

Coal Mining in West Virginia: Guidelines for Protecting the Indiana Bat (*Myotis sodalis*)

January, 2007



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INTRODUCTION

The purpose of this document is to aid coal mining applicants in understanding the options and protocol associated with mining in areas containing known or potential habitat for the Indiana bat, a Federal listed endangered species, and to provide guidance in meeting permitting and performance standards as it relates specifically to the Indiana bat. For reference, a detailed life history of the Indiana bat is presented in Appendix I.

This document was developed by the U.S. Fish and Wildlife Service, West Virginia Field Office (USFWS), in cooperation with the West Virginia Department of Environmental Protection (WVDEP) the West Virginia Division of Natural Resources (WVDNR) and the Office of Surface Mining (OSM) using the best available scientific research regarding the Indiana bat, its habitats, and behavior. As new research efforts result in additional knowledge about the species, revisions to this document may be necessary.

West Virginia's coal regulatory program contains several references to the protection of threatened and endangered species and their habitats (West Virginia Surface Mining Reclamation Rules 38 CSR 2 § 3.18, 38 CSR 2 § 8). A 1996 Biological Opinion provided by the FWS to OSM requires the development of species-specific conservation measures to help ensure protection of Federally-listed species and Federally-designated critical habitats. In most cases, the Biological Opinion takes the place of individual project consultation under the Endangered Species Act (ESA). However, to be exempt from section 9 of the ESA, WVDEP must comply with the specific terms and conditions of the Biological Opinion. One of the conditions is that WVDEP "must implement and require compliance with any species-specific protective measures developed by the Service (USFWS) field office and the regulatory authority with the involvement, as appropriate of the permittee and OSM." This document represents the development of such species-specific protective measures. Mine permit applicants may have different protective measure requirements or options, depending on the size, location, and other characteristics of the project area. This document outlines these requirements and options below (also see Figure 1. for flowchart summarizing the requirements and options).

Throughout the permitting process, applicants should coordinate directly with the WVDEP. Following initial application, the applicant will be notified by WVDEP if the proposed project falls within 2 miles of a known Indiana bat maternity roost, or within 5 miles of a known hibernaculum. In these cases, coordination with USFWS will be necessary. In some situations, direct communication with the USFWS will be necessary, and such situations are outlined in the document. This document focuses on the Indiana bat with the understanding that protocols for other Federally-listed species will be developed following finalization of this protocol.

GENERAL REQUIREMENTS

Mining operations may affect the Indiana bat in situations where proposed surface disturbance areas are located near a documented Indiana bat hibernaculum or maternity roost, or when forested habitat which could serve as foraging or roosting areas is cleared. To protect the Indiana bat during mine operations, the appropriate course of action will depend on the size, location, and circumstances associated with a project. Potentially occupied summer and/or winter habitat for the Indiana bat may exist within any proposed mining permit area within the state of West Virginia.

Forest habitat containing trees ≥ 5 inches in diameter at breast height (dbh) is considered suitable summer roosting habitat. The applicant should make a determination of the amount of suitable Indiana bat summer roosting habitat that will be removed from the proposed mine site.

In the past several years, the acreage limit used as a threshold was 17 acres. This number was based on the information at the time about available summer habitat in West Virginia and how much area foraging females need during the summer months. Recently, new information about foraging females associated with maternity colonies has become available. This new information is based on surveys performed in Pennsylvania (Butchkoski pers. com.; Butchkoski and Hassinger 2002). Pennsylvania and West Virginia share several common features including similar forest composition, elevations, and large tracts of forest. Therefore, Pennsylvania information has been used to fill data gaps in this analysis. The surveys indicated that females use between 50 and 96.4 acres, at a minimum, of habitat for foraging during the summer. Butchkoski (pers com) found that on average, females were using 167 acres for foraging. The surveys occurred in relatively high quality habitat areas with stands of older trees and access to riparian areas. A summary of foraging ranges used by Indiana bats throughout their range shows that the smallest documented foraging range to be 39.5 acres in Illinois (Gardner et al 1991). Studies in Kentucky (Kiser and Elliot 1996) and Missouri (Romme et al 2002) resulted in minimum home range sizes ranging from 69.1 to 150.7 acres, respectively.

While it is difficult to count the number of Indiana bats present in West Virginia in the summer, it is possible to count the number of hibernating bats. The West Virginia Department of Natural Resources (DNR) estimates that there were 12,677 hibernating Indiana bats in West Virginia during winter counts in 2005 (DNR 2005). In addition, 78% (12 million acres) of West Virginia is covered by forests (Childs 2005). If it is assumed that there is at least the same number of bats present during the summer, and based on an average acreage requirement of 167 acres per bat, then the total habitat requirement for Indiana bats in West Virginia is approximately 2 million acres. This means that there is sufficient habitat available for foraging Indiana bats in West Virginia.

This protocol is based on the assumption that given the quantity of available foraging habitat for female Indiana bats and the smallest foraging area documented, removal of timber less than 40 acres should not result in adverse impacts to foraging female Indiana bats. Therefore, based on the amount of available summer habitat and the recent information about female bat foraging areas, the revised threshold is 40 acres. Above 40 acres, non-discountable effects, including cumulative effects, to foraging female Indiana bats may occur. Forty acres applies to the project in its entirety, not to phases of the same project. This is based on the time required for maturation of the forest.

Forty (40) acres is presently used as the threshold between projects which will have discountable effects on Indiana bats. If less than 40 acres of Indiana bat summer habitat will be removed as a result of the proposed mine operation, tree removal can occur at any season of the year. If 40 or more acres but less than two hundred forty seven (247) acres of Indiana bat summer roosting habitat will be disturbed as a result of the proposed mine operation, the applicant can choose either (Option 1 or Option 2) to avoid incidental take of the Indiana bat (please see Figure 1.). If 247 or more acres of summer habitat will be removed, Option 1 is required.

Again, a previous method to determine when “too much” habitat was to be removed was used. However, that method was difficult to apply consistently and did not capture potential impacts to forest habitat over time. The threshold of 247 acres was chosen based on the requirement in the draft Indiana bat recovery plan (1999) that 2 mist net sites were required for every 247.1 acres of habitat to be removed. The same information about habitat use described in the recovery plan was used to adopt the 247 acre threshold. The 0.1 was dropped for ease of use.

One other change is included in this protocol. The mist net surveys are valid for 5 years, instead of 3 years. This is based on the permit renewal cycle for DEP SMCRA permits. The surveys are valid for 5 years if the applicant has a new application or is renewing an existing permit prior to initiation of mining activities (Permit Renewal of Not Started permits).

Assessment of Portals and Potential Winter Habitat:

All SMCRA permit applicants are also required to assess the presence of portals or caves on the permit area, evaluate any portals discovered, and to provide information related to portals and potential Indiana bat winter habitat in a Winter Habitat and Portal Survey Report (page 5). This report will contain, at a minimum, information related to portals and other potential winter habitat in the permit area. If there are no portals on the project area, this report will be brief, but will document the information and process used to confirm the absence of portals. In addition, it will contain the results of any Phase I Portal Assessments and Portal Mistnet Surveys determined to be necessary.

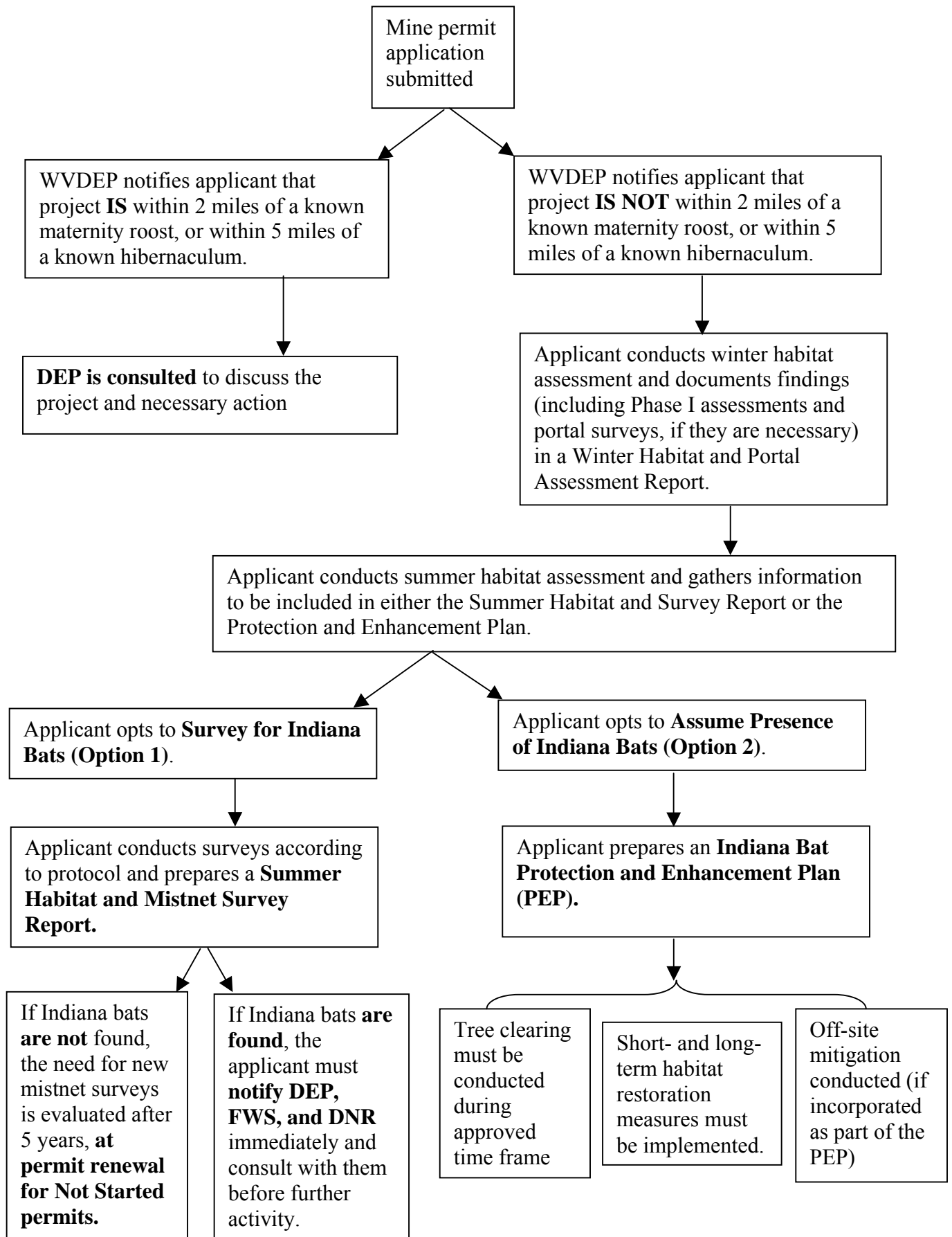
Assessment of Potential Summer Habitat:

All SMCRA permit applicants are required to evaluate potential Indiana bat summer habitat on the permit area. Information related to potential summer habitat is to be provided in the “Summer Habitat and Mistnet Survey Report,” or “the Protection and Enhancement Plan,” depending on the Applicant Option utilized.

Document Submission

Two copies of the Winter Habitat and Portal Survey Report, the Summer Habitat and Mistnet Survey Report or Protection and Enhancement Plan (depending on option utilized, as described below) should be submitted to WVDEP, one being for distribution to USFWS for expeditious review. The applicant will receive notification from WVDEP regarding the acceptability of the submission after WVDEP has received comments from USFWS. An application cannot be determined administratively complete until these documents are submitted to and found acceptable by WVDEP and USFWS. Throughout this entire process the applicant is encouraged to consult with WVDEP. WVDEP will coordinate with USFWS as necessary.

FIGURE 1- SUMMARY OF APPLICANT REQUIREMENTS AND OPTIONS



APPLICANT OPTIONS:

If the WVDEP determines that the mining project falls within 2 miles of a known Indiana bat maternity roost, or within 5 miles of a known hibernaculum, the applicant will be informed by WVDEP following initial application. In these cases applicants must coordinate with WVDEP. WVDEP will coordinate with USFWS.

Where the mining project does not fall within 2 miles of a known maternity roost or within 5 miles of a known hibernaculum and based upon the factors described above, such as size of the project area, two options are potentially available to applicants:

Option 1. – Survey for Indiana Bats

Conducting mistnet surveys to demonstrate presence or probable absence of the Indiana bat in summer habitat on the proposed permit area is the most efficient way to plan mining operations with only the necessary and appropriate conservation measures in place. This option will be required when a proposed activity will occur if more than 247 acres will be disturbed or if the activity occurs within 2 miles of a known maternity roost. Mistnet survey requirements must be followed (Appendix C). A detailed description of potential summer habitat on the permit area, mistnet survey procedures followed, and mistnet survey results must be provided in a Summer Habitat and Mistnet Survey Report (see page 6).

In addition to the Winter Habitat and Portal Survey Report (see page 5), this Option requires a Summer Habitat and Mistnet Survey Report (see page 6)

The mistnet capture of bats confirms their presence, and requires that the applicant immediately contact West Virginia Department of Natural Resources (WVDNR), WVDEP, and USFWS. All captured Indiana bats must be fitted with a radio transmitter upon capture and tracked to determine, if possible, the location of the roost tree(s) and foraging areas. Emergence counts must be conducted at any roost trees discovered during radio tracking. These activities should be coordinated with WVDNR, WVDEP, and USFWS to ensure appropriate tracking effort and protocol.

Although failure to catch Indiana bats does not confirm absence, negative data acquired during a survey conducted in accordance with approved protocol will be accepted as confirmation of the absence of the Indiana bat. The WVDEP will re-coordinate with the USFWS every five years, at Permit Renewal of Not Started permits, to determine whether additional surveys will be required. Capture of Indiana bats should be interpreted carefully. If only a single male or non-lactating female is captured, it may be a transient or migratory individual. Capture of lactating females or juveniles during the summer likely indicates a maternity colony. Multiple captures at a cave or portal during the fall sampling period likely indicates the presence of a hibernaculum.

Option 2. – Assume Presence of Indiana Bats

If the applicant wishes to pursue this option, it must first be discussed with the DEP to determine if it is appropriate. Because the summer presence of the Indiana bat is assumed with this option, a Protection and Enhancement Plan (PEP) which describes summer habitat in detail, assesses the risk of the activity to Indiana bat recovery, and includes measures to avoid and minimize impacts to Indiana bats, will be required.

In addition to the Winter Habitat and Portal Survey Report (see page 5), this Option requires an Indiana bat Protection and Enhancement Plan (see page 7).

WINTER HABITAT AND PORTAL ASSESSMENT REPORT FORMAT

(Required)

1. Site Information related to Potential Winter Habitat on permit area
 - a) Describe the pre- and post-SMCRA mining history of the permit area? (Has underground mining ever taken place?)
 - b) Provide a summary of interviews with surface-rights owners regarding presence/absence of potential caves, rockshelters, and/or abandoned mine portals, when appropriate
 - c) Copy of Topographic map, Proposal map, and Environmental Resources Information map.
 - d) Results of field inspection of areas containing potentially suitable winter habitat as identified in items a-c above (list describing and/or map showing portals on permit area).

2. Assessment of Portals found on permit area (*Include if necessary*)
 - a) Conduct a Phase I Portal Assessment on all portals which provide potentially suitable bat habitat (meet the criteria outlined in Appendix A).
 - b) Attach completed Phase I Portal Assessment datasheets for all portals assessed (See Appendix B for a sample Phase I Portal Assessment Datasheet).
 - c) Map showing location of Portals which provide potentially suitable bat habitat.

3. Portal Mistnet Surveys (*Include if necessary*)
 - a) Following any Phase I Portal Assessments, all portals which are determined to be suitable bat habitat should be surveyed following the protocol outlined in Appendix C. Sample survey data sheet provided in Appendix E.
 - b) **NOTE:** Capture of any Indiana bats in portal surveys must be immediately reported to WVDNR, WVDEP, and USFWS.
 - c) Provide a summary of Portal Mistnet Survey Results that includes:
 - i. Describe portal survey net set-up (include net height), survey dates, duration of survey, weather conditions, etc.
 - ii. Table with summarized information on all bats captured during the survey including: capture site, date of capture, time of capture, species, sex, reproductive condition of females, age, weight, direction of flight
 - iii. Include photographs of the net locations and all Indiana bats captured.
 - iv. Include mistnet survey datasheets as an appendix
 - v. Describe weather conditions that occurred during the survey and effects they might have had on the survey.
 - vi. Conclusion to be drawn from findings regarding impacts to the Indiana bat.

4. Portal Closure
 - a) Portals may serve as winter or roosting habitat for bats and can be included as part of the minimization measures if the portals are left open.
 - b) If opting to close portals, follow the Portal Closure Protocol (Appendix F), which involves temporary closure until permanent closure can be achieved.

SUMMER HABITAT AND MISTNET SURVEY REPORT FORMAT (Option 1)
(Required)

1. Introduction

Why and for whom the survey is being conducted

Objectives of the survey

Project Name

Permit Number if available

2. Description of Permit/Study Area (Including information related to Potential Summer Habitat)

- a) General description (e.g., location, county, USGS quadrangle, elevation, watershed, proposed mining operation methods, total acreage)
- b) Age structure of trees on permit area (e.g., even-aged or uneven-aged stand)
- c) Percent and acres forested with greater than 5 inches DBH of trees on permit area
- d) Tree species present on permit area (e.g., oaks, hickories, ash, poplars, etc...)
- e) Snags ≥ 5 " dbh present on permit area (# per acre, if possible)
- f) Representative photographs of the permit area (e.g., forested area and water sources)

3. Mistnet Survey Materials and Methods (Appendices C and D)

PROTECTION AND ENHANCEMENT PLAN (Option 2)

This plan has been developed to be used in cases where the applicant has elected to assume presence of the Indiana bat, and such assumption is deemed acceptable by the WVDEP. WVDEP will consult with USFWS as necessary. As long as all the minimum guidelines are fulfilled, the applicant can create a protection and enhancement plan that best fits the circumstances of the individual permit. A checklist is provided at the end of this section. The applicant should refer to this list to ensure that all criteria have been met.

As the applicant creates a protection and enhancement plan for the Indiana bat, certain objectives must be met. The first objective is to acceptably minimize the potential to take (i.e., harm or harass) an Indiana bat. This can be partially accomplished by removing any potential roosting habitat during a time when the bat is not present. The second objective is the protection of the most important foraging and potential roosting habitat, as well as the short-term replacement of the habitat that was lost during the mining operation. The final, long-term objective is to restore and enhance the Indiana bat roosting/foraging habitat that previously existed on the mine site. Hibernation, feeding, and watering needs at mine sites must also be met as appropriate.

Listed below are some recommended practices for fulfilling the required objectives. Alternative practices are permitted upon approval by DEP. The applicant will receive notification from WVDEP regarding acceptability of the Protection and Enhancement Plan.

PROTECTION AND ENHANCEMENT MEASURES

Avoidance and Minimization of Take of an Indiana Bat

Applicants may have the opportunity and added flexibility in meeting their responsibility to avoid and minimize impacts to bats through the protection of suitable Indiana bat habitat. The applicant may identify other opportunities to avoid impacts to suitable habitat within the permit area (e.g. forest and water resources, revised blasting plans, etc).

Avoidance and minimization of potential take of Indiana bats can take many forms. Site characteristics often define which minimization measures are available. A partial list of potential minimization measures are provided below. Additional measures may be available depending upon the site and type of impact:

Tree Clearing: This involves removal of all potential summer habitats. Potential summer habitat can only be cut between November 15 and March 31, in order to avoid impacting Indiana bat “swarming” behavior. New hibernacula have been discovered recently in mine portals, in counties with no previously documented hibernacula.

Riparian Buffer Zone: Indiana bats often forage along streams and wetlands, drinking water or catching flying insects. The removal of a stream, wetland, and/or associated edges/banks may harm bats by removing their foraging area, causing them to expend energy locating a new foraging area and potentially engaging in intraspecific (bat to bat) competition. Project plans that avoid impacting streams and wetlands, and leave a minimum 50 foot buffer along the stream or wetland, can avoid impacts to foraging bats.

Maternity Colonies: Female Indiana bats congregate in trees to bear their young. The young bats (called “pups”) are left at the tree as the female forages for flying insects. Females may have one primary maternity tree or occupy several secondary roost trees

throughout the summer. To avoid impacts to a maternity colony, seasonal tree clearing (see above) can be used or the maternity colony area plus an additional area of 2 miles around the maternity colony can be left undisturbed. The 2 mile buffer zone allows enough habitat for females to forage.

Abandoned Mine Portals: Abandoned mine portals may serve as winter or roosting habitat for a variety of bat species. The applicant may consider choosing to install a bat gate over a portal if a survey indicates that bats use the portal and the portal and/or bat gate do not pose a risk to human health and safety.

Caves: As with portals, caves may provide winter habitat for Indiana bats. If a survey indicates the presence of Indiana bats in a cave, then the applicant may choose to gate the cave or provide other protective measures. DEP has plans that detail gate placement and design.

Short-Term Habitat Replacement

Tree Girdling: Girdling trees along the perimeter of the permit area or trees within the undisturbed areas of the permit can create short-term habitat. Girdling is best applied when no suitable habitat is available in the project area. Trees selected for girdling should be selected from the tree species list provided in Appendix G. If there are not enough species from the tree list of the appropriate size, other species may be substituted. USFWS and WVDEP recommend against selected trees with slick, tight bark, such as American beech and sycamore. A biological consultant, or a person with expertise in tree identification must be contracted to select trees for girdling. Girdling one tree with a dbh of 9 inches or more every 500 feet is sufficient. It is important not to girdle every available large tree. Timing of the girdling should coincide with regrading and revegetation. Contact WVDEP if timing is not compatible with the mining plan. Girdling may not be necessary if it is observed that there are an adequate number of dead trees ($\geq 9''$ dbh) that provide suitable habitat for Indiana bats adjacent to the permit area at the time of regrading and revegetation. Applicants must provide a sufficient justification and/or explanation to WVDEP if they believe girdling is not necessary on the permit area

In cases where a portion of a permit area is 500 feet wide or less (e.g., some contour mines), it may be appropriate to girdle trees along only one edge of the permit boundary. This deviation from the standard girdling guideline should be coordinated with WVDEP and FWS. The permit boundary to receive the greatest solar exposure should be used for girdling in order to maximize the heating of potential bat roosting habitat.

Minimizing Temporal Loss of Indiana Bat Habitat: In order to minimize temporal loss of summer habitat and optimize the availability of suitable habitat on the permit area during mining, it is strongly recommended that applicants plan mining activities so that suitable habitat is not removed prior to planned mining. Applicants should recognize that any on-site minimization of temporal loss proposed may reduce the number and/or amount of other minimization and short- and long-term replacement measures required for their proposed action.

Long-Term Habitat Restoration and Replacement

Long-term habitat restoration and replacement often includes protection of the habitat from development in perpetuity. Deed restrictions, mineral rights, and similar legal documents may be required to demonstrate that logging, mining, development or other large-scale activities will not occur on the property after completion of mining.

Watering Areas: High quality, accessible water is very important to the Indiana bat. Watering areas need to be created in the form of shallow water depressions designed to provide water during the driest months of the year. These pools may require an MR-12 to be left after bond release. Landowner will have to take liability. One should be placed per half mile of narrow contour cuts or one per 50 acres of flatter mining area. These depressions should be placed immediately adjacent to existing trees (e.g., usually along permit boundaries) in order to take advantage of habitat that bats can use as escape cover. The techniques described in Thomas R. Biebighauser's "A Guide to Creating Vernal Ponds," published by the USDA Forest Service, are highly recommended for the creation of adequate watering areas (<http://herpcenter.ipfw.edu/outreach/VernalPonds/VernalPondGuide.pdf>).

Herbaceous Ground Cover: It is highly recommended that native and domesticated non-competitive species be used when establishing the herbaceous ground cover, as recommended in 38 CSR 2 § 7.6.e.1. The species listed in the sample form have been selected because they are compatible with tree growth and provide benefits to other wildlife.

Native Tree Species: The applicant is required to replace all potential Indiana bat habitat delineated on page 6 (Initial Requirements for the identification of summer habitat) that would be impacted by the proposed action. This area must be reclaimed by planting a minimum of eight different tree species from the list found in Appendix G (five of which must be from the exfoliating bark species, and three of which must be from the nitrogen-fixing trees or other trees lists), or by reclaiming to the new forestland standards found under 38CSR 2 § 7.6. Species selection will be determined by site-specific characteristics (soil moisture, sun exposure, etc.) and availability. Stocking success at the time of final bond release will be a minimum of 450 woody stems per acre (consistent with 38 CSR 2 § 7.6.f.2). A minimum of the five species identified as 'Exfoliating Bark Species' on the Appendix G species list must be planted and equal at least 300 of the minimum stems per acre required for final bond release. Tree species should be planted at approximately equal rates. The remaining 150 stems per acre may be selected from any of the tree categories listed in the species list, or can be volunteers. No more than 50 stems per acre can be black locust.

One technique available to applicants is OSM's Forestry Reclamation Approach (FRA). This approach advocates minimizing compaction and creating a suitable rooting medium during the final grading of a mine site. This will promote greater tree survival and growth.

Off-Site Compensation: Applicants have the opportunity and added flexibility to provide alternative minimization measures off-site. Upon notification, the regulatory authority and resource agencies will initiate discussions with the applicant to determine whether off-site compensation is appropriate. If approved, the applicant would then coordinate with the WVDEP to determine the appropriate level of off-site compensation required to minimize the potential taking of Indiana bat(s). The WVDEP will coordinate with the WVFWS as necessary.

PROTECTION AND ENHANCEMENT PLAN CHECK-OFF SHEET

This check sheet is provided to assist the applicant in the development of Indiana bat Protection and Enhancement plans.

Description of Proposed Project

- ___ Type and size of project
- ___ Potential impacts to bat habitat (hibernacula, roost trees)
- ___ Potential impacts to bat behaviors (feeding, breeding, sheltering, migrating, hibernating)

Description of Potential Summer Habitat

- ___ General description
- ___ Percent and acres forested with greater than 5 inches DBH of trees on permit area
- ___ Representative photographs of the permit area
- ___ Summary acreage of potential summer habitat

Minimizing Potential Take of an Indiana Bat

- ___ Avoidance of identified potential summer and/or winter habitat on-site
- ___ Appropriate tree clearing dates
- ___ Portals and caves addressed, if present
- ___ Protection of high quality streams, if applicable
- ___ Other minimization measures

Short-term Habitat Replacement

- ___ Tree girdling, if applicable
- ___ Minimization of Temporal Loss, if applicable
- ___ Other short-term habitat replacement option

Long-term Habitat Replacement

- ___ Appropriate herbaceous ground cover
- ___ Replacement of identified suitable summer habitat through tree planting (% of habitat replacement may depend on off-site compensation planned)
- ___ Minimum of 8 different tree species, including 5 Exfoliating Bark Species
- ___ Watering areas
- ___ Planting Plan map indicating locations of tree plantings, watering areas, tree girdling, stream buffer zones, and avoidance and minimization areas.
- ___ Off-site compensation, if applicable
- ___ Other long-term habitat replacement option

Summary

Summary of potential threats posed to Indiana bats by the proposed action, avoidance and minimization measures selected by the applicant, and final conclusion of affects to the bat population

APPENDIX A

INITIAL PORTAL SURVEY CRITERIA

Criteria for Determining Whether Abandoned Coal Mines Provide Potentially Suitable Bat Habitat (Developed by Cal Butchkoski, Pennsylvania Game Commission):

1. Openings should be at least one foot in diameter or larger.
2. Passage should continue for 100 feet (ft) or more and open into mine workings (may not be verifiable by inspector)
3. There should be some amount of air flow in or out of entrance. (Note: Air flow is not always detectable and changes by day and/or season.)
4. Mine entrances that are flooded or prone to flooding (debris on ceiling), collapsed, or otherwise inaccessible to bats should be excluded from survey.
5. Openings that have occurred recently (within the past 1-2 years) due to subsidence can be omitted from survey provided that the applicant provide a written description and photographs in the survey report.
6. Bats will use vertical shafts. Vertical passage should be at least 2 ft in diameter with some airflow.
7. Foliage and other vegetation in front of mine openings do not stop use by bats. The animals can navigate through foliage.
8. Bats can access mines via old buildings such as a fan house.

APPENDIX B

PHASE I PORTAL ASSESSMENT DATA SHEET

Location: _____

Observers: _____

Latitude/Longitude: _____

Date: _____ Time: _____ Temperature (external): _____

	Portal #1	Portal #2	Portal #3	Portal #4
Opening (vertical or horizontal)				
Opening size: height x width (or diameter)				
Internal dimensions: height x width				
Slope (up or down from entrance)				
Entrance stable?				
Direction of airflow (in or out of portal)				
Amount of airflow (slight, heavy)				
Internal air warmer or cooler than external temperature?				
Evidence of collapse?				
Ceiling condition				
Amount of water in portal				
Evidence of past flooding?				
Observed length of portal				
Distance to nearest water source				
Percent obstruction of portal entrance by trees, slide, etc.				
Foraging signs (e.g., moth wings)?				
Are any portals suspected or known to be connected? Which ones?				
Any observable side passages?				

APPENDIX C

SURVEY REQUIREMENTS

Fall Portal/Cave Surveys:

Any portals on the permit area should be evaluated for characteristics that may indicate potential use by bats (See Appendix A for criteria). If portals on the permit area appear to have suitable bat habitat characteristics, a Phase I survey must be completed, and a Phase I survey report submitted (Appendix B). This will facilitate determination of the need for a bat survey. Results of Phase I Portal Assessments and results of any subsequent portal/cave surveys must be included in the Winter Habitat and Portal Assessment Report (page 5).

Fall portal/cave surveys must be conducted between September 15 and October 31, and prior to any tree clearing. If the minimum external air temperature falls below 10°C, the survey should be postponed until acceptable temperatures are attained. Otherwise, sampling period, weather conditions, and equipment should comply with those specified in the “Summer Habitat Mist Net Surveys” requirements below. In addition, harp traps may be used to survey potential hibernacula where the cave or portal configurations are suitable and where open areas at the sides and top of traps can be enclosed. Entrances to caves or portals should be entirely enclosed by the survey gear.

In cases where one team of surveyors cannot feasibly sample all caves or portals in one night, a modified method may be used. This method may only be used in association with caves and portals that are known to be interconnected. During use of this modified method, half of the interconnected openings are netted on the first night. The other half of the openings are completely blocked using plastic or other material. On the second night, this is reversed. Caves and portals that are completely isolated do not need to be netted simultaneously.

CAUTION: Entry of abandoned mine portals can be extremely dangerous because of the potential for ceiling collapse and presence of toxic gases. Safety or health problems may occur as a result of entering abandoned mines. The U.S. Fish and Wildlife Service does not authorize or regulate this activity.

Summer Habitat Mist Net Surveys

IMPORTANT: One or more members of each field survey crew must hold (and have in their possession) valid endangered species collecting permits issued by WVDNR and/or USFWS.

1. Mistnet Survey Materials and Methods
 - a) Survey methods must follow the requirements outlined in Appendix C
 - b) Describe net locations, net set-up (include net height), survey dates, duration of survey, weather conditions, etc.
 - c) Sample survey data sheet for bat captures provided in Appendix E
 - d) Map identifying permit area, mist net locations and area of influence (of netting) survey
2. Mistnet Survey Results
 - a) Table with summarized information on all bats captured during the survey including: capture site, date of capture, time of capture, species, sex, reproductive condition of females, age, weight, direction of flight (if a cave or mine portal survey)
 - b) Include photographs of the net locations and all Indiana bats captured.
3. Discussion of Mistnet Survey Results
 - a) Description of weather conditions that occurred during the survey and effects they might have had on the survey.
 - b) Description of bat habitat at each site and on the overall permit area (presence of water, tree canopy density, understory and travel corridors).
 - c) General description of bat findings relative to site conditions, habitat adjacent to proposed permit area, and regional expectations.
 - d) Conclusion to be drawn from findings regarding impacts to the Indiana bat.
4. *Dates:* Summer surveys must be conducted between May 15 and August 15 and prior to any tree clearing. A minimum of two nights of mist netting is required.
5. *Net sites:* A net site consists of two net locations no less than 30 meters apart.
 - Every 1 km² (247 acres) of forested permit area requires two net sites for two nights.
6. *Timing and Duration:* The sampling period should begin at sunset and last at least five hours - even if Indiana bats are netted early in the evening. If bat activity has not declined after five hours, it is suggested that survey efforts continue until activity declines.
7. *Weather Conditions:* Severe weather adversely affects the capture of bats. If Indiana bats are caught during weather extremes, it is probably because they are at the site and active despite inclement weather. A lack of bat captures may result from an absence of bats at the site, or they may be inactive in order to avoid weather conditions. Negative results combined with adverse weather conditions during a substantial portion of a sampling period are likely to require additional netting. The time and duration of any of the following adverse conditions should be included with the survey report:
 - Precipitation.
 - Temperatures below 10°C (50°F).

- Strong Winds. Use your judgment; moving nets are more likely to be detected by bats.
 - Moonlight. There is some evidence that small myotine bats such as *Myotis sodalis* avoid brightly lit areas, perhaps as a predator avoidance mechanism. It is typically best to set nets under the canopy where they are out of moonlight, particularly when the moon is half full or greater.
8. *Equipment*: Mist nets should be made of the finest, lowest visibility mesh commercially available. Currently, this is two-ply, 50-denier nylon (denoted 50/2). The mesh size should be approximately 1 ½ (1 ¼ - 1 ¾) inch. No specific hardware is required.
 9. *Net Placement*: Potential travel corridors such as streams, road ruts or logging roads are typically the most effective place to net during feeding activity. Nets should be placed approximately perpendicular to the corridor. Nets should fill the corridor from side and from stream or ground level up to the canopy. A typical net is 7 meters high (3 nets “stacked” on top of each other) and up to 20 meters across.
 10. *Survey Report*: Survey methods, conditions, and results must be summarized in a Survey Report and two copies submitted to WVDEP for distribution and USFWS for expeditious review.

APPENDIX D**QUICK REFERENCE TO MIST-NETTING INTENSITY REQUIREMENTS**

If > x Acres	But < y Acres	Net Sites	Net Set Ups	Total Net Nights
40	247.1	2	4	8
247.1	494.2	4	8	16
494.2	741.3	6	12	24
741.3	988.4	8	16	32
988.4	1235.5	10	20	40
1235.5	1482.6	12	24	48
1482.6	1729.7	14	28	56
1729.7	1976.8	16	32	64
1976.8	2223.9	18	36	72
2223.9	2471	20	40	80
2471	2718.1	22	44	88
2718.1	2965.2	24	48	96
2965.2	3212.3	26	52	104
3212.3	3459.4	28	56	112
3459.4	3706.5	30	60	120
3706.5	3953.6	32	64	128
3953.6	4200.7	34	68	136
4200.7	4447.8	36	72	144
4447.8	4694.9	38	76	152
4694.9	4942	40	80	160

APPENDIX E

SAMPLE DATA SHEET FOR PORTAL AND MISTNET SURVEY BAT CAPTURES

Date: _____ Temperature: Start _____ End _____

Precipitation: _____ Wind: _____

Moonlight: _____ Time: Start _____ End _____

Personnel: _____

Harp trap/Mist net number/name					
Location					
Time of capture					
Species					
Sex					
Weight (grams)					
Age					
Reproductive condition of females					
Flight direction if portal survey (in or out)					
Band # (if applicable)					

APPENDIX F

PORTAL CLOSURE PROTOCOL

This plan details the approved exclusion methodology for the complete and permanent closing of a mine portal. It must be submitted as part of the protection and enhancement plan. Exclusion activities are limited to the following time periods: May 1-15 and August 1-31 and require two (2) nights of observation. Portal closure should not occur until a fall portal survey has been conducted and the survey report accepted by WVDEP, with appropriate consultations.

CAUTION: Entry of abandoned mine portals can be extremely dangerous because of the potential for ceiling collapse and presence of toxic gases. Safety or health problems may occur as a result of entering abandoned mines. The U.S. Fish and Wildlife Service does not authorize or regulate this activity

Exclusion Methodology

Portals (give portal names or #s) are proposed for closure on (date) .

Night 1 of closure includes:

1. Portals will be observed during the standard emergence period (typically within 2 hours after dusk). Night vision equipment may be used to assist in this task. The approximate end time for emergence will be noted.
2. After emergence is complete, chicken wire with 1-inch mesh will be placed securely over the openings to deter bats from re-entering.

Night 2 of closure includes:

1. Prior to dusk (and emergence) the chicken wire will be removed to allow any trapped bats to exit.
2. Emergence will be observed during the standard time period as noted previously.
3. The 1-inch mesh chicken wire will be secured over the openings until permanent closure is completed.

This wire closure will remain intact and functional over the opening. If at any point this covering is disturbed to the point that it no longer serves its function, the process will begin again. Exclusion activities must include all portal openings associated with the underground mine workings proposed to be impacted by the applicant, including those portal openings outside of the permit area.

APPENDIX G

TREE SPECIES LIST FOR INDIANA BAT PROTECTION AND ENHANCEMENT PLANS

Exfoliating Bark Species

<i>Acer saccharinum</i>	silver maple
<i>Acer saccharum</i>	sugar maple
<i>Carya cordiformis</i>	bitternut hickory
<i>Carya glabra</i>	pignut hickory
<i>Carya laciniosa</i>	shellbark hickory
<i>Carya ovata</i>	shagbark hickory
<i>Carya tomentosa</i>	mockernut hickory
<i>Fraxinus americana</i>	white ash
<i>Fraxinus pennsylvanica</i>	green ash
<i>Platanus occidentalis</i>	sycamore
<i>Quercus alba</i>	white oak
<i>Quercus coccinea</i>	scarlet oak
<i>Quercus falcata</i>	southern red oak
<i>Quercus prinus</i>	chestnut oak
<i>Quercus rubra</i>	northern red oak
<i>Quercus stellata</i>	post oak
<i>Quercus velutina</i>	black oak
<i>Sassafras albidum</i>	sassafras
<i>Ulmus americana</i>	American elm
<i>Ulmus rubra</i>	slippery elm

Nitrogen-fixing Trees

<i>Cercis canadensis</i>	redbud
<i>Robinia pseudoacacia</i>	black locust

Other Trees

<i>Cornus florida</i>	dogwood
<i>Diospyros virginiana</i>	persimmon
<i>Morus rubra</i>	red mulberry
<i>Prunus serotina</i>	wild black cherry

APPENDIX H

Updated – January 2007 Qualified Indiana Bat Surveyors *

Only qualified biologists holding valid endangered species collecting permits may conduct surveys.
This list may update yearly.

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* This list includes *individuals* who are qualified to conduct surveys for Indiana bats, this list may not include all individuals qualified to conduct such surveys. Inclusion of names on this list does not constitute endorsement by the WV Division of Natural Resources (WVDNR), the US Fish and Wildlife Service, nor any other government agency. A WV Scientific Collecting Permit will be required from the WVDNR to sample bats in WV. Note that various techniques are used to sample for and study bats, including mist-netting, Anabat detectors, and radio-telemetry. Some individuals on this list may not be qualified to conduct all three techniques

APPENDIX I

INDIANA BAT LIFE HISTORY

Additional life history details, as well as additional references to research and other sources, can be found in the Indiana Bat Recovery Plan (USFWS 1999). The plan is available online at http://ecos.fws.gov/docs/recovery_plans/1999/990301.pdf

Description and Range:

The Indiana bat (*Myotis sodalis*) was first described as a new species and given its common name after the first specimen was collected in Indiana by Miller and Allen in 1928. The Indiana bat was formally listed as endangered throughout its range on March 11, 1967, and thus is currently protected under the Endangered Species Act of 1973.

The Indiana bat is approximately the size of a small mouse (body length of 7.5-9 centimeters), with a wingspan ranging from 24 to 27 centimeters, and weighing 4.5 to 9.5 grams, with females being larger than males. The Indiana bat is most similar to its close relative, the little brown bat (*Myotis lucifugus*), but differs by its smaller feet, fewer and shorter toe hairs, and distinct keel on the calcar (USFWS 1999).

The range of the Indiana bat includes most of the eastern United States. The species is described as a social bat because of its tendency to congregate in large groups during winter hibernation, and because females form colonial maternity roosts in the summer to raise their young. The Indiana bat exhibits site high fidelity to both winter hibernation sites and to maternity roosting areas. The annual lifecycle of the Indiana bat consists of 4 distinct phases: Winter hibernation, spring migration, summer maternity period, and fall migration/swarming. The bat has specific biological needs during each phase of this cycle.

Hibernation:

Indiana bats hibernate during the winter months, typically in caves, sandstone rockshelters and abandoned mines, known as hibernacula (the singular of which is “hibernaculum”). During hibernation, bats use the body fat accumulated in the fall, “sleeping” through the season when their food source (flying insects) is not available (USFWS 1999). Most Indiana bats hibernate in a few hibernacula in Kentucky, Indiana and Missouri, although hibernacula have been identified in Ohio, West Virginia, Virginia, Pennsylvania, and Tennessee, as well. They require very specific habitat features in these hibernacula, with cool, stable temperatures (preferably between four and eight degrees Celsius) and humidity above 74 percent but below saturation (Hall 1962, LaVal et al. 1976). During hibernation, Indiana bats cluster in groups with densities reaching 300 to 450 bats per square foot (Clawson et al. 1980).

Spring Migration and Maternity Roosts:

After hibernation, most females depart from the hibernacula during April, while males typically remain longer before migrating to summer habitat. A few males may occupy hibernacula during the summer months, while others roost in trees around the hibernacula or up to 10 miles away (Gumbert et al. 2002, Hobson and Holland 1995). Females migrate to summer habitats, which are often far removed from winter hibernacula, where they will congregate to bear and raise young in groups known as maternity colonies. Female bats have been documented traveling distances in excess of 200 and even 300

miles from their winter hibernacula to maternity roosting areas (Gardner et al. 1996, Gardner and Cook 2002, Kurta and Murray 2002). Much of West Virginia falls within 300 miles or less of many important hibernacula, and thus suitable habitat throughout the forests of West Virginia could be serving as maternity roost areas.

Maternity colonies are often found in forests associated with, or otherwise near, streams or other water bodies, though they can be found in upland forested habitats as well. Research suggests maternity roosts are typically within about 0.6 miles or less of perennial streams (Garner and Gardner 1992, Gardner et al. 1991a, Kurta et al. 2002, Hofman 1996). Maternity colonies are usually found under exfoliating bark of dead or live trees, in cavities of trees, or in snags (i.e., dead trees or dead portions of live trees). Maternity colony activity is concentrated in one or a few large trees, known as primary roosts, which are used by most of the bats for some or all of the summer. However, bats often use several additional roost trees, known as alternate roosts, depending on weather conditions and other factors (Gardner et al. 1991a, Garner and Gardner 1992, Callahan et al. 1997, Kurta et al. 1993a). Most of the roost trees used by a maternity colony are close together (Callahan et al 1997), although some alternate roost trees could be up to 3 miles from the primary roost (USFWS 1999). Though rare, the use of manmade structures (e.g., barns, a church, bat boxes) for roosting during summer has also been documented. Pregnant females typically give birth to a single young bat in late June, and juveniles are capable of flying within a month.

Indiana bats exhibit site fidelity to their traditional maternity roosting and foraging areas, returning each year to the same area, and often to the same roost trees. When a primary roost tree is lost, bats that have utilized alternate roosting sites may be more likely to survive, provided those alternate roosts are still available (Kurta et al. 2002, Kurta and Murray 2002). However, little is known about how Indiana bats respond to the loss of roost trees, especially multiple roost trees at one time, and what effects such habitat loss has on the colony's social structure and subsequent reproductive success.

Foraging Habitat and Behavior:

Indiana bats generally prefer foraging in wooded areas (LaVal et al. 1977, Brack 1983, Gardner et al. 1991, Butchkoski and Hassinger 2002, and Murray and Kurta 2002), and are frequently associated with streams, floodplain forests, forested wetlands, and impounded water bodies (Garner and Gardner 1992, Murray and Kurta 2002). Woody vegetation with a width of at least 100 ft (30 m) on both sides of a stream has been characterized as excellent foraging habitat (Cope et al 1978). Streams, associated floodplain forests, and impounded bodies of water (e.g., ponds, wetlands, reservoirs) are the preferred foraging habitats for pregnant and lactating Indiana bats (Whitaker 1972, Lee 1993, Murray and Kurta 2002). This is presumably due to increased invertebrate abundance in these areas. They will also forage within the canopy of upland forests, over clearings with early successional vegetation, along the edges of forest openings, along wooded fencerows, and over ponds in pastures (Clark et al. 1987, Gardner et al. 1991b). As necessary, female bats will travel several miles from their maternity roosts to preferred foraging areas (Murray and Kurta 2004, Sparks et al *in press*). Similarly, male bats will travel a mile or more from roosting sites to preferred foraging areas (LaVal et al. 1976, LaVal et al. 1977, LaVal and LaVal 1980). However, Indiana bats avoid crossing large open areas, instead utilizing wooded travel corridors (Murray and Kurta 2004). Thus, streams and the associated riparian forest buffer not only serve as potential roosting areas and prime foraging habitat, but also can serve as travel corridors linking roosting areas with foraging areas.

Fall Migration and Swarming:

Indiana bats begin migrating to their hibernacula by September and an activity known as swarming occurs outside the hibernaculum or nearby caves (Cope and Humphrey 1977, Hawkins and Brack 2004, Rodrigue 2004). During swarming, the bats fly in and out of the hibernaculum at night. This is the period when Indiana bats mate and forage to build up fat reserves for the winter. Male bats still roost in trees during the day, though females may enter hibernation soon after mating (Cope and Humphrey 1977). Swarming continues for several weeks, during which time the forested habitat within 5 miles of the hibernaculum is important for foraging and day roosting (Kiser and Elliot 1996, Kurta 2000, Gumbert 2001, Ford et al. 2002). Hibernation is driven by ambient temperature and may occur later or earlier depending on weather conditions. Typically, by late October or early November, Indiana bats have entered the hibernacula for winter, and hibernation commences (Hall 1962, LaVal and LaVal 1980).

APPENDIX J

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