C)(2), the FWS believes it has the authority to do the same under the MBTA.

The MBTA is enforced by the FWS through the U.S. Department of Justice ("DOJ") and there is no private cause of action enabling others to bring suit to enforce this law.[46] The MBTA imposes only criminal penalties on those who violate the MBTA. The general misdemeanor provision of the MBTA is likely to be the most applicable provision in a wind energy context. Under this provision, a violator may be fined up to $15,000 and/or imprisoned for up to six months for an unauthorized take of a protected bird, regardless of intent. Under the felony provision of the MBTA, anyone who "shall knowingly (1) take by any manner . . . any protected bird with intent to sell, barter or offer to barter such bird, or (2) sell, offer for sale, barter or offer to barter, any protected bird" is subject to a felony violation and may be fined up to $250,000 ($500,000 for organizations) and/or imprisoned for up to two years. Neither this provision, nor a misdemeanor provision which imposes fines and/or penalties for placing or directing the placement of bait for a protected bird, is expected to be applicable in a wind energy context.[47]

To date no actions under the MBTA or the BGEPA have been brought against the developer of a wind energy project. The FWS has stated that it carries out its mission to protect migratory birds through investigations and enforcement and by fostering relationships with individuals, companies, and industries that have programs to minimize their impacts on migratory birds.[48] Because, the FWS has not promulgated regulations expressly providing for the issuance of permits for unintentional take, the FWS exercises enforcement discretion and focuses on those individuals, companies, or agencies that take

migratory birds without regard for their actions and the law, especially when conservation measures have been developed and not implemented.[49] Although two authors recently questioned whether the exercise of enforcement discretion and lack of enforcement by the FWS and State agencies effectively results in an exemption from the MBTA for wind energy developers,[50] it is possible that in the appropriate circumstances the FWS would pursue an action against a wind energy developer under the MBTA or the BGEPA.[51]

C. Bald and Golden Eagle Protection Act

The BGEPA provides specific protections to bald and golden eagles. Under the BGEPA, it generally is unlawful for anyone to "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or in any manner, any bald eagle . . . or any golden eagle, alive or dead, or any part, nest, or egg thereof . . . ."[52] As defined in the BGEPA, "take" for this purpose includes "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."[53] Recently, the FWS clarified the meaning of the word "disturb" in the BGEPA in anticipation of the ultimate removal of the bald eagle from the list of threatened species and thus loss of protection under the ESA.[54] Under the new regulation, "disturb" means

> to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.[55]

Although there are differences in the meaning of these terms, as noted by the FWS, the term "disturb" in the BGEPA significantly overlaps with the terms "harm" and "harass" in the ESA.[56] An unauthorized "take" of any one of the protected eagles constitutes a violation of the BGEPA and MBTA. By delegation of authority from the Secretary, the FWS administers the BGEPA.

The United States Supreme Court has described BGEPA as both "exhaustive" and "consistently framed to encompass a full catalog of prohibited acts."[57] Relying on this language, one court has held that the BGEPA prohibits electrocutions of eagles.[58] Such a decision suggests that the "taking" of a bald or golden eagle by a wind turbine could be prosecutable under the BGEPA.

Unlike the ESA—but like the MBTA—the definition of "take" in the BGEPA does not include "harm" or any other term that has been interpreted by the FWS to encompass death or injury arising from habitat modification.[59]

The BGEPA provides that the Secretary may authorize certain otherwise prohibited activities through promulgation of regulations. Specifically, the Secretary is authorized to prescribe regulations permitting the

> taking, possession, and transportation of [bald and golden eagles] . . . for the scientific or exhibition purposes of public museums, scientific societies, and zoological parks, or for the

> religious purposes of Indian tribes, or . . . for the protection of wildlife or agricultural or other interests in any particular locality [provided such permits are] compatible with the preservation of the bald eagle or the golden eagle.[60]

Unlike the ESA but like the MBTA, the BGEPA does not contain an express incidental take permit program. In connection with the removal of the bald eagle as a listed species under the ESA, however, the FWS recently adopted regulations which authorize incidental takes of eagles under BGEPA that had previously been authorized under the ESA, and has indicated that it intends to adopt an additional regulation concerning certain incidental takes under BGEPA in the near future.[61]

Like the MBTA, the FWS enforces the BGEPA through the DOJ and there is no private cause of action enabling others to bring suit to enforce this law. The BGEPA imposes both civil and criminal penalties on those who violate the BGEPA. In order to be criminally liable, a violator "shall knowingly, or with wanton disregard for the consequences of his act take, possess, sell, purchase, barter . . . transport . . . at any time or in any manner any [eagle] . . . or any part, nest, or egg thereof." If convicted of a criminal violation under the BGEPA, the first offense is a misdemeanor for which the violator may be fined up to $100,000 ($200,000 for an organization) and/or imprisoned for up to one year, and in the case of a second or subsequent conviction for such a violation the offense becomes a felony for which the violator may be fined up to $250,000 ($500,000 for an organization) and/or imprisoned up to two years. Civil penalties may be imposed regardless of intent up to a maximum of $5,000 for each violation.[62]

D. National Environmental Policy Act

NEPA and its implementing rules require that before any discretionary major Federal agency action with significant environmental consequences can be adopted, an environmental impact statement ("EIS") that assesses the environmental effects of the proposed action and alternatives must be prepared.[63] Additionally, NEPA rules require an environmental assessment before a Federal agency can take many actions that do not rise to the level of environmental significance requiring an EIS.[64] NEPA is an information-disclosure law that is procedural only, and does not limit the agency's substantive range of decision.[65] But NEPA compliance process, by obtaining and disclosing environmental impact information and allowing public comment, often affects the substance of the agency's decision. If a wind power project needs any federal permit (such as a Clean Water Act Section 404 permit, a permit for use of federal lands, or an ESA incidental take permit), this can trigger NEPA analysis duties. NEPA can be useful in analyzing the impacts of a proposed wind power project, and potential alternatives, on species and habitat, and in providing mitigation recommendations. That is, NEPA can add to the analytic rigor in considering wind power impacts.

E. Laws Relating to Native Americans

In contrast to the straightforward application of Federal and State wildlife laws to private land or public (State or Federal) land, the application of such laws to Indian land is more complex. Not only are the general rules applicable to jurisdiction in Indian country different, but Congress has also passed specific legislation for particular reservations or

States that change even those general rules. Federal law applies everywhere in Indian country just as it does across the rest of the United States. State regulatory law generally does not apply on land held by the United States in trust for Indian tribes or individual Indians, unless Congress has provided otherwise. The major exceptions are in portions of Oklahoma and lands of certain tribes in the Northeast, especially in Maine. If a State is administering Federal law elsewhere, *e.g.*, a delegated program under the Clean Water Act, the Federal agency will generally still administer that law on trust land within the State. Tribal law applies within the boundaries of the tribe's reservation (which is not necessarily the same as the land held in trust for the tribe or individuals). Tribal law also applies to non-Indians doing business with the tribe (*e.g.*, lessees), and to air and water flowing across the reservation.

II. METHODS FOR COMPLIANCE OR AVOIDANCE/REDUCTION OF LIABILITY FOR NON-COMPLIANCE

The Committee charged the Legal Subcommittee with identifying all existing methods for compliance and avoidance or reduction of liability for noncompliance with these four statutes. For each of the primary wildlife statutes identified in the Committee's Charter—the ESA, MBTA, and the BGEPA—we have identified all potentially relevant statutory, regulatory, judicial, and informal techniques.

A. Compliance with Section 7(a)(2) of the Endangered Species Act

Except in the extremely rare circumstance where a specially convened committee of cabinet members excuses compliance,[66] there is no method for avoiding compliance with Section 7(a)(2), although typically only the relevant Federal agencies are liable for noncompliance. As noted above, Section 7(a)(2) addresses Federal agency actions, but private landowners or project proponents frequently encounter Section 7(a)(2)'s requirements in the context of federal permitting or licensing actions, particularly "wetland permits" issued under Section 404 of the Clean Water Act.

Regulations establish three different processes for compliance with Section 7(a)(2) based on the degree of impact the Federal agency action may have on listed species or designated critical habitat. The FWS and NMFS also have published comprehensive guidance on the Section 7(a)(2) processes in the form of a detailed handbook.[67] If the Federal agency finds that the proposed agency action (in the case of federal permits, both the permit issuance and the private land use or project authorized by the permit) will not affect a listed species or critical habitat, the action may proceed without involvement of the FWS in a consultation process.[68] Otherwise, the Federal agency typically prepares a biological assessment to determine the effects of the proposed agency action. If the Federal agency finds that the action is "not likely to adversely affect" a listed species or critical habitat, the action may proceed if the FWS concurs in writing (termed "informal consultation").[69] If the Federal agency determines that the action is likely to affect adversely a listed species or critical habitat (or the FWS does not concur in the agency's not-likely-to-adversely-affect determination), the Federal agency and the FWS engage in what is termed "formal consultation" as prescribed in Section 7(b).[70] The formal consultation process begins with submission of the biological assessment to the FWS and proceeds under statutory and regulatory deadlines.[71]

The initial product of formal consultation is a biological opinion issued by the FWS. If the FWS finds that the proposed action passes the Section 7(a)(2) standards (jeopardy to the species or adverse modification of critical habitat is not likely), it will so advise the Federal agency in the biological opinion and then typically suggest "reasonable and prudent measures" to minimize any impacts of "takes" that might occur. Unlike the voluntary mechanisms for avoidance of take liability discussed below, the FWS is limited under Section 7(a)(2) to proposing measures to "minimize" take impacts and may not propose measures to mitigate for those impacts.[72] If the FWS finds instead that the action would result in jeopardy or adverse modification, it will suggest to the Federal agency "reasonable and prudent alternatives" to the proposed agency action.[73] FWS regulations limit the degree to which the reasonable and prudent measures or alternatives may alter the agency action.[74]

Federal agencies engaged in formal consultation are not required to follow the biological opinions and reasonable and prudent measures or alternatives;[75] however, the agencies seldom depart significantly from them. If the Federal agencies incorporate reasonable and prudent measures or a reasonable and prudent alternative in permits, licenses, and the like, then the authorized parties and certain other affected parties (*e.g.*, the owner of land leased to a permitted project) are also covered (including, as discussed below, granted immunity from certain possible take of listed species).[76]

Regulations require reinitiation of the Section 7(a)(2) process for a Federal agency action in certain circumstances.[77] The principal circumstances calling for reinitiation occur: (1) when the scientific understanding of the action's impacts on listed species or critical habitat covered by the original Section 7(a)(2) process changes significantly and results in harsher impacts than those analyzed in that process; (2) when a new species is listed or new critical habitat is designated that would be impacted by the agency action; or (3) when (described in Section II(B)(1) below) the amount of incidental take allowed by an incidental take statement is exceeded. The reinitiation of the Section 7(a)(2) process may lead to the FWS proposing new reasonable and prudent measures or alternatives for the proposed agency action.

B. Avoidance of Liability for Noncompliance with the Section 9 "Take" Prohibition in the Endangered Species Act

The ESA has a well-developed array of techniques for avoidance of liability for certain types of "take" otherwise prohibited under Section 9. Because the Section 9 standard is violated if an agency action or private land use or project takes even a single member of a listed wildlife species, it is quite stringent. Because the standard applies to all persons, it is also quite pervasive. In 1982 Congress enacted amendments to the ESA that established the basis for these take-liability-avoidance techniques. In so doing, Congress recognized that few agency actions or private land uses or projects that occur in the vicinity of a listed wildlife species could be designed to avoid entirely the possibility of take of even a single member of that species. The FWS has developed several additional techniques by regulation or practice. These statutory provisions, regulations, and practices apply to takes that are "incidental" to an otherwise lawful activity—commonly referred to as an "incidental take."[78] In the following ten subsections, the subcommittee has described one technique under Section 7(b)(4) for avoiding take liability in connection with Federal agency actions

and multiple techniques under Sections 10(a)(1)(A) and (B) for avoiding take liability for private land uses or projects.

1. Incidental Take Statements

The single technique for take liability avoidance for Federal agency actions under Section 7 is limited to those actions that undergo formal consultation (*i.e.*, actions for which a no effect or "not likely to adversely affect" listed species or critical habitat finding cannot be made). Section 7(b)(4) provides that, if the biological opinion issued by the FWS concludes that the proposed Federal agency action complies with the Section 7(a)(2) jeopardy and critical habitat standards, the FWS will issue an incidental take statement ("ITS") to the agency.[79] The ITS will allow a specified amount of incidental take (stated either in number of species members or in acreage or other measurement of occupied or suitable habitat) over a specified term, if the Federal agency complies with the reasonable and prudent measures recommended by the FWS. Should the biological opinion find that the Federal agency action would violate either the jeopardy standard or the critical habitat standard, the FWS may still issue an ITS if the agency adopts a reasonable and prudent alternative offered by the FWS. In the case of federal permits, licenses, or other authorizations, the ITS will grant immunity for the specified incidental takes not only to the applicable Federal agencies, but also to the permittees, licensees, and certain other associated parties (*e.g.*, the owner of land leased to the permitted or licensed project).[80]

The principal differences between the ITS for Federal agency actions under Section 7(b)(4) and the permits and agreements with private landowners or project proponents under Section 10(a)(1)(A) and (B) of the ESA described in the next sections below, are that: (1) the latter techniques provide critical "No-Surprises" assurances (also described below) and the ITS does not; (2) the ITS has statutory and regulatory deadlines and the latter techniques do not; and (3) the Federal agencies assume more of the costs in the formal consultation process that produces the ITS (even when private land or projects are involved) than in the latter techniques.

2. Habitat Conservation Plans and Incidental Take Permits

Section 10(a)(1)(B) of the ESA[81] authorizes the Secretary to issue an Incidental Take Permit ("ITP") that will authorize take of a listed wildlife species by a non-federal landowner engaged in an otherwise lawful activity covered by a Habitat Conservation Plan ("HCP"). The ITP will allow a specified amount of incidental take (stated either in number of wildlife species members or in acreage or other measurement of occupied or suitable habitat) over a specified term, if the permittee continues to comply with the ITP. The incidental taking of a listed species must be covered by the HCP and identified in the ITP. An HCP must be included in every application for an ITP.

In approving an HCP and issuing an ITP, the FWS or NMFS, as applicable, must find that the taking will be incidental, that the applicant will minimize and mitigate to the maximum extent practicable the impacts of the taking, that the applicant will ensure proper funding for the plan, and that the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.[82] The FWS and NMFS have published comprehensive guidance on HCPs and the incidental take permitting process in the form of a

detailed handbook, including an addendum which sets forth a five-point policy that provides clarifying guidance of these agencies for those applying for an incidental take permit under Section 10 of the ESA.[83] The so-called "No-Surprises" rule allows a permit holder to negotiate assurances that additional mitigation in the form of land, property interests, or financial compensation will not be required beyond the level of mitigation provided for under the HCP, regardless of a change in circumstance during the period covered by the ITP.[84] However, the trade-off for these regulatory assurances is that the ITP/HCP application process is lengthy. Because granting an ITP is a final Federal agency action subject to the Section 7 consultation requirement and NEPA, the FWS must consult with itself and comply with NEPA.[85] This may add significant time to the period it takes for a landowner to submit a HCP and obtain an ITP.

3. General Conservation Plans

A general conservation plan ("GCP") allows the FWS to develop a Section 10(a)(1)(B) conservation plan suitable for the needs of a local area, complete all NEPA requirements for a Section 10(a)(1)(B) ITP issuance, and then issue individual permits to landowners who wish to apply for an ITP and demonstrate compliance with the terms and conditions of the GCP. The development of a GCP is undertaken by the FWS, rather than an individual applicant, and is ideally based upon a conservation strategy for the species and addresses the needs of the local community. Basically, the GCP has everything that is contained in a traditional HCP, including No-Surprises assurances, except the names of the applicant and future permittees. The GCP is not a substitute for a regional multiple action HCP which a county or other jurisdiction may use. Such a large-scale effort would be better developed using the traditional HCP approach because of the complexity of fully analyzing all activities under a regional multiple action HCP.[86]

4. Safe Harbor Agreements

A safe harbor agreement is a voluntary agreement in which a non-federal landowner works with the FWS to develop management actions that will contribute to the recovery of a listed species for an agreed-upon time period.[87] Management actions can include habitat maintenance and reintroduction of listed species onto the land. In exchange for implementing these management actions, the FWS provides regulatory assurance to the landowner by issuing an enhancement of survival permit pursuant to Section 10(a)(1)(A) of the ESA.[88] This permit provides that property that is part of a safe harbor agreement can be altered and returned to agreed-upon baseline conditions at the end of the agreement time period, even if it involves the taking of listed species.[89] This permit also may include No-Surprises assurances similar to those discussed under Section II(B)(2).[90]

5. Candidate Conservation Agreements

A candidate conservation agreement is a formal agreement between a non-federal landowner and the FWS that addresses the conservation needs of candidate or at-risk species.[91] The goal of candidate conservation agreements is to prevent the listing of these species. A non-federal landowner that enters into a candidate conservation agreement with the FWS typically receives certain regulatory assurances.[92] In the case of a candidate

conservation agreement with assurances, the agreement provides incentives for the non-federal landowner to voluntarily implement conservation measures for candidate or at-risk species. In exchange for implementing conservation measures that will remove or reduce the threat to candidate or at-risk species, the FWS provides regulatory assurances (similar to the No-Surprises assurances) to the landowner by issuing an enhancement of survival permit pursuant to Section 10(a)(1)(A) of the ESA.[93] This permit provides that no additional conservation measures will be required of the landowner if the species becomes listed in the future, even if it involves the taking of listed wildlife species.[94] In addition, this permit allows permit holders to take wildlife species and modify habitat conditions to those baseline conditions agreed upon and specified in the agreement.[95]

6. Conservation Agreements and Memoranda of Understanding

A few FWS Regions have experimented with a basic contract between the FWS and a landowner—called a "conservation agreement" or memorandum of understanding ("MOU")—which describes land use activities the landowner intends to take and methods the landowner will use to provide protection for potentially affected listed species. The FWS' signing of a conservation agreement or MOU constitutes an agency action which permits the FWS to issue a biological opinion and ITS which provides incidental take immunity to the landowner as well as the FWS.[96] This technique to secure incidental take immunity was found valid by the Ninth Circuit Court of Appeals in a citizen suit challenge to the Plum Creek conservation agreement.[97] Recently, as a matter of practice, Region 8 of the FWS has settled on the "net conservation benefit" standard for conservation agreements identical to the standard applied by rule to safe harbor agreements.[98] This technique benefits the landowner by requiring significantly less time and fewer procedural steps to secure the incidental take immunity than does an ITP, but it lacks the No-Surprises assurances landowners obtain with an ITP.

7. Conservation Banking

Conservation banks are lands that are permanently protected and managed for listed or at-risk species, with the concept modeled on the concept of wetland mitigation banking.[99] The FWS approves these banks to sell mitigation credits to developers who need to offset adverse environmental impacts elsewhere. Thus, conservation banking utilizes traditional concepts of supply and demand to facilitate the buying and selling of mitigation credits. By selling mitigation credits, landowners can generate income, preserve their property, and participate in conservation management plans. Developers who purchase these habitat or species mitigation credits are able to offset their negative environmental impacts in one simple transaction.

One instance in which conservation banking can be utilized is to assist in the obtainment of incidental take permits pursuant to Section 10 of the ESA. In applying for an incidental take permit, a landowner must submit an HCP that reports actions that will be taken to minimize and mitigate any adverse impacts on listed species. This mitigation may involve the purchase of mitigation credits from a conservation bank.[100]

8. Section 6 State Cooperative Agreements

Section 6 of the ESA provides for substantial federal funding of State conservation programs benefiting listed species. Section 6(c) of the ESA authorizes the Secretary to enter into a cooperative agreement with any State or territory which establishes and maintains an adequate and active program for the conservation of endangered species and threatened species.[101] States with cooperative agreements approved by the FWS are eligible to receive funds from the Cooperative Endangered Species Conservation Fund ("CESCF") established pursuant to Section 6 of the ESA up to specified limits.

The "adequate and active programs" established by the States to secure funding under the CESCF are usually skeletal in substance and do not contain provisions for the protection of any specific listed species. These State programs provide no basis for securing take liability immunity. However, Section 6(c) does provide for cooperative agreements with States when "plans are included under which immediate attention will be given to those resident species of fish and wildlife [and, in a similar provision, for resident species of plants] which are determined by the Secretary [of the Interior] or the State agency to be endangered or threatened and which the Secretary and the State agency agree are most urgently in need of conservation programs."[102] If such a species-specific cooperative agreement is developed, the State, and private landowners or project proponents who enroll in the program, can secure incidental take immunity through an incidental take statement issued by the FWS. The FWS' decision to approve the species-specific cooperative agreement is a Federal agency action that is subject to the Section 7(a)(2) process; if that process includes formal consultation, the FWS issues an ITS. For example, the State of Idaho and the Federal government (the FWS and NMFS) are working on a cooperative agreement specific to listed salmonids in the Snake River basin in which irrigators and private timberland owners could voluntarily enroll and obtain certificates of inclusion that would secure for them the immunity of the ITS if they abide by the agreement's salmon protection provisions.

9. Section 4(d) Rules

Section 4(d) of the ESA gives the Secretary authority to issue regulations to conserve threatened species or apply in whole or in part the take prohibition to threatened species. As previously mentioned, this authority has been delegated to the FWS and NMFS. While the FWS has adopted a general blanket rule that extends the Section 9(a)(1) take prohibition to all threatened wildlife species, it has also retained the authority to remove or alter this general prohibition for certain threatened species on a species-specific basis.[103] Thus, it is within the jurisdiction of the FWS to provide exemptions for conservation efforts, for example, by providing species-specific take protection for landowners who pursue certain habitat conservation measures. However, a 4(d) rule is not easy to obtain, and it is generally very specific. Moreover, a 4(d) rule only applies to threatened species, as noted above.

10. Bird Letters

Landowners are encouraged to engage in open communication with the FWS on how to avoid a Section 9 violation, and the FWS has a history of providing advice and recommendations to landowners.[104] Historically, this advice has been rendered in the form of letters providing guidelines to avoid take of listed wildlife species or simple declarations of the FWS that it "believes" the landowner's property would not provide suitable habitat for particular listed species or that the landowner's activity would not likely result in a take of listed wildlife species. Although these so-called "bird letters" do not as a legal matter preclude future liability, the expectation is that the government will use enforcement discretion regarding landowners who have cooperated with the FWS in avoiding the taking of a listed species.[105]

C. Liability Avoidance and Mitigation under the Migratory Bird Treaty Act

1. Bird Letters and Avian Protection Plans

Like the ESA bird letters, MBTA bird letters are generally enforcement discretion documents that outline the FWS' willingness not to recommend prosecution for MBTA takings if a project proponent agrees to follow certain "best management practices."[106] This enforcement discretion approach can take several forms, including project-specific letters, general guidance, and the proffer of enforcement/prosecutorial discretion in avian protection plans. In particular, it has been used for avian protection plans for power lines prepared by electric utilities and acknowledged by the FWS.[107]

2. Incidental Take Authorizations Pursuant to a Possible New Regulation

The language of the MBTA gives the FWS authority and discretion to adopt regulations to permit reasonable activities that result in the taking of birds. Congress, in Section 704 of the MBTA, expressly authorizes the promulgation of regulations that permit the taking of migratory birds in a broad grant of authority to the FWS.

Pursuant to Section 704, the FWS has promulgated a series of regulations that permits the taking of migratory birds in many circumstances. For example, as discussed under Section I(B) above, current regulations authorize the issuance of permits and season limitations for migratory bird hunting, as well as for a number of other activities that would otherwise be proscribed by the MBTA, such as falconry, raptor propagation, scientific collecting, take of depredating birds, taxidermy, take of overabundant birds, and waterfowl sale and disposal. Special purpose permits, for activities outside the scope of the specific permits, are also available.[108]

From this broad Congressional grant of authority in Section 704(a), the FWS may have the authority to promulgate regulations establishing a new permit that would allow for the taking of birds at wind energy developments under certain conditions. Although the FWS does not have express authorization in the MBTA to issue "incidental take permits" as provided in the ESA, the broad grant of authority in Section 704 seems to allow issuance of such permits should the FWS choose to exercise this authority in the wind energy and other contexts. This would require the promulgation of a new regulation by the FWS.

3. Special Purpose Permits

As an alternative to a new regulation, under current MBTA regulations at 50 C.F.R. Part 21, "special purpose permits" may be granted when an applicant makes a sufficient showing of an activity's benefit to the migratory bird resource or other compelling justification.

FWS regulations provide for migratory bird permits for special purpose activities which are otherwise outside the scope of standard permits available for such activities as falconry, raptor propagation, scientific collecting, taxidermy, control of depredating birds, control of overabundant bird populations, etc.[109] According to 50 C.F.R. § 21.27, "permits may be issued for special purpose activities related to migratory birds, their parts, nests, or eggs, which are otherwise outside the scope of the standard form permits of this part." A special use permit may be issued to an applicant who submits a written application and "makes a sufficient showing of benefit to the migratory bird resource, important research reasons, reasons of human concern for individual birds, or other compelling justification."[110]

The FWS in very limited circumstances has issued special purpose permits to authorize incidental take. This approach potentially could be used to authorize incidental take caused by wind energy projects. For example, a wind energy project theoretically could apply to the FWS for a special use permit for an incidental take of birds based on a showing that the wind facility was providing an overall positive benefit to the migratory bird resource, perhaps through accompanying mitigation measures, or constitutes a situation of compelling justification due to the benefits of renewable energy generation. To date, however, the FWS has not endorsed such an interpretation of the special-purpose activity regulation.

4. FWS Interagency Memoranda of Understanding

Pursuant to Executive Order 13186,[111] FWS has worked with over twenty Federal agencies over the last few years in developing Memoranda of Understanding ("MOUs") to deal with possible violations of the MBTA by addressing migratory bird conservation in a proactive manner and to minimize take of migratory birds. There are currently two official MOUs between the FWS and Federal agencies, and the FWS hopes to enter into approximately eighteen more in the future. An MOU does not authorize a take, but it can establish a good faith effort of interagency communication, give agencies more certainty in their practices, and aid conservation in the long term. To date, the FWS has not entered into this type of MOU with the private sector.

D. Liability Avoidance and Mitigation under the Bald and Golden Eagle Protection Act

1. Special and Incidental Take Permits

As discussed under Section I(C), the Secretary may authorize otherwise prohibited activities by regulation and the Secretary recently proposed a permit program under the BGEPA.[112]

Endnotes

[1] 16 U.S.C. §§ 703–712.

[2] *Id.* §§ 668–668d.

[3] *Id.* §§ 1531–1544.

[4] 42 U.S.C. § 4371, *et. seq.*

[5] The full Committee's October 22, 2008, approval prospectively authorized the inclusion *nunc pro tunc* of technical revisions. This final version includes those technical revisions.

[6] 16 U.S.C. § 1531(b).

[7] *Id.* § 1536(a)(2).

[8] 50 C.F.R. § 402.02.

[9] *Gifford Pinchot Task Force v. U.S. Fish and Wildlife Serv.*, 278 F.3d 1059, 1069–72 (9th Cir. 2004); *Sierra Club v. U.S. Fish and Wildlife Serv.*, 245 F.3d 434 (5th Cir. 2001).

[10] 16 U.S.C. § 1532(5).

[11] *Id.* § 1532(3).

[12] Critical habitat has been designated for only thirty-eight percent of listed domestic species.

[13] *Gifford Pinchot*, 278 F.3d at 1071–74; *see Northern Spotted Owl v. Lujan*, 758 F. Supp. 621, 623 (W.D. Wash. 1991); 16 U.S.C. § 1533(b)(2).

[14] Memorandum of FWS Director to Regional Directors, December 9, 2004. The memorandum also advised the FWS to apply the statutory standard by "discuss[ing] whether, with implementation of the proposed Federal action, critical habitat would remain functional (or retain the current ability for the primary constituent elements [the regulatory wording for the statutory features 'essential to the conservation' of the species] to be functionally established) to serve the intended conservation role for the species."

[15] 16 U.S.C. § 1538.

[16] *Id.* § 1538(a)(1)(B). The Secretary has extended the "take" prohibition to threatened species of fish and wildlife. *Id.* § 1533(d); 50 C.F.R. § 17.31(a).

[17] 16 U.S.C. § 1532(19).

[18] 50 C.F.R. § 17.3.

[19] *Id.*

[20] *Id.* § 17.3. *See* 46 Fed. Reg. 54,750 (1981) ("To be subject to Section 9, the modification or degradation must be *significant* . . . .) (emphasis in original).

[21] 46 Fed. Reg. 54,750 (1981) ("[H]abitat modification or degradation, standing alone, is not a taking pursuant to Section 9.").

[22] *See Babbitt v. Sweet Home Chapter of Cmtys. for a Great Oregon*, 515 U.S. 687, 691 n.2 (1995); 40 Fed. Reg. 44,413 (1975) ("[P]otential restrictions on environmental modifications are

expressly limited to those actions causing actual death or injury to a protected species of fish or wildlife."). *See also* Memorandum from Associate Solicitor, Conservation and Wildlife, to Director, Fish and Wildlife Service (May 11, 1981) (stating that the *Palila* court decision "erroneously supports the view that habitat modification alone may constitute 'harm'"); "Endangered and Threatened Wildlife and Plants: Final Redefinition of 'Harm,'" 46 Fed. Reg. 54,748 (1981) ("[H]abitat modification or degradation, standing alone, is not a taking pursuant to Section 9.").

[23] *See Sweet Home*, 515 U.S. at 708–709 (O'Connor, J., concurring) ("[T]he challenged regulation is limited to significant habitat modification that causes actual, as opposed to hypothetical or speculative, death or injury to identifiable protected animals."); *Am. Bald Eagle v. Bhatti*, 9 F.3d 163, 166 (1st Cir. 1993) (stating that, while bald eagles can be harmed by ingesting lead, there is no evidence of actual harm to bald eagles as a result of deer hunting and eagles feeding on deer carrion containing lead slugs). *But see Forest Conservation Council v. Rosboro Lumber Co.*, 50 F.3d 781, 783 (9th Cir. 1995) ("[A] showing of a future injury to an endangered or threatened species is actionable under the ESA."); *Marbled Murrelet v. Babbitt*, 83 F.3d 1060, 1064 (9th Cir. 1996) (holding that an imminent threat of future harm is sufficient for an injunction under the ESA).

[24] 46 Fed. Reg. 54,749 ("[S]ection 9's threshold does focus on individual members of a protected species.").

[25] *See* 50 C.F.R. § 17.3.

[26] 40 Fed. Reg. 44,413 (1975).

[27] The third, and most stringent behavioral standard—species' "conservation"—is less relevant to wind energy projects. It is contained in two ESA sections—Sections 7(a)(1) and 4(f). Section 3(2) of the ESA defines "conservation" to mean actions that permit eventual recovery of the listed species to the point that it no longer requires ESA protection. *See* 16 U.S.C. § 1532(2). Section 7(a)(1) relates solely to federal agencies, and speaks of programs, not agency actions as does Section 7(a)(2). Section 7(a)(1) requires that federal "agencies shall, in consultation with" the Secretary or the Secretary of Commerce, as applicable, "utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of" listed species. 16 U.S.C. § 1536(a)(1). The House Committee with ESA jurisdiction and the FWS and NMFS rejected the notion that this provision requires that all federal agency actions be structured to advance conservation or recovery of listed species. 51 Fed. Reg. 19,954–55 (1986). The FWS and NMFS made their conservation recommendations non-binding in 50 C.F.R. § 402.14(j). Because the Section 7(a)(1) consultation requirement applies at the *program*-wide level, the Section 7(a)(2) agency *action* consultation requirement still leaves a federal agency with the discretion to approve a specific activity or project (such as a permit or authorization for a wind energy project) that does not foster conservation (and thereby, disregard conservation recommendations that are often included in the biological opinion prepared by the FWS or NMFS during the consultation process). Even as to agency programs (including any "program" that might be established in a federal agency for wind energy development), due to those Congressional and regulatory interpretations, federal agencies often have ignored the Section 7(a)(1) "consultation" command for possible conservation programs. However, the finding of the Fifth Circuit Court of Appeals that such consultations with the FWS or NMFS are

legally enforceable in *Sierra Club v. Glickman*, 156 F.3d 606 (5th Cir. 1998), may prompt more Section 7(a)(1) consultations, as evidenced by the emphasis given to this provision in the Memorandum of Agreement between FWS/NMFS and the Environmental Protection Agency on "Enhanced Coordination Under the Clean Water Act and Endangered Species Act." 66 Fed. Reg. 11,202 (2001).

In recognition that "conservation" is the ultimate objective of the ESA and to enlist the most knowledgeable in the cause, Section 4(f) directs the Secretary and the Secretary of Commerce, as applicable, to prepare "recovery plans" for most listed species and suggests the appointment of "recovery teams" to draft those documents. 16 U.S.C. § 1533(f). A recovery plan is not a legally binding document under *Fund for Animals v. Rice*, 85 F.3d 535, 547 (11th Cir. 1996). However, some courts have conducted judicial review of recovery plans and required compliance with Section 4(f). *See, e.g.*, *Grand Canyon Trust v. Norton*, 2006 WL 167560 (D. Az. 2006).

[28] 16 U.S.C. §§ 1540(a) and (b).

[29] *Id.* § 1540(e)(6).

[30] *Id.* § 1540(g). In any suit filed by a private citizen pursuant to Section 11(g), a court may award costs of litigation, including reasonable attorney and expert witness fees, to any party whenever the court deems such an award appropriate. *Id.* § 1540(g)(4).

[31] *Id.* §§ 1540(a) and (b) ("Any person who knowingly violates . . . .").

[32] *See United States v. McKittrick*, 142 F.3d 1170, 1177 (9th Cir. 1998) (ESA is a general intent statute, meaning the defendant did not have to know he was killing a wolf, only that he was shooting an animal that turned out to be a wolf); *United States v. Nguyen*, 916 F.2d 1016 (5th Cir. 1990) (defendant did not need to know that possessing the turtle was illegal to violate the ESA, only that he possessed the turtle); *United States v. St. Onge*, 676 F. Supp. 1044 (D. Mont. 1988) (government did not have to show the defendant knew the animal he was killing was a grizzly bear).

[33] 16 U.S.C. § 1540(a) and (b). The statutory fines and periods of imprisonment authorized for violations of the ESA, MBTA, and BGEPA noted herein reflect the inflation-based adjustments required by Federal Fines and Sentencing Laws, 18 U.S.C. §§ 3551, *et. seq.* The Alternative Fines Act, 18 U.S.C. § 3571, in general sets forth maximum monetary fines a defendant who has been found guilty of any federal crime (not just a wildlife crime) may be sentenced to pay. The Alternative Fine Based on Gain or Loss, 18 U.S.C. § 3571(d), requires that if any person derives pecuniary gain from the offense, or if the offense results in pecuniary loss to a person other than the defendant, the defendant may be fined not more than the greater of twice the gross gain or twice the gross loss, unless imposition of a fine under this subsection would unduly complicate or prolong the sentencing process.

[34] For a list of the migratory birds protected by the MBTA, *see* 50 C.F.R. § 10.13.

[35] 16 U.S.C. § 703(a).

[36] 50 C.F.R. § 10.12.

[37] 952 F. 2d 297 (9th Cir. 1991).

[38] *Id.* at 302.

[39] *E.g.*, *United States v. FMC Corp.,* 572 F.2d 902 (2d Cir. 1978); *United States v. Corbin Farm Serv.,* 444 F. Supp. 510 (E. D. Cal. 1978)*, aff'd*, 578 F.2d (9th Cir. 1978).

[40] *See* Blaydes and Firestone, *Wind Power, Wildlife and the Migratory Bird Treaty Act*: *A Way Forward*, accepted for publication, 38(4) ENVTL. L. ___ (2008) ("The line between habitat modification and direct harm can be quite fine, if not nonexistent."); Baldwin, *The Endangered Species Act, Migratory Bird Treaty Act, and Department of Defense Readiness Activities*: *Background and Current Law*, CRS Report for Congress (2004) at 7 ("There evidently is . . . confusion as to what constitutes direct harm [from habitat modification and destruction]."); Lemly and Ohlendorf, *Regulatory Implications of Using Constructed Wetlands to Treat Selenium-Laden Wastewater*, 52 ECOTOXICOLOGY ENVT'L SAFETY 46–56 (2002) (noting the unforeseen impact of selenium-laden wastewater in artificial wetlands on migratory birds).

[41] 45 F. Supp. 2d 1070 (D. Co. 1999).

[42] *Id.* at 1185. According to the court, the proximate causation requirement distinguished the bird deaths involved in the case from those which may result from "driving an automobile, piloting an airplane, maintaining an office building, or living in a residential dwelling with a picture window . . . ." *Id.* at 1085.

[43] The U. S. Congress first explicitly acknowledged that the MBTA covers "incidental take" in some circumstances when, in 2002, it enacted P.L. 107-314, which provides that during a specified period of time the take proscription in the MBTA does not apply to the incidental take of a protected bird during authorized military readiness activities. This suspension of the MBTA was enacted in response to a case finding that take of protected birds during military readiness activities was unlawful under the MBTA (*Center for Biological Diversity v. Pirie*, 191 F. Supp. 2d 161 (D. D.C. 2002) and remained in effect until a new regulation to exempt incidental take of migratory birds during military readiness activities was finally adopted by the FWS. The final regulation was adopted by the FWS in 2007 and is located at 50 C.F.R. § 21.15. The regulation generally permits incidental take in connection with military preparedness activities, and requires for those ongoing or proposed activities that the armed forces determines may result in a significant adverse effect on a population of a migratory bird species that the armed forces must confer and cooperate with the FWS to develop and implement appropriate conservation measures to minimize or mitigate such significant adverse effects.

In addition to the above-noted Congressional action, while not dispositive for purposes of the MBTA, an executive order signed by President Clinton which imposed additional obligations on federal agencies to protect migratory birds defined the term "take" to include "unintentional take" (in a manner which did not mean "unintended" but the equivalent of incidental take as defined above). Exec. Order No. 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, 66 Fed. Reg. 3853 (2001).

[44] 16 U.S.C. § 704.

[45] *See* 50 C.F.R. Parts 13, 20, and 21.

[46] Although the MBTA does not authorize a private cause of action, two decisions out of the District of Columbia have found that citizens can sue a federal agency for violations of the MBTA by asserting a claim against a federal agency under the Administrative Procedure Act,

which allows courts to review and set aside agency actions which are "not in accordance" with law. *See Humane Society v. Glickman*, 217 F.3d 882 (D.C. Cir. 2002); *Fund for Animals v. Norton*, 281 F. Supp. 2d 209 (D.D.C. 2003).

[47] 16 U.S.C. § 707(a), (b), and (c).

[48] *See* Letter from Jamie Rappaport Clark, Director, U.S. Fish and Wildlife FWS, to Regional Directors (Sept. 14, 2000), *available at* http://www.fws.gov/migratorybirds/ issues/towers/comtow.html; Suggested Practices for Avian Protection on Power Lines—The State of the Art in 2006, at 21, available on the website for the Avian Power Line Interaction Committee at http://www.aplic.org. *See also* "Authorizations Under the Bald and Golden Eagle Protection Act for Take of Eagles," 73 Fed. Reg. 29,075 (2008) (noting that incidental take permits issued under Sections 7 and 10 of the ESA for the bald eagle while it was listed under the ESA were issued with regulatory assurances that the FWS would exercise enforcement discretion with respect to violations of the MBTA and the BGEPA).

[49] *Id*.

[50] Blaydes and Firestone, *supra* note 40.

[51] There is an extensive history of discussions between the DOI (and its subdivisions, including the FWS) and the DOJ about the interpretation of the MBTA, and the application of its criminal penalty provisions in circumstances other than unpermitted "take" by hunting. In 1985, Secretary Hodel and Solicitor Richardson sought the DOJ's opinion as to whether DOI officials and employees would be subject to prosecution for MBTA offenses in connection with the operation of Kesterson Reservoir, an agricultural water body at which toxic levels of selenium were bioaccumulating in migratory waterfowl, causing thousands of bird deaths, mutations, and reproductive dysfunction. The DOJ memorandum reviewed the entire body of judicial and administrative interpretations of the statute to that juncture, including the limited case law imposing liability on the basis of avian mortalities resulting from hazardous or inherently dangerous activities such as chemical or pesticide manufacture and disposal. The DOJ concluded in that situation that MBTA charges were not appropriate. The rationale of the DOJ memorandum clearly would not have approved MBTA prosecution of entities or persons involved solely in the construction, or use of houses, office buildings or other structures in the air column, into which birds might speculatively or even predictably collide. Since the DOJ's comprehensive analysis of MBTA prosecution authority in 1985, there has been no significant change in its broad institutional position of non-liability except in matters of hazardous chemical or petroleum activities. In sum, the DOJ's longstanding charging policy does not criminalize actors solely on the basis of their construction or use of structures with which avian collisions may occur.

[52] 16 U.S.C. § 668a.

[53] *Id*. § 668c.

[54] *See* "Protection of Bald Eagles; Definition of 'Disturb,'" 72 Fed. Reg. 31,132 (2007).

[55] *See* 50 C.F.R. § 22.3.

[56] *See* "Authorizations under the Bald and Golden Eagle Protection Act for Take of Eagles," 72 Fed. Reg. 31,132, 31,141 (2007). At the same time as it adopted the final definition of

"disturb," the FWS proposed to amend the regulatory definition of "take" as it applies to eagles to add the word "destroy" and thereby make it consistent with the statutory prohibition on unpermitted eagle nest destruction. *Id*.

[57] *Andrus v. Allard,* 444 U.S. 51, 56–59 (1979).

[58] *See Moon Lake,* 45 F. Supp. 2d at 1086–88.

[59] The only court to have addressed the relationship between the prohibitions of the ESA and the BGEPA suggested that the latter may cover habitat modification through the term "disturb" in the definition of "take" in the BGEPA. The court stated as follows in this regard:

> Both the ESA and the Eagle Protection Act prohibit the take of bald eagles, and the respective definitions of 'take' do not suggest that the ESA provides more protection for bald eagles than the Eagle Protection Act . . . . The plain meaning of the term 'disturb' is at least as broad as the term 'harm,' and both terms are broad enough to include adverse habitat modification.

Contoski v. *Scarlett*, Civ No. 05–2528 (JRT/RLE), slip op. at 5–6 (D. Minn. Aug 10, 2006). In response to a public comment that the FWS' proposed definition of the term "disturb" in the BGEPA inappropriately incorporates habitat protection which is not authorized by the BGEPA, the FWS stated that it "agrees that the Eagle Act is not a habitat management law," but noted that "there is a difference between protecting habitat per se, and protecting eagles in their habitat. The proposed and final definitions protect eagles from certain effects to the eagles themselves that are likely to occur as the result of various activities, including some habitat manipulation." 72 Fed. Reg. at 31,134.

[60] 16 U.S.C. § 668a. Pursuant to this authority the Secretary has promulgated BGEPA permit regulations for scientific and exhibition purposes, Indian religious purposes, to take depredating eagles, to possess golden eagles for falconry, and for the take of golden eagle nests that interfere with resource development or recovery operations. 50 C.F.R. §§ 22.21–22.25.

[61] Under new paragraph (a) to 50 C.F.R. § 22.11, the FWS provides take authorization under the BGEPA to existing holders of incidental take permits under Section 10 of the ESA where the bald eagle is covered in a habitat conservation plan or the golden eagle is covered as a non-listed species, as long as the permit holder is in full compliance with the terms and conditions of the ESA permit. Under a new regulation located at 50 C.F.R. § 22.28, the FWS established a new permit category to provide expedited permits to entities authorized to take bald eagles through incidental take statements issued pursuant to Section 7 of the ESA. It is anticipated that Section 22.28 will be superseded later this year upon adoption of a previously-proposed regulation which would establish a new permit for incidental take of eagles. Under this proposed regulation, to be located at 50 C.F.R. § 22.26, incidental take of bald or golden eagles would be authorized only where it is determined to be compatible with the preservation of bald and golden eagles and cannot practicably be avoided. *See* "Authorizations Under the Bald and Golden Eagle Protection Act for Take of Eagles," 73 Fed. Reg. 29,075 (2008). For a description of proposed Section 22.26, *see* 72 Fed. Reg. 31,141. At the same time that it announced this proposal, the FWS proposed another new regulation, to be located at 50 C.F.R. § 22.27, which would

authorize the removal of bald and golden eagle nests where necessary to protect human safety or the welfare of eagles. *Id.*

[62] 16 U.S.C. §§ 668a and 668b.

[63] 40 U.S.C. § 4332(2)(C); 40 C.F.R. pts. 1500–1508.

[64] 40 C.F.R. §§ 1501.3 and 1508.9.

[65] *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349–53 (1989).

[66] *See* 16 U.S.C. § 1536(a)(2) and (e)–(h).

[67] *Endangered Species Consultation Handbook—Procedures for Conducting Consultation under Section 7 of the Endangered Species Act* (FWS 1998), available at http://www.fws.gov/ Endangered/consultations/s7hndbk/s7hndbk.htm.

[68] 50 C.F.R.§ 402.14(a) and (b). Any such finding by a Federal agency must be with the consent of a specified representative of the FWS or NMFS, as applicable. *Id*. § 402.14(b).

[69] *Id.* § 402.13.

[70] 16 U.S.C. § 1536(b); 50 C.F.R. § 402.14.

[71] *See* 16 U.S.C. § 1536(b)(1); 50 C.F.R. § 402.14(e).

[72] *See* 16 U.S.C. § 1536(b)(4); *supra* note 67 at 4-50 ("*Section 7 requires minimization of the level of take. It is not appropriate to require mitigation for the impacts of incidental take*." (emphasis in original)).

[73] *See* 50 C.F.R. §§ 402.02 and 402.15(i)(2).

[74] *See* 16 U.S.C. § 1536(b)(5)(A).

[75] *Bennett v. Spear*, 520 U.S. 154, 169–70, 177–78 (1997).

[76] *See* 16 U.S.C. § 1536(b)(4); 50 C.F.R. § 402.14(*i*); *Ramsey v. Kantor*, 96 F.3d 434, 440–42 (9th Cir. 1996).

[77] 50 C.F.R. § 402.16.

[78] 16 U.S.C. §§ 1536(b)(4) and 1539(a)(2) (allowing a permit to be issued if the "taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity").

[79] 16 U.S.C. § 1536(b)(4); *see* 50 C.F.R. § 402.14(*i*) (incidental take statement issued only after formal ESA consultation).

[80] 50 C.F.R. § 402.14(i); *Ramsey*, 96 F.3d at 440–42.

[81] 16 U.S.C. § 1539(a)(1)(B).

[82] *Id.* § 1539(a)(2)(B).

[83] The *Handbook for Habitat Conservation Planning and Incidental Take Permitting Process* is available at http://www.fws.gov/Endangered/hcp/hcpbook.html. In the addendum to the *Handbook*, the FWS and NMFS provide guidance on the following five concepts: permit duration, public participation, adaptive management, monitoring and biological goals and

objectives. *See generally* "Notice of Availability of a Final Addendum to the Handbook for Habitat Conservation Planning and Incidental Take Permitting Process," 65 Fed. Reg. 35,242 (2000).

[84] 50 C.F.R. §§ 17.22(b)(5), 17.32(b)(5), and 222.307(g). *See generally*, "Habitat Conservation Plan Assurances ('No Surprises') Rule," 63 Fed. Reg. 8859 (1998).

[85] 16 U.S.C. § 1536.

[86] Hall, Dale, FWS Memo, "Final General Conservation Plan Policy," October 5, 2007.

[87] *See generally* "Announcement of Final Safe Harbor Policy," 64 Fed. Reg. 32,717 (1999); FWS—Safe Harbor Agreements for Private Landowners (2004), available at http://www.fws.gov/endangered/factsheets/harborqua.pdf.

[88] 16 U.S.C. § 1539(a)(1)(A).

[89] 64 Fed. Reg. at 32,717–26 (1999).

[90] 43 C.F.R. §§ 17.22(c)(5) and 17.32(c)(5).

[91] *See generally* "Announcement of Final Policy for Candidate Conservation Agreements with Assurances," 64 Fed. Reg. 32,726 (1999); FWS—Candidate Conservation Agreements with Assurances for Non-federal Landowners (2004), available at http://www.fws.gov/endangered/factsheets/CCAAsNon-Federal.pdf. Candidate conservation agreements are authorized in 50 C.F.R. §§ 17.22(d) and 17.32(d).

[92] For privacy and other reasons a non-federal landowner may not request regulatory assurances.

[93] 16 U.S.C. § 1539(a)(1)(A).

[94] 64 Fed. Reg. at 32,726–36.

[95] *Id*.

[96] Examples of such conservation agreements and MOUs include a 2007 agreement involving the FWS, State of California, Sonoma County, several towns, and stakeholders concerning the California tiger salamander and three listed plants in the Santa Rosa Plain, California; a 1997 agreement among the FWS, Plum Creek Timber Company and the State of Montana concerning the grizzly bear on private land in Swan Valley, Montana; a 1995 MOU between the FWS and White Mountain Apache Tribe concerning endangered species on tribal land in Arizona; and a 1993 MOU between the FWS and Georgia-Pacific Corp. concerning the red-cockaded woodpecker on 4.2 million acres of Southern timberland.

[97] *Friends of the Wild Swan v. Babbitt*, 168 F.3d 498 (table) (9th Cir. 1999), 1999 WL 38606 (unpublished opinion).

[98] 50 C.F.R. §§ 17.22(c)(2)(ii) and 17.32(c)(2)(ii). "Conservation agreements" were specifically identified in an August 2, 2004, memorandum from the FWS's Manager of California-Nevada Operations Office (now Region 8) to all staff, entitled "Updating Guidance for Designating Critical Habitat on Private Lands in California and Nevada."

[99] *See generally,* "Guidance for the Establishment, Use and Operation of Conservation Banks," 60 Fed. Reg. 58605 (1995); FWS—Conservation Banking: Incentives for Stewardship, available at http://www.fws.gov/endangered/factsheets/ banking_7_05.pdf.

[100] *Id*.

[101] *See* 16 U.S.C. § 1535(c)(1) (for fish and wildlife) and 1535(c)(2) (for plants). Requirements for state programs pertaining to plants differ from those for fish and wildlife only in that plant programs need not include land acquisition.

[102] 16 U.S.C. § 1535(c).

[103] 50 C.F.R. § 17.31.

[104] *See, e. g*., *Marbled Murrelet v. Babbitt*, 83 F.3d 1060, 1068 (9th Cir. 1996) (stating that letters between the FWS and the lumber company were "desirable communication" on how to comply with the ESA).

[105] As noted above, the FWS similarly has used enforcement discretion under the MBTA. *See, supra,* notes 48–49 and accompanying text.

[106] *See id.*

[107] *See* MOU between the FWS and Edison Electric Institute regarding the use and development of avian protection plans.

[108] 50 C.F.R. §§ 13 (general permit procedures), 20.1–20.155 (hunting permits, season limits), 21.21–21.60 (specific permits), and 21.27 (special purpose permits).

[109] 50 C.F.R. Part 21.

[110] *Id.*

[111] Exec. Order No. 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds," 66 Fed. Reg. 3853 (2001).

[112] *See, supra,* note 61, and accompanying text.

Data available from different organizations, accessible for preliminary project planning. For general planning purposes only. Final siting should be based on field investigation and consultation with appropriate agencies and organizations.
The absence of data does not necessarily mean the absence of a sensitive species or sensitive habitat. These maps do not necessarily reflect the complete distribution or occurrence for sensitive species.
This is a summary of data available as of 7 August 2009. Users are advised to seek updated information to assess potential sites for wind energy development.

Map/Database Title	Organization Managing File(s)	How to Access File	Regions/States Covered	Fauna/Flora	Habitat types covered	Information not included	Source Info	Date of Source	Date of Compilation
Bat Distributions	Bat Conservation International	http://www.batcon.org/index.php/all-about-bats/species-profiles.html	US and Canada only.	Bats	All	Other flora and fauna besides bats. Specific migration routes may not be included. Hibernacula are not delineated.	U.S. State Natural Heritage Programs, Canadian Conservation Data Centers, published literature, unpublished reports, museum collections, and personal communications from university, federal, state, and local biologists.	reflect available data from 1900 to current.	2003
Ecoregional Portfolio Sites	The Nature Conservancy	http://ecad.tnc.org/	Lower 48 states expected by end of 2008	NA (applicable to birds and most other organsims)	Large & intact landscapes	Freshwater and marine ecoregional portfolios; biodiversity conservation targets (species and ecosystems) and goals for their conservation.	TNC ecoregional assessments conducted by TNC ecologist and outside agency experts.	Varies from mid to late 1990s and 2008.	ongoing
Environmental Conservation Online System (ECOS)	Fish and Wildlife Service	http://ecos.fws.gov/imf/?site=ecos	USA	ETSC designated critical habitat areas	ETSC designated critical habitat areas	common and undesignated species not included.	USFWS	varies	varies, usually recent and ongoing
Great Plains Untilled Landscapes	The Nature Conservancy	http://ecad.tnc.org/	Great Plains Bioregion	NA (applicable to birds and most other organsims)	Large & intact landscapes	This coverage represents a snapshot in time, circa 1990.	Derived from early 1990s Landsat TM Imagery, visually interpreted by one TNC staff person and digitized into GIS data layer	Source images from the early 1990s.	Data created in 2001.
Habitat and Population Evaluation Team (HAPET) modeling	Fish and Wildlife Service	http://www.fws.gov/midwest/hapet/DistgbcaMap.htm; http://www.nwrc.usgs.gov/wdb/pub/hsi/hsiintro.htm#top;	Prairie Pothole Region (midwestern states).	Grassland birds, specific models of some sparrows, prairie chickens, duck nesting habitat , etc.	grasslands, duck nesting habitat, wetlands.	Varies.	Varies.	Varies.	Varies.
Important Bird Areas	National Audubon Society	Internet search for state name and "Audubon Important Bird Area" Other states contact jcecil at audubon.org	Most US states.	Focuses on breeding and wintering birds and bird in migration.	All	No info on taxa other than birds. Focuses on habitat and not on use of air column.	Biological surveys of birds; includes data from Breeding Bird Survey and Audubon's Christmas Bird Count	BBS & CBC annually. States do not use data that is more than ten years old.	Ongoing; IBA program began in mid-1990s; sites re-evaluated every ten years.
Federal, State, and Local land managed for wildlife conservation	Federal, State, and Local agencies	Contact federal, state and local agencies	All. NWR, State managed wildlife areas, State Parks, etc.	Varies	Varies	Varies.	Fed. state and local agencies.	Varies	Varies.
National Wetlands Inventory	Fish and Wildlife Service	http://www.fws.gov/wetlands/	USA	N/A	Wetlands	Does not cover wildife.	USFWS		
Natural Resources Inventory (NRI)	Natural Resources Conservation Service	Contact state DNR	All states and territories	ETSC, significant rookeries and some biological "hotspots".		common species may not be included.	Varies	Varies	Varies, usually recent and ongoing
NatureServe	Natural Heritage Programs	Contact host agency, varies by State. Web search for state name and "natural heritage information".	State by state for USA (50 States)	All tracked (ES, rookeries - hibernacula variable)	Endangered plants, natural communities	Common and untracked spp., migratory stop-over spp.	State DNRs, University biological survey, varies and ongoing	Varies	Varies, usually recent and ongoing
Oklahoma untilled landscapes	Oklahoma Wind Power Initiative	http://www.ocgi.okstate.edu/owpi/	Oklahoma	Whooping crane, greater prairie chicken, lesser prairie chicken.	Untilled landscapes, TNC conservation areas.				2005
Wetlands and Bird Migration; Lesser Prairie Chicken	Playa Lake Joint Venture	http://www.pljv.org/cms/wind-energy	So. Plains & SW US	Birds, Prairie Chicken	playa lakes, wetlands, grasslands				

	Prairie Pothole habitats	Prairie Pothole Joint Venture	http://www.ppjv.org/implement2.htm; http://www.ppjv.org/thunderstorm_maps.htm	Portions of ND,SD,MN,MT,IA	Grassland birds, breeding ducks, marbled godwit, Northern Harrier	Habitats for breeding ducks and grassland birds.	Non-bird taxa and woodland birds are not covered.	HAPET data, varies by map.	1990's; 2003-2005	2007
	Priority Habitats and Species	Washington Department of Fish and Wildlife	http://www.wdfw.wa.gov/hab/phslist.htm	Washington	Birds, fish, and wildlife.	All	PHS data do not identify what is not present.	Data are most often supplied by WDFW professional biologists, but may include local government biologists or tribal biologists.	Varies. Regional data reviewed every 2-3 years and updated as necessary.	Varies. Regional data reviewed every 2-3 years and updated as necessary.
	State Wildlife Action Plans	Association of Fish and Wildlife Agencies	http://www.wildlifeactionplans.org/	All states and Territories	All wildlife	All	Not specific to wind farms	Various	Varies	Varies
	Sensitive species	The Nature Conservancy	http://ecad.tnc.org/	Species ranges in North America	Sensitive species	All	Common species may not be included.	NatureServe, USFWS	Varies by species	
	Natural Resource Planner	Kansas Biological Survey	http://www.kars.ku.edu/maps/windresourceplanner/	Kansas	Sensitive species, Prairie Chicken.	Untilled landscapes, playa lakes, grasslands.		Kansas Department of Wildlife and Parks, The Kansas Biological Survey, the Kansas Natural Heritage Program and The Nature Conservancy		2009
	Western resources maps	Google Earth, NRDC, Audubon	http://www.nrdc.org/land/sitingrenewables/default.asp; Google Earth "protected Areas and Energy Development"	13 western states	Sage Grouse, Audubon Important Bird Areas	All		National Parks, refuges, roadless areas, designated critical habitat, wilderness, roadless areas, historic sites, natioanl monuments, etc.	Varies	2009
	Wind Energy Potential	US Department of Energy	http://www.windpoweringamerica.gov/wind_maps.asp	Most Lower 48 states, except LA, KY, TN, MI, AL, FL, GA, and SC.	N/A	N/A	All wind energy potential data require validation using local meteorological field measurements at potential and actual wind turbine sites.	NREL (US Dept of Energy); MN Dept of Commerce; AWS Truewind, LLC; IA Energy Center; West Texas A&M University	Varies, from 1990s to present	Varies, from 1990s to present
	Current and Proposed Wind Farms	Industrial Info; state permitting agencies	existing wind areas http://industrialinfo.com/ ; planned wind developments contact local permitting agencies	varies	NA	All	Does not cover wildife.	Varies	NA	NA
	Current and Proposed Transmission Lines	Platt/DOE/Local transmission councils	Information may be available from DOE, local transmission councils, or available for purchase from Platt (http://www.platts.com/Maps%20&%20Spatial%20Software/). .	Tx (Platt), other states?	NA	All	Does not cover wildife.	Varies	Varies	Varies
Forthcoming:										
	Wind-wildlife transmission maps	Western Governors Association	http://www.westgov.org/							
	Prairie grouse habitats	North American Grouse Partnership	http://www.grousepartners.org/; http://w	All prairie grouse range. (Oklahoma available now)	Grouse	Grouse habitat				
	Wind & wildlife resource maps	Am. Wind & Wildlife Institute	http://www.awwi.org/home.php	September 2009 include WY, MT, SD, ND, NE, rest of US sometime in 2010.						

This is a summary of data available as of 7 August 2009. Users are advised to seek updated information to assess potential sites for wind energy development.

Map/Database Title	**Organization Managing File(s)**	**Pros/Cons**
Bat Distributions	Bat Conservation International	Not Available as GIS layer. Data is not sufficient to infer absence. All available data is not included in these maps. It is intended for general distribution information only.
Ecoregional Portfolio Sites	The Nature Conservancy	Covers all species, regardless of wind power related impacts.
Environmental Conservation Online System (ECOS)	Fish and Wildlife Service	
Great Plains Untilled Landscapes	The Nature Conservancy	May be out of date. May include small areas with varying degrees of impact including grazing, oil extraction, and shrub/tree removal.
Habitat and Population Evaluation Team (HAPET) modeling	Fish and Wildlife Service	Use maps with some caution. GIS publicly available but no system set up for distirbution as yet. Access maps on internet first.
Important Bird Areas	National Audubon Society	Available as GIS layer. Highest priority bird habitats. Telescope between site to state and national levels. Information varies. Some states have point locations while others have complete spatial boundaries.
Federal, State, and Local land managed for wildlife conservation	Federal, State, and Local agencies	
National Wetlands Inventory	Fish and Wildlife Service	Available as GIS layer.
Natural Resources Inventory (NRI)	Natural Resources Conservation Service	
NatureServe	Natural Heritage Programs	May be available as GIS layer. Covers many important features/If looking at individual sites, may miss migration stop-over spp., may be missing non-reported information (e.g. common species).
Oklahoma untilled landscapes	Oklahoma Wind Power Initiative	created explicitly for wind power and wildlife concerns. Large scale.
Wetlands and Bird Migration; Lesser Prairie Chicken	Playa Lake Joint Venture	Available as GIS layer.
Prairie Pothole habitats	Prairie Pothole Joint Venture	
Priority Habitats and Species	Washington Department of Fish and Wildlife	Available as GIS layer.
State Wildlife Action Plans	Association of Fish and Wildlife Agencies	Not specific to wind farms, but provides a good overview of state priority areas.
Sensitive species	The Nature Conservancy	Some species locations may be randomly generalized to obscure exact locations. Absence of species occurrences does not mean the species is not present.
Wind Resource Planner	Kansas Biological Survey	created explicitly for wind power and wildlife concerns. Large scale.
Western resources maps	Google Earth, NRDC, Audubon	The maps help users identify areas where land use is legally restricted. Other data layers highlight unprotected areas that should be avoided in energy development, including habitats critically important to wildlife. Users exploring specific geographical areas (such as those proposed for energy development) can easily see how little land is legally off-limits and which of the remaining areas have unique qualities that deserve special protection to avoid imperiling sensitive resources. Lack of special area designation does not mean lands are appropriate for development.
Wind Energy Potential	US Department of Energy	Detail varies and requires validation using local meteorological data.

Current and Proposed Wind Farms	Industrial Info; state permitting agencies	
Current and Proposed Transmission Lines	Platt/DOE/Local transmission councils	May be available as GIS layer. Data may be sensitive (homeland security) and have release restricted.

Wind-wildlife transmission maps	Western Governors Association	
Prairie grouse habitats	North American Grouse Partnership	
Wind & wildlife resource maps	Am. Wind & Wildlife Institute	

Appendix D: Literature Cited

Anderson, R., M. Morrison, K. Sinclair, and D. Strickland. 1999. 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. National Wind Coordinating Committee/RESOLVE. Washington, D.C., USA.

Arnett, E.B., and J.B. Haufler. 2003. A customer-based framework for funding priority research on bats and their habitats. Wildlife Society Bulletin 31 (1): 98–103.

Arnett, E.B., technical editor. 2005. Relationships between Bats and Wind Turbines in Pennsylvania and West Virginia: An Assessment of Bat Fatality Search Protocols, Patterns of Fatality, and Behavioral Interactions with Wind Turbines. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA. http://www.batsandwind.org/pdf/ar2004.pdf

Arnett, E.B., J.P. Hayes, and M.M.P. Huso. 2006. An evaluation of the use of acoustic monitoring to predict bat fatality at a proposed wind facility in south-central Pennsylvania. An annual report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

http://batsandwind.org/pdf/ar2005.pdf.

Arnett, E.B., D.B. Inkley, D.H. Johnson, R.P. Larkin, S. Manes, A.M. Manville, R. Mason, M. Morrison, M.D. Strickland, and R. Thresher. 2007. Impacts of Wind Energy Facilities on Wildlife and Wildlife Habitat. Issue 2007-2. The Wildlife Society, Bethesda, Maryland, USA.

Arnett, E.B., K. Brown, W.P. Erickson, J. Fiedler, B. Hamilton, T.H. Henry, G. D. Johnson, J. Kerns, R.R. Kolford, C.P. Nicholson, T. O'Connell, M. Piorkowski, and R. Tankersley, Jr. 2008. Patterns of fatality of bats at wind energy facilities in North America. Journal of Wildlife Management 72: 61–78.

Arnett, E.B., M. Schirmacher, M.M.P. Huso, and J.P. Hayes. 2009. Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. An annual report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

http://batsandwind.org/pdf/Curtailment_2008_Final_Report.pdf.

Arnett, E.B., M. Baker, M.M.P. Huso, and J. M. Szewczak. In review. Evaluating ultrasonic emissions to reduce bat fatalities at wind energy facilities. An annual report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

Avian Powerline Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington D.C. and Sacramento, CA. http://www.aplic.org/SuggestedPractices2006(LR-2watermark).pdf

Baerwald, E.F., J. Edworthy, M. Holder, and R.M.R. Barclay. 2009. A Large-Scale Mitigation Experiment to Reduce Bat Fatalities at Wind Energy Facilities. Journal of Wildlife Management 73(7): 1077-81.

Bailey, L.L., T.R. Simons, and K.H. Pollock. 2004. Spatial and Temporal Variation in Detection Probability of Plethodon Salamanders Using the Robust Capture-Recapture Design. Journal of Wildlife Management 68(1): 14-24.

Becker, J.M., C.A. Duberstein, J.D. Tagestad, J.L. Downs. 2009. Sage-Grouse and Wind Energy: Biology, Habits, and Potential Effects from Development. Prepared for the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Wind & Hydropower Technologies Program, under Contract DE-AC05-76RL01830.

Breidt, F.J. and W.A. Fuller. 1999. Design of supplemented panel surveys with application to the natural resources inventory. Journal of Agricultural, Biological, and Environmental Statistics 4(4): 391-403.

Bright J., R. Langston, R. Bullman, R. Evans, S. Gardner, and J. Pearce-Higgins. 2008. Map of Bird Sensitivities to Wind Farms in Scotland: A Tool to Aid Planning and Conservation. Biological Conservation 141(9): 2342-56.

California Energy Commission and California Department of Fish and Game. 2007. California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development. Commission Final Report. California Energy Commission, Renewables Committee, and Energy Facilities Siting Division, and California Department of Fish and Game, Resources Management and Policy Division. CEC-700-2007-008-CMF.

Chamberlain, D.E., M.R. Rehfisch, A.D. Fox, M. Desholm, and S.J. Anthony. 2006. The Effect of Avoidance Rates on Bird Mortality Predictions Made by Wind Turbine Collision Risk Models. Ibis 148(S1): 198-202.

"Clean Water Act." Water Pollution Prevention and Control. Title 33 *U.S. Code*, Sec. 1251 et. seq. 2006 ed., 301-482. Print.

Connelly, J.W., H.W. Browers, and R.J. Gates. 1988. Seasonal Movements of Sage Grouse in Southeastern Idaho. Journal of Wildlife Management 52(1): 116-22.

Connelly, J.W., M.A. Schroeder, A.R. Sands, and C.E. Braun. 2000. Guidelines to manage sage grouse population and their habitats. Wildlife Society Bulletin 28(4):967-85.

Corn, P.S. and R.B. Bury. 1990. Sampling Methods for Terrestrial Amphibians and Reptiles, Gen. Tech. Rep. PNW-GTR-256. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Cryan, P.M. 2008. Mating Behavior as a Possible Cause of Bat Fatalities at Wind Turbines. Journal of Wildlife Management 72(3): 845-49.

Dettmers, R., D.A. Buehler, J.G. Bartlett, and N.A. Klaus. 1999. Influence of Point Count Length and Repeated Visits on Habitat Model Performance. Journal of Wildlife Management 63(3): 815-23.

Drewitt, A.L. and R.H.W. Langston. 2006. Assessing the Impacts of Wind Farms on Birds. Ibis 148: 29-42.

Erickson, W.P., M.D. Strickland, G.D. Johnson, and J.W. Kern. 2000b. Examples of Statistical Methods to Assess Risk of Impacts to Birds from Windplants. Proceedings of the National Avian-Wind Power Planning Meeting III. National Wind Coordinating Committee, c/o RESOLVE, Inc., Washington, D.C.

Erickson, W.P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Final Report: July 2001 - December 2003. Technical report for and peer-reviewed by FPL Energy, Stateline Technical Advisory Committee, and the Oregon Energy Facility Siting Council, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington, and Northwest Wildlife Consultants (NWC), Pendleton, Oregon, USA. December 2004. http://www.west-inc.com.

Erickson, W., D. Strickland, J.A. Shaffer, and D.H. Johnson. 2007. Protocol for Investigating Displacement Effects of Wind Facilities on Grassland Songbirds. National Wind Coordinating Collaborative, Washington, D. C. http://www.nationalwind.org/workgroups/wildlife/SongbirdProtocolFinalJune07.pdf

Fiedler, J.K., T.H. Henry, C.P. Nicholson, and R.D. Tankersley. 2007. Results of Bat and Bird Mortality Monitoring at the Expanded Buffalo Mountain Windfarm, 2005. Tennessee Valley Authority, Knoxville, Tennessee, USA. https://www.tva.gov/environment/bmw_report/results.pdf

Fuller, W.A. 1999. Environmental surveys over time. Journal of Agricultural, Biological, and Environmental Statistics 4(4): 331-45.

Gauthreaux, S.A., Jr., and C.G. Belser. 2003. Radar ornithology and biological conservation. Auk 120(2):266–77.

Giesen, K.M. and J.W. Connelly. 1993. Guidelines for management of Columbian sharp-tailed grouse habitats. Wildlife Society Bulletin 21(3):325-33.

Graeter, G.J., B.B. Rothermel, and J.W. Gibbons. 2008. Habitat Selection and Movement of Pond-Breeding Amphibians in Experimentally Fragmented Pine Forests. Journal of Wildlife Management 72(2): 473-82.

Hagen, C.A., B.E. Jamison, K.M. Giesen, and T.Z. Riley. 2004. Guidelines for managing lesser prairie-chicken populations and their habitats. Wildlife Society Bulletin 32(1):69-82.

Hagen, C.A., B.K. Sandercock, J.C. Pitman, R.J. Robel, and R.D. Applegate. 2009. Spacial variation in lesser prairie-chicken demography: a sensitivity analysis of population dynamics and management alternatives. Journal of Wildlife Management 73:1325-32.

Hagen, C.A., J.C. Pitman, T.M. Loughin, B.K. Sandercock, and R.J. Robel. In Press. Impacts of anthropogenic features on lesser prairie-chicken habitat use. Studies in Avian Biology.

Holloran, M.J. 2005. Greater Sage-Grouse (*Centrocercus urophasianus*) Population Response to Natural Gas Field Development in Western Wyoming. Ph.D. dissertation. University of Wyoming, Laramie, Wyoming, USA.

Holloran, M.J., B.J. Heath, A.G. Lyon, S.J. Slater, J.L. Kuipers, S.H. Anderson. 2005. Greater Sage-Grouse Nesting Habitat Selection and Success in Wyoming. Journal of Wildlife Management 69(2): 638-49.

Horn, J.W., E.B. Arnett and T.H Kunz. 2008. Behavioral responses of bats to operating wind turbines. Journal of Wildlife Management 72(1):123-32.

Hunt, G. 2002. Golden Eagles in a Perilous Landscape: Predicting the Effects of Mitigation for Wind Turbine Bladestrike Mortality. California Energy Commission Report P500-02-043F. Sacramento, California, USA.

Hunt, G. and T. Hunt. 2006. The Trend of Golden Eagle Territory Occupancy in the Vicinity of the Altamont Pass Wind Resource Area: 2005 Survey. California

Energy Commission, PIER Energy-Related Environmental Research. CEC-500-2006-056.

Huso, M. 2009. Comparing the Accuracy and Precision of Three Different Estimators of Bird and Bat Fatality and Examining the Influence of Searcher Efficiency, Average Carcass Persistence and Search Interval on These. Proceedings of the NWCC Wind Wildlife Research Meeting VII, Milwaukee, Wisconsin. Prepared for the Wildlife Workgroup of the National Wind Coordinating Collaborative by RESOLVE, Inc., Washington, D.C., USA. S. S. Schwartz, ed. October 28-29, 2008.

Johnson, G.D., D.P. Young, Jr., W.P. Erickson, C.E. Derby, M.D. Strickland, and R.E. Good. 2000. Wildlife Monitoring Studies, SeaWest Windpower Project, Carbon County, Wyoming, 1995-1999. Final report prepared for SeaWest Energy Corporation, and the Bureau of Land Management by Western EcoSystems Technology, Inc. Cheyenne, Wyoming, USA.

Johnson, G.D., W.P. Erickson, and J. White. 2003. Avian and Bat Mortality During the First Year of Operation at the Klondike Phase I Wind Project, Sherman County, Oregon. March 2003. Technical report prepared for Northwestern Wind Power, Goldendale, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, USA. http://www.west-inc.com.

Kerns, J. and P. Kerlinger. 2004. A Study of Bird and Bat Collision Fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia: Annual Report for 2003. Prepared for FPL Energy and the Mountaineer Wind Energy Center Technical Review Committee by Curry and Kerlinger, LLC. http://www.wvhighlands.org/Birds/MountaineerFinalAvianRpt-%203-15-04PKJK.pdf

Kronner, K., B. Gritski, Z. Ruhlen, and T. Ruhlen. 2007. Leaning Juniper Phase I Wind Power Project, 2006-2007: Wildlife Monitoring Annual Report. Unpublished report prepared by Northwest Wildlife Consultants, Inc. for PacifiCorp Energy, Portland, Oregon, USA.

Kuenzi, A.J. and M.L. Morrison. 1998. Detection of Bats by Mist-Nets and Ultrasonic Sensors. Wildlife Society Bulletin 26(2): 307-11.

Kunz, T.H., G.C. Richards, and C.R. Tidemann. 1996. Small Volant Mammals. In D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster, (eds.), Measuring and Monitoring Biological Diversity: Standard Methods for Mammals. Smithsonian Institution Press, Washington, D.C. USA. pp. 122-46.

Kunz, T. H., E. B. Arnett, B. M. Cooper, W. P. Erickson, R. P. Larkin, T. Mabee, M. L. Morrison, M. D. Strickland, and J. M. Szewczak. 2007. Assessing impacts of wind-energy development on nocturnally active birds and bats: a guidance document. Journal of Wildlife Management 71: 2449-2486.

Kunz, T.H. and S. Parsons, eds. 2009. Ecological and Behavioral Methods for the Study of Bats. Second Edition. Johns Hopkins University Press.

Leddy, K.L., K.F. Higgins, and D.E. Naugle. 1999. Effects of Wind Turbines on Upland Nesting Birds in Conservation Reserve Program Grasslands. Wilson Bulletin 111(1): 100-4.

Mabee, T. J., B. A. Cooper, J. H. Plissner, and D. P. Young. 2006. Nocturnal bird migration over an Appalachian ridge at a proposed wind power project. Wildlife Society Bulletin 34(3): 682–90.

Madders, M. and D.P. Whitfield. 2006. Upland Raptors and the Assessment of Wind Farm Impacts. Ibis 148: 43-56.

Manly, B.F., L. McDonald, D.L. Thomas, T.L. McDonald, and W.P. Erickson. 2002. Resource Selection by Animals: Statistical Design and Analysis for Field Studies. 2nd Edition. Kluwer, Boston.

Manly, B.F.J. 2009. Statistics for Environmental Science and Management. 2nd edition. CRC Press, Boca Raton, Florida, USA.

Manville, A. M. II. 2004. Prairie grouse leks and wind turbines: U.S. Fish and Wildlife Service justification for a 5-mile buffer from leks; additional grassland songbird recommendations. Division of Migratory Bird Management, USFWS, Arlington, VA, peer-reviewed briefing paper.

Master, L.L., B.A. Stein, L.S. Kutner and G.A. Hammerson. 2000. Vanishing Assets: Conservation Status of U.S. Species. pp. 93-118 IN B.A. Stein, L.S. Kutner and J.S. Adams (eds.). Precious Heritage: the Status of Biodiversity in the United States. Oxford University Press, New York. 399 pages. ("S1, S2, S3; G1, G2, G3")

McDonald, T.L. 2003. Review of environmental monitoring methods: survey designs. Environmental Monitoring and Assessment 85(2): 277-92.

Morrison, M.L., W.M. Block, M.D. Strickland, B.A. Collier, and M.J. Peterson. 2008. Wildlife Study Design. Second Edition. Springer, New York, New York, USA. 358 pp.

Murray, C. and D. Marmorek. 2003. Chapter 24: Adaptive Management and Ecological Restoration. In: P. Freiderici (ed.), Ecological Restoration of Southwestern Ponderosa Pine Forests. Island Press, Washington, California, and London. Pp. 417-28.

National Research Council (NRC). 2007. Environmental Impacts of Wind-Energy Projects. National Academies Press. Washington, D.C., USA. www.nap.edu

O'Farrell, M.J., B.W. Miller, and W.L. Gannon. 1999. Qualitative Identification of Free-Flying Bats Using the Anabat Detector. Journal of Mammalogy 80(1): 11-23.

Olson, D., W.P. Leonard, and B.R. Bury, eds. 1997. Sampling Amphibians in Lentic Habitats: Methods and Approaches for the Pacific Northwest. Society for Northwestern Vertebrate Biology, Olympia, Washington, USA.

Organ, A. & Meredith, C. 2004. 2004 Avifauna Monitoring for the proposed Dollar Wind Farm – Updated Risk Modeling. Biosis Research Pty. Ltd. Report for Dollar Wind Farm Pty. Ltd.

Orloff, S. and A. Flannery. 1992. Wind Turbine Effects on Avian Activity, Habitat Use, and Mortality in Altamont Pass and Solano County Wind Resource Areas, 1989-1991. Final Report P700-92-001 to Alameda, Costra Costa, and Solano Counties, and the California Energy Commission by Biosystems Analysis, Inc., Tiburon, California, USA.

Pearce-Higgins, J.W., L. Stephen, R.H.W. Langston, & J.A. Bright. (2008) Assessing the cumulative impacts of wind farms on peatland birds: a case study of golden plover *Pluvialis apricaria* in Scotland. Mires and Peat, 4(01), 1– 13.

Pennsylvania Game Commission (PGC). 2007. Wind Energy Voluntary Cooperation Agreement. Pennsylvania Game Commission, USA. http://www.pgc.state.pa.us/pgc/lib/pgc/programs/voluntary_agreement.pdf

Pierson, E.D., M.C. Wackenhut, J.S. Altenbach, P. Bradley, P. Call, D.L. Genter, C.E. Harris, B.L. Keller, B. Lengas, L. Lewis, B. Luce, K.W. Navo, J.M. Perkins, S. Smith, and L. Welch. 1999. Species Conservation Assessment and Strategy for Townsend's Big-Eared Bat (*Corynorhinus townsendii townsendii* and *Corynorhinus townsendii pallescens*). Idaho Conservation Effort, Idaho Department of Fish and Game, Boise, Idaho, USA.

Pitman, J.C., C.A. Hagen, R.J. Robel, T.M. Loughlin, and R.D. Applegate. 2005. Location and Success of Lesser Prairie-Chicken Nests in Relation to Vegetation and Human Disturbance. Journal of Wildlife Management 69(3):1259-69.

Pruett, C.L., M.A. Patten and D.H. Wolfe. Avoidance Behavior by Prairie Grouse: Implications for Development of Wind Energy. Conservation Biology. 23(5):1253-59.

Rainey, W.E. 1995. Tools for Low-Disturbance Monitoring of Bat Activity. In: Inactive Mines as Bat Habitat: Guidelines for Research, Survey, Monitoring, and Mine Management in Nevada. B. R. Riddle, ed. Biological Resources Research Center, University of Nevada-Reno, Reno, Nevada, USA.148 pp.

Ralph, C.J., J.R. Sauer, and S. Droege, eds. 1995. Monitoring Bird Populations by Point Counts. U.S. Department of Agriculture, Forest Service General Technical Report PSW-GTR-149.

Reynolds R.T., J.M. Scott, R.A. Nussbaum. 1980. A variable circular-plot method for estimating bird numbers. Condor. 82(3):309–13.

Richardson, W.J. 2000. Bird Migration and Wind Turbines: Migration Timing, Flight Behavior, and Collision Risk. In: Proceedings of the National Avian Wind Power Planning Meeting III (PNAWPPM-III). LGL Ltd., Environmental Research Associates, King City, Ontario, Canada, San Diego, California. www.nationalwind.org/publications/wildlife/avian98/20-Richardson-Migration.pdf

"Rivers and Harbors Act." Protection of Navigable Waters and of Rivers and of Harbor and River Improvements Generally. Title 33 U.S. Code, Sec. 401 et. seq. 2006 ed., 42-84. Print.

Robel, R.J., J. A. Harrington, Jr., C.A. Hagen, J.C. Pitman, and R.R. Reker. 2004. Effect of Energy Development and Human Activity on the Use of Sand Sagebrush Habitat by Lesser Prairie-Chickens in Southwestern Kansas. North American Wildlife and Natural Resources Conference 69: 251-66.

Sawyer, H., R.M. Nielson, F. Lindzey, and L.L. McDonald. 2006. Winter Habitat Selection of Mule Deer Before and During Development of a Natural Gas Field. Journal of Wildlife Management 70(2): 396-403. http://www.west-inc.com

Shaffer, J.A. and D.H. Johnson. 2008. Displacement Effects of Wind Developments on Grassland Birds in the Northern Great Plains. Presented at the Wind Wildlife Research Meeting VII, Milwaukee, Wisconsin, USA. Wind Wildlife Research Meeting VII Plenary. http://www.nationalwind.org/pdf/ShafferJill.pdf

Sherwin, R.E., W.L. Gannon, and J.S. Altenbach. 2003. Managing Complex Systems Simply: Understanding Inherent Variation in the Use of Roosts by Townsend's Big-Eared Bat. Wildlife Society Bulletin 31(1): 62-72.

Smallwood, K.S. and C.G. Thelander. 2004. Developing Methods to Reduce Bird Fatalities in the Altamont Wind Resource Area. Final report prepared by BioResource Consultants to the California Energy Commission, Public Interest Energy Research-Environmental Area, Contract No. 500-01-019; L. Spiegel, Project Manager.

Smallwood, K.S. and C.G. Thelander. 2005. Bird Mortality at the Altamont Pass Wind Resource Area: March 1998 - September 2001. Final report to the National Renewable Energy Laboratory, Subcontract No. TAT-8-18209-01 prepared by BioResource Consultants, Ojai, California, USA.

Smallwood, K.S. 2007. Estimating Wind Turbine-Caused Bird Mortality. Journal of Wildlife Management 71(8): 2781-91.

Stewart, G.B., A.S. Pullin and C.F. Coles. 2007. Poor evidence-base for assessment of windfarm impacts on birds. Environmental Conservation 34(1):1:1-11.

Strickland, M.D., G. Johnson and W.P. Erickson. 2002. Application of methods and metrics at the Buffalo Ridge Minnesota Wind Plant. Invited Paper. EPRI Workshop on Avian Interactions with Wind Power Facilities, Jackson, WY, October 16-17, 2002.

Strickland, M. D., E. B. Arnett, W. P. Erickson, D. H. Johnson, G. D. Johnson, M. L., Morrison, J.A. Shaffer, and W. Warren-Hicks. In Review. Studying Wind Energy/Wildlife Interactions: a Guidance Document. Prepared for the National Wind Coordinating Collaborative, Washington, D.C., USA.

Suter, G.W. and J.L. Jones. 1981. Criteria for Golden Eagle, Ferruginous Hawk, and Prairie Falcon Nest Site Protection. Journal of Raptor Research 15(1): 12-18.

Urquhart, N.S., S.G. Paulsen, and D.P. Larsen. 1998. Monitoring for policy-relevant regional trends over time. Ecological Applications 8(2):246-57.

U.S. Fish and Wildlife Service. 2009. DRAFT Rising to the Challenge: Strategic Plan for Responding to Accelerating Climate Change.

U.S. Fish and Wildlife Service Mitigation Policy; Notice of Final Policy, 46 Fed. Reg. 7644-7663 (January 23, 1981). Print.

Vodehnal. W.L., and J.B. Haufler, Compilers. 2007. A grassland conservation plan for prairie grouse. North American Grouse Partnership. Fruita, CO.

Walters, C. J., and C. S. Holling. 1990. Large-scale management experiments and learning by doing. Ecology 71(6): 2060–68.

Weller, T.J. 2007. Evaluating Preconstruction Sampling Regimes for Assessing Patterns of Bat Activity at a Wind Energy Development in Southern California. California Energy Commission, PIER Energy-Related Environmental Research Program. CEC-500-01-037.

Williams, T.C., J.M. Williams, P.G. Williams, and P. Stokstad. 2001. Bird migration through a mountain pass studied with high resolution radar, ceilometers, and census. The Auk 118(2):389-403.

Williams, B. K., R. C. Szaro, and C. D. Shapiro. 2009. Adaptive Management: The U.S. Department of the Interior Technical Guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC.