

**GUIDELINES for CONDUCTING BIRD and BAT STUDIES
at
COMMERCIAL WIND ENERGY PROJECTS**

Prepared by

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Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects

The 2002 New York State Energy Plan placed a priority on increased energy diversity and use of renewable energy sources, and the New York Renewable Portfolio Standard promotes the research and development of alternative energy projects, particularly commercial wind energy, to help meet our increasing demand for electricity. While wind energy appears to have significant environmental benefits when compared to energy produced from fossil fuel, the Department of Environmental Conservation (DEC) must also consider the potential negative environmental impacts of wind energy production when evaluating proposed projects. Currently, the nature and severity of both site-specific and cumulative impacts that commercial wind energy projects may have on birds and bats in New York State is DEC's most pressing issue related to wind energy development. The Department's concern for and jurisdiction over these natural resources derives from the Environmental Conservation Law which articulates the policies of the DEC (Article 1), the powers and duties of the Commissioner (Article 3) and the requirements for protection of fish and wildlife and their habitats (Article 11).

These guidelines set forth DEC's recommendations to commercial wind energy developers on how to characterize bird and bat resources at on-shore wind energy sites, and how to estimate and document impacts resulting from the construction and operation of wind energy projects. By issuing these guidelines, DEC intends to provide a consistent and predictable methodology for developers to assist them in the planning and development process. *Bird and bat resources* includes all species of birds (Class *Aves*) and bats (Order *Chiroptera*) that use or may use the site, as well as the habitats that support them. The guidelines also provide a general framework for the developer to propose site-specific studies needed to evaluate the potential and/or actual effects of a given wind energy project. It should be recognized that the effort required to fully understand the movement of birds and bats at any given locale would be monumental and would take many years. Therefore, the studies recommended here are considered the minimum effort necessary to characterize bird and bat activity at a given project location within a reasonable time frame relative to construction. This guidance provides two tracks for pre-construction and post-construction studies: "standard" and "expanded." It is anticipated that most sites will warrant the "standard" studies; however, where site-specific conditions or other findings suggest the potential for more than *de minimus* adverse impacts to birds and/or bats, expanded studies and/or additional years of study will be recommended. *Adverse impact* means 1) mortality of birds and/or bats due to collision or other effects such as barotrauma caused by a wind turbine; 2) displacement of birds or bats from their habitat due to the presence and/or operation of a wind energy project; or 3) a measured reduction in bird or bat use of the site due to construction and operation of the project.

Along with providing essential data for evaluation of project operation, the protocols set forth here are intended to provide comparability of data collection among sites and between years such that the information from each site may contribute to a statewide understanding of the ecological effects of wind energy generation. A list of web sites, published papers, and other

references and information sources is included at the end of the document.

1. **Purpose** The purpose of this document is to set forth the protocols for conducting bird and bat studies at wind energy projects to provide information necessary for DEC to:
 - a. assess ongoing or expected environmental impact; and
 - b. make a recommendation to the SEQRA lead agency regarding the construction and operation of the project in order to avoid or minimize adverse environmental impact.

To perform such assessments and make a recommendation, DEC must consider information pertaining to the presence and activity of birds and bats at or in the vicinity of the site. In this context, *the site* means not only the real property boundaries or outline of proposed turbine locations on the ground, but includes the air space over and surrounding the project. One of the most effective means of reducing direct and indirect impacts to birds and bats is to site turbines in a location that will cause the least disturbance to migrating, breeding, wintering, roosting, and feeding birds and bats. It should be noted, however, that currently observed patterns of bat mortality at wind energy projects in eastern North America, especially for the migratory bat species, suggest that it may not be possible to greatly reduce the direct impact to bats by selective siting of turbines because turbines may, in fact, attract bats, perhaps from long distances. In addition to direct mortality caused by turbine blades, other negative effects from factors such as habitat loss or fragmentation, avoidance of otherwise potentially suitable habitat, increased human activity and development, and increased predator presence can result from the construction and operation of a wind energy project.

As wind energy development continues to expand throughout New York, more information is needed about the temporal and spatial use of habitats and the species composition of birds and bats using those habitats in order to relate wind energy production to its potential impacts. The recommendations for post-construction studies described in these guidelines are based on DEC's current knowledge of the best procedures for conducting thorough and meaningful post-construction mortality and displacement surveys at operating wind energy facilities in New York. As post-construction studies are conducted at more projects throughout the state over the next several years, these guidelines will be fine-tuned to incorporate the most efficient, effective and accurate methodologies to fill post-construction data needs. Figure 1 illustrates the steps described below for conducting pre- and post-construction studies.

2. **Site and Project Description**

A characterization of bird and bat resources includes documenting pertinent existing information, and collecting and analyzing additional data in the field on bird and bat use of the site and surrounding area. Few detailed studies have been conducted to date to gather site-specific data on where, when and how birds and bats use various habitats within the state. The study guidelines in this document are intended to provide a template for gathering such information and to aid DEC in assessing impact and making a recommendation to the lead agency.

a. *Compile existing information on bird and bat resources.*

Prior to expending significant effort in planning a wind energy project, the developer should compile existing information on bird and bat resources at the site, including available relevant information from other existing or proposed wind energy projects. The following sources should be consulted:

- i. The DEC Central Office Division of Environmental Permits and Division of Fish, Wildlife and Marine Resources should be the initial point of contact for information regarding the permitting and assessment process for wind energy development;
- ii. The New York Natural Heritage Program (NYNHP) should be contacted for information on state and federally listed species and sensitive ecological communities that may be located in or near the proposed project site;
- iii. Biologists in the DEC Regional office where the project is located should be contacted for available information on specific resources in the area of the proposed project site;
- iv. To the extent required by the US Fish and Wildlife Service (USFWS), information collected through the use of DEC's *Guidelines* should also be provided to the USFWS. The USFWS regional office should also be contacted for information on federally listed species that may be present within or near a proposed project;
- v. Local ornithologists, Audubon Societies, birding clubs, hawk watches and nature centers can provide specific information about bird and bat resources, as well as reference to data from Breeding Bird Surveys, Breeding Bird Atlases and Christmas Bird Counts;
- vi. DEC's mammal specialist in the Bureau of Wildlife Endangered Species Unit can provide site specific information regarding the proximity of major bat hibernacula and summer roosting areas, as well as information on technical research being conducted within New York, and;
- vii. Bat Conservation International can provide general information about bats and bat biology.

b. *Identify landscape features and resources of potential concern.*

The presence of certain landscape features and/or ecological resources at a site can increase the likelihood that adverse impacts to bird and bat resources will result from a proposed wind energy project. The developer should identify whether any of these features or resources are present at the site of the proposed project. Such features or resources of concern include:

- i. Habitat of a listed bird or bat species per 6 NYCRR Part 182 (e.g., species of special concern, threatened or endangered). The project sponsor should be aware that if a threatened or endangered species or habitat known to support listed species is present on-site and/or likely to be impacted by a project, the permit requirements of ECL Article 11-0535 may be applicable;
- ii. Proximity of the project (approximately 5 miles) to the Atlantic coastline,

- the shoreline of one of the Great Lakes, or the corridor of large rivers (e.g. the Hudson, St. Lawrence);
- iii. The presence of, or proximity to areas that concentrate raptors, waterfowl or other specifically identified species of concern for the site (approximately 2 miles), or a major bat hibernaculum (approximately 40 miles); and/or
 - iv. The presence of a specifically identified habitat or landscape feature that may function to funnel or concentrate birds during migration or for feeding, breeding, wintering, or roosting activities, such as National Wildlife Refuges, high elevation mountaintops, or ridgelines.

c. *Provide project information to DEC.*

Once existing information is compiled, the developer should meet with DEC to discuss an overview of the proposal, the bird and bat resources of potential concern, and the application of these guidelines to the environmental assessment of the project. DEC understands that some of the information requested below in part 2(c) i-viii may be undetermined, considered proprietary, or is likely to evolve as a project planning progresses, and may need to be submitted at a later time. To aid in project planning, the developer should prepare a complete description of the site prior to meeting with DEC, including:

- i. Description of the geographical, topographical and other physical features of the site and within 10 miles of the site, even if the proposed project is further than 5 miles from a shoreline or 2 miles from a raptor concentration area;
- ii. Identification of state and federal wetlands, waterbodies, and drainage patterns;
- iii. Location of contiguous forest areas, expanses of grassland, and wetland habitat located within the proposed project township and county;
- iv. Location of permanent meteorological (met) towers, a summary of local weather patterns (e.g., annual precipitation, prevailing winds), and a summary of the wind resource; and,
- v. Maps with vegetation types, soils/bedrock, land use, and other information relevant to siting the project.

Prior to submitting the study work plan, additional information regarding the proposed project should be provided including:

- vi. Maps of the proposed preliminary turbine layout;
- vii. Description of turbine type, size and rotor swept area;
- viii. Figures showing existing and proposed roads, transmission line routes, and substation location(s).

Data regarding proposed site development should be provided in the form of shapefiles, coverages, geodatabases, and/or geometric networks for use in Geographical Information Systems (GIS) software via ESRI's ArcGIS suite of software (e.g. ArcMap) including:

- ix. Polygon coverages/shapefiles for the total project area as well as any concrete and building structures proposed for construction;

- x. Line coverages/shapefiles/geometric networks for the transmission and interconnect lines as well as proposed temporary construction and maintenance roads;
- xi. Polygons of the proposed temporary construction and maintenance roads for assessing the overall impact of the road footprints; and,
- xii. Point coverages/shapefiles for any tower locations and/or any other structures that would be best represented as a point.

d. *Prepare to select and implement a standard or expanded pre-construction study protocol.*

Sites that contain, are within, or are in close proximity to the features or resources of concern listed in 2(b) above have the potential to cause unacceptable adverse impacts to bird and bat resources. Therefore, for such sites, project sponsors should anticipate a DEC recommendation to conduct expanded rather than standard pre- and post-construction studies to identify and quantify potential or actual impacts. In some cases, DEC may recommend against the project in the first instance. In particular, a proposal to site a wind energy project in proximity to an Indiana bat hibernaculum (40 miles), wildlife concentration area (2 miles), along a coastline (5 miles), or on a prominent ridgeline will result in a recommendation to conduct expanded pre-construction studies. In preparation for conducting either standard or expanded studies:

- i. Contact the DEC Bureau of Fish and Wildlife Services Special Licenses Unit regarding necessary licenses/permits for collection and possession of birds and bats, or special licenses to handle endangered species;
- ii. Contact the US Fish and Wildlife Service (USFWS) regarding Migratory Bird Treaty Act and Rare, Threatened and Endangered species collection permits;
- iii. Engage an experienced wildlife biologist or ecologist knowledgeable about New York state fauna, natural history and habitat requirements; and experienced in wildlife study and habitat assessment protocols.

3. **Study Objectives and Rationale**

The overall goal of the recommended studies is to determine the potential for a specific wind energy project to have an adverse impact on bird and bat resources by characterizing the use of the site and surrounding area by bird and bat species under a variety of environmental conditions throughout the year, and by estimating the mortality rate of birds and bats due to collisions and other effects associated with turbines. The effects of construction and operation on habitat and changes in wildlife use of the site will also be studied to determine any displacement or loss of species related to project operation. Data collected prior to construction can be compared to information collected in a similar manner after construction to determine what impact, if any, the project has on migrating and resident breeding and wintering birds and bats. With regard to migratory bats, the recommendations in this document may allow DEC to quantify the impact of wind power development on bat populations. Ultimately, information gained from pre- and post-construction studies will be used to identify mitigative measures that may be used to minimize direct and indirect impacts from project operation.

a. *Pre-construction studies*

The objectives of the pre-construction studies are to determine:

- i. To what extent the area of the proposed project is used by migrating, breeding, and wintering birds and bats and how the physical and biological features of the proposed site may influence such use; and,
- ii. The expected and potential impact to birds and bats as a result of using the site during operation of the project.

b. *Post-construction studies*

The objectives of the post-construction studies are:

- i. To estimate direct impacts of the operating project in terms of mortality rates of birds and bats caused by collisions or other effects of the turbines; and,
- ii. To document any indirect impacts of construction and operation in the form of habituation/avoidance behavior of birds and bats in the area.

c. *Bird Studies*

Migrating birds, particularly neo-tropical migrants, are sensitive to changes occurring across the landscape that alter the amount and quality of habitat available to them during migration. Many aspects of the biology, population structure, and ecology of these birds are poorly understood. In a general sense, the following is known:

- i. Most songbirds and many shorebirds and waterfowl migrate at night, while raptors move during the day;
- ii. The exact spatial and temporal distribution of this migration is affected by weather patterns, food availability, and geographic features;
- iii. Concentrations of species and individual birds vary with the habitat, season, and year;
- iv. Birds are much more physiologically vulnerable during migration than at other times of the year; and,
- v. The effects of human-caused habitat and landscape alterations are persistent over time.

Study methods for bird surveys include reconnaissance surveys, habitat surveys for sensitive/listed species, and radar. The radar surveys provide information on target passage rate, flight altitude, and flight direction. Acoustical monitoring of migratory birds can also be used to identify some species that vocalize in flight, and provide an estimate of flight height for these species. DEC will recommend a combination of some or all of these methods based on the specifics of the site, as each provides a different type and scope of information about the bird species utilizing the area.

d. *Bat studies*

At this time, the greatest concern is for the Indiana bat (*Myotis sodalis*), and the species that typically migrate--eastern red (*Lasiurus borealis*), hoary (*Lasiurus cinereus*), and silver-haired bats (*Lasionycteris noctivagans*). These species are likely to be exposed to multiple wind projects across much of their migration routes, and thus face the largest potential mortality.

Studies in eastern North America and in Canada have shown that these three migratory species comprise the majority of turbine-related bat mortalities. There is some evidence to suggest that pipistrelles are migratory as well. Migratory bats potentially occupy the landscape from April until the end of October, with the peak of movements occurring from mid-April until June, and from mid-July until early October.

It is not currently known if these bats migrate across a broad front, if they use migratory corridors, what the typical flight height is, or if their migration is affected by geographic features. If bats are reluctant to cross large bodies of water, then the shores of the Great Lakes are more likely to have concentrations of migrating bats at lower altitudes than other regions of the state. Methods used to determine passage rates of bats and to estimate the likelihood of collisions with turbines include mist netting, radar, thermal and/or light amplification imaging and acoustical monitoring. None of these methods provides definitive information and all have some drawbacks, although acoustical monitoring is the most widely used because of the relatively low cost, low commitment of staff time, the ability to distinguish between birds and bats, and the ability to identify most individual calls to species or species guild. A limitation of this method, however, is that it records only the number of calls detected, and does not give an estimated number of individuals of any bat species in the project area. Nevertheless, DEC recommendations include acoustical sampling, in conjunction with mist-netting and radio tracking where appropriate to gather information on bat presence and movements at a wind energy project.

4. **Standard Pre-construction Studies**

After compiling the site and project description and before commencing field studies, the developer should consult with DEC regarding the scope and specifics of pre-construction field studies at the site. A minimum of one year of pre-construction studies is recommended for all proposed wind energy projects. Additional years of study will be recommended if warranted by the results of initial on-site studies, or by the results of post-construction studies from other projects in the state.

a. *Weather conditions*

For all studies described in these guidelines (standard, expanded, pre- and post-construction) standard daily weather observations should be recorded any time field studies are being conducted. Weather information such as temperature, cloud cover, ceiling height, precipitation, wind speed and direction, and the timing of any cold or warm fronts passing through the area should be recorded on an hourly basis. Any additional weather information relevant to specific studies is identified in the individual study descriptions that follow.

b. *Habitat surveys*

Surveys should be undertaken at all sites to identify existing habitat for New York State or federally listed rare, threatened or endangered species or State species of special concern. If such habitat exists on or adjacent to the project area, additional surveys should be undertaken to determine if any such species are actually present on or near the site. Developers should consult with DEC to determine the methodology, scope and timing of habitat surveys for a given species.

Surveys should be seasonally appropriate for each of the listed target species, and their potential use of the area (e.g., summer for upland sandpiper, fall and spring for migrating golden eagles, and winter for short-eared owls).

c. *Raptor migration surveys*

Raptor migration surveys should be conducted from one or more prominent locations within the project area during spring and fall migration periods (March 1 to end of May; August 15 to December 1). The size and location of the proposed project will influence the number of survey points that DEC recommends. Observations should take place starting at 9:00am and continuing until two hours prior to sunset, or later if birds are continuing to move through the area. Surveys should be conducted on as many favorable weather days as possible during the migration periods, with surveys done at least once every seven days during each season. It may be important to evaluate the migratory passage of other raptor species at site-specific locations as determined during consultation with DEC. Information on the species, number of individuals, sex and age class (if possible), behavior, flight height and direction, time of sighting, and location of each bird relative to the project area should be recorded.

Concurrent with the information described above, observations of the movements of any other large flocks or individual birds (waterfowl, waders, corvids, icterids, swallows, etc.) should be recorded on a similar, separate data sheet. However, preference should be given to observing and recording data on raptors.

d. *Breeding and migrating bird surveys*

Songbird surveys should be conducted a minimum of once per week during the months of May, June, and September. These surveys should be done from first light until no later than 10:00am. Weather conditions should be conducive to hearing birdsong and seeing birds move about in vegetation and in flight. Excessively windy, rainy, or cold days should not be surveyed, as birds are not as active under these conditions. Observation points should be marked with GPS coordinates for future reference. All birds identified by sight or sound at each survey point should be recorded, though the focus should be on songbirds. Other species, including soaring raptors, waterfowl and other fly-overs, should also be counted and recorded. Depending on the size and habitat distribution of the project area, one or more transects should be walked with stops every 50 meters to record all species seen and heard during a 5 minute session. These surveys are intended to provide an estimate of the type and number of each species moving through the area in the spring and fall, and using habitat in the project area during nesting time. Conducting these surveys separately from the raptor migration surveys in the spring and fall will allow for more time and attention to be given to detecting songbird species that move through the project area but may not nest or winter there, and would therefore likely be missed during other types of migration surveys. The location, length, and number of songbird survey transects may vary for each project, and should be determined in consultation with DEC staff.

e. *Bat acoustical monitoring*

Movements of bats feeding in or passing through the site should be characterized using acoustical detectors. Detectors should be situated to sample as much of the rotor swept area as possible or at least 150 feet above ground surface. Wherever possible, detectors should be attached to existing meteorological (met) towers. At least two detectors sampling in a horizontal

plane should be installed at each sampling location, one as high on the met tower as possible and the other at two to three meters above the ground. If a third detector is available, it should be placed at the middle of the tower. Recording at all detectors should occur daily from one half hour prior to sunset until one half hour after sunrise between April 15 and October 15. Although some bats are likely to be still moving across the landscape after mid-October, acoustic sampling until the 15th of October should provide an adequate representation of the species composition, timing, and habitat use of bats within the project area.

Summer surveys should also include active acoustical sampling to determine which species are present on the site. This would entail one or more field investigators with a detector walking across the study area in a variety of habitats that are likely to contain bats, and recording what is present. Active sampling should be conducted on at least nine warm (>55 deg F), dry, and calm evenings between June 1 and July 10, starting at dusk and ending no earlier than 2:00 AM. The number and distance of transects to be traversed should be determined through consultation with DEC. Analysis of calls should include the criteria used for species identification and should be verified by a reputable, independent authority on bat vocalization.

5. **Expanded Pre-construction Studies**

If a developer proposes to construct a wind energy project in or near one of the features or resources of concern identified in section 2(b), then two to three years of pre-construction study will be recommended incorporating one or more of the following expanded pre-construction studies to provide in-depth information on the bird and bat resources of the site. Similarly, if post-construction study results from a wind energy project in a locale with similar physiographic or ecological features to the proposed project have shown that pre-construction predictions under-estimated the actual post-construction impacts, expanded pre-construction studies will be recommended.

a. *Radar studies*

DEC will request the use of remote sensing marine radar to determine the use of the project area by nocturnally migrating birds and bats. The radar should sample in both horizontal and vertical modes to collect information on target passage rate, flight height, direction, and speed. Radar units should be operated from sunset to sunrise April 15 to May 31 and August 15 to October 15. Data should be recorded in digital format. Nocturnal visual observations should be undertaken for a minimum of five minutes each hour during radar operation to estimate the proportion of birds and bats using the airspace immediately over or adjacent to the radar unit. Moon watching, spotlighting, and/or thermal imaging are the most commonly used methods. Consultation with DEC biologists is recommended to determine an appropriate location, duration, intensity, and time frame for these surveys. An analysis of NEXRAD data from one of the five radar stations in New York may provide information on mass movements of migrants relative to major nightly weather patterns. Only projects near the cities of Buffalo, Binghamton, Montague, Albany, or Brookhaven are able to utilize this type of information. As NEXRAD samples a portion of the airspace far above the highest turbine height, this method does not provide any kind of estimate for number of targets within the rotor swept zone or a likelihood of collision.

b. *Raptor migration surveys*

For projects proposed to be sited on a ridgeline, in a known raptor migration route (e.g. close to the shores of Lakes Erie and Ontario), or near an established spring or fall hawk watch, expanded raptor migration surveys will be recommended. In addition, if observations during a standard study detected migrating raptor species listed by the state or federal government as threatened or endangered, expanded raptor surveys will be recommended. Surveys should be conducted from one or more prominent locations within the project area during spring and fall migration periods (March 1 to end of May; August 15 to December 15). If standard surveys have already been conducted, expanded surveys should be done from the same observation point(s). If golden eagles are observed migrating through the project area, the fall observation period should extend through the end of December. Observations should take place starting at 9:00am and continuing until two hours prior to sunset, or later if birds are continuing to move through the area. Every favorable weather day should be surveyed during the migration periods.

Information on the species, number of individuals, sex and age class (if possible), behavior, flight height and direction, time of sighting, and location of each bird relative to the project area should be recorded. Consultation with DEC biologists is recommended to determine an appropriate survey time frame for target species.

c. *Waterfowl surveys*

Waterfowl surveys should be conducted if the project is in close proximity to a recognized major waterfowl concentration or migration area. Surveys should include both driving and static observations in a variety of seasons and weather conditions. Driving surveys consist of slowly driving roads throughout the project site and surrounding area at various times during the day to observe and record the species, numbers, and behavior of birds in wetlands, rivers, fields and other habitats. For static surveys, an observer is stationed for a designated period of time at a given location making the same observations as driving surveys. Multiple static survey points should be located throughout the project area. Consultation with DEC biologists is recommended to determine an appropriate location, duration, intensity, and time frame for these surveys.

d. *Breeding bird surveys*

Targeted breeding bird surveys for state or federally listed threatened or endangered species or species of concern should be conducted if the project is in close proximity to a wetland, grassland, forest or other habitat area that may harbor marsh birds, nightjars, owls, or other birds that would not easily be detected during a morning survey, either because they are not active during the morning or are not typically vocal. These surveys should incorporate playback of species-specific songs and calls and/or mobbing calls, and take place in the very early morning and/or in the evening hours until after sunset, depending on the target species. A number of points should be designated in appropriate habitat, where an observer should listen for calling birds before broadcasting a recording and listening again for a response. The number of individuals estimated to be present, the number of times and length of time each bird called during the survey period, the approximate distance from the observer, the habitat the bird is likely located in while calling, and other relevant information should be recorded. The details of specific timing, duration, and method of detection for these surveys would be site-specific and

dependant on the species involved. Consultation with DEC biologists is recommended to determine an appropriate location, duration, intensity, and time frame for these surveys.

e. *Wintering bird surveys*

Wintering bird surveys are recommended for projects that contain or are near a location known to harbor significant numbers of wintering birds, primarily focusing on but not limited to raptors. Particular attention should be paid to the presence of short-eared owls, snowy owls, northern harriers, bald eagles, and rough-legged hawks. Consultation with DEC biologists is recommended to determine appropriate location, duration, intensity, and time frame for these surveys.

f. *Expanded studies for Indiana bats*

If the project site contains habitat likely to harbor Indiana bats and is also within 40 miles of an Indiana bat hibernaculum, within a known summer range, or if there is other information to suggest that Indiana bats are present, DEC will recommend an expanded version of the standard acoustical monitoring to include an inventory of the actual number of Indiana bats in the area using such techniques as mist netting, radio tracking, and roost counts. The likelihood of bats from a maternity colony encountering a turbine diminishes as distance from the hibernaculum increases, with little chance of breeding bats encountering a turbine more than 40 miles away.

The following methodologies are based on the USFWS Indiana Bat Recovery Plan, however, developers are encouraged to consult with DEC to determine an appropriate location, duration, intensity, and time frame for these surveys:

- i. Between May 15 and August 15, bats should be captured in standard net sets, tagged and tracked to the roost;
- ii. At each roost, bats leaving the roost should be captured, banded and radio tagged;
- iii. This sequential tracking and netting process at each roost tree should be used to identify all of the maternity colonies in the project area;
- iv. Concurrent exit counts of all bats leaving the identified roosts should be conducted to provide an estimate of the number of individual bats in the project area; and,
- v. Exit counts of radio-tagged bats from each roost should be conducted on nights with sunset temperatures greater than 55 degrees F^o over the duration of the transmitter's life (generally less than 20 days).

g. *Expanded studies for migratory bats*

The primary concern for red, hoary, and silver-haired bats is that they are being killed in numbers far larger than might be expected based on their relative rarity on the landscape. Additionally, a compounded potential for mortality exists as bats move seasonally through the many proposed turbine fields in eastern North America. Recommendations for monitoring and surveying these bats in expanded study situations include enhanced acoustical monitoring, radio telemetry surveys, and intensive post-construction mortality monitoring. As methodologies for studying migratory bat use of an area are currently not fully defined, the developer of a wind project where these bats are known to occur should consult with DEC for information on site-

specific recommended protocols. In addition, developers are asked to participate in the additional field collections outlined in Appendix A for region-wide bat mortality studies.

6. **Standard Post-construction Studies**

The developer should conduct post-construction studies to evaluate actual impacts to birds and bats at the project site during turbine operation. Standard post-construction studies include mortality surveys, bird habituation and avoidance studies, and bat acoustical monitoring. DEC will evaluate the data from the first year of study to determine any changes to protocols that may become necessary after analysis and review of the initial data. The developer must coordinate with landowners to ensure DEC staff and its agents have full access to the site over the life of the project.

a. *Ground Searches*

Ground searches for bird and bat carcasses should be conducted under turbines at operating wind projects for a minimum of three years. For small projects (10 or fewer turbines), all turbines should be searched daily. At larger projects (more than 10 turbines) at least 33% of the total number of turbines should be included in the ground searches. All collection/possession permits need to be obtained at the state and federal level prior to the commencement of searches. Should a state or federally listed species be found dead or injured either during a regular survey period or incidentally, DEC and USFWS, respectively, are to be notified within 48 hours for direction on how to proceed with handling the animal.

- i. Turbine searches - A standard turbine-searching pattern should be designed such that ten turbines or one third of the total number of turbines in the study (whichever is greater) are searched daily, and the remainder of the total number of turbines in the study are searched weekly from April 15 to November 15 during the first and second year after the entire project becomes operational. Whether the third year of study is done in sequence or postponed to a later year (e.g., the fifth) will be determined following analysis of data from the first and second years. Should the wind project expand to include more turbines, the number and location of turbines in the search pattern will be altered accordingly.
- ii. Area to be searched - The area to be searched beneath each turbine should be no less than 1.5 times the rotor diameter. Although plot size will be dependent on specific turbine height and rotor diameter, 120 meters by 120 meters or 130 meters by 130 meters is likely to be adequate for most modern turbines currently being used in New York. Transects should be approximately five (5) meters apart, allowing for a visual search area of 2.5 meters on either side of the centerline. These distances may vary slightly from one site to another, due to varying ground conditions.
- iii. Ground cover - The type and amount of ground cover under each turbine should be recorded every day that searches occur. Vegetation growth, crop harvesting and other changes in the substrate could greatly alter the

efficiency of carcass recovery. Mowing and/or brush-hogging some or all of the search plots, each in their entirety, is recommended to increase searcher efficiency and provide a relatively consistent ground cover throughout the study area and between projects. Mowing should take place as often as necessary to maintain vegetation height suitable for seeing small, dark, potentially wet carcasses at a distance of 2.5 meters. Early notification to and coordination with landowners holding study turbines is essential to ensure an agreement can be made that will be satisfactory to all parties.

- iv. Search conditions - Searches should begin as close to sunrise as possible. Overnight weather conditions greatly affect the number of animals that will fly and how they are distributed in the airspace, and thus their exposure to turbine blades. The standard weather data collection noted in section 4(a) need only be collected on a daily basis for ground searches.

- v. Photographs - Digital photographs should be taken of each carcass found. At least one picture of each carcass should include a ruler or other standard item used for scale. These photos, along with all field data information described above, should be sent with the final report for DEC verification of species identification. At a minimum, documentation for each carcass should include photos showing:
 - (1) the position in which it was found;
 - (2) the dorsal and ventral sides;
 - (3) photos that indicate the gender and reproductive condition of bats (if possible);
 - (4) any identifying characteristics such as bill, foot, wing or tail shape, and plumage coloration for birds.

- vi. Data collection - The following data should be recorded for each carcass found:
 - (1) date, time, and turbine number;
 - (2) location on plot marked with GPS coordinates;
 - (3) distance and cardinal direction from turbine;
 - (4) distance and bearing from transect from which it was first spotted;
 - (5) condition of carcass (whole or partial, extent of injury and some measure of decomposition to estimate time of death);
 - (6) position of carcass (face-up/down, sprawled, balled up, etc);
 - (7) species, age and sex, if determinable;
 - (8) substrate conditions when found (gravel, short/long grass, crops, brush, etc);
 - (9) identification of searcher/collector;
 - (10) for all carcasses found incidentally (associated with a turbine outside of the study area, under a study turbine during non-survey

times, or by someone other than a trained searcher), as much information as possible from 1-9 above should be recorded, and the carcasses labeled and stored in the same manner as a study carcass, with a marker identifying it as an incidental find.

b. *Searcher efficiency and carcass removal trials*

To accurately estimate mortality rates, searcher efficiency tests and scavenger removal tests should be conducted at least monthly throughout the study period for each year of post-construction monitoring, using carcasses of various sizes and species that breed and migrate through the project area. Factors such as ground topography, vegetation cover, current weather conditions, searcher experience and fatigue level, and scavenging rates all affect the overall efficiency of carcass detection for a given project area. Searcher efficiency trials should be conducted to estimate search accuracy, and should take place unbeknownst to the searcher(s). Recovery rates should be calculated separately for bats and small, medium, large and all birds combined. Methodologies for this type of study will evolve as new information is gathered, and specifics on data-gathering techniques will be updated and posted on the NYSDEC website. The following process for conducting the trials is recommended:

- i. Carcass placement - A project manager should place bird and bat carcasses throughout the search areas under various turbines representing different types of ground cover early in the morning that a trial is to occur. The project manager should record the location of each carcass within the study area, and any not found by the searchers should be removed at the completion of the trial. Carcasses should be discreetly marked with a non-reflective material to identify them as test animals. If enough bat carcasses are not readily available, fresh brown mice may be used as a surrogate for searcher efficiency trials.
- ii. Carcass recovery - Information collected on trial carcasses should be identical to all non-test carcasses as outlined in section 6(a)(vi). The number of test carcasses recovered and the accuracy of data recorded will be determined for each searcher, and an efficiency rate calculated for each trial conducted throughout the course of the study.
- iii. Carcass removal trials - Most mammalian and avian scavengers quickly recognize easy food sources, can readily incorporate wind farms in their daily routes, and are often active at pre-dawn hours. Insect scavengers are active mostly in warmer months, and in some cases can drastically deteriorate a carcass in a matter of hours. Carcass removal trials should continue throughout post-construction monitoring, as scavenging rates change in response to a steady source of food.
- iv. Number and condition of carcasses - Carcasses should be as fresh as possible, since long-frozen carcasses are much more difficult to find and are far less attractive to scavengers. The number of carcasses used should not cause an excessive attraction to bring scavengers into the area. Carcasses should be placed in a variety of habitats and checked daily for the first week, and every two days thereafter until the carcass disappears (due to scavenging or decomposition). On each check, the location and

condition of the carcass should be recorded to determine if any scavenging has occurred. Any tracks, scat, marks, or other signs that may indicate the type of scavenger should be noted. Scavenging rates for each season and habitat type in the project area will be calculated.

c. *Bird habituation and avoidance studies*

The pre-construction Breeding and Migrating Bird Surveys should be repeated during the first and second years after the full project is operational. A third year of study should be conducted on the third, fourth or fifth year of project operation as determined through consultation with DEC. Post-construction survey transects, points, and methods should be as close as possible to those used during pre-construction surveys. At pre-construction sample locations that become actual turbine sites, surveys should, to the greatest extent possible, take place during a period when turbine noise does not interfere with the observer's ability to hear, see, and record birds. Any land use or habitat changes that may have occurred since pre-construction or the previous post-construction survey was conducted should be noted, as this could potentially alter the bird species composition and density within the project area. Information from this post-construction survey is intended to be comparable to pre-construction surveys, and will examine whether the wind project is having any effect on bird use of the site during breeding and migration periods, and whether habituation or avoidance is occurring.

d. *Bat Acoustical sampling*

Conduct standard bat acoustical monitoring concurrently with ground searches for as many years as mortality surveys are done. The same methods and time frames as outlined in section 4(e) and/or 5(f) and 5(g) should be used for summer resident and migratory bat surveys, or as recommended by DEC.

7. **Expanded Post-construction Studies**

For wind energy projects constructed in or near one of the identified features or resources of concern, expanded post-construction monitoring studies will be recommended to provide in-depth information on the impacts to bird and bat resources of the site.

a. *Radar surveys*

If radar studies during pre-construction surveys showed high passage rates, low flight altitudes, or if other unanticipated conditions were observed, then a radar survey will be recommended during the first year of post-construction mortality surveys. The use of radar during subsequent years of post-construction surveys will be contingent on the results of the first year of post-construction study. For any project where post-construction monitoring reveals a higher than expected level of mortality based on pre-construction data and analysis, the use of radar will be recommended for the following year of study regardless of whether radar studies were conducted during pre-construction studies.

b. *Raptor migration surveys*

Raptor surveys should be repeated during at least the first year of post-construction operation if expanded raptor surveys were conducted during pre-construction surveys, or if the

results of post-construction studies from other projects estimate impacts to raptors that are not consistent with pre-construction expectations. Raptor migration surveys should be done using the methods described under the expanded pre-construction survey section 5(b), or as recommended by DEC staff.

8. **Planning and Reporting**

a. *Work Plans*

After discussions with DEC staff regarding application of these guidelines to a particular site, the developer should submit a draft work plan incorporating the recommended elements for study at the site. The work plan should include the site description and project layout provided for the initial consultation with staff. Pre-construction work plans should be discussed with and accepted by DEC before implementation of the proposed work. A comprehensive post-construction study plan should be developed and submitted to DEC for review and acceptance prior to completion of project construction, and all work should be conducted in close consultation with DEC. Developers should work closely with DEC to provide a work plan detailing the search regime, bias corrections, bat acoustical monitoring, bird displacement/habituation surveys, reporting techniques, and other aspects of a project's post-construction mortality study.

b. *Reports*

After completion of the recommended studies, the developer should prepare a report presenting the results. A description of the proposed project should be provided including maps of the proposed turbine layout, existing and proposed roads, transmission line routes, substation location, topography, and state and federal wetlands. A composite map containing all project and study information (turbine locations, raptor observation points, BBS points, radar unit location (if applicable), wintering bird and waterfowl survey points/routes, and habitat types) should be provided. The preferred format for reporting is as follows:

- i. Habitat surveys: The habitat survey report should describe the types of habitat found on site, including the location and identity of any invasive species, and whether there are potentially any state and/or federally listed species that could be associated with each habitat type. The report should also include the results of listed species presence/absence surveys. A map of habitat locations (grassland, forest, shrub, wetland, etc.) within and near the project area should be provided, including the locations of habitat suitable for any listed species, as well as the locations of any actual observations made of listed species.
- ii. Breeding and migrating bird surveys : The breeding and migrating bird survey report should identify the location and length of each transect, the number and location of survey points, survey dates, the time and duration of surveys at each point, the number of species, and the number of individuals of each species identified at each transect point survey. A summary should include the number and behavior of birds seen (e.g. individual, moving in a small flock, feeding, resting, etc.), the number of

species observed overall, species seen or heard most frequently throughout the study, point(s) with the greatest number of species, and habitat type(s) with the highest and lowest species diversity and abundance. The report should also include maps, tables and graphs reporting the location of each survey point and its relation to the proposed/existing turbine locations, any disruptions and/or distractions that occurred during each sampling period that may have precluded an adequate survey, and GPS coordinates of each point. Weather conditions during and immediately prior to survey days, a list of all species with the dates and points where they were observed, and the number and identification of observer(s) conducting each survey should also be provided.

- iii. Raptor migration survey: The report should identify the number of observation point(s), the dates and times surveys were conducted, the number of species observed overall, the number of individuals of each species observed on each survey, species seen most frequently during the survey, the average and median flight height and direction of each species, and any notable behavior. The following information should also be included in the main report or as an appendix: the duration of each survey, the number and identification of observer(s) conducting each survey, a table containing an hourly breakdown of each survey day with information on weather conditions and any disruptions and/or distractions that occurred during each hour that may have precluded an adequate survey, the species composition, flight height and direction of each bird, a map with the observation point location(s) and overall mean flight paths over and adjacent to the project area.
- iv. Radar studies: For each migration season, report the dates, total number of days, and number of hours per night that surveys took place; the radar unit location, elevation and surrounding vegetation/topography; the elevation and total height of the proposed turbines; and mean and median target flight height, direction, passage rate in targets/km/hr, and percentage of targets detected below the maximum height of the proposed turbines. The report should also include tables and graphs reporting the times and number of hours actually sampled each night in both horizontal and vertical modes, hourly weather information (particularly wind speed and direction, percent cloud cover, ceiling height, and the presence of fog and/or precipitation), a picture from both the horizontal and vertical screen views indicating the location and amount of ground clutter surrounding the sampling area, mean and median hourly flight heights, direction, passage rate and percentage of birds and bats below the proposed turbine height. The evaluation of results should also report the type of equipment, including capabilities, limitations, and settings used for all equipment, as well as the amount of down time, failures, or suspected malfunctions that may have occurred during the survey periods. All equipment performance

data should be reported to better assess the efficiency and accuracy of the units being used at each location.

- v. Wintering bird surveys: The report should include the number of survey points and routes surveyed, dates surveys were conducted, the duration and time of surveys at each point/location, any disruptions and/or distractions that occurred during each survey that may have precluded an adequate collection of data, the number of species observed overall, the number of individuals of each species observed on each survey, whether birds were identified visually or via vocalizations, the species seen most frequently throughout the study, the point(s) with the greatest number of species, and the survey locations with the highest and lowest species diversity and abundance. Also included in the main report or as an appendix should be a description of the behavior (feeding, perching, soaring, flocking, etc.) of the birds observed and the habitat they occupied, along with a map showing the locations of the sightings relative to proposed/existing turbine locations and from the survey points/driving route, weather conditions during and immediately prior to survey days, a list of all species with the dates and points where they were observed, and the number and identification of observer(s) conducting each survey.
- vi. Waterfowl surveys: The static survey report should include the number of survey points, dates surveys were conducted, the duration and time of surveys at each point, any disruptions and/or distractions that occurred during each survey that may have precluded an adequate collection of data, the number of species observed overall, the number of individuals of each species observed on each survey, whether birds were identified visually or via vocalizations, the species seen most frequently throughout the study, the point(s) with the greatest number of species, and the locations/habitat type (open water, river, marsh, agricultural field, etc.) with the highest and lowest species diversity and abundance. The driving survey report should include the same information provided for the static surveys, as well as the roads/areas that were driven/surveyed, and the type and number of species observed and their approximate location on the route. Behavior of individual birds and flocks seen should be noted (feeding, resting, flying, etc.), as well as any movements of birds within or across the project area. Also included in the main report or as an appendix should be maps, tables and/or graphs reporting the location of each survey point/route in relation to proposed/existing turbine locations, weather conditions during and immediately prior to survey days, a list of all species with the dates and points where they were observed, and the number and identification of observer(s) conducting each survey.
- vii. Bat acoustical surveys: All acoustical data should be recorded and archived for quality control and to verify the identification of calls. A

table depicting calls from each detector should be organized by species (including any unidentified calls) indicating the number of calls by date and by hour. A total number of calls per detector-night should be reported for the spring, summer, and fall seasons. The habitat in the immediate area of the detectors and the broader landscape habitat should be described. The report should identify the type of detectors, the settings used, and performance data for each detector, its height above the ground, and the orientation (noting changes, if any) during the course of the study. Include a description of the performance of each piece of equipment as it is configured for field data collection (sensitivity setting, housing, etc.) in order to determine the variability in detection based on species, and the distance from the target. Determine the reception range of all equipment used so as to identify variations between units and the variation between sensitivity settings used during the study. This should be described using a common metric (maximum detection range of each unit of a signal generated at a fixed DB at 20, 30 and 40 khz). The individual(s) and/or company/organization(s) conducting the identification of bat call sequences should be identified. The location, length of, dates, and times that each active survey was conducted should be reported, including weather conditions the day prior to and the night of surveys. Call data collected during active sampling should be reported in the same manner as but separately from that collected at the stationary detectors. Any hours and/or days that any detector is non-functional during the study period should be reported, along with the suspected reason for the malfunction. A map indicating the location of met towers with detectors, routes/points used during active surveys, and any other locations at which acoustical detectors were placed should be included in the report or as an appendix.

- viii. Indiana and migratory bat surveys: If studies targeting Indiana, red, hoary, or silver-haired bats were conducted for a proposed wind project, the following information should be reported: the dates, locations, number of net hours, height, configuration and total number of nets used during all mist-netting efforts; the total number of each species caught; relevant banding information (band number, age, sex, reproductive condition, general disposition, etc.) for each bat; weather conditions the day prior to and the night of surveys; whether a radio transmitter was placed on an individual; detailed information on the movements of each bat tracked, including dates, distance, and direction traveled each night, roost trees used, habitats traversed, and other relevant data; the total number and locations of all roost trees found; the dates roost exit counts were conducted and the number of individuals detected during each count; the fate, if determinable during the life of the transmitter, of each bat tracked; the results of any acoustical monitoring that may have been done, reported as described above; and any other information pertinent to the study effort.

- ix. Mortality studies: An interim progress report should be submitted to DEC no later than mid-July summarizing the post-construction survey results from spring and early summer of that year. This report should include at least the number and species of birds and bats found, the turbine number each was found at, the date each animal was found, and a review of the number of searcher efficiency and carcass removal trials conducted to date. The interim report is not intended to be an exhaustive analysis of methods, results and estimates. A final report, to be submitted by January 31 following the November ending the study period, should include details of the post construction mortality studies including the results of the ground searches with: the number of turbines searched and the frequency of searches (daily, weekly etc.); habitat type surrounding each turbine; table of how many birds and bats were found beneath each turbine; size class of carcass (small or large bat, small, medium or large bird); the dates found and condition of each carcass; photographs of all carcasses found; daily weather conditions prior to and during each search; and the number of people, conducting each survey. Results of the searcher efficiency tests and scavenger removal study should also be presented. The estimated searcher efficiency should be reported by carcass size, ground cover type, and season for each searcher. Estimated scavenging rate should be reported for each carcass size, habitat type, and season. This should include the types of scavengers present on site (avian, mammalian, insect) and the frequency at which each occurs. All statistical methodologies should be fully explained and justified. Estimates should be made of overall mortality during the study period on a per turbine, per megawatt rated, per megawatt produced, and per rotor swept area for bats and birds (including small, medium and large birds, and all birds together). These estimates should take into account the searcher efficiency rate, scavenger removal rate, the overall search plot size, and the number of birds and bats estimated to have fallen outside of the search plot.
- x. Other post-construction surveys: Either inclusive with the mortality report, or as a separate document, information on the post-construction bat acoustical surveys, bird habituation/avoidance study, raptor migration surveys, and/or radar surveys should be reported as described above for pre-construction surveys, with the following additions: specific avoidance behavior of flying birds and/or bats observed near turbines; and any other information relevant to how birds and bats are using or avoiding the operating project area, especially with respect to the level of habitat restoration that has occurred at the time.

9. **Sources of Information**

Arnett, E.B., *et al.* 2008. Patterns of fatality of bats at wind energy facilities in North America.

Journal of Wildlife Management. 72:61–78.

Audubon of New York Christmas Bird Counts
<http://www.audubon.org/chapter/ny/ny/christmas.html>

Audubon of New York Important Bird Areas
http://www.audubon.org/chapter/ny/ny/IBA_new.htm

Audubon of New York Local Chapters
<http://www.audubon.org/states/index.php?state=NY>

Audubon/Cornell New York e-bird
ebird.org/content/ny

Bat Conservation International
<http://www.batcon.org/home/default.asp>

Bat genomic and stable isotope study information
<http://research.amnh.org/mammalogy/batgenetics/>

Clemson University RADAR Ornithological Laboratory
<http://virtual.clemson.edu/groups/birdrad/>

Hawk Migration Association of North America
<http://www.hmana.org/sitesel>

Indiana Bat Recovery Plan
<http://ecos.fws.gov/speciesProfile/SpeciesReport.do?sPCODE=A000>

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. *Frontiers in Ecology and the Environment*. 5:315–324.

Kunz, T.H., E. B. Arnett, B. M. Cooper, W. P. Erickson, R. P. Larkin, T. Mabee, M. L. Morrison, M. D. Strickland, J. M. Szewczak. 2007. Assessing impacts of wind-energy development on nocturnally active birds and bats: a guidance document. *Journal of Wildlife Management*. 71(8):2449-2486.

North American Bird Conservation Initiative
<http://www.nabci-us.org/main2.html>

New York Audubon
ny.audubon.org/birdsci_ibas.html

New York Natural Heritage Program
<http://www.dec.state.ny.us/website/dfwmr/heritage/>

New York Renewable Portfolio Standard
<http://www.nyserda.org/rps/default.asp>

NYSDEC Breeding Bird Atlas
<http://www.dec.ny.gov/animals/7312.html>

NYSDEC Division of Environmental Permits
<http://www.dec.ny.gov/about/642.html>

NYSDEC Division of Fish, Wildlife and Marine Resources
<http://www.dec.ny.gov/about/634.html>

NYSDEC Endangered Species Unit
Alan Hicks (bats) 518-402-8854 and Barbara Loucks (birds) 518-402-8863
<http://www.dec.state.ny.us/website/dfwmr/wildlife/endspec/>

NYSDEC Regional Office Information
<http://www.dec.ny.gov/about/255.html>

NYSDEC Special Licenses Unit
Collect and Possess: <http://www.dec.ny.gov/permits/28633.html>
Endangered Species: <http://www.dec.ny.gov/permits/25012.html>

NYSDEC State Listed Species Information
<http://www.dec.ny.gov/animals/7494.html>

NYSDEC Wind Energy Information
<http://www.dec.ny.gov/energy/40966.html>

USFWS Federally Listed Species Information
www.fws.gov/northeast/nyfo/es/section7.htm

USFWS Indiana Bat Recovery Plan
<http://www.fws.gov/midwest/endangered/mammals/inba/index.html>

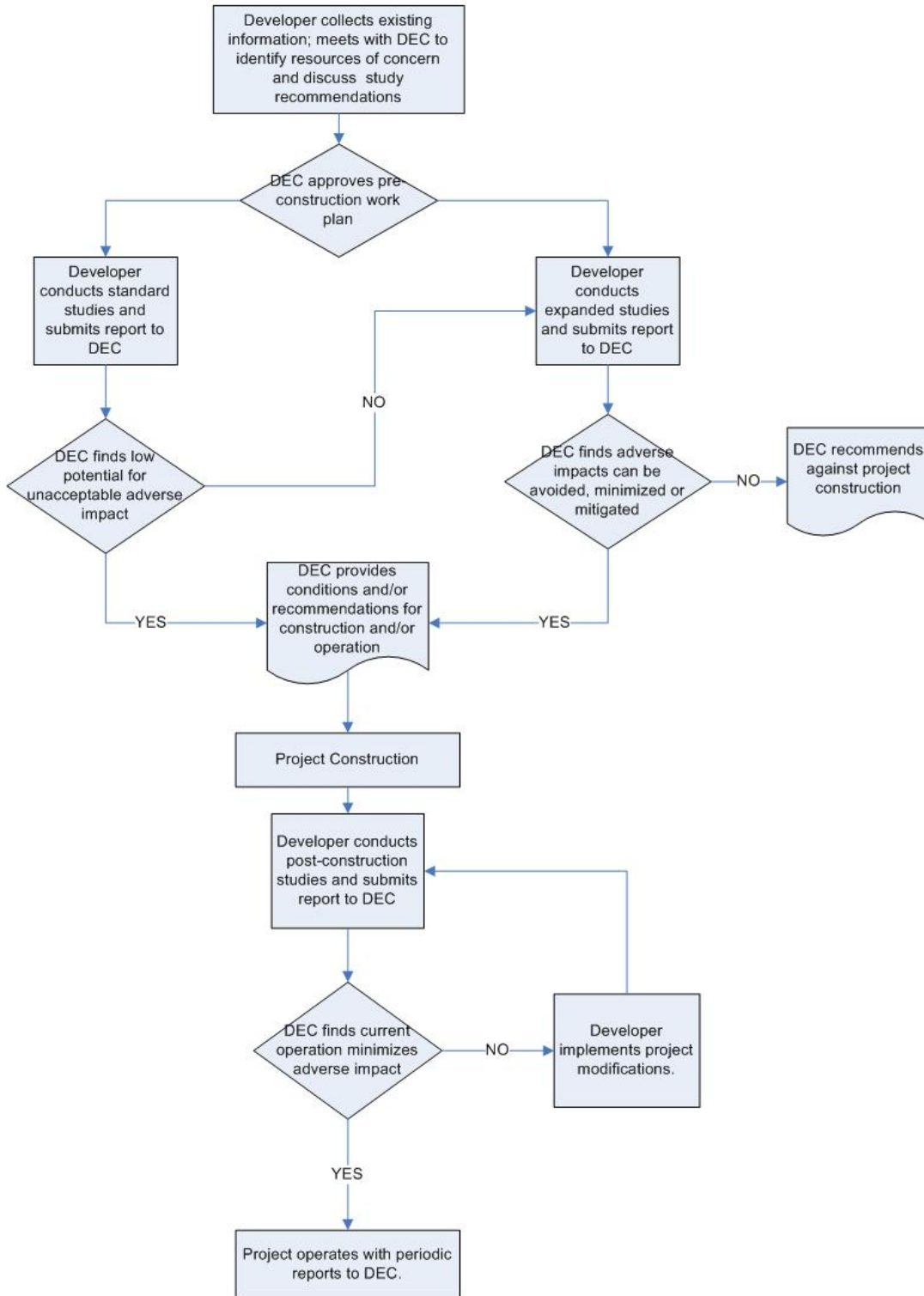
USFWS Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines
www.fws.gov/habitatconservation/wind.pdf

USFWS Migratory Bird Treaty Act Collection Permit
<http://www.fws.gov/forms/3-200-7.pdf>

White-Nose Syndrome Information
http://www.fws.gov/northeast/white_nose.html

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Figure 1. Process for Conducting Bird and Bat Studies at Wind Energy Projects



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APPENDIX A

Additional Collections for Voluntary Participation in Region-wide Bat Mortality Studies

Bat specimen collection for White Nose Syndrome

In light of the White-Nose Syndrome (WNS) affecting bats throughout New York and the northeast, DEC is requesting samples from every individual bat found during post-construction surveys, either incidentally or during scheduled searches, to be submitted for testing for WNS. It will not likely be necessary to send all entire animals, as some hair and tissue samples may be properly collected in the field. At the time of this writing, a specific protocol has not yet been established with respect to the number of whole bats needed from each site, exact methods for collecting, storing, and transporting carcasses/samples, and where collections should be sent. Wind energy projects are currently the only reliable source for carcasses of red, hoary, and silver-haired bats. No information has been gathered to determine if these species have been impacted by WNS, as they do not winter in caves, and little is known about their breeding habits. As developments in this area of bat research and conservation move forward, more information will become available. Project sponsors are asked to contact DEC prior to the start of their first post-construction survey to receive the most up-to-date information regarding contributing to research on WNS in New York.

Genetic Isotope Analysis Project

As a means of assessing the population size and geographic origin of individual bats in New York and throughout the northeast, a regional bat mortality and genetic isotope analysis project is being implemented by a consortium of bat experts and resource agencies. The American Museum of Natural History (AMNH) is coordinating this effort. The study will initially focus on the three bat species that appear most vulnerable to wind turbine-caused mortalities. These are the red (*Lasiurus borealis*) hoary (*Lasiurus cinereus*) and silver-haired bats (*Lasionycteris noctivagans*). Gathering information on these species in areas where turbines do and do not exist will help determine if there are unique geographic population segments that should be of regional conservation concern. Each wind developer is being asked to participate in this study as follows:

- a. During post-construction mortality surveys, collect a minimum of 10 carcasses of each of the three migratory bat species over the duration of fall and spring migration for every year that ground searches are done at the project;
- b. Provide hair/tissue samples and/or entire animals to the AMNH, as directed by their protocol, and;
- c. Discuss with AMNH the costs associated with the collection, field processing and analysis of specimens

Reporting

Either inclusive with the mortality report for post-construction surveys described in the Guidelines, or as a separate document, participants should report the number and species of bats (or samples) submitted for White-nose Syndrome testing or to the AMNH for genetic and stable isotope testing.