

PENNSYLVANIA GAME COMMISSION  
WIND ENERGY VOLUNTARY COOPERATION AGREEMENT  
AMENDMENT I

July 26, 2013

The Pennsylvania Game Commission (Commission) seeks to coordinate wind energy projects with wind energy developers (Cooperator) in order to work collaboratively to ensure that wind-energy development project sites are developed in both an environmentally conscientious manner and with best regard to the conservation of the Commonwealth's wildlife resources.

Whereas, the Commission under its jurisdiction from Title 34 (Game and Wildlife Code) has authority to avoid, propagate, manage and preserve the game or wildlife of this Commonwealth and to enforce, by proper actions and proceedings, the laws of this Commonwealth relating thereto.

Whereas, both the Commission and Cooperator support renewable energy initiatives and are dedicated to arriving at uniform guidance, in the absence of comprehensive state regulations, on how best to avoid, minimize, and/or potentially mitigate adverse impacts to wildlife resources.

Whereas, the Commission and Cooperator, in an effort to best avoid, minimize, and/or mitigate potential adverse impacts with specific intent to birds and mammals, have entered into this Cooperative Agreement in an effort to standardize wildlife monitoring protocols and wildlife impact review methods associated with wind-energy development projects in a mutually beneficial and flexible manner and with high regard to both parties goals, objectives, and purviews.

Therefore, the Commission and Cooperator enter into this Cooperative Agreement and agree as follows:

1. The Cooperator will notify the Commission of any potential wind energy development sites (or an expansion of an existing site with the addition of 5 or more turbines), at least fourteen months prior to construction. The notification prior to the initiation of construction at the site will allow the Commission to provide as much known information on bird and mammal resources which may be present and/or potentially impacted by the development of the proposed wind-

energy project. The notification should include a brief narrative of the project's planned development and proposed construction times and include as much detailed information as available such as: ArcGIS shapefiles depicting the proposed project area boundary, the proposed project site's general infrastructure delineations (both known and planned) to include access roads, electric transmission lines, wind turbine locations, planned surface impact areas, development and future maintenance of the project, and any known wetland areas or predetermined wildlife habitat regimes which are deemed to be of critical importance or high value.

For those projects, which the Cooperator has already initiated prior to the effective date of this agreement the Cooperator shall submit the required information within ninety days (90) from the date of this agreement.

For all other projects, which are currently under construction prior to the date of this agreement, the Cooperator shall only be required to comply with the monitoring efforts within Paragraph 6 *iii* (post-construction bird & bat mortality) as contained herein. All other paragraphs, provisions, terms and conditions, which are not inconsistent to the above, shall remain in full force and effect.

2. It is understood between the Cooperator and Commission that both parties may support the use of other potential funding mechanisms or processes which directly or indirectly reduce the overall costs associated with the Cooperator's monitoring requirements as identified herein providing further the intent of those monitoring requirements remain the same.
3. The Commission and Cooperator will share all relevant information concerning wildlife resources under the jurisdiction of the Commission in and around the project area and the potential adverse impact to those resources. Shared information will include all known publicly available data from past/current/future monitoring efforts and pre and post-construction study results relative to the subject project area. The Commission further agrees to consider all existing relevant wildlife resource information provided by the Cooperator and the Commission will reduce to the fullest extent possible any further requests made to the Cooperator to provide additional relevant data

and/or monitoring results which can be ascertained from known existing data regarding potential known wildlife impacts.

4. The Commission will provide the Cooperator with the results of all its internal reviews and provide written comment and or meet with the Cooperator within 45 days of receiving the information specified in Paragraph 1, as well as the results of the Pennsylvania Natural Diversity Inventory, and all pre and post-monitoring methods and recommendations on how best to avoid and reduce direct and indirect impacts to birds and mammals. Additional coordination will occur from the Commission for actions needed in regards to species listed in Pennsylvania's Wildlife Action Plan (WAP) to include all state threatened and endangered bird and mammal species known to occur or determined to exist within or adjacent to the project area.
5. The Commission in consultation with the Cooperator will determine the risk level for monitoring and survey efforts. If needed, the risk level may be adjusted based on new relevant information. The Commission may request the Cooperator conduct an additional year's post-construction monitoring if a T&E species is killed or other mortality is deemed to be at an unacceptable level for any species. If the purpose of subsequent years of mortality monitoring is to validate the effectiveness of minimization efforts, as such alternative monitoring methods may be appropriate. Cooperators should coordinate with the Commission prior to commencing subsequent years of mortality monitoring.

Bat populations in the United States are generally not well understood. The emergence of white-nose syndrome in the Eastern United States and Canada elevated concerns of bat populations due to the dramatic decrease in cave dwelling bats. In addition to white-nose syndrome, bat species are subjected to cumulative effects such as industrial development, timber and agriculture practices, loss of habitat, human interactions, as well as predation by non-native species.

To address concerns regarding cumulative impacts to bats and in an effort to provide protection for bats, Cooperators and the Commission developed mutually agreeable consultation points for wind sites in Pennsylvania. Operational facilities have limitations such as old

turbine technology and contractual obligations that may prohibit the implementation of some types of minimization efforts. However, developing projects do not have such limitations and thus have the ability to incorporate the necessary measures to implement minimization efforts into the project design. Therefore, developing projects will be held to a higher standard regarding minimizing bat mortality, than facilities already in operation. Details of these minimization efforts are found below and also in Exhibit B.

**i. Operating Projects** - Operating Projects shall be defined as all wind energy projects that have achieved commercial operation in accordance with PJM Interconnection rules prior to January 1, 2013; and all wind energy projects that achieve commercial operation in accordance with PJM Interconnection rules on or after January 1, 2013 and also qualify for the federal production tax credit under the extension of said program in the American Taxpayer Relief Act of 2012.

1. A Cooperator with an Operating Project will arrange a consultation meeting with the Commission within sixty (60) days following either; (a.) the execution of this Amendment to the Agreement if bat fatalities at the Operating Project are greater than thirty (30) bats per turbine per year, as determined by the most recent annual post-construction fatality monitoring performed by the Cooperator prior to the execution of this Amendment and in adherence to Exhibit C of the Agreement or; (b.) the submittal of the most recent year of fatality monitoring data showing the bat fatalities at the Operating Project are greater than thirty (30) bats per turbine per year as determined by the post-construction fatality monitoring performed by the Cooperator in adherence to Exhibit C of the Agreement. If the Operating Project has post-construction fatality monitoring ongoing at the time of execution of this Amendment to the Agreement and said fatality monitoring is in adherence to Exhibit C of the Agreement, the results of that ongoing post-construction fatality monitoring shall be considered the most recent year of fatality monitoring data on which the need for the Cooperator to consult with the Commission shall be determined.

2. The purpose of the consultation is to discuss project impacts, consider bat minimization efforts, and discuss the implementation of voluntary measures to address bat fatalities. The Cooperator and Commission agree to consider all options that are reasonable and proven scientifically effective and shall include all relevant factors including, but not limited to, project specific conditions, turbine technology, operational impacts, financial impacts and contractual impacts on the Operating Project.

**ii. Developing Projects -** In order to provide protection for bats while providing planning and financial certainty to the Cooperator, all Developing Projects may be subject to minimization measures based on results of post-construction monitoring performed by the Cooperator in adherence to Exhibit C of the Agreement. In this document, “Developing Projects” are defined as any project that is not defined as an Operating Project.

1. Potential minimization measures will be based on the level of mortality estimated from the project’s first year of monitoring. If mortality is greater than 4 bats per 1000 square meters of rotor sweep area per year (hereinafter referred to as 4 bats/1000m<sup>2</sup>/yr), which represents a 25% reduction of the state-wide average through 2012, the Cooperator will consult with the Commission to consider bat minimization efforts and discuss the implementation of voluntary measures to address bat fatalities. Depending on the initial risk category designated for the project, minimization measures may include any mutually acceptable methods, but will be limited to reasonable levels up to and including the efforts summarized in the table below.

Maximum Effort for Reduction of Bat Mortality

	<b>High Risk</b>	<b>Low Risk</b>
<b>Time of Year</b>	April 1 - November 15	July 1 - September 30
<b>Time of Night</b>	Start 1/2 hour before sunset and end 1/2 hour after sunrise	Start 1/2 hour before sunset and continue for 5 hours
<b>Cut-in Speed (m/s)</b>	April 1 - June 31 = 5.0 July 1 - September 30 = 5.5 October 1 - November 15 = 5.0	5.0
<b>Temperature (F)</b>	> 50	> 50

2. Any project that implements the Maximum Effort for high risk criteria is anticipated to reduce bat mortality between 50% and 73% based on previous research conducted. Likewise, a program that implements the Maximum Effort for low risk criteria is anticipated to reduce bat mortality between 40% and 58%. Once a Developing Project implements the Maximum Effort applicable to its risk criteria, no further minimization measures shall be required. If at any point after the first year of post-construction monitoring, a Cooperator can demonstrate that mortality is below 4 bats/1000m<sup>2</sup>/yr, no additional minimization measures shall be required. The Cooperator may demonstrate mortality levels through direct on-site monitoring data modified by minimization measures as described above, or through application of mortality reduction percentages agreed to with the Commission.

6. All suggested pre-construction and some post-construction techniques are designed to reduce the exposure of state-listed species in order to avoid, minimize or mitigate potential adverse risk to species of special concern. Study plans for all pre and post-construction surveys are to be submitted to the Commission at least 30 days prior to initiating the survey for review and approval. The study plan should include maps delineating all areas to be surveyed, observation locations, anticipated survey schedule, a list of the persons and equipment to be used to conduct survey, etc.

i. Birds

Breeding Bird Surveys

Goal: Assess risk to bird species listed in Pennsylvania's WAP in order to avoid and minimize direct and indirect impacts to these species and evaluate the potential for habitat enhancement/mitigation measures.

Objective 1) Proactively evaluate critical wildlife resources that may cause risk to the future stability of project operation.

Objective 2) Use the data to help develop and implement the most appropriate post-construction habitat reclamation and management for the site.

Objective 3) Determine if state listed species are present. If present then further coordination with the Commission is required in order to avoid, minimize, or mitigate potential impacts to the species or their habitat.

Cooperator will conduct pre and post-construction monitoring surveys as outlined in the Commission's attached Exhibit A & C. The Commission will to the extent feasible, be made available to provide consistency and oversight management for all conducted surveys.

Data and reports for any bird surveys requested by the U.S. Fish and Wildlife Service, which were not specifically requested by the Commission, will be shared with the Commission.

ii. Bats

Hibernacula

Goal: Determine if any hibernacula exist within the project area in order to avoid and minimize impacts to active

hibernacula and the associated bat species due to project development and operation.

Objective 1) Conduct an on site field review to locate and determine use of potential bat hibernacula in the project area.

Objective 2) Survey bat hibernacula for species presence and abundance in order to assess potential impacts to bat species during the planning phase of the project construction.

Objective 3) Evaluate the potential to avoid, minimize, and mitigate adverse impacts to bats and or enhance their habitat from project construction and operations.

1. Pre-construction survey- If recommended by the Commission, the Cooperator is responsible for surveying the project area for any caves, abandoned mine portals, or other openings that may harbor bats as per the Commission's protocol. All openings with potential as suitable bat hibernacula will be surveyed by a qualified bat biologist according to Exhibit B.

Goal: Determine those bat hibernacula existing within 10 miles of the project area that may induce additional avoidance and minimization measures due to anticipated adverse bat impacts from project operations.

Objective 1) The Commission will conduct surveys to locate and determine use of potential bat hibernacula within 10 miles of the project area boundary.

Objective 2) The Commission will survey bat hibernacula (outside of the project area) for species presence and abundance in order to establish potential impacts to bat species during the planning phase of the project construction.



Objective 3) Evaluate the potential to avoid and minimize adverse impacts to bats and their habitat from project construction and operations.

2. Prior to the Cooperator conducting the field survey(s) as noted in Paragraph 6 (ii), the Commission will conduct a literature search for other mine portals/caves/openings which are suitable and/or known bat hibernacula and are on or within 10 miles of the proposed wind-energy project boundary delineation. The information will be provided to the Cooperator along with the relevant known bat hibernacula as per the Commission's review and the Commission's recommendations on the need for the Cooperator to conduct additional surveys based on the probable presence of Pennsylvania listed threatened, endangered, and/or candidate bat species. If the Commission recommends additional surveys, the Cooperator will conduct those surveys with a qualified bat biologist according to the attached protocol Exhibit B.
3. Cooperator will conduct pre and post-construction monitoring surveys as outlined in the Commission's attached Exhibit B & C.

#### Acoustic Monitoring

The Commission will no longer request pre or post-construction bat acoustic surveys. However, all data collected under the auspices of the U.S. Fish and Wildlife Service's Rangelwide Indiana Bat Summer Survey Guidance and resulting acoustic reports will be provided to the Commission upon completion.

#### Mist Netting/Telemetry

Goal: Determine the presence of threatened or endangered bat and habitat use of the project area in order to avoid and minimize potential adverse impacts.

Objective 1) Surveys will be conducted to determine presence of special concern species within the project area and determine their habitat use.

Objective 2) Evaluate the potential to avoid and minimize adverse impacts to bats based on their probable use of the project area during the project's construction and future operations.

Cooperator will conduct mist netting following protocols in Exhibit B and if captured, special concern species listed in the Commission bat packet (Exhibit B) are to be tracked to determine habitat use.

The Commission will to the extent feasible, be made available to provide consistency and oversight management for all conducted surveys.

iii. Post-Construction Bat & Bird Mortality Monitoring

Goal 1) Determine the mortality of bats and birds from project operation and whether those mortality rates would cause an unacceptable level of impact and if needed induce additional minimization or mitigation measures.

Objective 1) Conduct mortality surveys in the most cost-effective and proficient manner.

Objective 2) Provide a mechanism to evaluate the proficiency of the project's mortality survey methodology.

Goal 2) Assess the predictive value of pre-construction monitoring, minimization and avoidance measures by comparing those results with post-construction mortality.

Objective 1) Identify those protocols or monitoring methods that need revision, adaptation, replacement, or abandonment because of their level of success.

Objective 2) To make appropriate adjustments to monitoring protocol and future effort as indicated by the acquired information.

1. The Cooperator will perform the bird and bat mortality monitoring as outlined in the Commission's attached mortality protocol Exhibit C for a minimum of one year post-construction. Mortality studies shall be conducted from April 1 through November 15 by a qualified biologist(s) having expertise in the identification of bats and/or birds and at the interval as noted in the attached Exhibit C.
2. The Commission will to the extent feasible, be made available to provide consistency and oversight management for all conducted surveys.
7. Cooperator agrees to utilize to the greatest extent possible, all reasonable and feasible generally accepted wind industry and Commission best management practices relevant to the conservation of wildlife resources during construction and subsequent operation of the wind-energy facility. The Pennsylvania Game Commission Endorsed Best Management Practices (BMPs) can be found in Exhibit D. Any new BMPs to be added to Exhibit D will be mutually agreed upon by both the Commission and Cooperators.
8. Commission agrees to issue a special use permit defining the terms and conditions for use throughout the project area by the Cooperator's designated biologist(s) for all bats, birds, and state listed threatened or endangered species which are collected while conducting the Commission's approved monitoring plan and mortality protocol. The special use permit may be automatically renewed upon the anniversary date of the permit, providing further that the permit terms and conditions have been strictly adhered to and this Cooperation Agreement remains in effect. It is the responsibility of the Cooperator to acquire any federal and/or local permits required for such monitoring prior to monitoring commencing.

9. The Commission agrees not to pursue liability against the Cooperator due to any incidental takings of the Commonwealth's bird and mammal resources for which it has purview under Title 34 (Game & Wildlife Code) as a result of the Cooperator's wind energy development and operations within the Commonwealth of Pennsylvania providing further such incidental takings were not malicious in their intent and the Cooperator remains in compliance with the terms and conditions of this agreement and has with a good faith effort avoided and minimized potential adverse impacts by way of implementing best management practices and Commission guidance as noted herein.

The Commission and Cooperator agree to work cooperatively in the future to avoid, and minimize further impacts to the Commonwealth's bird and mammal resources as new relevant project information becomes available. In the event that an incidental take occurs upon a Pennsylvania listed threatened or endangered species of bird or mammal during the operation of any of the Cooperator's wind-energy facilities, the Cooperator agrees to take all reasonable measures as deemed appropriate by the Commission and the Cooperator to further avoid, minimize and/or mitigate such wildlife losses in the future.

10. Commission recommendations or decisions under the Cooperative Agreement do not supersede any comments, decisions, or recommendations of the United States Fish & Wildlife Service.
11. The Cooperator agrees to provide coordinated access, upon prior notice during normal business hours, to all its wind energy facilities as deemed necessary by Commission staff in order to ensure both parties compliance to this agreement. All Commission access shall be coordinated as far in advance as possible and subject to all the normal safety measures implemented by the Cooperator with regard to access to the facility.
12. Either party upon their own discretion and reason can terminate this agreement in its entirety after having first provided the

other party written notification of such termination forty-five (45) days in advance of such termination date. Said written notification to be sent certified mail to the respective parties place of address as noted herein. Termination can be conditioned to exclude those projects identified, which remain in compliance with the agreement.

13. It is understood between the parties that information resulting from the Cooperator's compliance with this agreement shall be treated with the highest affordable level of confidentiality available unless otherwise agreed to in writing by both parties OR if it is necessary to support the Commission's waiver of liability set forth in Paragraph 9 hereof. It is the intent of both parties to release to the general public relevant project monitoring & mortality information deemed to be in the best interest of both the Commission and Cooperator. Release of information will be by mutual consent only.
  
14. Assignment: The Cooperator may assign this Agreement, or any project covered under the terms of this Agreement, to any affiliate (as defined below) without the approval or consent of the Commission provided that (i) the Cooperator is not in default of this Agreement with respect to the project(s) being so assigned at the time of the proposed assignment and (ii) the Cooperator notifies the Commission of any proposed assignment in accordance with this Agreement. The Cooperator may assign this Agreement, or any project covered under the terms of this Agreement, to any non-affiliate (as defined below) provided that (a) the Cooperator is not in default of this Agreement with respect to the project(s) being so assigned at the time of the proposed assignment, (b) the proposed assignee has agreed in writing to be bound by all of the terms and conditions of this Agreement, (c) the Commission has met with the proposed assignee and the Cooperator, after being notified of the proposed assignment, to discuss the terms and conditions of the project(s) covered by the assignment and (d) the Commission consents to the proposed assignment in writing, which consent shall not be unreasonably withheld, conditioned or delayed. For purposes of this section, an "affiliate" of the Cooperator refers to any person, corporation or entity that (i)

has a direct or indirect ownership interest in the Cooperator or vice versa or (ii) is subject to common operating control and is operated as part of the same system or enterprise as the Cooperator. Any person, corporation or entity that is not an "affiliate" as defined above shall be a non-affiliate for purposes of this section. At the request of the Cooperator, the Commission and the assignee shall execute, after said assignment is approved if required, a new Agreement with terms identical to the terms of the Agreement at the time of the assignment.

15. Notices. All notices demands or requests required or permitted under this Agreement shall be in writing and shall be personally delivered or sent by certified United States mail (postage prepaid, return receipt requested), overnight express mail, courier service, facsimile transmission or electronic mail with confirming receipt (in the case of facsimile transmission and electronic mail with the original transmitted by any of the other aforementioned delivery methods) addressed as follows:

If to Commission to:        Pennsylvania Game Commission  
  ATTN: William A. Capouillez, Director  
  Bureau of Wildlife Habitat Management  
  2001 Elmerton Avenue  
  Harrisburg, PA 17110-9797

and

If to Cooperator to:

or to such other person at such other address as a Party shall designate by like Notice to the other Party. Unless otherwise provided herein, all Notices hereunder shall be effective at the close of business on the Day actually received, if received during business hours on a Business Day, and otherwise shall be effective at the close of business on the first Business Day after the Day on which received.

16. No Third-Party Beneficiaries. This Agreement is not intended to, and does not, confer upon any Person other than the Parties hereto and their respective successors and permitted assigns, any rights or remedies hereunder.
  
17. Entire Agreement. This Agreement, including all Schedules hereto, constitutes the entire agreement between the Parties hereto with respect to the matters contained herein and therein, and all prior agreements with respect to the matters covered herein are superseded, and each Party confirms that it is not relying upon any representations or warranties of the other Party, except as specifically set forth herein or incorporated by reference hereto.
  
18. Amendment. This Agreement may not be amended or modified except by a written instrument signed by each of the Parties hereto.

IN WITNESS WHEREOF, Commission and Cooperator have caused this agreement to be duly executed and have caused their seals to be hereto affixed and attached by their proper officers, all hereunto duly authorized, on the date first above written.

COMMONWEALTH OF PENNSYLVANIA  
 PENNSYLVANIA GAME COMMISSION  
 ATTEST:

\_\_\_\_\_  
 Executive Director Date

COOPERATOR  
 ATTEST:

\_\_\_\_\_  
 President or Vice-President Date

\_\_\_\_\_  
 Company Name

**EXHIBIT A** (Explicitly Used in Conjunction with the Wind Energy Cooperative Agreement)

# **Protocols to Monitor Bird Populations at Industrial Wind Turbine Sites**

**Commonwealth of Pennsylvania  
Pennsylvania Game Commission  
July 26, 2013**



## **Pre and Post-Construction Monitoring of Birds**

Pre and post-construction bird monitoring efforts at wind energy developments will be scaled based on this classification.

### **I. Classification of Monitoring Effort for Birds**

A two-tiered approach is recommended for bird monitoring at prospective wind development sites:

#### **A. High Priority Sites: Containing one or more on or within one mile of the project area:**

- 1) Known occurrences of threatened or endangered species breeding
- 2) An Important Bird Area as designated by the Audubon process
- 3) Unique habitat supporting a diversity of Wildlife Action Plan species

##### **Pre-construction survey work required:**

- 1) One year of breeding bird surveys following Pennsylvania Game Commission (PGC) protocols

##### **Post-construction survey work required:**

- 1) One year of breeding bird surveys after construction is complete following PGC protocols
- 2) Minimum of one year of mortality monitoring with possible extension based on severity of impacts

#### **B. Low Priority Sites: Does not contain any of the following on or within one mile of the project area:**

- 1) Known occurrences of threatened or endangered species breeding
- 2) An Important Bird Area as designated by the Audubon process
- 3) Unique habitat supporting a diversity of Wildlife Action Plan species

##### **Pre-construction survey work required:**

- 1) None. While no surveys are required, it may be prudent to do a field check for threatened or endangered bird species to avoid risk to birds

##### **Post-construction survey work required:**

- 1) Minimum of one year of mortality monitoring with possible extension based on severity of impacts

### **II. Pre and Post-Construction Sampling for Breeding Birds**

1. Point Counts: For wind development sites designated as high priority, breeding bird surveys should be conducted once in May and two visits in June. Points should be established

systematically at 250-meter intervals (or at 500 meters in grassland settings) using a grid or track that covers the projected development site. Based on overall project size and project configuration, the PGC will be flexible with regard to breeding bird survey sampling intervals. Generally, the same point counts and area searches surveyed pre-construction should be surveyed post-construction. Cooperators should coordinate with the PGC to ensure that point counts and area searches selected for post-construction surveys are adequate to sample the actual project area footprint.

A circle is delineated around each point of 50-meters and allowance is made for detecting birds outside that ring (unlimited circle). Observers should be experienced or take practice at judging distances, using a range-finder and local landscape features as cues. Sample period should be divided into three periods, starting with the first three minutes, the subsequent two minutes, and the final five minutes. These time bands allow comparisons between these data sets with other point-counts (including the BBS route data) of 3 and 5-minute lengths (Ralph et al. 1995).

Sampling should occur in the morning when detection of birds is greatest. Sampling should commence at dawn, prior to sunrise and cease for the day at 10:00 a.m. EST. Counts should not be conducted in periods of heavy rains or high winds. Each location should be approached quietly in order to avoid disturbance of the birds and to observe birds near the sample point, but outside of the detection circle. Each bird should be recorded in the first period it is observed. A small bull's eye is provided on the point count data sheet for registering the general direction of the bird. The up position is North with the lines dividing the circle into four quadrants. Additional notes on location of birds can be made on separate sheets. Birds detected while flying over should be counted separately.

In each successive time-band, the observer should attempt to relocate each singing bird and record its detection in that period. Each observation should be categorized as either inside or outside the designated center circle (50 meter radius). If a bird moves from one distance circle to the other, the original observation distance circle should be noted. For example, if a bird is observed outside the 50m distance circle during the first time-band, but then the same bird is observed inside the 50m distance circle during the second time-band, the move should be documented on the worksheet and the bird should ultimately be classified in the first distance circle it was observed. There are columns for non-singing observations provided for birds within and outside the circle. Care is needed to avoid duplicate counting of individuals at the same point or at multiple points.

The location of each point should be registered on a separate form using GPS (Attachment Form Wind 7008). The use of standard four-letter species alpha codes, breeding bird atlas codes, and other standard abbreviations are helpful to the standardized collection of data (Ralph et al. 1993, Hamel et al. 1996, PA Breeding Bird Atlas website). A stopwatch or other chronometry is very helpful to ensure conformity to the time band data periods. A compass or GPS unit with compass capacity is needed to identify the position of the birds.

The field observer should provide evidence of rare or unexpected species by taking photographs, making field recordings, or field sketches. Digital recordings are preferable because of their ease of storage and transfer.

The data collected with the removal method point-counts should be analyzed using methods outlined by Farnsworth et al. (2002). The program SURVIV also is used for finding estimates of densities and associated variables (White 1992). This program is available from the U.S.G.S. Patuxent Wildlife Research Center website (<http://www.mbr-pwrc.usgs.gov/software.html#a>).

2. Area Searches are fairly effective for developing a species site list and detecting birds not as effectively detected by point counts (Ralph et al. 1993). This approach may replace or supplement the point count method, with PGC approval.

The observer visits the variety of habitats at a site and records all birds observed, both visually or audibly. As for any field survey, the weather conditions and field times also are recorded. The field time can be used as a measure of effort made by the observer and the bird data can be interpreted as birds per party hour or a similar efforts measure. There is a form for use in Area Searches that will organize observations (Attachment Form Wind 7008). Any breeding behavior should be recorded using standardized Breeding Bird Atlas codes (see 2<sup>nd</sup> Pennsylvania Breeding Bird Atlas website and point count form). The locations of Species of Special Concern and Watch List species should be recorded (NAD27 format). Additional information about bird sightings and behavior can be recorded separately.

Area searches are conducted at and in the vicinity of the construction site during periods when birds are most detectable (<http://www.pgc.state.pa.us/pgc/cwp/view.asp?a=496&q=164510>). Breeding season for birds can vary greatly by species. For example, many raptors are more easily detected fairly early in the nesting season, while some migratory passerines breed late in the season. As such a full sample protocol should include three visits to each area search location: the first visit conducted between mid-March and April 30, a second visit between May 1 and 31 (to target earlier nesting species and has the potential for early-arriving forest migrants), and a third visit between June 1 and July 10 (the peak of the nesting season for most songbirds). Visits should be separated by at least one week.

Electronic datasheets will be provided by the PGC for point count and area surveys once the work plan is approved. Data collected on these forms, maps, and associated documents should be sent to the Pennsylvania Game Commission.

## **II. Pre and Post-Construction Sampling for Raptors**

The PGC will no longer request pre or post-construction raptor migration surveys. However, the PGC requests that reports and data for all Diurnal Raptor Migration Surveys and Raptor Nest Surveys conducted under the auspices of the U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines be submitted to the PGC upon completion.

Pennsylvania Breeding Bird Point Count				
Site:		Observer:		Date:
Point #		Assistant:		Start time:
Sky:		Wind:	Temp (°C):	Stop time:

Indiv. & Posit.	Species Code <sup>a</sup>	1 0 – 3 min.		2 3 – 5 min.		3 5 – 10 min.		Non-song Cues		Fly Over #	Breeding Code, Behavior, and Other Notes
		<50m	>50m	<50m	>50m	<50m	>50m	<50m	>50m		
		1									
2											
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<sup>a</sup> Use standard 4-letter alpha codes for species names available at PBBA website, USGS, and various references.

Notes:

Codes for Breeding Bird Point Counts and Area Searches

Sky Condition Codes		Wind Speed Codes (Beaufort Scale)	
Code	Sky condition indicator	Code	Wind Speed Indicators
0	Clear or a few clouds	0	Smoke rises vertically (< 1 mph, <2 kmh)
1	Partly cloudy (scattered) or variable sky	1	Wind direction shown by wind drift (1-3 mph, 2-5 kph)
2	Cloudy (broken) or overcast	2	Wind felt on face; leaves rustle (4-7 mph, 6-12 kph)
4	Fog or smoke	3	Leaves, small twigs in constant motion (9-12 mph, 20-29 kph)
5	Drizzle	4	Dust rises; small branches move (13-18 mph, 20 – 29 kph)
7	Snow	5	Small trees in leaf begin to sway (19-24 mph, 30-38 kph)
8	Showers		

Pennsylvania Breeding Bird Atlas Breeding Codes (BC)

*For further explanations of BCs, Safe Dates, and other Breeding Bird Information, see the website of the 2<sup>nd</sup> Pennsylvania Breeding Bird Atlas*

<b>Observed</b>	
O	Observed within safe dates, but not in suitable habitat
<b>Possible</b>	
X	Bird seen or heard in suitable nesting habitat within safe dates
<b>Probable</b>	
T	Territorial behavior observed
P	Pair observed
C	Courtship behavior observed
U	Used nest of species found
A	Agitated behavior or anxiety calls given by adults
<b>Confirmed</b>	
CN	Bird seen carrying nesting material
NB	Nest building observed at nest site
DD	Distraction display
FL	Recently fledged young observed
CF	Adult carrying food or fecal sac
ON	Occupied nest found, contents unknown
NE	Nest found containing eggs
NY	Nest found containing young





## **Bird Protocol References:**

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**Exhibit B** (Explicitly Used in Conjunction with the Wind Energy Cooperative Agreement)

# **Pre and Post-Construction Monitoring of Bat Populations at Industrial Wind Turbines Sites**

**Commonwealth of Pennsylvania  
Pennsylvania Game Commission  
July 26, 2013**

## I. Classification of Monitoring Effort for Bats

Pre- and post-construction bat monitoring efforts will be scaled to the type of bat activity on or within 10 miles of the proposed wind power project area. A **Hibernacula of Concern** is identified as a hibernaculum that houses the state threatened small-footed bat (*Myotis leibii*) or the state and federally listed endangered Indiana bat (*Myotis sodalis*) or a hibernaculum that houses three bats of any species captured via trapping.

Sites are classified in the following two categories:

### A. High Priority Sites: Meets one or more of the following criteria.

- 1) Hibernacula of Concern present on or within 10 mile of the project area.
- 2) Any known occurrence supporting breeding or hibernating state-listed threatened or endangered species is present on or within 10 miles of the project area.
- 3) Any known maternity colony of cave-dwelling bats present on or within 5 miles of the project area.

#### **Pre-construction work required:**

- 1) Consultation with the Pennsylvania Game Commission (PGC) required for state-listed bat occurrences.
- 2) Investigate project area for abandoned mines and caves suitable for bat hibernacula following PGC protocols.
- 3) One season of mist netting following PGC protocols to determine the presence/absence of state-listed species and potential use of the area as maternity colonies. Work is conducted by approved bat consultants that are prepared to adhere with the transmitter requirements.
- 4) Site-specific surveys including telemetry during spring/fall migration and telemetry of state-listed species captured during mist netting to determine areas of high use, travel corridors, and roost locations following PGC Environmental Review telemetry protocols.

#### **Post-construction work required:**

- 1) Minimum of one year of mortality monitoring with possible extension based on severity of impacts.

### B. Low Priority Sites: Meets all of the following criteria.

- 1) No known Hibernacula of Concern on or within 10 miles of the project area.
- 2) No known occurrence supporting breeding or hibernating state-listed threatened or endangered species present on or within 10 miles of the project area.
- 3) No known maternity colony of cave-dwelling bats present on or within 5 miles of the project area.

#### **Pre-construction work required:**

- 1) Investigate project area for abandoned mines and caves suitable for bat hibernacula following PGC protocols.

**Post-construction work required:**

- 1) Minimum of one year of mortality monitoring with possible extension based on severity of impacts.

**II. Protocols for Hibernacula Surveys**

Hibernacula (natural caves, mines, tunnels, and other underground workings) within the project area should be located using mineral literature (The Pennsylvania Cave Database, maps and records from the Office of Surface Mining, and the PA Bureau of Abandoned Mines) and properly investigated by a USFWS approved bat consultant.

Due to the increased bat activity around such sites and/or the presence of threatened and endangered species, Hibernacula of Concern on or within 10 miles of a proposed wind development site triggers bat monitoring efforts. The Pennsylvania Game Commission (PGC) will notify the developer if such a hibernaculum is known on or within 10 miles of the proposed project and the developer should enter into consultation with the PGC to determine if additional protection or investigation will be useful to siting turbines. The PGC may conduct a survey in or around the project area for potential hibernacula that are not currently known and survey them for the developer. In the event that the PGC survey results confirm a previously unknown hibernaculum the PGC will notify the Cooperator and further coordination will be required. If a mine contains multiple entrances, then all the bats captured at each entrance will be added together to determine if the site qualifies as a Hibernaculum of Concern.

The following progression of action should generally be followed in order to meet the agreement, as fits the site classification hierarchy above:

- 1) A consultant/cooperator will perform a literature search for potential hibernacula within project area.
- 2) Following the literature review, a consultant will conduct ground searches to examine each identified potential hibernaculum, record the location with a GPS, and search for unknown openings (mine collapse, abandoned tunnels, new caves, etc) within the project area.
- 3) Consult with PGC to determine if any sites have ever been surveyed for bats.
- 4) Newly discovered sites and sites that have not been investigated within 10 years will be surveyed via the methods and protocols set forth in the USFWS mine sampling protocol.
- 5) Bat consultants from the USFWS approved list must be hired to examine any potential hibernacula within the project area.
- 6) If a state-listed species is located within the project area, the bat consultant will consult with the Cooperator and PGC to discuss telemetry protocols, effort levels and site specific details.
- 7) Consultation between the consultant and the PGC is required prior to this work for site-specific details.
- 8) If the federally endangered Indiana bat is known to exist at any time within 10 miles, telemetry may be requested, and areas of use are to be determined. Buffer areas

- around the Indiana bat location should not be included in the project area. All captures of state-listed bats must be photo documented as described in Appendix A.
- 9) Data must be entered on provided sheets (Appendix A) and submitted to the PGC before construction. Maps should indicate all turbines, hibernacula surveys, and results of telemetry if applicable. PGC may conduct literature and ground searches for potential hibernaculum located up to 10 miles from the project area.
  - 10) PGC may survey hibernacula up to 10 miles from the project area.

### **III. Protocols for Mist Netting Surveys**

The length of the project area (or summation of all roads, whichever is longer) will be tallied. There will be 1 mist netting site per kilometer of the project area. For projects that are not linear in design, a polygon surrounding the entire project area will be tallied and there will be 2 sites per square kilometer. Cooperator will conduct mist netting and telemetry following protocols in Appendix A below.

### **IV. Protocols for Bat Acoustic Surveys**

The PGC no longer requests pre or post-construction bat acoustic surveys. However, the PGC requests the report and data from any bat acoustics conducted in conjunction with mist netting or under the auspices of the U.S. Fish and Wildlife Service's Rangewide Indiana Bat Summer Survey Guidance.

### **V. Post-Construction Bat Minimization Efforts**

Bat populations in the United States are generally not well understood. The emergence of white-nose syndrome in the Eastern United States and Canada elevated concerns of bat populations due to the dramatic decrease in cave dwelling bats. Winter hibernacula surveys in Pennsylvania revealed an overall decline of 98% of cave dwelling bat species (Turner et al. 2011). Cumulative impacts to bats are a major concern, especially at a time when many bat species, including tree-roosting bats are known to be in decline (Winhold and Kurta 2006).

Several studies investigated methods to reduce bat mortality at operating facilities. One study conducted in Canada revealed a 60% reduction in bat mortality by increasing the cut-in speed from 4.0 m/s to 5.5 m/s during fall bat migration periods (Baerwald et al. 2009). A study in Pennsylvania investigated the effectiveness of two different increased cut-in speeds, 5.0 m/s and 6.5 m/s. Similar to the Canadian study, the researchers noted a 44-93% decrease in bat mortality at curtailed turbines, with no significant difference between the 5.0 m/s and 6.5 m/s cut in speeds (Arnett et al. 2010). Acknowledging the studies that have demonstrated methods to reduce bat mortality at wind facilities, the Commission encourages and supports Cooperators to implement bat mortality minimization efforts at all wind facilities in Pennsylvania.

To address concerns regarding cumulative impacts to bats in Pennsylvania, Cooperators and the Commission developed mutually agreeable consultation points for wind sites in Pennsylvania. The following outlines the progression of action for minimization efforts that will

be followed for facilities in operation as well as developing facilities. The below consultation points and minimization efforts are also found in section 5 of the Agreement.

### **Operating Projects**

Operating Projects shall be defined as all wind energy projects that have achieved commercial operation in accordance with PJM Interconnection rules prior to January 1, 2013; and all wind energy projects that achieve commercial operation in accordance with PJM Interconnection rules on or after January 1, 2013 and also qualify for the federal production tax credit under the extension of said program in the American Taxpayer Relief Act of 2012.

A Cooperator with an Operating Project will arrange a consultation meeting with the Commission within sixty (60) days following either; (a.) the execution of this Amendment to the Agreement if bat fatalities at the Operating Project are greater than thirty (30) bats per turbine per year, as determined by the most recent annual post-construction fatality monitoring performed by the Cooperator prior to the execution of this Amendment and in adherence to Exhibit C of the Agreement or; (b.) the submittal of the most recent year of fatality monitoring data showing the bat fatalities at the Operating Project are greater than thirty (30) bats per turbine per year as determined by the post-construction fatality monitoring performed by the Cooperator in adherence to Exhibit C of the Agreement. If the Operating Project has post-construction fatality monitoring ongoing at the time of execution of this Amendment to the Agreement and said fatality monitoring is in adherence to Exhibit C of the Agreement, the results of that ongoing post-construction fatality monitoring shall be considered the most recent year of fatality monitoring data on which the need for the Cooperator to consult with the Commission shall be determined.

### **Developing Projects**

In order to provide protection for bats while providing planning and financial certainty to the Cooperator, all Developing Projects may be subject to minimization measures based on results of post-construction monitoring performed by the Cooperator in adherence to Exhibit C of the Agreement. In this document, "Developing Projects" are defined as any project that is not defined as an Operating Project.

Potential minimization measures will be based on the level of mortality estimated from the project's first year of monitoring. If mortality is greater than 4 bats per 1000 square meters of rotor sweep area per year (hereinafter referred to as 4 bats/1000m<sup>2</sup>/yr), which represents a 25% reduction of the state-wide average through 2012, the Cooperator will consult with the Commission to consider bat minimization efforts and discuss the implementation of voluntary measures to address bat fatalities. Depending on the initial risk category designated for the project, minimization measures may include any mutually acceptable methods, but will be limited to reasonable levels up to and including the efforts summarized in the table below.

Maximum Effort for Reduction of Bat Mortality

	<b>High Risk</b>	<b>Low Risk</b>
<b>Time of Year</b>	April 1 - November 15	July 1 - September 30
<b>Time of Night</b>	Start 1/2 hour before sunset and end 1/2 hour after sunrise	Start 1/2 hour before sunset and continue for 5 hours
<b>Cut-in Speed (m/s)</b>	April 1 - June 31 = 5.0 July 1 - September 30 = 5.5 October 1 – November 15 = 5.0	5.0
<b>Temperature (F)</b>	> 50	> 50

Any project that implements the Maximum Effort for high risk criteria is anticipated to reduce bat mortality between 50% and 73% based on previous research conducted. Likewise, a program that implements the Maximum Effort for low risk criteria is anticipated to reduce bat mortality between 40% and 58%. Once a Developing Project implements the Maximum Effort applicable to its risk criteria, no further minimization measures shall be required. If at any point after the first year of post-construction monitoring, a Cooperator can demonstrate that mortality is below 4 bats/1000m<sup>2</sup>/yr, no additional minimization measures shall be required. The Cooperator may demonstrate mortality levels through direct on-site monitoring data modified by minimization measures as described above, or through application of mortality reduction percentages agreed to with the Commission.

**Bat Protocol References:**

Arnett E. B., M. Huso, M. R. Schirmacher, and J. P. Hayes. 2011. Altering turbine speed reduces bat mortality at wind-energy facilities. *Frontiers in Ecology and the Environment* **9**: 209–214.

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. *J Wildlife Manage* **73**: 1077–81.

Turner, G. G., Reeder, D. M., and J. T. H. Coleman. 2011. A Five-year Assessment of Mortality and Geographic Spread of White-Nose Syndrome in North American Bats, with a Look at the Future. *Update of White-Nose Syndrome in bats. Bat Research News*, 52:13-27.

Winhold, L., and A.Kurta. 2006. Are red bats (*Lasiurus borealis*) declining in southern Michigan? *Bat Research News* 46:22.

## APPENDIX A

### Commonwealth of Pennsylvania, Pennsylvania Game Commission

#### **Standard and Minimum Effort Requirements for Qualified Indiana Bat Surveyor Netting within the Commonwealth of Pennsylvania for Environmental Review Projects.**

Mist-net surveys will be carried out in accordance with the U.S. Fish and Wildlife Service's (USFWS) *Indiana Bat Mist Netting Guidelines* and will include effort and measures above and beyond those guidelines as specified in this document as a requirement of the PA Game Commission (PGC) Permit. Accompanying a State Permit are required reporting information and bat White-Nose decontamination protocols. Make certain to review and adhere to the requirements. All field personnel must be familiar with these guidelines.

#### **Netting Season: May 15 – August 15**

**Minimum Net Equipment for Site Sets:** 2 net sets (4 poles) capable of stacking a minimum of 3 (2.6m high) nets to reach canopy/sub-canopy (>7 m / 23 ft). Poles will have a pulley system for efficient bat removal. An additional assortment of poles will also be available for situations where stacked nets can not be used. Nets will be the lowest visibility weights available (50 denier 2-Ply Nylon or 75 denier 2-Ply Polyester) and 38 mm (~1.5 in) mesh. Standard net lengths will be available to cover most travel corridors ranging from 6 m (~19 ft) to 18 m (~59 ft). Nets will be hung in the standard manner to provide bag in panels. Overstretched nets that eliminate panel bagging will not be permitted. Nets should be placed in what is considered Indiana bat habitat and among "clutter" to minimize bat detection. Sites will be monitored quietly; loud noises (other than low volume occasional communication), running engines, campfires and other activities that disturb/alert bats will not be allowed within 300 m of a Site.

**Standard Site Sets:** A minimum of 2 net sets,  $\geq 30$  m (98 ft) apart, will be placed at a net Site. A standard set will consist of 3-stacked nets\*. If triple high sets are not used, a thorough justification must be provided in the comments section of the PGC Bat netting/Trapping Site Survey Record (P-70008-N/T). Should we find that quality netting locations suitable for triple-high net sets are available but that lower net sets were deployed or poor quality netting locations were selected, permits may be revoked and the qualified surveyor may be considered unable to select and set Sites resulting in removal from the Pennsylvania list of qualified surveyors. Each net Site will be sampled for 2 nights beginning at sunset for at least 5 hours (300 minutes). Each net set will be checked ~every 10 minutes. Minimally, one person will monitor a Site at all times.

\*Sites will be selected for prime capture locations in Indiana bat habitat which is often forested travel corridors (streams, trails etc) rather than locations capable of placing triple high net sets (open field). Professional judgment is foremost in site selection and net sets. However, given that Indiana bats are often captured in elevated net sets, they will be considered the standard when conducting surveys in PA and if not used, a justification must be provided.

**Minimum Nightly Effort/Site = 420 Units of Effort (UE):** One unit of effort is equal to  $1\text{m}^2$  of net area in place for 1 hour - (total  $\text{m}^2$  of capture area) x (minutes in place/60).

Each net Site must provide a minimum of 420 UE. For example, 2 sets-each measuring 7 m high by 6 m wide in place for the required 5 hours would meet the minimum effort of 420 UE:

$((7\text{ m} \times 6\text{ m}) + (7\text{ m} \times 6\text{ m})) \times 5\text{ hrs}$ . In the rare situation where stacked nets can't be used, minimum effort must still be met with more nets or net sets at a Site. As of 2008, average effort/Site of companies capturing Indiana bats in PA range from 490 to 680 UE. If unable to complete the required effort on one night, such as bad weather, the site will be repeated using full UE on another night.

#### **Weather -- Netting will be suspended when:**

1. Rain, steady drizzle or heavy fog soaks nets.
2. Temperature falls below 10°C (50°F).
3. Winds result in frequently moving/billowing nets **OR** wind gusts exceed 18 mph (Windy-small trees in canopy sway).

Commonwealth of Pennsylvania, Pennsylvania Game Commission  
**Standard and Minimum Effort Requirements for Qualified Indiana Bat Surveyor Netting within the  
Commonwealth of Pennsylvania for Environmental Review Projects.**

**Qualified Indiana Bat Surveyors (QIBS):** A qualified surveyor is one who's credentials and experience have been reviewed by the USFWS, State College Field Office (USFWS-SCO) and the (PGC) and found to have expertise in all the following:

1. Correct identification of bats of the northeast, to species.
2. Collection of biological information on bats of the northeast.
3. Selecting Net Sites and placing Net Sets to maximize bat captures.
4. Attaching radio transmitters, and bat bands.
5. Radio-tracking and mapping behavior gained thru biotelemetry.
6. Identifying, describing, and conducting emergence counts of day roosts.
7. Documenting study information (bats, net sets, portal entrances, etc.) with photography

**A QIBS is responsible for overseeing all aspects of surveys, and is, therefore, required to be at an active project site (including net surveys, telemetry monitoring and roost evaluations). The QIBS will select sites, sets and inspect net sets each night.** QIBS are the individuals who act in the capacity of Principal Investigator (PI), having in-field oversight responsibility for net setup, bat captures, bat identification, telemetry studies, safe handling procedures and adherence to WNS disinfection protocols. They are also the individuals responsible for ensuring bat permitting requirements are met, and ensuring that reports are accurate and complete and submitted to the appropriate agencies. In addition, the QIBS will be in contact (2 way radio and/or cell phones) with site workers, or if not possible the QIBS will visit all sites every hour. The QIBS will verify and photo document captures of *M.sodalis*, *M.leibii*, and other species not regularly found in Pa., and supervise radio tagging and telemetry.

**Bat Identifier (BI):** The QIBS may select experienced personnel capable of identifying northeastern bats and is responsible for BI's qualifications. A list of BI's with documented experience will be provided to the PGC and USFWS-SCO for review and approval. The QIBS and BI may have oversight for the identification of bats at up to 2 net Sites at a time unless travel between sites is >30 minutes in which case only 1 Site can be monitored. Captured bats may not be held more than 1 hour unless outfitting for telemetry or other processing documented in the permit.

**Only QIBS's and BI's are permitted to be bat identifiers (responsible recorder) on PGC Forms: P-70008-NT and P-70008-M. The ratio of net Sites to QIBS's and BI's will be 2:1, except as noted above.**

**Assistants:** Assistants are under the supervision of the QIBS and are only responsible for assisting in site set-up, take-down and removal of bats. All bats must be held until verified by a QIBS or BI and the verification will occur within 1 hour of capture.

Only a QIBS may apply for a permit. The permit will list all QIBS', and BI's for a project. There will be no sub-permittee designations on the permit request. BI's and Assistants that wish to document their bat experience can briefly note these activities in the comment sections of PGC Forms: P-70008-NT and/or P-70008-M. (example: Name identified 2 Indiana bats upon removal from net, measured, banded, attached transmitters and verified by QIBS as acceptable work.). Spelling Name clearly will facilitate future retrieval of this information from the database.



**Telemetry:** Telemetry will be conducted on the below mentioned species, roosts will be identified, at least one roost emergence count conducted, and a map of foraging activity areas provided. Minimum foraging activity shall relate to the project area. This should include triangulation/bi-angulation data points and general monitoring from roads and trails etc. for at least three full nights. The PA Game Commission shall be notified for all species and the USFWS State College, PA Field Office shall be notified for Indiana bat captures and telemetry. Notification will occur as soon as possible but not to exceed 72 hours after capture. Additional nights of telemetry may be required depending upon project impacts to species habitat<sup>1</sup>. Telemetry will not be conducted on light weight animals if transmitter attachment exceeds 10% of bat's weight.

*Species:* All Indiana bats (*M.sodalis*); All small-footed bats (*M.leibii*); reproductive female and juvenile silver-haired bats (*L.noctivigans*); and reproductive female and juvenile Seminole bats (*L.seminolus*).

**Telemetry Frequency:** Transmitters, receivers and antennas will be tuned to **172 MHz**. This will avoid conflicts with game species transmitters on animals and in storage. This frequency will also allow PGC Diversity Staff to assist if a need arises (both on the ground and with aircraft).

<sup>1</sup>*When conducting telemetry at the request of **PGC Environmental Review**, refer to standards and requirements located in Appendix I. Appendix I also has general guidance for transmitter attachments etc.*

### **Ethical Standards from USFWS, PA Field Office-Reminder that Surveyors are expected to:**

- >Have current permits to conduct surveys in Pennsylvania.
  - >Follow all provisions of State Permits including White Nose Syndrome decontamination protocols.
  - >Report Indiana bat findings to the Service and PGC within 72 hours.
  - >Contact the Service and PGC immediately (same day) if an Indiana bat is killed or injured
  - >Follow established survey guidelines, and accurately, fully, and truthfully report on the methods used and results obtained during these surveys.
  - >Maintain field notes documenting their work and provide scopes of field notes upon request.
  - >Maintain the confidentiality of Indiana bat sites.
  - >Obtain landowner permission before accessing land.
  - >Conduct surveys and studies in a manner that ensures the safety of Indiana bats.
  - >Refrain from removing any Indiana bats from their habitat, holding them in captivity, collecting tissue (wing punches) or blood samples, conducting radio-telemetry studies, or harp trapping unless specifically authorized by a State Permit (Weighing, measuring, analyzing and photographing Indiana bats are standard operating procedures that take place when conducting mist net surveys).
- (Failure to adhere to these ethical standards may result in an individual's removal from the list of qualified surveyors and revocation of their State Permit)*

### **Contacts**

**USFWS State College, PA Field Office** (814) 234-4090  
Pam Shellenberger Pamela\_Shellenberger@fws.gov

**PA Game Commission, Wildlife Diversity**  
Cal Butchkoski (814)667-3685 cbutchkosk@state.pa.us  
Greg Turner (814)237-1432 grturner@state.pa.us

## COMMONWEALTH OF PENNSYLVANIA

Pennsylvania Game Commission, Bureau of Wildlife Protection, Special Permits Enforcement Division  
2001 Elmerton Avenue, Harrisburg, PA 17110-9797

### **Procedure and format for permittee reports to the PA Game Commission when conducting bat capture surveys within the Commonwealth.**

The report is divided into six sections that include: (1) Cover page, (2) Site Survey Record, (3) Bat Measurement and Capture Data Forms, (4) Roost forms, (5) Maps and (6) Photo Documentation.

#### **Section 1 - Cover**

A separate cover page should be provided for each project with the accompanying data of Sections 2 through 6 contained within. An example is provided.

#### **Section 2\* - Bat Netting/Trapping Site Survey Record**

(FORM P-70008-N/T)

This is a **mandatory** two-page summary of site(s) surveyed and of captures. It should be completed for all sites surveyed, including those with no captures. If a capture technique other than mist netting or harp trapping is used, it should be described in remarks. Complete 1 for each site survey night (If site is trapped twice, 2 site survey records are required, etc.).

#### **Section 3\* - Bat Measurement and Capture Data Form**

(FORM P-70008-M)

Band color restrictions: Yellow- only on *M.sodalis* at Canoe Creek St. Park; Orange- may only be used on *M.sodalis* elsewhere.

This form is **mandatory** for:

1. *Myotis sodalis* captures
2. *Myotis leibii* captures
3. Bats you are banding and all band recaptures (*orange and yellow band colors have restrictions*)
4. All radio-tagged bats (describe transmitter in remarks)
5. Bat species not usually found in Pennsylvania\*.

\* Pennsylvania species: *Myotis lucifugus*, *Myotis septentrionalis*, *Myotis leibii*, *Myotis sodalis*, *Eptesicus fuscus*, *Perimyotis subflavus*, *Lasiurus borealis*, *Lasiurus cinereus*, and *Lasionycteris noctivagans*

The surveyor also has the option to use this form for measuring and reporting all bats. All measurements should follow North American collector standards (Nagorsen, D. W. and R. L. Peterson.

1980. Measurements and Weights. Pp. 22-26 in Mammal Collectors' Manual. Royal Ontario Museum, Publications in Life Sciences). Banded bat information will be maintained in a database and future recaptures of your bands will be reported to you.

#### **Section 4\* – Roost Forms**

When conducting telemetry 2 roost forms are provided: one for describing roosts (WD-DR-02/13) and another for bat emergence data (WD-EM-02/13). It is recommended and often required that *M. sodalis*, *M.leibii*, and *L. noctivagans* be radio-tagged when captured in summer habitats and their roosts located.

**\*Section 2, 3, and 4 forms may not be modified for reporting because they are used for data entry. If necessary, supplemental pages may be added to report unique data.**

#### **Section 5 - Maps**

An example is provided. All survey sites will be reported on a map (preferably a 7.5' USGS Topographic Map) so that locations can be accurately located and coordinates verified.

#### **Section 6 - Photo Documentation**

An example is provided. Photographs (preferably digital) will be taken of identification characteristics of all *M.sodalis*, *M.leibii*, and species not usually found in PA. The photos should be labeled with the site, date and capture number.

COMMONWEALTH OF PENNSYLVANIA  
Pennsylvania Game Commission  
Bureau of Wildlife Protection, Special Permits Enforcement Division  
2001 Elmerton Avenue, Harrisburg, PA 17110-9797

**Section 1 - Cover**

**PERMITTEE BAT CAPTURE REPORT**

Mail **hard copy** of reports to address on the heading of this page within 90 days of project completion.

Permit Number \_\_\_\_\_

Project Name: \_\_\_\_\_

Company/  
Organization/  
Permittee Name: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Phone:** (\_\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_ **Fax:** (\_\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_

**E-Mail:** \_\_\_\_\_

Project Supervisor Name: \_\_\_\_\_

Supervisor Contact: Phone: (\_\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_

E-Mail: \_\_\_\_\_

If this is contracted work, provide the name & address of the individual/organization work is being performed for:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Mail **hard copy** of report to address on the heading of this page within 90 days of project completion.

**BAT NETTING/TRAPPING SITE SURVEY RECORD**

1. Survey Date: \_\_\_\_\_ 2. Company Name: \_\_\_\_\_

3. Bat Identifier: \_\_\_\_\_ 4. Assistants: \_\_\_\_\_  
(Responsible Recorder)

5. Site Name and/or Number: \_\_\_\_\_

6. Site is (circle one):      hibernation site                  summer habitat

7a. If hibernation site circle one: limestone mine, coal mine, limestone cave, sandstone cave, RR tunnel,  
other structure, describe - \_\_\_\_\_.

7b. If summer habitat, describe area being sampled (e.g. forested stream or forest clearing with stream):  
\_\_\_\_\_

8. County: \_\_\_\_\_ 9. 7.5' Quad.: \_\_\_\_\_

10. Was site GPS'd (required) ?      YES - NO

11. Geographic Coordinates (D-M-S): Latitude: \_\_\_\_\_°-\_\_\_\_\_'-\_\_\_\_\_"N, Longitude: \_\_\_\_\_°-\_\_\_\_\_'-\_\_\_\_\_"W  
Datum (circle one): NAD27 (Preferred), NAD83, WGS84, Other: \_\_\_\_\_

12. Ownership and Access: (Who owns site or controls access? Give name and address.) \_\_\_\_\_  
\_\_\_\_\_

13. Time (military) & Temperature: Start Time \_\_\_\_\_ h Stop Time \_\_\_\_\_ h Total Minutes: \_\_\_\_\_  
Start Temp. \_\_\_\_\_°C End Temp. \_\_\_\_\_°C (must stay ≥10°C for summer netting)

14. General Weather (circle one): Clear; Partly Cloudy; Mostly Cloudy; Cloudy; Drizzle; Intermittent Rain;  
(suspend netting during periods of rain)                  Steady Rain; Thunderstorms; Snow; Other: \_\_\_\_\_.

15. General Wind Conditions (circle one): Calm, Breezy (Leaves Rustling), Windy (Trees Swaying).

**16. Capture Setup at Site:**

Set #	Type	Count	Dimensions	Description	TOTAL AREA (m)
1	Nets	4	12m x 2.6m	Stacked over trail	124.8 sq. m

Total Capture Area: \_\_\_\_\_ sq. m

(Site Survey Record – Continued) Site Name/No.: \_\_\_\_\_ Date: \_\_\_\_\_

17. Describe habitat 150 m around site: (topography and vegetation including dominant tree species.)

18. Was reproductive status checked? YES / NO (if “NO” only enter numbers in **Total** columns)

**\*CAPTURE RESULTS**

Species	Number of Adult Females				No. Juv. Fem.	Total No. Fem.	Number of Adult Males		No. Juv. Male	Total No. Males	Species Totals
	NR	PG	L	PL			SCR	NR			
<i>Eptesicus fuscus</i>	2		1			3	2	1	1	4	7
<i>Myotis lucifugus</i>											
<i>Myotis septentrionalis</i>											
<i>Myotis leibii</i>											
<i>Myotis sodalis</i>											
<i>Eptesicus fuscus</i>											
<i>Perimyotis subflavus</i>											
<i>Lasiurus borealis</i>											
<i>Lasiurus cinereus</i>											
<i>Lasionycteris noctivagans</i>											
Other – specify:											
Other – specify:											
Reproductive Status: NR= nonreproductive, PG= pregnant, L= lactating, PL= post lactating, SCR= scrotal/epididymis swollen. <b>*Complete Measurement and Capture Data Form for all:</b> (1) <u>Myotis sodalis</u> , (2) <u>Myotis leibii</u> , (3) bats you are banding or band recaptures, (4) radio-tagged bats and (5) bat species not usually found in PA.											Grand Total

19. BAT DETECTORS & OTHER MONITORING DEVICES: Tallies of bat passes / hour. One to 5 hours required for Indiana bat hibernacula surveys. Monitor one hour after 22:00 hrs when trapping/netting hibernacula and 5 hours when only monitoring with bat detectors, night vision or infrared device (when site can not be trapped/netted). Describe procedure & equipment used in remarks.

1 <sup>st</sup> hour	2 <sup>nd</sup> hour	3 <sup>rd</sup> hour	4 <sup>th</sup> hour	5 <sup>th</sup> hour
Start Time:	Start Time:	Start Time:	Start Time:	Start Time:
End Time:	End Time:	End Time:	End Time:	End Time:
Tallies:	Tallies:	Tallies:	Tallies:	Tallies:

20. REMARKS:

**Bat Measurement and Capture Data Form**

(Complete for all (1) *Myotis sodalis*, (2) *Myotis leibii*, (3) bats you are banding or band recaptures, (4) radio-tagged bats and (5) bat species not usually found in PA)

Site Name Or Number:				Date:				Set No. Captured In:			Name of Person Identifying the Bat:				*Capture Number:
Height in meters captured above ground surface: _____ m				Body Measurements (grams and millimeters)						Band Information (if banded) (Band Males on bat's RIGHT fa., Females on bat's LEFT fa.)					Transmitter Attached? If so: Frequency (mHz)
<u>Species</u>	<u>Sex</u>	<u>Age</u>	<u>Repro. Condition</u>	<u>Wt. (g)</u>	<u>Ear</u>	<u>Tragus</u>	<u>Fore- arm</u>	<u>Hind Foot</u>	<u>Recapture Yes/No</u>	<u>Band Material</u>	<u>Band Color</u>	<u>Band Inscription</u>	<u>Band on Left/Right</u>		
<u>Time of Capture</u>	<u>Photo Taken</u> Yes / No	<u>WNS Wing Score</u>		<u>Wing Photo ID:</u> Remarks:											
<i>Repro. Condition: NR= nonreproductive, PG= pregnant, L= lactating, PL= post lactating, SCR= scrotal/epididymis swollen</i>															
Site Name Or Number:				Date:				Set No. Captured In:			Name of Person Identifying the Bat:				*Capture Number:
Height in meters captured above ground surface: _____ m				Body Measurements (grams and millimeters)						Band Information (if banded) (Band Males on bat's RIGHT fa., Females on bat's LEFT fa.)					Transmitter Attached? If so: Frequency (mHz)
<u>Species</u>	<u>Sex</u>	<u>Age</u>	<u>Repro. Condition</u>	<u>Wt. (g)</u>	<u>Ear</u>	<u>Tragus</u>	<u>Fore- arm</u>	<u>Hind Foot</u>	<u>Recapture Yes/No</u>	<u>Band Material</u>	<u>Band Color</u>	<u>Band Inscription</u>	<u>Band on Left/Right</u>		
<u>Time of Capture</u>	<u>Photo Taken</u> Yes / No	<u>WNS Wing Score</u>		<u>Wing Photo ID:</u> Remarks:											
<i>Repro. Condition: NR= nonreproductive, PG= pregnant, L= lactating, PL= post lactating, SCR= scrotal/epididymis swollen</i>															
Site Name Or Number:				Date:				Set No. Captured In:			Name of Person Identifying the Bat:				*Capture Number:
Height in meters captured above ground surface: _____ m				Body Measurements (grams and millimeters)						Band Information (if banded) (Band Males on bat's RIGHT fa., Females on bat's LEFT fa.)					Transmitter Attached? If so: Frequency (mHz)
<u>Species</u>	<u>Sex</u>	<u>Age</u>	<u>Repro. Condition</u>	<u>Wt. (g)</u>	<u>Ear</u>	<u>Tragus</u>	<u>Fore- arm</u>	<u>Hind Foot</u>	<u>Recapture Yes/No</u>	<u>Band Material</u>	<u>Band Color</u>	<u>Band Inscription</u>	<u>Band on Left/Right</u>		
<u>Time of Capture</u>	<u>Photo Taken</u> Yes / No	<u>WNS Wing Score</u>		<u>Wing Photo ID:</u> Remarks:											

\*Capture Number = number in sequence by site.

**PA GAME COMMISSION  
Wildlife Diversity Section  
Day Roost Data Sheet**

1-

**Landowner:** Name: \_\_\_\_\_ Address: \_\_\_\_\_

Phone: \_\_\_\_\_

**2-BAT INFO**

**Dates on Roost:** \_\_\_\_\_ **Day Roost Number:** \_\_\_\_\_

*(Date = Date bat was on roost; Roost No.= Bat # & numbered roost, in sequence, for that bat ~ 241PGC-01)*

**Surveyors:** \_\_\_\_\_ **Type:** Tree - Building - Rock - Other \_\_\_\_\_  
*(Describe rock and other roost structures)*

**Bat Species:** \_\_\_\_\_ **Band No.:** \_\_\_\_\_ **Transmitter Frequency:** \_\_\_\_\_

**Ht.(m) bat is roosting off ground:** \_\_\_\_\_ Was Bat Emergence Form Completed? **YES - NO**

**Comments:** *(Where is bat roosting? Under bark? If building-describe)*

**3-LOCATION**

**County:** \_\_\_\_\_ **Quadrangle:** \_\_\_\_\_

**Latitude:** \_\_\_\_\_ (DMS) **Elevation (ft.):** \_\_\_\_\_

**Longitude:** \_\_\_\_\_ (DMS) **%Slope:** \_\_\_\_\_ **Slope Aspect (0-360):** \_\_\_\_\_

**Datum:** Nad27 (prefered) NAD83 / WGS84 (circle one)

**4-Roost INFORMATION** *(If other than tree, indicate rock, rock cliff, house, barn etc. for species)*

**Species:** \_\_\_\_\_ **DBH (cm):** \_\_\_\_\_ **Is Tree Alive? YES - NO** (CIRCLE)

**Height:** (%UP \_\_\_\_\_ + %DOWN \_\_\_\_\_) X **Dist.(m) to tree** \_\_\_\_\_ = \_\_\_\_\_ m *(For Trees)*

**1st Branch Ht.** (%UP \_\_\_\_\_ + %DOWN \_\_\_\_\_) X **Dist.(m) to tree** \_\_\_\_\_ = \_\_\_\_\_ m *(For Trees)*

**Estimate % Canopy Cover Around Roost:** \_\_\_\_\_

Is suitable roost area exposed to direct sunlight? **YES - NO** (circle one)

If so - estimate # of hours of exposure to direct sun: \_\_\_\_\_

Azimuth of Exposure (which way does exposed part of roost face): \_\_\_\_\_ (1-360)

*For Trees:*

Exfoliating Bark? **YES - NO**

**Estimate % of tree with Exfoliating Bark:** \_\_\_\_\_ %

**Cavities? YES - NO If yes - Describe:** \_\_\_\_\_

**5-SURROUNDING HABITAT**

**Distance (m) to Water:** \_\_\_\_\_ **Water Type:** \_\_\_\_\_

**Understory Species:** \_\_\_\_\_

**Overstory Species:** \_\_\_\_\_

**6-Comments** *(Comment on Overstory Species, Habitat Composition and non-tree roosts. Use back if needed)*

PA GAME COMMISSION, Wildlife Diversity Section  
Bat Emergence Form

\* It is important to keep lights and noise disturbance to a minimum during the emergence period. \*

ROOST NO.: \_\_\_\_\_ DATE: \_\_\_\_\_

ROOST TYPE: Building - Tree - Rock - Other \_\_\_\_\_

Surveyors: \_\_\_\_\_  
\_\_\_\_\_

Transmitted Bat Band No.: \_\_\_\_\_ Transmitter Frequency: \_\_\_\_\_

Weather Temperature: \_\_\_\_\_ \*F

Sky Condition Code: \_\_\_\_\_ Wind Scale Code: \_\_\_\_\_

<u>Sky Conditions</u>		<u>Beaufort Wind Scale</u>	
<u>Code</u>		<u>Code</u>	<u>MPH</u> <u>Indicators</u>
0	Clear or a few clouds	0	<1      Smoke rises vertically
1	Partly cloudy/variable sky	1	1-3 mph      Smoke Drift shows wind direction
2	Cloudy (broken) or overcast	2	4 - 7 mph      Wind felt on face/leaves rustle
4	Fog or smoke	3	8 - 12 mph      Leaves&sm.twigs in constant motion
5	Drizzle	4	13 - 18 mph      Raises dust & loose paper
7	Snow	5	19 - 24 mph      Small trees in leave sway
8	Showers		

Night Vision Equipment Used? YES - NO      Bat Detector Used? YES - NO

Telemetry Equipment Present? YES - NO

Time Surveyors arrived at Roost : \_\_\_\_\_ (use 24 hour clock for times)

Time First Bat Seen Flying: \_\_\_\_\_

Time Transmitted Bat Emerged: \_\_\_\_\_ And Azimuth Last Detected: \_\_\_\_\_

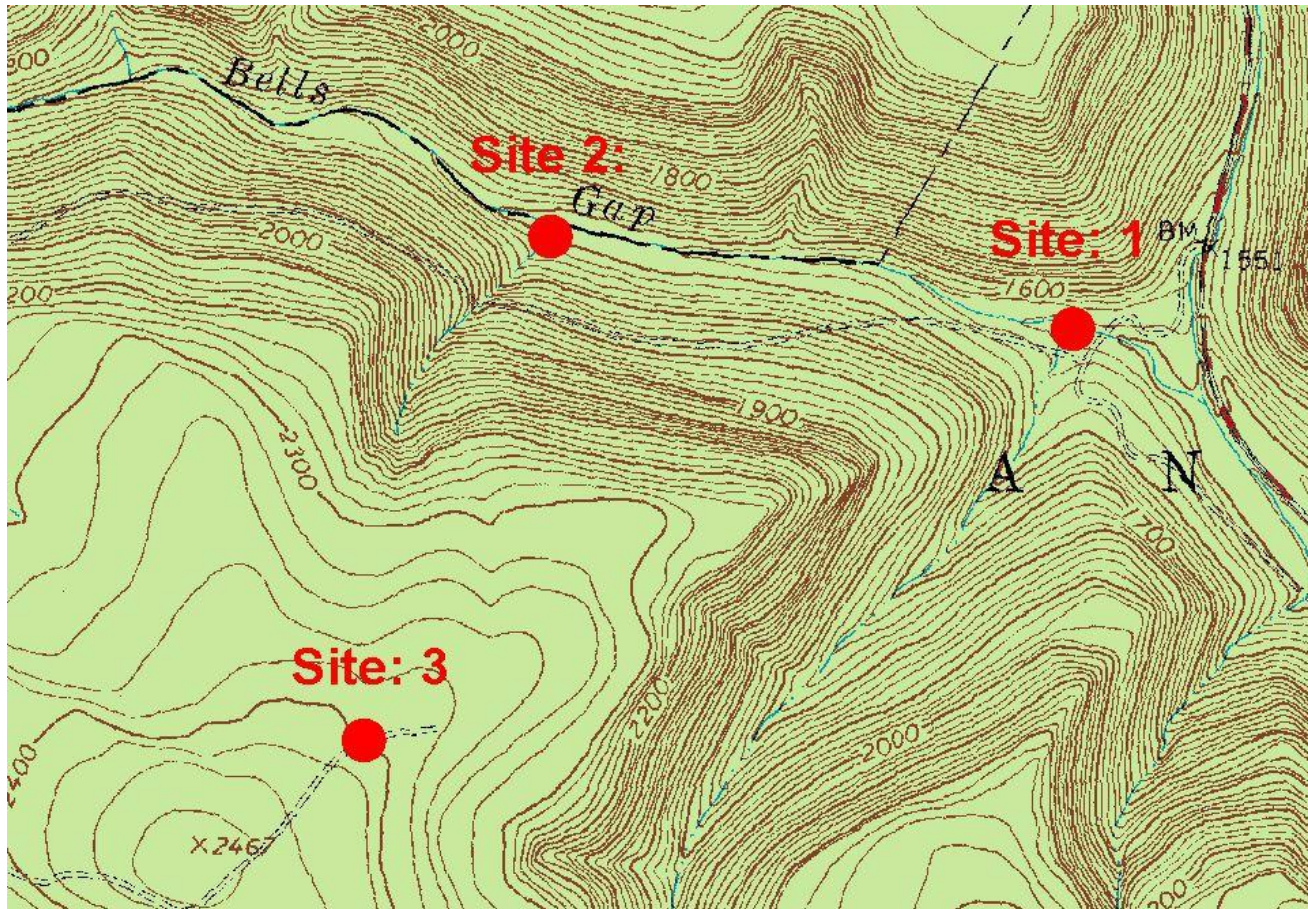
Time Last Bat Seen Emerging: \_\_\_\_\_ Total Emergence Count: \_\_\_\_\_

Comments: (include other emergence observations, weather, bat behavior, etc.)



**Section 5 - Maps** (example)

Blair Co., Blandburg Quadrangle, Bells Gap Area.  
Location of Sites 1, 2, and 3 for Project PA-24



Mail **hard copy** of report to address on the heading of cover page within 90 days of project completion.

**Section 6 - Photos** (example)

Male *Myotis sodalis* captured at **Site 1**

Capture date: **7/18/01**

Capture Number: **06**

Portrait



Keeled Calcar



Mail **hard copy** of report to address on the heading of this page within 90 days of project completion to:

Pennsylvania Game Commission  
Bureau of Wildlife Protection, Special Permits Enforcement Division  
2001 Elmerton Avenue, Harrisburg, PA 17110-9797

# **Appendix I**

## **of Standards and Minimum Requirements**

### **Pennsylvania Game Commission Environmental Review Telemetry Protocol**

**Refer to these standards when specific telemetry is requested by  
The Bureau of Habitat Protection. This document also provides  
general guidance for attaching transmitters to bats.**

Contact:

Tracey Librandi-Mumma  
Wildlife Biologist / Habitat Protection Section Chief  
Pennsylvania Game Commission  
2001 Elmerton Avenue  
Harrisburg, PA 17110  
717-787-4250 3614  
717-787-4251 Fax 717-787-6957  
[tlibrandi@pa.gov](mailto:tlibrandi@pa.gov)

- ❖ Objective: To identify and characterize roosts (trees, buildings, rocky areas), foraging areas, and travel corridors.
- ❖ Data collected from telemetry surveys will be used by PGC Environmental Review staff to determine how to best avoid, minimize, and if necessary, mitigate for potential impacts to bat species.
- ❖ PGC Environmental Review staff may request the use of this telemetry protocol for Eastern small-footed bats (*Myotis leibii*), silver-haired bats (*Lasiorycteris noctivagans*), Seminole bats (*Lasiurus seminolus*), or other bat species as specified in PA Game Commission (PGC) PNDI response letters.

## **Bat Telemetry Protocol:**

---

- *Banding and Transmitter Attachment*
  - Banding
    - Do not attach arm bands or take wing punches without prior PGC approval: banding materials and ID numbers must be approved prior to use. No orange or yellow darvic bands are to be used without specific approval. Split metal bands with tabs and unique number system are preferred for generic banding of species, numbering must be approved ahead of time
    - No banding *M. leibii*
  - Transmitters
    - Try not to exceed 5% and **DO NOT** exceed more than 10% of the bats body weight
    - With the lighter transmitters you should be able to be close to 5%; any transmitter that fits weight rule may be used
- *Equipment*
  - Receivers: Receiver can be a scanning or non-scanning type
  - Antennas
    - Antennas must be tuned to the frequencies of your transmitters and receiver (172 MHz)
    - Antennas should be at least a 2-element (H-antenna) or 3+ element (yagi)
  - Transmitters
    - Transmitters should be tuned to 172 MHz to match the PGC; Approval and justification required in advance from the PGC
    - Transmitter application
      - Transmitters are attached with latex, medical adhesive
      - Recommend PERMA-TYPE surgical cement (Plainville, CT 06062).
      - Using scissors, remove a small patch of fur from the mid-dorsal region (between shoulder blades), then glue the transmitter to the bat's skin with a latex, medical adhesive (Perma-type, Skin-Bond Cement or Osto-Bond)
      - A thin layer of glue is applied to the bat and transmitter separately, allowed to dry a couple minutes until tacky, then joined together to form a secure bond according to manufacturer recommendations
- *Level of effort*
  - Maximum number = 6 bats per survey season
    - All eastern small-footed bats (*Myotis leibii*)



- Reproductive female and juvenile silver-haired bats (*Lasionycteris noctivagans*)
  - Reproductive female and juvenile Seminole bats (*Lasiurus seminolus*)
  - Any other bat species as requested by PGC Environmental Review staff
- Minimum of 3 nights of telemetry per bat
- Minimum of 10 hours a night with a minimum of 3 successful triangulations per hour totaling 30 successful triangulations per night
  - Lead biologist should have experience conducting telemetry on flying bats, be familiar with triangulation programs, be able to overcome typical field application difficulties (i.e. bounce/terrain), and be confident they are meeting these requirements
  - 10 hour minimum per night includes the time spent by the bat roosting, unless time spent roosting can be attributed to weather (rain, wind over 18 mph, and/or night with starting temperatures below 60°F).
  - No more than 2 hours of any night should be missed due to telemetry crew error and/or weather reasons (rain, wind over 18 mph, and/or night with starting temperatures below 60°F).
- For each day any transmittered bat is documented roosting at a particular day roost, a minimum of 1 emergence count is required.
  - All day roost found must have a minimum of 1 emergence count conducted
  - Surveyors should arrive at least ½ hour before sunset and remain at the roost tree, counting all bats emerging until the time at which all bats have emerged or the lighting diminishes to a point at which the surveyor can no longer see to count the bats
  - If emergence counts during telemetry are conducted on nights when the starting temperature is below 60°F or wind codes are 4 and above an additional emergence count is needed when more favorable weather conditions exist
- *Data sheets and Data*
  - Process data by individual animal and provide shapefiles of data points, minimum convex polygons of evening activity and fixed kernel utilization distribution of 95%, 75%, and 50% of the activity data.
  - PGC data sheets MUST be completed:
    - Bat-Netting/Trapping Site Survey Record
    - Bat Measurement and Capture Data Form
    - Bat Transmitter Detection Record
    - Day Roost Forms
      - Complete this form for all roost types – trees, rocks, building, etc.
      - Regardless of roost type, fill out the following under 4-Roost Information:
        - Canopy cover estimation
        - Whether roost is exposed to direct sunlight
        - Hours of exposure to direct sunlight
        - Azimuth of exposure
    - Bat Emergence Form
    - Bats' activity schedule referenced to general locations on a map
      - Foraging and Roosting as a minimum for activity remarks
      - Fall telemetry of males should include amount of time within mine, foraging and roosting

**Exhibit C** (Explicitly Used in Conjunction with the Wind Energy Cooperative Agreement)

# **Protocols to Monitor Bat & Bird Mortality at Industrial Wind Turbines Sites**

**Commonwealth of Pennsylvania  
Pennsylvania Game Commission  
July 26, 2013**

# **Post-Construction Mortality Monitoring**

## I. Duration and Frequency of Monitoring

All mortality monitoring should take place between April 1 and November 15 for a minimum of one year following construction. Selected turbines should be monitored at a frequency no greater than once every three days. Mortality monitoring should commence at such time to ensure that all turbines scheduled to be searched can be completed prior to one hour before sunset. Any missed searches should be rescheduled during the two interval days. Turbines that are being chosen for monitoring should be determined with the initial proposal and must be approved by the PGC prior to commencing surveys.

## II. Number of Turbines to Monitor

The number of turbines monitored will follow the guidelines below as per “Standard Mortality Transect Survey.” Monitored turbines shall be identified in consultation between the parties and base upon pre-determined bat and bird risk assessment. A minimum of 10 turbines will be sampled, or a maximum of 20% of the turbines will be sampled (which ever is greater). If the project contains less than 10 turbines, all turbines in the project area will be sampled unless otherwise agreed to by the Commission.

## III. Mortality Monitoring Procedures

At each turbine to be monitored, a rectangular plot that is 120 meters by 120 meters will be centered on the turbine. Although evidence suggests that > 80% of the bat fatalities fall within ½ the maximum distance of turbine height to ground (Erickson 2003a,b) search areas vary and often do not allow surveys to consistently extend to this distance. Therefore, the searchable area underneath turbines will be delineated and mapped, and estimates of mortality will be produced. Maps are to be constructed illustrating all turbine locations, a designated numbering system for turbines, 120 meter plot, boundaries of survey areas, and searchable areas (broken down into visibility classes and transect numbering if performing standard transect surveys).

- 1) Times spent surveying each turbine should be recorded for each search and remain consistent.
- 2) Each search of a single turbine can be surveyed by no more than two search personnel. If two searchers are used, the search teams must rotate between turbines searched and in what order the team searches each turbine throughout the entire monitoring season. Additionally, searchers will rotate on what side (east vs. west, and north vs. south) they begin their searches. The transects of each search plot will be divided such that each searcher surveys approximately equal transect distance. Searchable transects will be assigned to each searcher at each turbine. For example: searcher A will begin their search at the southern end of a central transect on odd calendar days and work their way West while searcher B will begin at the northern end of an adjacent central transect and work their way East. On even calendar days, searcher A will begin at the northern end of a central transect and work their way West while searcher B will begin at the southern end of an adjacent central transect and work their way East. At no time will both searchers search the same transect of any one turbine on any one day.

- 3) All information gathered (i.e. specimen location, species, transect/net grid number, etc.) should be entered on data sheets provided. Any mortality that occurs to state listed endangered or threatened species should be reported to the PGC within 72 hours.
- 4) Any large mortality events (>50 total animals) or mortality of any eagle that occur outside of the survey periods are to be reported to the PGC within 72 hours.
- 5) Separate data sheets will be used for each date of survey completed. All carcasses are to be picked up and bagged upon discovery. They are to be identified, handled, labeled, and labeled properly, in accordance with the special use permit, with the date, turbine number, transect number, and unique specimen number.
- 6) All specimens located should have a distance and azimuth **from** tower recorded on data sheet. It is appropriate to use a numbered flag for each specimen and record distance and azimuth upon completion of transect searches, so long as flags are removed after each day/turbine.
- 7) All carcasses are to be submitted with data sheets at a minimum of every 2 months to the local regional office of the PGC.
- 8) A summary report of this monitoring, including all data sheets and maps are to be submitted with the annual reports (due December 31) until monitoring is complete. A complete set of all post-construction mortality data sheets should be included.

#### IV. Standard Mortality Transect Surveys:

The basis for the methods to be followed for this procedure are set forth by Erickson 2003a, 2003b, Bats and Wind Energy Cooperative 2005 final report, and Kerns and Kerlinger 2004. Areas defined for surveys should be mapped and depict not only prominent structures and area, but in addition to previous studies, label search areas into 1 of 4 visibility classes. All visibility classes represented should be included in the map and proportion of each noted in report. Each visibility class will be equally tested, with a minimum of 50 trials per visibility class using carcasses returned by the PGC.

#### V. Visibility Classes

Each turbine will have the vegetation in the searchable area defined into one of the following 4 classes and mapped for submission.

Class 1 (easy): Bare ground 90% or greater; all ground cover sparse and 6 inches or less in height (i.e. gravel pad or dirt road).

Class 2 (moderate): Bare ground 25% or greater; all ground cover 6 inches or less in height and mostly sparse.

Class 3 (difficult): Bare ground 25% or less; 25% or less of ground cover over 12 inches in height.

Class 4 (very difficult): Little or no bare ground; more than 25% of ground cover over 12 inches in height.

- 1) Following the establishment of searchable areas, the breakdown of this area into visibility classes, and mapping of each turbine, transects should be established at no greater than 6 meters apart and marked every 10 meters.



- 2) Each transect will be walked with ½ of the distance between transects to be examined by the searcher.
- 3) As transects are searched, carcasses should be bagged and labeled properly (date, turbine number, transect number, carcass number) and a numbered flag placed in their place. At completion of each turbine, the distance and bearing from each turbine should be recorded and then all flags removed.
- 4) Searches will be abandoned if severe weather is present, and continue if it clears.

## VI. Validation Guidelines

Performing carcass removal and searcher efficiency trials are the standard methods performed together to correct for bias in data collection. When available, the PGC will provide additional carcasses for use in these trials. Below are accepted techniques to perform this correction. However, please note the PGC will consider alternative methods of validation, to include but not limiting to the use of dogs, thermal imaging, night optical devices, etc.

## VII. Carcass Removal Trials

Because there are numerous variables that may make every turbine unique, we suggest placing an equal number of carcasses per turbine to be monitored for removal. Additionally, all 4 visibility classes should have an equal sample size. A random bearing and distance from the turbine should be selected to determine placement of the carcass. For these trials, carcasses should be monitored daily for at least the first seven days. After seven days, the carcasses may be monitored at a lesser frequency not to exceed every three days until the trial carcass has been removed or the trial ends at 21 days. Ideally, the total number of bird and bat carcasses used should be representative of the actual mortality at the site, with no less than 50 specimens monitored per year. These trials should be performed periodically throughout each monitoring session. Before placement, each carcass must be uniquely marked in a manner that does not cause additional attraction and have its location recorded. Records shall include the turbine number, a brief description of immediate vegetation that may impede visibility, classification using one of the 4 visibility classes described above, and length of time before removal.

## VIII. Searcher Efficiency Trials

To produce the best estimates of mortality, a high number of searcher efficiency trials will be performed. A minimum of 200 individual trials will be performed to test searchers. The carcasses will be toe clipped, wing punched, or other method that does not cause additional attraction, to identify them. Carcasses missed by searchers should be picked up after their survey is complete and will be used again unless the condition of the carcasses is deteriorated beyond use. The habitat surrounding turbines may vary considerably and searcher efficiency appears highly correlated to visibility and habitat types. Therefore, the search area defined for each turbine surveyed will be divided into the 4 visibility classes (illustrated on map). An equal number of carcasses will be placed in each visibility class, and will be placed at a random azimuth and distance. Each turbine monitored by searchers should be examined, with an equal number of carcasses placed at each turbine.

Testing should occur sporadically throughout monitoring periods and searchers should not be made aware they are being tested. An effort should be made to test searchers equally during both inclement and good weather, with weather conditions recorded. Carcasses placed

should be representative of the percentage and number of species found during the mortality monitoring, and should replicate the manner in which the majority of bats are found in that visibility class (i.e. crawled under vegetation).

### IX. Mortality Estimator

Use at least the following two methods to determine mortality; other methods are welcome and encouraged as long as they are done in addition to the below method.

1. Erickson Estimator: To estimate the time that carcasses persisted in the study plots, the average time that a carcass was present in scavenger removal trials,  $t$ , was calculated. Because trials were halted after X days, the data are right-censored, and this was compensated for by estimating the mean time to removal using a maximum likelihood estimator for  $t$  using the following formula:

$$\bar{t} = \frac{\sum_{i=1}^s t_i}{s - s_c}$$

where  $s$  = the number of test carcasses used in search trials,  $s_c$  = the number of test carcasses that remained in the study area at the end of the carcass removal trial, and  $t_i$  = the number of days carcass  $i$  remains in the search area. The probability that a carcass would be detected by searchers ( $p$ ) was assessed through searcher efficiency trials. The estimate of  $p$  was calculated as the number of trial carcasses found by searchers divided by the total number of successful trials (excluding trials where the carcasses were not found by searchers and were also not found later that day by testers; these carcasses were assumed to be scavenged).

Erickson et al.'s (2004) mortality estimator calculates a per-turbine annual fatality rate ( $m$ ) as:

$$m = \frac{\bar{c}}{\hat{\pi}}$$

where  $c$  is the mean number of carcasses observed per turbine, and  $\hat{\pi}$  adjusts for both carcass removal and searcher efficiency under the assumption that carcass removal times ( $t_i$ ) follow an exponential distribution:

$$\hat{\pi} = \frac{\bar{t} \cdot p}{I} \cdot \left[ \frac{e^{\frac{I}{\bar{t}}} - 1}{e^{\frac{I}{\bar{t}}} - 1 + p} \right]$$

This searcher-efficiency, scavenger-removal (SESR) corrected estimate was calculated separately for each turbine, using the averaged figures of  $t$  and  $p$ .

Individual SESR-adjusted mortality figures for each turbine were adjusted for searchable area. Finally, the estimated total annual mortalities for the searched turbines were summed and adjusted for the proportion of turbines searched. The final result is an estimate of the total mortality.

A confidence interval for the corrected estimate of total mortality is determined by bootstrapping the trials of carcass removal and searcher efficiency.

*NOTE: Erickson (2004) equation must be used along with the USGS estimator. Other equations are acceptable but only if they are used in addition to the Erickson equation. If a third equation is used, please provide a comparison between the methods and results.*

**Bootstrapping Guidance:** The statistic whose confidence limits we are interested in calculating is the total fatality at a site. You have sampled a subset of turbines at the site and should have three different data sets that need to be combined in order to calculate fatality: Searcher efficiency (SE) trial data, carcass persistence (CP) trial data, and the actual casualty data. Your SE and CP trials should be able to estimate different parameters for different size classes of birds and bats and perhaps different seasons. It is critical that you have an adequate sample size to estimate each parameter (if you have two size classes and 4 seasons that's 8 SE and 8 CP parameters), i.e. no less than 25 and preferably closer to 50 trial carcasses should have been used for each parameter. For illustration, let's assume you have 30 large and 30 small carcasses that you have placed in SE trials in 4 seasons, for a total of  $30 \times 2 \times 4 = 240$  trial carcasses, or 30 in each of 8 groups; same for CP trials. For this example we will assume you have searched 24 out of 63 turbines at a site.

Here's the algorithm –

- 1) Draw a sample with replacement from the SE trial data in each size class and season, i.e. draw a sample of 30 with replacement from the 30 carcasses in each group. Estimate SE for each of the 8 groups.
- 2) Draw a sample with replacement from the CP trial data in each size class and season, i.e. draw a sample of 30 with replacement from the 30 carcasses in each group. Estimate average CP for each of the 8 groups using interval censored (not right censored) survival analysis methods.
- 3) Draw a sample with replacement from the set of 24 sampled turbines. Sample the casualty data based on the re-sampled set of turbines, i.e. if turbine #3 is drawn twice, all the casualty data from that turbine will be included, and if turbine #5 is drawn twice, then all the casualty data from that turbine will occur twice. But you need to keep information from each re-sampled turbine separate in order to calculate the per turbine fatality. It is easiest to just renumber the turbines in the sample so that those like #5 that occur twice, are given a two unique turbine IDs. We don't need to keep track of the actual turbine numbers, just that some set of casualties came from that turbine. We also need to know when a turbine has 0 casualties and include those 0s in our estimates.
- 4) Merge CP and SE estimates with the casualty data by size class and season.
- 5) Apply the correction factors, using the equations presented above (being sure to include the 'effective' interval factor where appropriate), to each carcass.
- 6) Append these data to a base file, including an identifier for the iteration.
- 7) Repeat the process 5000 times.

Once you have 5000 iterations (with varying numbers of observations in each depending on which turbines you select and how many casualties are found at each), you should

have a fairly large data set that we'll call the BOOT data. Now you need to:

- 1) Sum the corrected fatality within each iteration and turbine ID to give total fatality in each turbine. You should have 24 \* 5000 observations in this data set.
- 2) Calculate the average fatality per turbine for each iteration. You should have 5000 observations.
- 3) Order these data and find the mean and 2.5th and 97.5th quantiles of these 5000 fatality estimates. That is your bootstrapped estimate of average fatality per turbine at the site. To get total site fatality simply multiply these estimates by N or 63 in this example.

Because the 8 SE parameters and 8 CP parameters will be the same within an iteration, you can:

- 1) Calculate the average SE and CP for each size class \* season in each iteration. You should have 8 \* 5000 observations of each (SE & CP).
- 2) Calculate the mean and 2.5th and 97.5th quantiles of these 5000 SE & CP estimates for each combination of size and season to give your bootstrapped estimates and CIs of these.

If there are subsets of the data that are of interest, say raptors or passerines, you can summarize the BOOT data accordingly.

It is critical to remember the parameter that we are interested in bootstrapping is the fatality. We do not have a closed form estimate of its variance, so we need to bootstrap it. We cannot bootstrap the SE separately from the CP then apply them once to estimate fatality. We need to bootstrap sample each of these at each iteration. Because this process involves three bootstrap samples, there is no canned software that will carry this out but an experienced programmer should be able to calculate this in R or C or C++ or SAS. Excel should not be used to bootstrap.

2. USGS Fatality Estimator: In addition to the Erickson Estimator, the PGC now requests that mortality estimates be calculated using the USGS Fatality Estimator Software, This software is available free to the public, and includes a user's guide for instructions. The PGC recommends reporting all confidence intervals at 95%. The user's guide and software can be found at the USGS website: <http://pubs.usgs.gov/ds/729/>.

In the future, if additional estimators are deemed appropriate by both PGC and Cooperators, they will be implemented.

COMMONWEALTH OF PENNSYLVANIA  
Pennsylvania Game Commission  
Bureau of Law Enforcement, Technical Services Division  
2001 Elmerton Avenue, Harrisburg, PA 17110-9797

**Section 1 - Cover**

**WIND FARM PERMITTEE**  
**POST-CONSTRUCTION BAT MORTALITY SURVEY REPORT**

**Permit Number** \_\_\_\_\_

**Project Name:** \_\_\_\_\_

**Company/  
Organization/  
Permittee Name:** \_\_\_\_\_

**Address:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Phone:** (\_\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_ **Fax:** (\_\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_

**E-Mail:** \_\_\_\_\_

**Project Supervisor Name:** \_\_\_\_\_

**Supervisor Contact:** Phone: (\_\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_

**E-Mail:** \_\_\_\_\_

If this is contracted work, provide the name & address of the individual/organization work is being performed for:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**GPS Locations of All Wind Turbines at this Project.**  
*(Provide Lat/Lon coordinates in Decimal Degrees format.  
Also provide datum used (NAD27 Preferred))*

Project Name: \_\_\_\_\_

Page: \_\_\_\_ of \_\_\_\_

Total No. of Turbines: \_\_\_\_\_

Lat/Lon GPS Location Information (Decimal Degrees) for All Turbines.

DATUM used:

Turbine No.	Latitude	Longitude	Comments

*Use additional pages if necessary*

**Description of Wind Turbine Searched for Carcasses.**

**Project Name:** \_\_\_\_\_ **Turbine Number:** \_\_\_\_\_

**1. Diameter of Blade Span:** \_\_\_\_\_ m **Number of Blades:** \_\_\_\_\_

**2. Blade Height Above Ground- Max.:** \_\_\_\_\_ m; **Min.:** \_\_\_\_\_ m

**3. Surface Area of Search Plot:** \_\_\_\_\_ m<sup>2</sup>

**4. Attach map of each turbine with 120 meter plot, search boundaries, location and numbering of transects/area covered by nets, and visibility classes if applicable on separate sheet.**

**5. Attach a spread sheet with weather data collected at 10-minute intervals. Data should include wind speed, temperature, precipitation, cloud ceiling height, and height and altitude of monitoring device.**

**6. General Habitat Description and Topography within 100 m of Turbine:**

**7. General Habitat Description and Topography >100m from Turbine:**

**COMMONWEALTH OF PENNSYLVANIA**

Pennsylvania Game Commission

Daily Search Summary

Page: \_\_\_\_\_ of \_\_\_\_\_

Project Name: \_\_\_\_\_

*(complete each day of search)*

Date	Turbine Number	Observer	Time		Weather <sup>a</sup>	Number of Carcasses Found				Comments
			Start	End		Bat	Bird	Other	Total	

<sup>a</sup>Weather: F= fog, D= drizzle, R= steady rain

(Use additional pages as needed)













**Exhibit D** (Explicitly Used in Conjunction with the Wind Energy Cooperative Agreement)

**Pennsylvania Game Commission (PGC)  
Endorsed Best Management Practices for  
Pennsylvania Wind Energy Facilities**

**Commonwealth of Pennsylvania  
Pennsylvania Game Commission  
July 26, 2013**

# **Pennsylvania Game Commission (PGC) Endorsed Best Management Practices for Pennsylvania Wind Energy Facilities**

## **Overview and Objective**

These are Best Management Practices (BMPs) for Wind Energy Facilities in Pennsylvania. They do not stand alone and are an element of the Pennsylvania Game Commission's (PGC) Wind Energy Voluntary Cooperative Agreement.

These BMPs are designed for use by developers and operators to establish a goal for best-in-class wind energy development/operation in Pennsylvania. They offer a set of practices to ensure the proper construction/operation of wind energy in Pennsylvania.

The BMPs should be applied to each project site. Although they establish best-in-class goals, they do not constitute regulatory standards or development obligations. Technical and economic feasibility, as well as wildlife and environmental resource management, should be considered in applying these BMPs. In addition, regulations and landowner rights and agreements shall take precedence where they apply.

The following BMPs are recommended for the construction, operation, and decommissioning of wind energy facilities. Please note the following:

- a. Siting BMPs are not included because siting in regards to birds and mammals is addressed within the other sections of the PGC Wind Energy Voluntary Cooperative Agreement.
- b. BMPs found within the PGC Wind Energy Voluntary Cooperative Agreement are not included in the below list (such as conducting one-year pre-construction and one-year post-construction surveys to assess impacts to birds and mammals).
- c. Only BMPs that fall under the PGC jurisdiction in that they relate to the protections of birds and mammals and their habitats, are included.
- d. Wind developers typically lease and do not own the land on which they develop wind projects; therefore private landowner's land use plans have been taken into consideration in the development of these BMPs.
- e. Revisit the BMPs as needed to discuss new information and operational protocols identified during ongoing mitigation studies.

## **A. CONSTRUCTION**

1. To the extent practicable, avoid and minimize impacts to important habitats not protected under the Pennsylvania Natural Diversity Inventory environmental review process, such as those identified in the Pennsylvania Wildlife Action Plan (WAP), that provide critical

habitats for Species of Greatest Conservation Need (SGCN). SGCN are listed in WAP Tables 10.6, 10.7 and individual SGCN/habitat associations are defined in WAP Tables 12.5, 14.9, 15.3, 16.3, 17.2, 19.3, 20.3, 21.8, 22.4 (Williams, L., et al., editors. 2005. Pennsylvania Comprehensive Wildlife Conservation Strategy. Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission. Version 1.0. Harrisburg, Pennsylvania, USA).

2. To minimize habitat fragmentation during construction of the project site, locate facilities (such as tower footprint, collector cable routes, t-line, access road, substation, etc.) in or adjacent to existing ROW and disturbed areas and minimize the number and length of access roads, using existing roads to the fullest extent practicable.
3. Each project will have a designated point of contact for environmental and public inquiries.
4. Each project will designate representatives to ensure compliance with project permits and approvals by employees and contractors.
5. Use tubular turbine towers or best available technology to reduce ability of birds to perch and to reduce risk of collision. Turbines should be a non-obtrusive color, such as white, off-white or gray, monopole design.
6. Avoid guyed towers (i.e. communication and meteorological) at wind energy project sites. If guy wires are necessary, bird flight diverters or high visibility marking devices should be used.
7. Wind turbines should not be permanently artificially lighted, except to the extent required by the FAA or other applicable authority. Employ only red, or dual red and white strobe, strobe like, or flashing lights, not steady burning lights, to meet FAA requirements for visibility lighting of wind turbines, permanent met towers, and communication towers (see Gehring et al. 2009)<sup>1</sup>. Only a portion of the turbines within the wind project should be lighted, and all pilot warning lights should fire synchronously.
8. Keep lighting at both operation and maintenance facilities and substations 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.
9. Wind turbines should not display advertising, except for reasonable identification of the turbine manufacturer, facility owner and operator to minimize impacts to wildlife.

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<sup>1</sup> Gehring, J., P. Kerlinger, A. M. Manville II. 2009. Communications towers, lights, and birds: successful methods for reducing the frequency of avian collisions. *Ecological Applications* 19: 505-514.



10. Minimize, to the extent practicable, the area disturbed during construction. Each turbine clearing area should be five acres or less and post-construction turbine cleared area should be less than two acres per turbine or minimum for operation and/or maintenance.
11. Electrical collection systems between turbines should be buried below plow depth where feasible, and if possible co-located with roadways where practicable.
12. To reduce avian collisions, place low and medium voltage connecting power lines associated with the wind energy development underground to the extent possible, unless the burial of the lines is prohibitively expensive (i.e. 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, such as between roosting and feeding areas or between lakes, river, and nesting habitats. To the extent practicable, they should be marked in accordance with Avian Power Line Interaction Committee (APLIC) collision guidelines.
  - b. Overhead lines may be used when they 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.”
13. All infrastructure should be constructed in as small an area as is practical.
14. Segregate topsoil for use in reclaiming temporarily disturbed areas. Upon completion of construction activity, areas to be reclaimed should be planted within the first growing season to achieve 70% re-vegetation. Incorporate native plants into the reseeding mix where consistent with permits and applicable regulations. Soil supplements (lime, fertilizer, and/or mulch) should be added as needed and are the responsibility of the operator.
15. To the extent practicable, measures should, be implemented during construction to avoid the introduction and spread of invasive species by following applicable local policies for noxious weed control which may include: cleaning vehicles and equipment arriving from areas with known invasive species issues, using locally sourced topsoil, and monitoring for and rapidly removing noxious weeds. Project construction areas to be reclaimed should be re-vegetated with appropriate non-invasive seed mixes, incorporating native species where consistent with permits and applicable regulations.

## **B. OPERATIONS**

1. Reduce project road access to extent practical and consistent with safety needs, environmental concerns, legal requirements and the requests of the landowner.
2. 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.

3. Instruct employees, contractors, and site visitors to avoid harassing or disturbing wildlife, particularly during reproductive seasons.
4. Implement a Wildlife Incident Reporting System for the life of the project. A Wildlife Incident Reporting System is a specific set of processes, procedures and training for monitoring, responding to, and reporting bird or mammal injuries and fatalities to the Pennsylvania Game Commission.
5. On project maintained land, limiting mowing to the fullest extent possible between April 1 and July 31.
6. Each site should have a Spill Protection, Control, and Countermeasure plan in place as required under Pennsylvania Department of Environmental Protection regulations to avoid and minimize impacts to wildlife.

### **C. DECOMMISSIONING**

1. Except where otherwise required by an applicable regulation or an agreement with the landowner, the facility owner and operator should, at its expense, complete decommissioning of the wind energy facility within eighteen (18) months after the end of the useful life of the facility to reduce the likelihood of additional wildlife collisions with the non-operational structures.
2. Except where otherwise required by an applicable regulation or an agreement with the landowner, decommissioning should include removal of all facilities, including turbine foundations to a depth of 36 inches except that facilities may be left in place at the request or with the consent of the landowner.
3. During decommissioning of the wind energy facility, additional wildlife habitat loss should be minimized by utilizing existing ROWs and previously disturbed corridors to the fullest extent practicable.
4. Prior to decommissioning, and in coordination with the landowner, the facility owner and operator should develop a re-vegetation plan that favors Pennsylvania native plant species in order to enhance the wildlife habitat value of the project area.