Appendix N

BAT MIST-NET SURVEY

Barrelhead Solar, LLC

Wayne County, Kentucky

COPPERHEAD
ENVIRONMENTAL CONSULTING

Final Report

Summer 2025 Bat Mist-Net Survey for the Barrelhead Solar Project, Wayne County, Kentucky

IPaC Consultation Code: 2024-0069739

Submitted To:

Mike Armstrong
Southeast Region Bat Recovery Biologist
Kentucky Field Office
U.S. Fish and Wildlife Service

Laura Burford
State Wildlife Action Plan Coordinator
Kentucky Department of Fish and Wildlife Resources

On Behalf Of:

Barrelhead Solar, LLC

Prepared By:

Ian Burns, Taylor Culbertson, Zachary Baer
Copperhead Environmental Consulting, Inc.

17 September 2025

COPPERHEAD ENVIRONMENTAL CONSULTING, INC.
P.O. BOX 73 ■ 471 MAIN STREET ■ PAINT LICK, KENTUCKY 40461
(859) 925-9012 OFFICE (859) 925-9816 FAX

www.copperheadconsulting.com

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PROJECT BACKGROUND

Barrelhead Solar, LLC (the Applicant) contracted Copperhead Environmental Consulting, Inc. (Copperhead) to conduct a bat mist-net survey for the Barrelhead Solar Project (Project) in Wayne County, Kentucky (Figure 1). The goal of this survey was to document the presence or probable absence of the federally endangered Indiana bat (*Myotis sodalis*) and northern long-eared bat (*Myotis septentrionalis*), and the proposed federally endangered tricolored bat[1] (*Perimyotis subflavus*) (collectively referred to as target species) within the Project area of investigation (AOI) during the summer maternity season. Additionally, any target species captured would be radio-tagged to determine their roost locations to inform Project design. Based on mapping provided by the Applicant, the AOI contains approximately 89 acres of suitable forested bat habitat.

A Study Plan was submitted to the U.S. Fish and Wildlife Service (USFWS) Kentucky Field Office and the Kentucky Department of Fish and Wildlife Resources (KDF&WR) on 1 May 2025. Study Plan approval was received from USFWS on 1 May 2025 and from KDF&WR on 2 May 2025. Surveys were conducted under USFWS Federal Fish and Wildlife Permit #ES94849B-3 and #ES56515D-1, and KDF&WR Scientific Wildlife Collecting Permit SC2511027. Agency coordination is documented in Appendix A.

[1] On 14 September 2022, USFWS announced a proposal to list the tricolored bat as endangered under the Endangered Species Act (USFWS 2022).

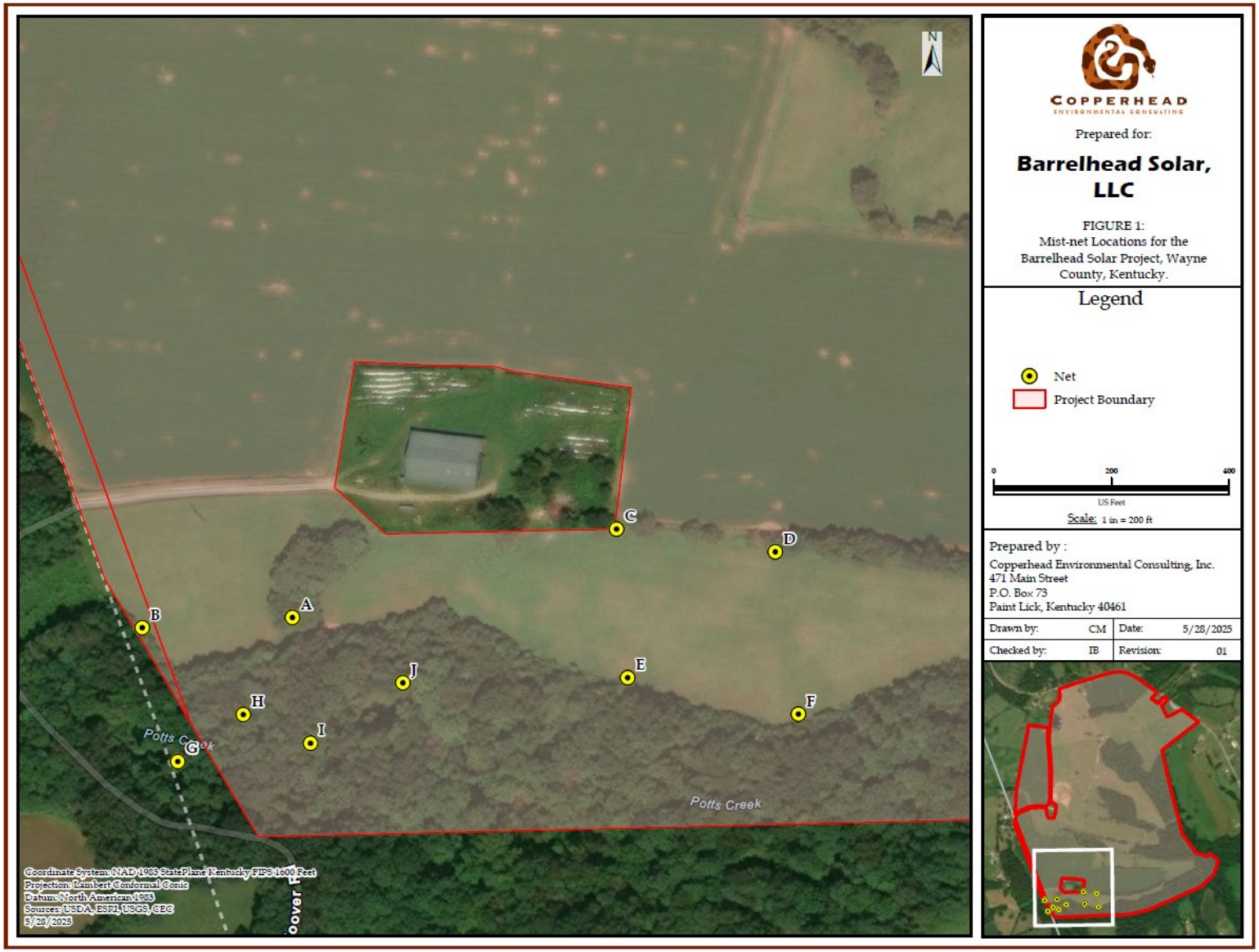

Figure 1. Mist-net locations for the Barrelhead Solar Project, Wayne County, Kentucky.

METHODOLOGY

Level of Effort/Site Selection

Mist-net surveys were conducted in accordance with the USFWS 2024 *Range-wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines* (USFWS 2024; Guidance). Based on the Guidance for the required number of net nights (nn) for non-linear projects, the requisite mist-net survey level of effort (LOE) for Indiana bats is 6 nn per 123 acres of forested habitat, and the requisite LOE for northern long-eared bats in non-coastal areas is 10 nn per 123 acres of forested habitat. The Guidance states that the northern long-eared bat survey LOE is also adequate to determine the presence or probable absence of tricolored bats during the 2025 survey season. To complete a presence or probable absence survey for all three target species, the greater northern long-eared bat survey LOE (10 nn per 123 acres of forest) was used during the mist-net survey. Based on the estimated amount of suitable forested bat habitat within the Project area (89 acres), 10 nn of survey were completed to ensure regulatory compliance for the Project. Proposed potential mist-net site locations were included in the Study Plan approved by USFWS; however, final mist-net sites were selected in the field.

Mist-Net Surveys

Prior to the survey, Copperhead biologists conducted field reconnaissance of the Project AOI to select mist-net locations best suitable for target species bat capture. Mist-nets were set up to maximize coverage of flight paths used by bats along suitable travel corridors, foraging areas, or drinking areas. Placement of mist-nets were based on the extent of canopy cover, presence of an open flyway, and forest conditions near the site. Mist-net locations and orientations were determined in the field to maximize target species captures by biologists permitted to survey for federally listed bats. Individual net locations were recorded using handheld GPS-enabled tablets and mapped with ArcGIS Pro (v. 3.x ESRI, Redlands, CA).

One three-person survey team (consisting of a federally and state permitted biologist and two technicians) surveyed a maximum of four net sets each night. The site was surveyed for three calendar nights, and individual net locations within the site were moved prior to each night of survey. Low visibility, high-quality nylon nets, 6 to 12 meters (~20 - 39 feet) in length and 5.2 meters (~17 feet) high were used for each net set. Nets were deployed at sunset each night, left open for at least 5 hours, and checked every 10 minutes. Disturbance near the nets was kept to a minimum between checks. Weather data, including temperature, wind speed, and cloud cover, were recorded for each site on an hourly basis to ensure compliance with the Guidance. Mist-net surveys cannot be conducted during inclement weather (i.e., temperatures <50°F, precipitation/heavy fog that exceeds 30 minutes, or sustained wind speeds greater than 9 mph that exceeds 30 minutes). Therefore, if inclement weather was encountered during the survey, mist-net survey efforts were suspended for that night and repeated on a subsequent night when weather conditions were suitable.

Bats were live-caught, processed within 30 minutes from the time of capture, and released unharmed near the point of capture. Data recorded for each individual bat included time of capture, capture net ID, capture height, species, sex, age class, reproductive condition, mass, and forearm length.

White-Nose Syndrome and Safety Protocols

To minimize the transmission of White-nose Syndrome (WNS) between captured bats, all survey activities adhered to the March 2024 *National White-Nose Syndrome Decontamination Protocol* (WSDMWG 2024). All hard, non-porous netting equipment was sanitized with Isopropyl alcohol wipes (70%) prior to arrival and after each survey night; all other equipment was submersed in hot water (131°F) for a minimum of 5 minutes. Individual bats were kept in unused paper bags while awaiting processing. Disposable latex gloves were worn over sanitized handling gloves and changed or sanitized after the handling of each bat. Additionally, biologists wore site-dedicated clothing while handling bats. All non-disposable equipment (e.g., PESOLA® scales, rulers, calipers, etc.) coming into contact with bats was sanitized immediately after the handling of each bat. Bats were evaluated for potential WNS infection through wing scoring following the *Wing-Damage Index Used for Characterizing Wing Condition of Bats Affected by White-nose Syndrome* (Reichard 2008). All Copperhead employees coming in direct contact with bats had up-to-date rabies vaccinations.

COVID-19 Protocol

To minimize the potential for transmission of COVID-19, Copperhead conducted surveys in accordance with *Guidance for Fish and Wildlife Service Employees Engaging in Activities with Bats* (USFWS 2020) and our federal and state permit guidelines. In addition to the personal protective equipment identified in the March 2024 *National White-Nose Syndrome Decontamination Protocol*, biologists wore non-vented N95 masks while handling bats. Photographs of bats were taken for confirmation of species when required, but unnecessary handling was avoided. While in the field, personnel monitored themselves and each other for signs of COVID-19 infection. If any person had shown signs of infection, that person would have been isolated and returned home as soon as possible. Employees who test positive for COVID-19, or are suspected to have COVID-19, are not allowed to work on a Copperhead project until the most current CDC criteria for when infected persons can safely be around others are met.

RESULTS

Mist-Net Surveys

Mist-net surveys were conducted on 15, 17, and 18 May 2025 (Table 1). Inclement weather during the night of 16 May resulted in the survey night being cancelled. The remainder of the survey was conducted on the following nights under suitable weather conditions.

Table 1. Mist-Net Locations Surveyed During the Barrelhead Solar Project, Wayne County, Kentucky.

Mist-Net	Survey Date (2025)	Net Height (meters)	Net Length (meters)	Latitude	Longitude	Net Set Habitat
A	15 May	5.2	9	36.772808	-85.010377	Corridor
B	15 May	5.2	12	36.772766	-85.011248	Forest Edge
C	17 May	5.2	12	36.773208	-85.008493	Forest Edge
D	17 May	5.2	9	36.773097	-85.007573	Forest Edge
E	17 May	5.2	12	36.772514	-85.008435	Forest Edge
F	17 May	5.2	12	36.772339	-85.007446	Forest Edge
G	18 May	5.2	9	36.77214	-85.011048	Creek
H	18 May	5.2	9	36.772357	-85.010666	Forest Gap
I	18 May	5.2	6	36.772221	-85.010278	Creek
J	18 May	5.2	9	36.772499	-85.009739	Corridor

A total of eight bats of two species were captured during the survey (Table 2). Eastern red bats (*Lasiurus borealis*) comprised 75% of total captures (n=6), with evening bats (*Nycticeius humeralis*) comprising the remaining 25% of total captures (n=2). Detailed mist-net site, capture, and weather data are provided in Appendix B, mist-net site photographs are provided in Appendix C, and representative bat photographs are provided in Appendix D.

Table 2. Summary of Bat Captures During the Barrelhead Solar Project, Wayne County, Kentucky.

	Adult			
	Male	Female		
Species	NR	PR	UNK	Total
Eastern red bats *(Lasiurus borealis)*	1	4	1*	6
Evening bats *(Nycticeius humeralis)*	2	-	-	2
Total	3	4	1	8

NR = non-reproductive, PR = Pregnant, UNK = Unknown
* Bat escaped or released prior to processing

Habitat

The Project AOI is located directly north of Alpha, Kentucky. The Project AOI consists of a variety of habitats, including agricultural fields, fallow fields, forested areas, and riparian areas.

The quality of land cover around the site was considered as moderate, with small woodlots and wooded fence rows with little connection to adjacent forested areas. Forest structure was moderate, with some diversity in age of trees in the stand, and with trees 5 to 15 inches present. Understory clutter was dominant but not ubiquitous. Common tree species within the Project AOI were tulip tree (*Liriodendron tulipifera*), tree of heaven (*Ailanthus altissma*), black walnut (*Juglans nigra*), hackberry (*Celtis occidentalis*), black locust (*Robina pseudoaccacia*), sugar maple (*Acer saccharum*), bitternut hickory (*Carya cordiformis*), winged elm (*Ulmus alata*), American elm (*Ulmus americana*), and common buckeye (*Aesculus flava*). Water resources were optimal for bats at the site, with Potts Creek running east to west along the southern border of the AOI. Roost habitat was considered moderate, with snags or trees with sloughing bark greater than 5-inch diameter present.

CONCLUSIONS

During the mist-net survey, six eastern red bats and two evening bats were captured on the southern edge of the Project AOI. No Indiana bats, northern long-eared bats, or tricolored bats were captured during the mist-net survey. This suggests the target species are not likely present within the Project AOI during the maternity season or are present in numbers too low to be detected by approved USFWS protocols. According to the Guidance, probable absence results for federally listed bat species are valid for up to 5 years (USFWS 2024).

LITERATURE CITED

Reichard, J. D. 2008. Wing-Damage Index Used for Characterizing Wing Condition of Bats Affected by White-nose Syndrome. https://s3.us-west-2.amazonaws.com/prod-is-cms-assets/wns/prod/6f17b4a0-78ad-11e8-b37b-4f3513704a5e-reichard_scarring_index_bat_wings.pdf. Accessed 25 September 2024.

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White-nose Syndrome Disease Management Working Group (WSDMWG). 2024. National White-Nose Syndrome Decontamination Protocol – March 2024. https://s3.us-west-2.amazonaws.com/prod-is-cms-assets/wns/prod/669f6310-dd5e-11ee-9008-8dbb177a1768-March2024-%20revised%20WNS%20Decon%20Protocol%20-%20Final.pdf. Accessed 25 September 2024.

APPENDIX A

Agency Correspondence

U.S. Fish and Wildlife Service

Study Plan Form for Bat Surveys and Monitoring (v. 2.2)[1]

PROJECT & SURVEY INFORMATION

Project Name: Barrelhead Solar Project

Proposed Survey Start Date: 15 May 2025

Project Proponent's Name (e.g., client/company/institution): Birch Creek Development, LLC

Project Location: State(s): Kentucky

County(s): Wayne

Latitude: 36.778335

Longitude: -85.006662

REQUIRED: Attach or provide links to Google Earth® KMZ files (preferred) and/or shapefiles (mapping must show project boundaries, impacted forest habitat (if known) and all proposed survey sites)
Files are attached: Yes ☑ No ☐
File Links: _____

Project Summary. In the space provided below, please provide a description of the proposed action, including any activities that will permanently or temporarily alter the current environment and existing habitat features.

Birch Creek Development, LLC plans to develop a solar generating facility within the proposed Project AOI. The majority of site development will occur in non-forested areas, but tree clearing may be required depending on final Project design and layout.

CONTACT INFORMATION

Project Manager/Primary Point of Contact (POC): Zachary Baer

Phone: 724-549-6739

Field Survey Crew Leader (if different from POC): TBD

Cell Phone: 724-549-6739

Institution/Company Name: Copperhead Environmental Consulting

Mailing Address: 471 Main St., Paint Lick, KY 40461

POC Email Address: zbaer@copperheadconsulting.com

USFWS Sec. 10(a)(1)(A) Permit No.(s) (if applicable): ES94849B-2, ES25612A-2, ES56515D-1

State Permit No.(s) (if applicable): SC2511025, SC2511027, SC2511030, SC2511033, SC2511034, SC2511036, SC2511037

[1] Unless otherwise directed by the Service, surveyors may complete this fillable form, in lieu of a traditional narrative format, and submit it (and supporting files) to the Ecological Services Field Office in the state(s) where the work is to be completed (https://www.fws.gov/our-facilities). Use of this form is not a requirement at this time. Our goal is to improve pre-survey coordination and to expedite the Field Office review and approval process. Please submit your study plan at least 15 working days in advance of your proposed survey start date. Suggestions for improving this document may be sent to R4_Bat_Survey_Guidance@fws.gov.

Have project proponents been informed that abiding by protective time-of-year restrictions (where available) may be sufficient to avoid take of federally listed bats and (in some cases) may negate the need for a bat survey? Yes☑ No☐

Have project proponents been informed that the Service does not require presence/probable absence surveys for federally listed species and that presence can be assumed in a project area containing suitable habitat? Yes☑ No☐

Will this survey be conducted on private or public lands? *(Check both if applicable)*: Private☑ Public☐

Has permission of all necessary landowners/managing agencies been obtained? Yes☑ No☐

If no, explain: _____

Does this project have a federal nexus[2]? Yes☐ No☐ Unsure☑

If yes, explain: USACE Permit may be required

IPaC[3] Consultation Code (if applicable): 2024-0069739

Purpose of Survey: Official P/A Survey ☑ Research ☐ Monitoring ☐
Educational Outreach/Training Other: _____

Survey Target Species: Indiana bat (IBAT) ☑ Northern long-eared bat (NLEB) ☑
Tricolored bat (TCB) ☑ Other: _____

Has a Phase-1 Habitat Assessment* of the project area been conducted? Yes☑ No☐
If yes, how was the habitat assessment conducted? Field☐ Desktop☐ Combo☑
*(*if available, attach a written report)*

Is suitable habitat[4] present (or assumed present) for all "target" species? Yes☑ No☐

If no, explain: _____

Does this project fall within the outer-tier[5] of any "target" species known home range? Yes☐ No☐ Unsure☑

If yes, which species: _____

Project Configuration

Is this project **linear** (>1 km in total length)? Yes☐ No☑ Combo☐ Unsure☐

If yes, how many 1-km sections containing suitable IBAT/NLEB habitat will be impacted? _____

Is this project **non-linear**? Yes☑ No☐ Combo☐ Unsure☐

If yes, how many acres of suitable IBAT/NLEB habitat is in the overall project area? ~89

If yes, how many acres of suitable IBAT/NLEB habitat will be directly impacted/cleared? TBD

PROPOSED METHODS & SURVEY LEVEL OF EFFORT[6]

ACOUSTICS

Total number of detector sites proposed to be surveyed: _____ Number of detector nights/site: _____

[2] A project or action that is carried out, authorized, funded, and/or permitted by a federal agency.
[3] https://ipac.ecosphere.fws.gov/
[4] See Appendix A of the Guidelines regarding suitable habitat definitions.
[5] See Appendix G of the Guidelines if you are unclear what the out-tier of a known range includes.
[6] Survey level of effort (acoustic or netting) must be spread over at least two calendar nights/survey site.

Total number of detector nights for entire survey: _____

Total proposed number of calendar nights to complete the entire survey: _____

Detector(s) (Brand, Model): _____ Microphone(s): directional☐ omnidirectional☐

Recording Format: Full Spectrum☐ Zero-Crossing☐

FWS-Approved[7] Acoustic Bat ID Software: KPro vers.____ KPro Classifier, NA vers. ____ BCID vers.____
Other Candidate Programs (e.g., Sonobat) vers.: _____

Species to be included for automatic software ID classification analysis:

EPFU☐ CORA☐ COTO☐ LABO☐ LACI☐ LANO☐ LASE☐ TABR☐ MYCI☐ MYEV☐ MYGR☐ MYLU☐
MYLE☐ MYSE☐ MYSO☐ MYTH☐ MYVO☐ NYHU☐ PESU☐ Others:_____

Will qualitative analysis (i.e., manual vetting) be used? Yes☐ No☐ Unsure☐

Name(s) of qualified biologist(s) conducting qualitative/manual identifications (attach resume or link with qualifications):

_____

MIST-NETTING

Total number of net sites to be surveyed: 1 Total number of net nights/site: 10

Total number of net nights for entire survey (No. of sites X No. of net nights/site): 10

Total proposed number of calendar nights to complete the entire survey: 3

A) Maximum number of net set-ups that will be operated/checked (10-min interval) on a given calendar night at a given survey site: 4
B) Minimum Number of personnel present to operate/check X (see A) net set-ups on a given site: 2
C) Proposed Staffing Rate (A divided by B): 2

Staffing Rate

Number of Section 10-permitted biologists per net site (or state-permitted in USFWS R5): 1

Do you propose to band bats? Yes☑ No☐

If yes, please answer the following:

What species will be banded? COTO☐ MYGR☐ MYLU☑ MYSE☑ MYSO☑ PESU☑
Others:_____ All captured bats:
If banding *Myotis* sp. or PESU, specify band size: 2.9mm - MYSO, MYSE, MYLU; 2.4mm - PESU
Describe your proposed bands (color and letter-numbers) and banding scheme: Aluminum alloy KYF&W bands
Will banding pliers be used? Yes☑ No☐

Will any biological samples be collected from captured bats (e.g., guano, hair, swab, wing punch)? Yes☐ No☑

If yes, explain: _____

Name of institution or facility to conduct DNA analysis: _____

RADIO-TRACKING

Will any bats be radio-tagged and tracked? Yes☑ No☐

[7] https://www.fws.gov/media/automated-acoustic-bat-id-software-programs

If yes, please answer following:

Which species will be radio-tagged? MYSO, MYSE, and PESU

Name of USFWS Section 10 permitted biologist(s) who will apply transmitter(s): TBD - State permit numbers provided above

Make/model and approximate weight of transmitter(s) to be used: Holohil, LB-2x, 0.27-0.32g (dependent on species)

Manufacturer date and estimated life-span of transmitters to be used: Manufactured <1 year, 14 days

Frequency range (MHz) of transmitters (e.g., 150.xxx or 172.xxx): 172.xxx

If radio-tracking multiple targeted bats/species, what criteria will be used in selecting which bats will be tracked?
Two bats of each species with preference given to females and juvenile males - see additional survey information

Will all radio-tagged bats be tracked (min. of 4-hrs. search effort/day) to their diurnal roosts for the minimum recommended period of 7 days? Yes☑ No☐

If no, explain: _____

Will night-time foraging data/telemetry be collected? Yes☐ No☑

Glue used for attaching transmitters: Type: Latex-based Surgical Cement Name: Torbot

Manufacturer: Torbot Group, Inc. Other: _____

EMERGENCE SURVEYS

After diurnal roost sites of radio-tagged bats are identified, will emergence surveys be conducted at each identified roost (assuming landowner permission is obtained)? Yes☑ No☐

If yes, how many emergence surveys/roost? 2

Have you identified a small number (e.g., ≤10) of potentially suitable roost trees* that you propose to conduct emergence surveys for? Yes☐ No☑

*(*If yes, provide photographs of each tree documenting that all of the tree can be observed by the surveyor along with coordinates (lat/long and/or KML/shapefile) of all trees to be surveyed.)*

POTENTIAL HIBERNACULA SURVEYS

Are you aware of any known hibernacula used by the target species within the project area itself or nearby?

Yes☐ No☑ Unknown☐

If yes or unknown, list sites or explain: _____

Has your desktop analysis identified any natural or man-made features that could be used as a hibernaculum by any of the target bat species? Yes☐ No☑ Unknown☐

If yes, underground features (e.g., caves, mines, tunnels, bunkers, cisterns) present: Yes☐ No☐

If yes, above-ground features* (e.g., crawl spaces) present: Yes☐ No☐

If unknown, explain: _____

Are you requesting approval of a field survey for potential hibernacula at this time? Yes*☐ No☑

*(*If yes, attach a separate narrative explaining how the project area(s) will be surveyed for potential hibernacula.)*

Are you submitting the results of a Phase 1 Habitat Assessment of potentially suitable hibernacula identified from field surveys? Yes*☐ No☑

*(*If yes, provide a Phase 1 Habitat Assessment Data Sheet for each potential hibernaculum/portal(s)[8] identified to be surveyed.)*

BRIDGE & CULVERT ASSESSMENTS

Will any bridges or culverts be surveyed for bat presence? Yes☐ No☑

If yes, please answer the following:

[8] If multiple cave entrances/portals, please list all locations.

Structure type(s) (check all that apply): Bridge☐ Culvert☐ Other☐
If "other", explain: _____

Survey methodology for structure(s) (check all that apply):
Visual inspection☐ Guano collection☐ Emergence survey☐ Acoustics*☐
Mist-net*☐ Harp-trap*☐ Other _____
*(*Due to site-specific conditions of structures, coordination with the local USFWS Field Office and appropriate state agency(ies) is necessary before proceeding with these survey methodologies)*

Will guano be collected and analyzed to confirm species ID? Yes☐ No☐
If "yes", name of institution/entity performing analysis: _____

ADDITIONAL SURVEY INFORMATION[9]

Will the proposed bat survey deviate from the current version of the USFWS Survey Guidelines?[10] Yes☐ No☑

If yes, provide justification for any departures or modifications to the guidelines (if applicable) below:

Proposed mist-net sites are provided on the attached Project mapping files; however, actual locations will be determined in the field based on site specific conditions. Proposed survey state date and field survey crew leader will be dependent on staff availability and scheduling. If more than 2 individual target bats are captured during the survey, Copperhead will coordinate with USFWS to determine the need for additional bats to be transmittered.

I hereby acknowledge that the information being provided to the Service is accurate and complete as of today's date.

Signature: Zachary Baer Digitally signed by Zachary Baer Date: 2025.05.01 15:13:24 -04'00' Date: 1 May 2025

[9] Attach additional pages to this form, if needed.

[10] Proposed surveys deviating from the current Range-wide IBAT & NLEB Survey Guidelines will only be accepted with a thoroughly described justification. Coordinate with your local USFWS Field Office (https://www.fws.gov/our-facilities) for acceptable modifications.

********FOR U.S. FISH AND WILDLIFE SERVICE USE ONLY**********

United States Department of the Interior

Fish and Wildlife Service

Kentucky ES Field Office

330 W. Broadway, Room 265, Frankfort, KY 40601

Office Phone: (502) 695-0468

SITE-SPECIFIC AUTHORIZATION - BAT WORK

Our Field Office has reviewed your study plan and found it to contain sufficient information for our approval. When signed, this statement serves as your site-specific authorization to conduct the proposed activities at the specified locations included in the attached Study Plan Form and supporting files and must be carried with your federal permit when conducting work for this project. All activities must be carried out with strict adherence to permit conditions and authorizations specified in your federal permit as well as your state permit(s) (if needed). The section 10(a)(1)(A) permit authorizing the activities must remain with the surveyor at all times. This authorization is not valid if you have not obtained permission from the owner of the lands where activities will occur.

For federal permit reporting purposes, please use the appropriate USFWS bat survey data spreadsheet, available on the IBAT and NLEB Summer Survey Guidance website[1]. To mitigate the risk of humans transmitting viruses (e.g., SARS-CoV-2) to bats or viral transmission from bats to humans, the U.S. Fish and Wildlife Service requests anyone directly handling or working in close proximity to bats follow current guidelines prepared by the CDC[2] and IUCN Bat Specialist Group[3] in addition to the following the standard WNS decontamination protocols[4].

If the work expands beyond the scope of your original study plan or if there are adverse effects to bats that were not anticipated, cease all survey and/or research activities, and contact this office prior to continuing. Additionally, if a federally listed bat is captured, this USFWS Field Office must be notified within 48 hours with information regarding species, sex, age, and whether or not the bat has a transmitter attached.

Field Office POC: Mike Armstrong

email: Mike_Armstrong@fws.gov phone: (502) 229-4632

☐ **Authorized as Proposed**

☑ **Authorized with Conditions** (see below)

You are authorized to proceed provided that the following adjustment(s) and/or conditions are met.

(1) Please band all cave hibernating species with appropriate sized KDFWR bands using pliers with the exception of MYSE.
(2) Ensure net set placements reflect variation of habitats present on site and preferred by MYSO, MYSE, and PESU.
(3) Ensure a minimum of two (2) biologists (e.g., one qualified and one technician)

☐ **Not Authorized.**

Comments:

Signature & Date: MICHAEL ARMSTRONG

Digitally signed by MICHAEL ARMSTRONG
Date: 2025.05.01 16:34:23 -04'00'

NOTE: Please check the appropriate box above before signing/locking the document.

[1] https://www.fws.gov/library/collections/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines
[2] https://www.cdc.gov/healthypets/covid-19/wildlife.html
[3] https://www.iucnbsg.org/uploads/6/5/0/9/6509077/amp_recommendations_for_researchers_final.pdf
[4] https://www.whitenosesyndrome.org/mmedia-education/national-wns-decontamination-protocol-u-s

Zack Baer

From: Armstrong, Mike <mike_armstrong@fws.gov>
Sent: Thursday, May 1, 2025 4:46 PM
To: Zack Baer; FWWildlifeDiversity@ky.gov; KentuckyES, FW4; Burford, Laura S (FW)
Cc: Marty Marchaterre; Barb Sargent
Subject: Re: [EXTERNAL] Study Plan - Barrelhead Solar Project Mist-Net Survey (IPaC: 2024-0069739)
Attachments: 1717_Barrelhead Solar Project Mist-Net Survey Study Plan_04282025_Signed_KFO approved.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Afternoon Zack.

See attached for your approved study plan. Please review the conditions and let me know if there are any questions.

Good luck with the survey and stay safe,

Mike

Mike Armstrong
Southeast Region Bat Recovery Biologist
U.S. Fish & Wildlife Service
Kentucky Field Office
330 W. Broadway, Room 265
Frankfort, KY 40601
Cell: 502-229-4632
Office/Teams: 502-653-0498

**Check us out at https://www.fws.gov/office/kentucky-ecological-services

---

From: Zack Baer <zbaer@copperheadconsulting.com>
Sent: Thursday, May 1, 2025 3:23 PM
To: Armstrong, Mike <mike_armstrong@fws.gov>; FWWildlifeDiversity@ky.gov <FWWildlifeDiversity@ky.gov>; KentuckyES, FW4 <kentuckyes@fws.gov>; Burford, Laura S (FW) <Laura.Burford@ky.gov>
Cc: Marty Marchaterre <mMarchaterre@copperheadconsulting.com>; Barb Sargent <bsargent@copperheadconsulting.com>
Subject: [EXTERNAL] Study Plan - Barrelhead Solar Project Mist-Net Survey (IPaC: 2024-0069739)

Mr. Armstrong, and Ms. Burford,

Please find attached Copperhead Environmental Consulting, Inc.'s (Copperhead) Study Plan to conduct a bat mist-net, and radio-telemetry survey for the proposed Barrelhead Solar Project in Wayne County, Kentucky (IPaC: 2024-0069739). Can you please review the completed USFWS Study Plan form and attached Project mapping and provide Study Plan approval and site specific authorization, if appropriate.

I have also attached the KDFWR Project Proposal Form and the Indiana Bat Project Form.

Please let me know if you have any questions or require any additional information.

Thank you,

COPPERHEAD
ENVIRONMENTAL CONSULTING

Zack Baer
Senior Wildlife Biologist/Project Manager
Office: 859.925.9012
Direct: 859.279.2732
Cell: 724.549.6739
www.copperheadconsulting.com
Canonsburg, Pennsylvania

Zack Baer

From: Burford, Laura S (FW) <Laura.Burford@ky.gov>
Sent: Friday, May 2, 2025 11:09 AM
To: Zack Baer
Cc: Marty Marchaterre; Barb Sargent; Rogers, Michaela L (FW)
Subject: Re: Study Plan - Barrelhead Solar Project Mist-Net Survey (IPaC: 2024-0069739)
Attachments: Outlook-Title_ KY

Follow Up Flag: Follow up
Flag Status: Completed

Hi Zack,

Thank you for sharing your study plan for the bat mist-net and radio-telemetry survey for the proposed Barrelhead Solar Project in Wayne County, Kentucky. Notification of your plans satisfies the requirements for your Kentucky Collection permit.

No questions at this time- good luck with the survey!

Best regards,

Laura

Laura Burford
Nongame Program Coordinator
Kentucky Department of Fish and Wildlife Resources
#1 Sportsman's Lane, Frankfort, KY 40601
502-892-4576 | Laura.Burford@ky.gov

From: Zack Baer
Sent: Thursday, May 1, 2025 3:23 PM
To: Armstrong, Mike; FW Wildlife Diversity; KentuckyES, FW4; Burford, Laura S (FW)
Cc: Marty Marchaterre; Barb Sargent
Subject: Study Plan - Barrelhead Solar Project Mist-Net Survey (IPaC: 2024-0069739)

Mr. Armstrong, and Ms. Burford,

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I have also attached the KDFWR Project Proposal Form and the Indiana Bat Project Form.

Please let me know if you have any questions or require any additional information.

Thank you,

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www.copperheadconsulting.com
Canonsburg, Pennsylvania

APPENDIX B

Mist-Net Survey Data

Appendix A, Table 1. Mist-Net Site Data for the Barrelhead Solar Project, Wayne County, Kentucky.

Latitude	Longitude	County	State	Site Location Description	Site Habitat Type	Dominant Vegetation	Roost Habitat[1]	Water Resources[2]	Forest Structure[3]	Land Cover[4]
36.772808	-85.010377	Wayne	Kentucky	Potts Creek, the surrounding forested habitat, and the edge of the grass field, directly to the north of Potts Creek	Creek/Riparian/Field Edge	*Liriodendron tulipifera, Ailanthus altissma, Juglans nigra, Celtis occidentalis, Robina pseudoaccacia, Acer saccharum, Carya cordiformis, Ulmus alata, Ulmus americana, Aesculus flava*	Moderate	Optimal	Moderate	Poor

[1]Roost Habitat - Poor: No or few snags >= ~5" DBH with sloughing bark or other usable roost features (cracks, crevices, etc.); Moderate: Snags with sloughing bark or other roost features present ~5-15-inch DBH within 1000 feet of forested areas; Optimal: Snags with sloughing bark or other roost features present >~15-inch DBH within 1000 feet of forested areas.
[2]Water Resources - Poor: bat drinking resources not present at the site; Moderate: Ephemeral or intermittent streams or ponded areas present but too cluttered to allow many bats to drink easily or simultaneously. No corridors, openings or canopy gaps allow bats easy access to the resource; Optimal: Streams or ponds (including road ruts) present that appear to offer drinking resource throughout the majority of the summer. Flyways to resources are available.
[3]Forest Structure - Poor: Habitat even aged and young. Trees smaller than 5-inch DBH. Understory growth cluttered and restricts flying/foraging. Hardwoods are absent or stand is monoculture; Moderate: some diversity in age of trees in the stand. Trees 5 to 15 inches present. Understory clutter dominant but not ubiquitous. Trees greater than 15" DBH may be present but rare; Optimal: Mature forest. Diverse age classes of trees present. Trees > 15-inch DBH frequent. Varying tree height and treefalls allow for frequent small openings and gaps that facilitate bat foraging.
[4]Land Cover- Poor: Area surrounding site predominantly un-forested. Few mature trees present not connected to other areas of trees; Moderate: Trees present in the form of small woodlots and wooded fence rows. Little connection to adjacent forested areas; Optimal: Area is largely forested. Wooded stands are connected to other wooded stands via wooded stream, fence row, or other wooded corridor.

Appendix A, Table 2. Nightly Mist-Net Survey Data for the Barrelhead Solar Project, Wayne County, Kentucky.

Survey Date (2025)	Total Nightly Net Sets	Time Nets Up	Time Nets Down	Bat Captures (Per Night)	Moon Percent	Moonrise	Moonset	Sunrise	Sunset	Nightly Survey Status	Permitted Biologist
15-May	2	20:40	01:40	1	81-Full	23:58	8:11	6:31	20:40	Complete	Ian Burns
17-May	4	20:42	01:42	5	61-80	0:45	10:08	6:30	20:42	Complete	Ian Burns
18-May	4	20:43	01:43	2	61-80	1:27	11:14	6:29	20:43	Complete	Ian Burns

Appendix B, Table 3. Mist-Net Data for the Barrelhead Solar Project, Wayne County, Kentucky.

Net ID	Survey Date (2025)	Mist-Net Set Habitat	Net Height (m)	Net Length (m)	Latitude	Longitude	Comments
A	15-May	Corridor	5.2	9	36.772808	-85.010377	-
B	15-May	Forest Edge	5.2	12	36.772766	-85.011248	-
C	17-May	Forest Edge	5.2	12	36.773208	-85.008493	-
D	17-May	Forest Edge	5.2	9	36.773097	-85.007573	-
E	17-May	Forest Edge	5.2	12	36.772514	-85.008435	-
F	17-May	Forest Edge	5.2	12	36.772339	-85.007446	-
G	18-May	Creek	5.2	9	36.77214	-85.011048	-
H	18-May	Forest Gap	5.2	9	36.772357	-85.010666	-
I	18-May	Creek	5.2	6	36.772221	-85.010278	-
J	18-May	Corridor	5.2	9	36.772499	-85.009739	-

Appendix B, Table 4. Bat Capture Data for the Barrelhead Solar Project, Wayne County, Kentucky.

Date (2025)	Nightly Capture No.	Species	Time Caught	Capture Net	Net Height (m)	Age	Sex	Repro Status	Mass (g)	RFA (mm)	Wing Damage Index	Comments
15-May	1	LABO	22:20	B	5	U	U	U	U	U	U	Escaped from net.
17-May	1	LABO	23:05	E	2.5	A	F	PR	14	39	0	-
17-May	2	LABO	23:57	E	2	A	M	N	10.25	40	0	-
17-May	3	LABO	0:20	E	1.5	A	F	PR	13.75	41	0	-
17-May	4	LABO	0:44	E	2.5	A	F	PR	15.25	41	0	-
17-May	5	LABO	1:50	E	1.5	A	F	PR	16.5	41.5	0	-
18-May	1	NYHU	21:50	H	3	A	M	N	8.5	34.5	0-P	-
18-May	2	NYHU	23:20	H	2	A	M	N	10.25	35	0	-

LABO=*Lasiurus borealis* (eastern red bat); NYHU=*Nycticeius humeralis* (evening bat)
A=adult; M=male; F=female; N=non-reproductive; PR=pregnant

Appendix B, Table 5. Nightly Weather Conditions Data for the Barrelhead Solar Project, Wayne County, Kentucky.

Survey Date (2025)	Time	Temperature (°F)	Sky Conditions	Estimated Wind Speed	Comments
15-May	20:40	74	3	1	-
15-May	21:40	74	3	1	-
15-May	22:40	73	3	1	-
15-May	23:40	73	0	2	-
15-May	00:40	74	3	2	-
15-May	01:40	74	3	2	-
17-May	20:42	72	0	2	-
17-May	21:42	68	0	0	-
17-May	22:42	64	0	0	-
17-May	23:42	61	0	0	-
17-May	00:42	57	0	0	-
17-May	01:42	55	0	0	-
18-May	20:43	70	0	0	-
18-May	21:43	67	0	0	-
18-May	22:43	64	0	0	-
18-May	23:43	61	0	0	-
18-May	00:43	61	0	0	-
18-May	01:43	61	0	0	-

Weather Conditions Key	
Sky Conditions Code	
0	Clear
1	Few Clouds
2	Partly Cloudy
3	Cloudy or Overcast
4	Fog or Smoke
5	Drizzle or light rain
6	Heavy Rain - thunderstorm
Estimated Wind Speet (Beaufort Wind Scale)	
0	Calm: <1 mph
1	Light air: 1-3 mph
2	Light breeze: 4-6 mph
3	Gentle breeze: 7-10 mph
4	Moderate breeze: 11-16 mph

APPENDIX C

Mist-Net Site Photograph Log

COPPERHEAD ENVIRONMENTAL CONSULTING	Barrelhead Solar Project Mist-Net Photograph Log	
Project No.: **1717**	**County, State:** **Wayne County, Kentucky**	**Client:** **Birch Creek Development, LLC**

Description: Net A	

Description: Net B	

COPPERHEAD ENVIRONMENTAL CONSULTING	Barrelhead Solar Project Mist-Net Photograph Log	
Project No.: **1717**	**County, State:** **Wayne County, Kentucky**	**Client:** **Birch Creek Development, LLC**

Description: Net C	

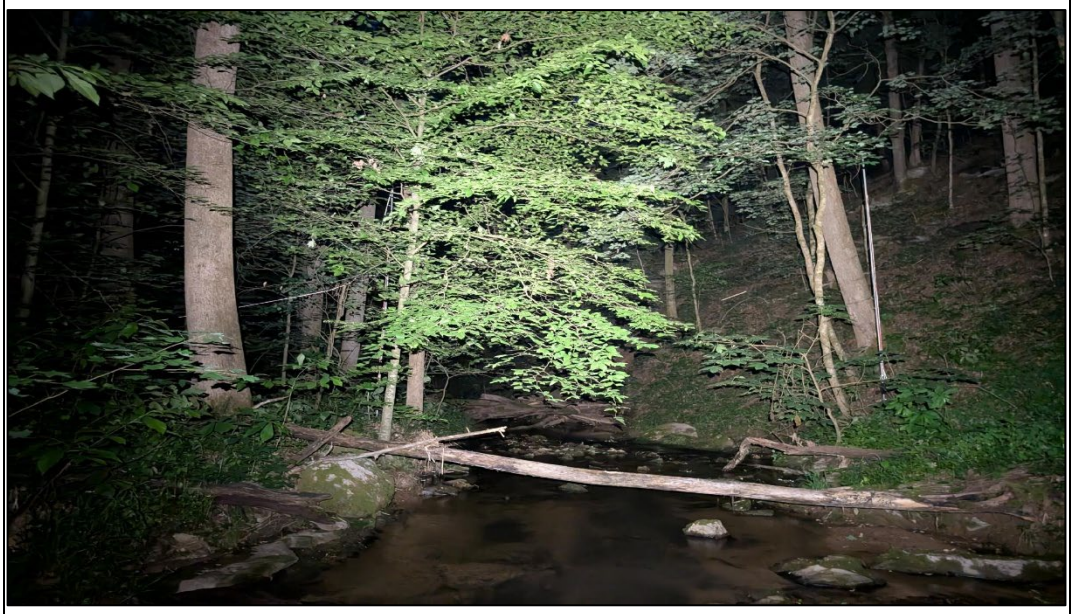
Description: Net D	

COPPERHEAD ENVIRONMENTAL CONSULTING	Barrelhead Solar Project Mist-Net Photograph Log	
Project No.: **1717**	**County, State:** **Wayne County, Kentucky**	**Client:** **Birch Creek Development, LLC**

Description: Net E	

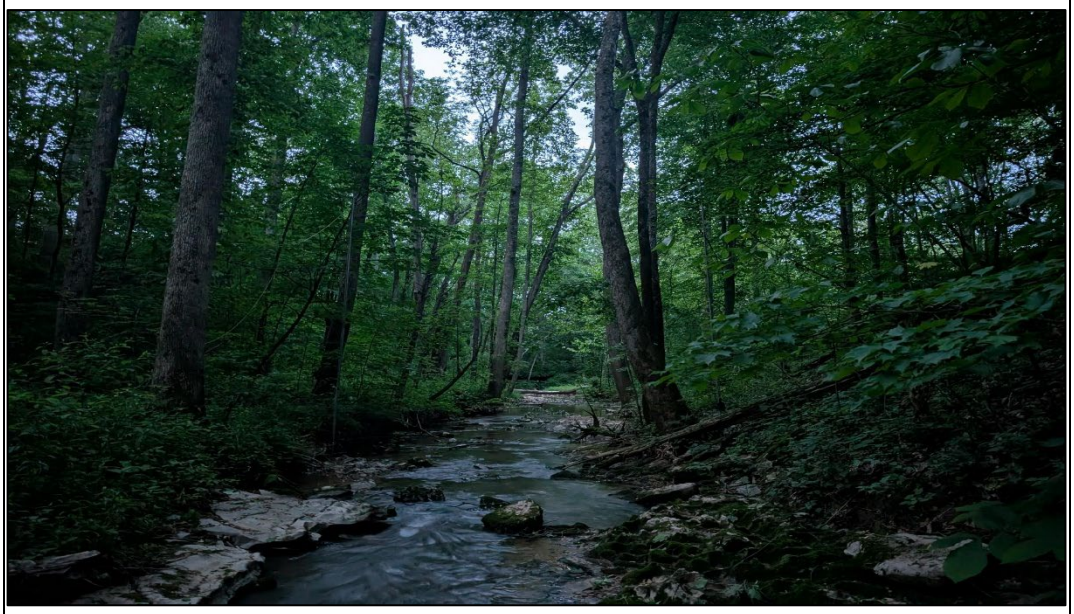
Description: Net F	

COPPERHEAD ENVIRONMENTAL CONSULTING	Barrelhead Solar Project Mist-Net Photograph Log	
Project No.: **1717**	**County, State:** **Wayne County, Kentucky**	**Client:** **Birch Creek Development, LLC**

Description: Net G	

Description: Net H	

COPPERHEAD ENVIRONMENTAL CONSULTING	Barrelhead Solar Project Mist-Net Photograph Log	
Project No.: **1717**	**County, State:** **Wayne County, Kentucky**	**Client:** **Birch Creek Development, LLC**

Description: Net I	

Description: Net J	

APPENDIX D

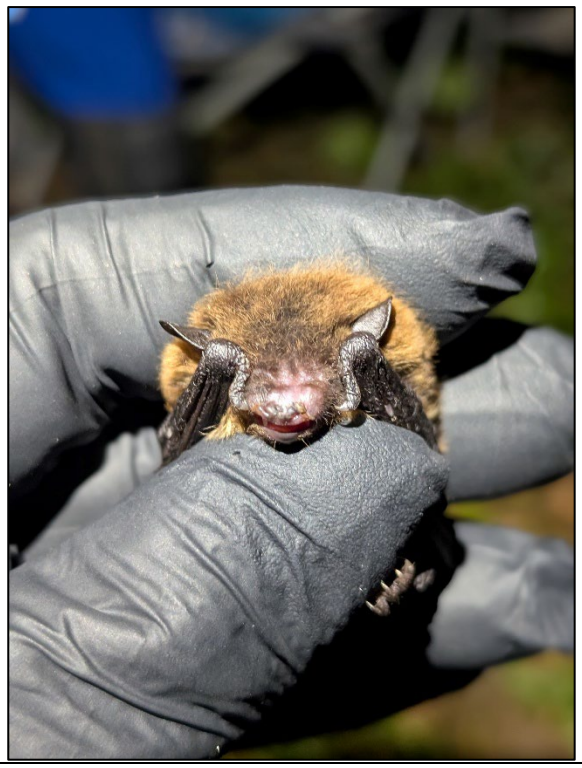
Bat Photograph Log

COPPERHEAD ENVIRONMENTAL CONSULTING	**Barrelhead Solar Project** **Bat Photograph Log**	
Project No.: **1717**	**County, State:** **Wayne County, Kentucky**	**Client:** **Birch Creek Development, LLC**

Description: Eastern red bat (*Lasiurus borealis*)	

Description: Eastern red bat (*Lasiurus borealis*)	

COPPERHEAD ENVIRONMENTAL CONSULTING	**Barrelhead Solar Project** **Bat Photograph Log**	
Project No.: **1717**	**County, State:** **Wayne County, Kentucky**	**Client:** **Birch Creek Development, LLC**

Description: Evening bat (*Nycticeius humeralis*)	
Description: Evening bat (*Nycticeius humeralis*)	

COPPERHEAD
ENVIRONMENTAL CONSULTING

Barrelhead Solar Listed Bat Species Portal Assessment
Wayne and Clinton Counties, Kentucky

Jackson Denton
Associate Project Development Manager
Barrelhead Solar, LLC

9 October 2024

COPPERHEAD ENVIRONMENTAL CONSULTING, INC.
P.O. BOX 73 ■ 471 MAIN STREET ■ PAINT LICK, KENTUCKY 40461
(859) 925-9012 OFFICE (859) 925-9816 FAX

www.copperheadconsulting.com

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INTRODUCTION

Copperhead Environmental Consulting, Inc. (Copperhead) was contracted by Barrelhead Solar, LLC (the Applicant) to conduct bat suitability assessments for three portals located within the Barrelhead Solar Project (Project) area in Wayne and Clinton Counties, Kentucky (Figure 1). While conducting wetland and stream delineations for the Project, Copperhead staff located three potential karst features (portals) that could provide suitable winter hibernacula habitat for listed bat species. This preliminary report documents the findings of the portal field assessment survey.

METHODS

Copperhead biologists conducted a one-day field assessment of the three previously identified portals. Portals were assessed for their bat winter hibernacula suitability based on the specifications outlined in the US Fish and Wildlife Survey (USFWS) *2024 Range-wide Indiana Bat & Northern Long-eared Bat Survey Guidelines* (Guidance). Biologists completed a USFWS *Phase 1 Habitat Assessment Sample Data Sheet* for each of the three portals and representative photographs were taken of each portal.

Underground openings were considered unsuitable and therefore would not require a presence/probable absence (P/A) survey if:

- There is only one horizontal opening, and it is less than 6 inches in diameter.
- Vertical shafts are less than 1 foot in diameter.
- Passage continues less than 50 feet and terminates with no visible fissures that bats can access.
- Openings are prone to flooding, collapsed shut and completely sealed, or otherwise are inaccessible to bats.
- Openings that have occurred recently (i.e., within the past 12 months) due to human activity or subsidence

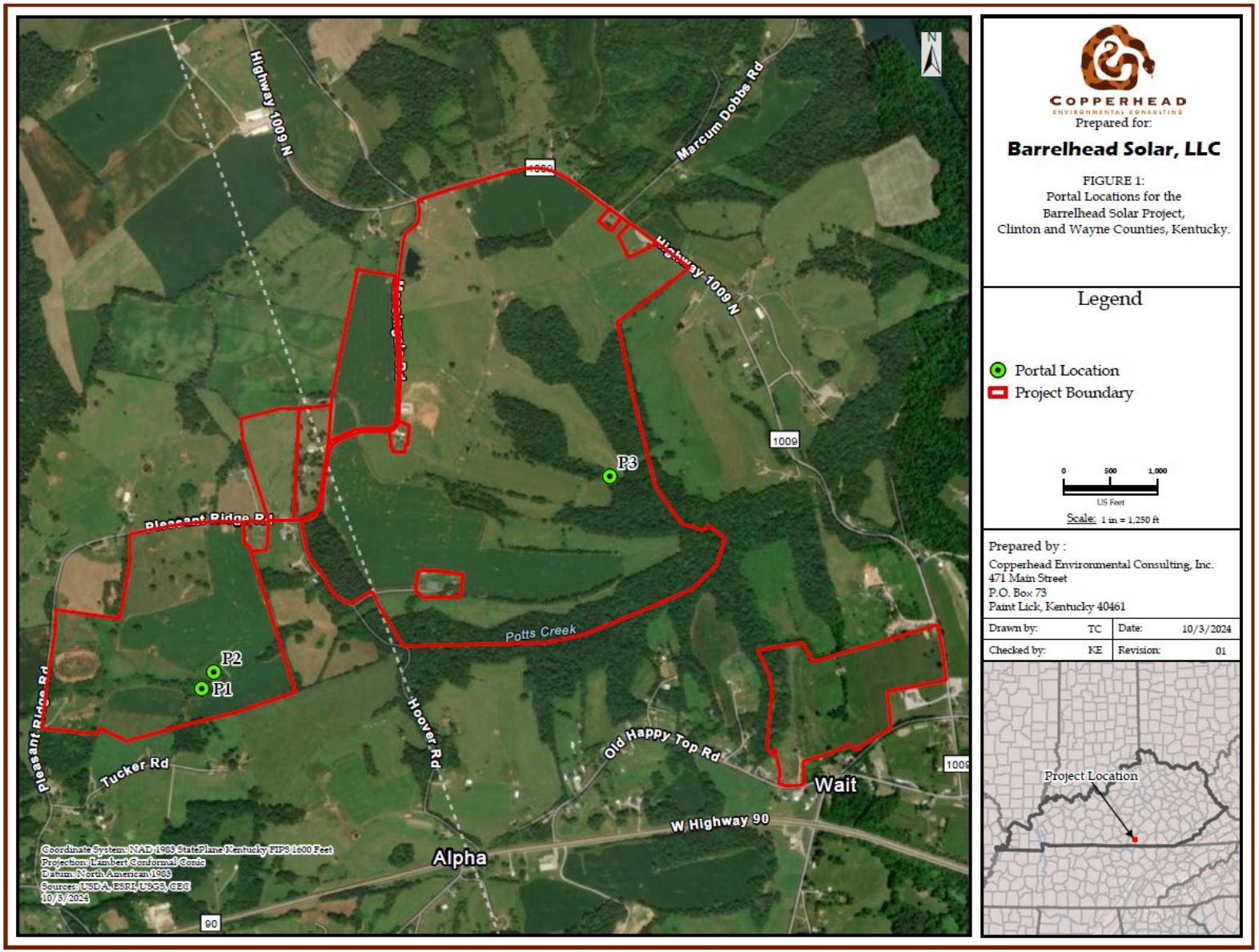

Figure 1. Portal Locations for the Barrelhead Solar Project, Clinton and Wayne Counties, Kentucky

RESULTS

One mobilization for field reconnaissance of the three previously identified portals occurred. Copperhead biologist Taylor Culbertson (USFWS permit number ES94849B-2) conducted the field assessment on 30 September 2024.

Based on the results of the field assessment, all three portals were determined not suitable winter bat habitat based on the Guidance. Data documenting the conditions of each portal are provided below in Table 1 and Appendix A, and photographs of each portal entrance are provided in Appendix B.

Table 1. Potential Hibernaculum Survey Portal Assessment Data and Suitability Considerations.

Portal ID	Opening Type	Latitude	Longitude	Underground Feature Connectivity	Estimated Internal Length (ft)	Opening Dimensions (in)	Airflow	Likely Suitable Winter Bat Habitat	Justification of Suitability Determination	Considered for Future Survey	Notes
P1	Sinkhole	36.770599	-85.01794	None	4	24 x 30	None	Unsuitable	Cluttered/ evidence collapse	No	Obvious sinkhole. Tree trunks and debris fill the area around the hole.
P2	Sinkhole	36.771079	-85.017464	None	5	48 x 36	None	Unsuitable	Filled in with tires	No	This is a man-made well. Flat and squared sides of rock. Used as a tire dump.
P3	Sinkhole	36.77670	-85.003045	None	6-8	48 x 36	None	Unsuitable	Cluttered/ evidence of flooding	No	Cluttered with multiflora rose and briar. 1x1 foot shaft leads north and is water floored, mud ceiling, with debris.

CONCLUSION

All three portals were deemed as unsuitable habitat according to the criteria laid out in the Guidance. Based on the results of this suitability assessment, it is Copperhead's opinion that no further P/A surveys are necessary regarding the three identified portals.

LITERATURE CITED

US Fish and Wildlife Service. 2024. Range-Wide Indiana Bat and Northern Long-Eared Survey Guidelines. March 2024.

APPENDIX A:

Phase I Habitat Assessment Data Sheets

Phase I Habitat Assessment Sample Data Sheet

Location P1

Observers (include permit numbers) T. Culbertson

Latitude 36.770599 **Longitude**[82] -85.01794

Date 9-30-2024 **Time** 11:30 **Temp (outside)** 70°

	Opening #1	Opening #2	Opening #3	Opening #4
Opening Type (e.g., cave, portal, shaft)	cave/sinkhole			
Opening vertical or horizontal	Vert			
Opening Size: Height x Width (or Diameter)	24 x 30 inch			
Internal Dimensions: Height x Width	ht <3ft wd unk			
Slope (up or down from entrance)	down			
Entrance Stable?	unk			
Direction of Airflow (In or out?)	Ø			
Amount of Airflow (e.g., none, slight, heavy)	none			
Internal air warmer or cooler than outside temp.?	cooler 60°			
Evidence of collapse?	yes			
Ceiling Condition	unk			
Amount of water in opening	none			
Evidence of past flooding?	yes			
Observed length of internal passage	4 ft			
Distance to nearest water source	SAA runs into sink			
% Canopy Cover at entrance	90			
Foraging Signs? (e.g., moth wings)	no			

Are any portals suspected or known to be connected? Which ones?

Ø

Any observable side passages?

Ø

Additional comments:

Obvious sink hole. Tree trunks + debris fill the area around and in hole. Bat suitability very low, not suitable.

Entry of abandoned mine portals, quarries, or caves 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 FWS does not authorize or require anyone to enter any potential hibernaculum that is or could be unsafe while implementing surveys. These guidelines do not require any applicant or applicant employee, consultant, lessee, or other such designee to enter any cave, quarry, or mine portal.

[82] Provide coordinates for each opening.

Phase I Habitat Assessment Sample Data Sheet

Location P2

Observers (include permit numbers) J Culbertson

Latitude 36.771079 **Longitude**[82] -85.017464

Date 9-30-2024 **Time** 11:57 **Temp (outside)** 71°

	Opening #1	Opening #2	Opening #3	Opening #4
Opening Type (e.g., cave, portal, shaft)	shaft			
Opening vertical or horizontal	vert.			
Opening Size: Height x Width (or Diameter)	48 x 36 in (square)			
Internal Dimensions: Height x Width	⊗			
Slope (up or down from entrance)	Vertical			
Entrance Stable?	yes			
Direction of Airflow (In or out?)	⊗			
Amount of Airflow (e.g., none, slight, heavy)	none			
Internal air warmer or cooler than outside temp.?	same 70°			
Evidence of collapse?	no			
Ceiling Condition	⊗			
Amount of water in opening	⊗			
Evidence of past flooding?	⊗			
Observed length of internal passage	5ft down			
Distance to nearest water source	130 ft to SFA			
% Canopy Cover at entrance	0			
Foraging Signs? (e.g., moth wings)	⊗			

Are any portals suspected or known to be connected? Which ones?

⊗

Any observable side passages? ⊗

Additional comments:

This is a man-made well. Flat and squared sides of Rock. Used as a tire dump. Can only see down about 5 ft. No potential for Bat use.

Entry of abandoned mine portals, quarries, or caves 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 FWS does not authorize or require anyone to enter any potential hibernaculum that is or could be unsafe while implementing surveys. These guidelines do not require any applicant or applicant employee, consultant, lessee, or other such designee to enter any cave, quarry, or mine portal.

[82] Provide coordinates for each opening.

Phase I Habitat Assessment Sample Data Sheet

Location P3

Observers (include permit numbers) J. Culbertson

Latitude 36.77670° **Longitude**[82] -85.003045

Date 9-30-2024 **Time** ~~12:~~ 13:00 **Temp (outside)** 74°

	Opening #1	Opening #2	Opening #3	Opening #4
Opening Type (e.g., cave, portal, shaft)	cave/sink			
Opening vertical or horizontal	horiz.			
Opening Size: Height x Width (or Diameter)	48 x 36 in (oval)			
Internal Dimensions: Height x Width	H 60 in /			
Slope (up or down from entrance)	down			
Entrance Stable?	yes			
Direction of Airflow (In or out?)	Ø			
Amount of Airflow (e.g., none, slight, heavy)	none			
Internal air warmer or cooler than outside temp.?	Cooler 71°			
Evidence of collapse?	no			
Ceiling Condition	mud			
Amount of water in opening	small.			
Evidence of past flooding?	ukc			
Observed length of internal passage	6-8 ft			
Distance to nearest water source	5 ft to SBF			
% Canopy Cover at entrance	70 (Canvo)			
Foraging Signs? (e.g., moth wings)	no			

Are any portals suspected or known to be connected? Which ones?

Ø

Any observable side passages? Ø

Additional comments: Entrance 5ft to bottom. 1x1 ft shaft leads north. → cluttered with M. flora Rose + Briar. shaft is water floored, mud ceiling, with debris. Very unlikely. But suitable

Entry of abandoned mine portals, quarries, or caves 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 FWS does not authorize or require anyone to enter any potential hibernaculum that is or could be unsafe while implementing surveys. These guidelines do not require any applicant or applicant employee, consultant, lessee, or other such designee to enter any cave, quarry, or mine portal.

[82] Provide coordinates for each opening.

APPENDIX B:

Photographic Record of the Bat Portal Survey

Photo Number: 1

9/30/2024

Description:

P1

Photo Number: 2

9/30/2024

Description:

P1

Photo Number: 3

9/30/2024

Description:

P1

Photo Number: 4

9/30/2024

Description:

P1

Photo Number: 5

9/30/2024

Description:

P1

Photo Number: 6

9/30/2024

Description:

P1

Photo Number: 7

9/30/2024

Description:
P2

Photo Number: 8

9/30/2024

Description:
P2

Photo Number: 9

9/30/2024

Description:
P2

Photo Number: 10

9/30/2024

Description:
P2

Photo Number: 11

9/30/2024

Description:
P3

Photo Number: 12

9/30/2024

Description:
P3

Photo Number: 13

9/30/2024

Description:
P3

Photo Number: 14

9/30/2024

Description:
P3

Photo Number: 15

9/30/2024

Description:
P3