APPENDIX C – Acoustic Bat Survey and Analysis

TERRA TECHNOLOGIES

Engineers • Scientists • Permit Specialists

I-49 Industrial Center

Acoustic Bat Survey and Analysis

Prepared for

Platform Ventures

June 2021

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APPENDICES

1.0 INTRODUCTION

Terra Technologies is retained by the applicant, Platform Ventures, to conduct an acoustic bat survey and analysis for the purpose of determining the presence or absence of federally endangered Indiana Bats (*Myotis sodalis*) and/or federally threatened Northern Long Eared Bats (NLEB) (*Myotis septentrionalis*) within the project area located in Kansas City, Jackson County, Missouri. The Information Planning and Consultation (IPaC) system advance notice output report provided by USFWS signifies the project area is within the range of the endangered Indiana Bat and Gray Bat, and the threatened NLEB, thus an acoustic survey and analysis was conducted to determine the presence/absence of such bats.

In accordance with Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.), National Environmental Policy Act of 1969 (42 U.S.C 4241-4347) and the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1534), the U.S. Fish and Wildlife Service (USFWS) administers the permitting of activities that may affect threatened and endangered species, including their habitat. Most activities that would result in the potential harm to threatened or endangered species or their critical habitat require permit authorization from the USFWS. The information contained in this report will assist USFWS and other regulatory agencies in the determination of the presence or absence of Indiana Bats and/or NLEBs within the project area.

2.0 PROJECT LOCATION, LAND USE, AND DESCRIPTION

The subject area is approximately 258.25 acres in size and is located in Section 26 of Township 47N Range 33W in southwest Jackson County, Missouri (see Figures 1a & 1b [Google, 2019]).

The USGS topographic map published by the U.S. Geological Survey (USGS) indicates three streams and no ponds on the site (see Figure 1c [Google, 2019]).

The project site consists mainly of agricultural land and forested land. It is bordered by agricultural, commercial, and residential land to the north, by a railroad to the east, by MO Highway 150 to the south, and by Botts Road to the west (see Figure 1d [Google, 2019]).

3.0 POTENTIALLY SUITABLE HABITAT REQUIREMENTS

Indiana Bat Habitat

Indiana Bats feed on insects in the tree canopy of floodplain, riparian, and upland forests. Streams, wetlands, and open water features are preferred feeding habitats for pregnant and lactating bats.

Potentially suitable Indiana Bat summer habitat can include a diversity of forested or wooded habitats which are used for roosting, hunting, and travel. Herbaceous wetlands and the edges of agricultural fields, pastures, and old fields are also used as habitat when they are adjacent or within forested or wooded habitats. Suitable forested or wooded habitats can include any of the following characteristics (USFWS, 2019):

1) The presence of potential roost trees (live or overly mature trees and snags with a diameter at breast height greater than 5 inches with peeling or exfoliating bark and/or split tree trunks or cavities which may be used as maternity or bachelor roosts)
2) Linear wooded features such as fence rows, wooded corridors, and riparian forests
3) Dense forested areas or loose aggregates of trees with variable canopy closure
4) Individual trees within 1,000 feet of other forested or wooded habitat

Indiana Bats utilize two types of habitat depending on the season. Summer habitat consists of wooded or semi-wooded areas usually along streams. Solitary females or small clusters of females (maternity colonies) bear their offspring in hollow trees or under loose bark of living or dead trees. Dead trees in sunny openings or in woodland interiors are preferred to living trees. Large specimens of white oak (*Quercus alba*) and shagbark hickory (*Carya ovata*) are often preferred for maternal roosts because of loose bark. During the winter, the bats hibernate in caves, mines, or similar protective structures.

Examples of unsuitable habitat for Indiana Bats include the following (USFWS, 2019):
1) Individual trees more than 1,000 feet from forested or wooded areas
2) Trees in highly developed areas such as street trees or trees located in downtown areas
3) A pure stand of trees less than 3 inches in diameter at breast height that lacks larger trees

Northern Long Eared Bat (NLEB) Habitat

Suitable winter habitat (hibernacula) for the NLEB includes underground caves and cave-like structures with high humidity and minimal air currents (*e.g*., abandoned or active mines, railroad tunnels). These hibernacula typically have relatively constant, cool temperatures (0-9 degrees Celsius) and large passages with significant cracks and crevices for roosting. Within hibernacula, surveyors find NLEBs in small crevices or cracks, often with only the nose and ears visible. NLEBs will typically hibernate between mid-fall through mid-spring each year.

Suitable summer habitat for NLEB consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (*i.e.*, live trees and/or snags ≥3 inches in diameter at breast height that have exfoliating bark, cracks, crevices, and/or cavities), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit characteristics of suitable roost trees and are within 1,000 feet of other forested/wooded habitat. NLEB has also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures are also considered potential summer habitat. NLEBs typically occupy their summer habitat from mid-May through mid-August each year and the species may arrive or leave some time before or after this period (USFWS, 2019).

NLEB maternity habitat is defined as suitable summer habitat used by juveniles and reproductive (pregnant, lactating, or post-lactating) females. NLEB home ranges, consisting of maternity, foraging, roosting, and commuting habitat, typically occur within three miles of a documented capture record or a positive identification of NLEB from properly deployed acoustic devices, or within 1.5 miles of a known suitable roost tree.

Examples of unsuitable habitat for NLEBs include the following (USFWS, 2019):

1) Individual trees more than 1,000 feet from forested or wooded areas
2) Trees in highly developed areas such as street trees or trees located in downtown areas
3) A pure stand of trees less than 3 inches in diameter at breast height that lacks larger trees

4.0 METHODS

A Draft Study Plan was approved by the USFWS for two locations to survey a total of eight (8) detector nights. The acoustic survey was conducted May 21 – May 25, 2021 by Danny DeAngelo, a scientist qualified to perform bat acoustic surveys and analysis (Curriculum vitae included in Appendix D).

4.1 Acoustic Survey Background

Acoustic surveys for bats involve recording their high-frequency echolocation calls with a specially designed high-frequency sensitive microphone on a "bat detector," capable of digitizing these recordings and saving them as audio *.WAV files. Analysis of echolocation calls involves converting the digitized sound into illustrations (*i.e.*, "spectrograms") representing how the frequencies and intensities of the sounds change over time and then qualitatively and quantitatively analyzing the content of the spectrograms. Acoustic surveys are based on the premise that different species have unique call-types much like birds and other vocal animals, so by collecting a recording from a bat, researchers can determine its species by measuring the frequency and intensity of the bat's vocalizations.

Acoustic surveys can be "passive," where stationary microphones are autonomously listening to and recording all echolocation calls from the airspace covered by the microphone, "active," where a researcher moves a microphone in line with an observable bat as it is flying, or "mobile," where a researcher moves through a habitat or between a series of habitats, listening for bats along a pre-defined route and/or at pre-defined locations. For this survey, only passive acoustic monitoring methods were used.

The benefits of acoustic surveys are that they collect data in a "non-contact" manner without affecting the behavior of the animal. No bats are disturbed or handled during acoustic surveys. Acoustic surveys are biased towards recording bats that produce the loudest echolocation calls and the lowest frequency echolocation calls since these are detectable over longer distances. The same microphone will sample a larger volume of airspace for these bats than for those who produce quiet and/or high-frequency echolocation calls, as these attenuate more rapidly across distances.

4.2 Survey Locations

As shown in Figure 4, two survey sites were established to evaluate the presence or absence of threatened and endangered bats at the project area. Site 1 was located in the northeastern portion of the project area while Site 2 was located in the southwestern portion of the project area.

Site 1 was located on the edge of a forested area and was overlooking a stream. This location was chosen because of the openness and the high likelihood the area would be used by the target species for foraging or travel. The location of this site changed slightly from the draft study plan as onsite observations determined the location on the draft study plan had to too much foliage and clutter to get good recordings. Therefore, the site was moved to a more ideal location which was clear and still pointed along the forested edge and was overlooking the stream.

Site 2 was located in a linear forested opening. Placing the detector in the linear opening allows one to record bats as they are foraging or traveling along it. The location of this site did not change from the draft study plan as onsite observations found the location to be ideal for recording bats.

4.3 Survey Tools and Deployment

Equipment used included two Petterson D500x full spectrum bat detectors with external D500x microphones absent of windscreens and/or aftermarket horns on 25-foot extension cables. The microphones are capable of recording a 40kHz sounds. Detection distance varies under actual field conditions based upon: (1) the intensity (volume) of the bat echolocation call, (2) the frequency of the echolocation call (*i.e.*, higher frequencies attenuate more rapidly in air and therefore are detected at shorter distances), and (3) the temperature and/or humidity of the air. Barometric pressure, wind, and other conditions also affect how far high-frequency sound travels in air and how well sound can be recorded. Despite these limitations, over a long-term deployment enough bats are echolocating under suitable conditions to identify the majority of species occupying an area.

Detectors were placed in 767 cubic-inch capacity sealed "dry-storage, ammunition boxes" made of heavy-duty molded-plastic. These boxes provide a shaded and moisture-proof environment for the detector and associated monitoring gear (spare batteries, memory cards, microphone cable, and deployment materials). A channel was cut between the box and the lid to accommodate the microphone cable without crimping the cable when the box was sealed.

Boxes were set at or near the base of a microphone mast and efforts were made to shade the units using vegetation and/or other natural barriers. Boxes are labeled with appropriate signage designating the purpose of the survey and contact information for the primary investigator in the event of questions or problems. Microphone masts were constructed of portable, lightweight, and extendable aluminum poles to create masts that were 18 feet tall. Microphones were attached to the top of the masts using heat- and UV-resistant, non-latex EPDM rubber bands and with the microphone membrane oriented horizontally to prevent moisture damage during precipitation events and/or the accumulation of dew on the microphone. Microphone cables were wrapped tightly around the masts to prevent noise from cable slap during windy weather and to keep the microphone securely mounted. Masts were secured with a 3-foot "pole anchor" made of heavy-duty 1/2” rebar or pipe. The rebar and pipe were pounded into the ground with a mini-sledge to about 1/3-1/2 their length and the hollow base of the microphone mast is slipped over the rebar. For this deployment no additional stabilization with guy lines was required. After the detector was fully deployed, a clap test or ‘microphone check’ was performed in order to make sure the microphone and detector were functioning properly. This was also done at the end of each deployment to ensure the microphone and detector were still functioning properly, ensuring that the equipment was functioning properly throughout the entire deployment.

Detector settings were the same for each of the detectors deployed and are shown below in Table 1.

Table 1. Detector Settings

Detector ID	Sam. Freq.	Pre-trigger	Rec. Length	HP Filter	Auto Rec.	Trig. Sens.	In. Gain	Trigger Level	Int.	Start Rec.	Stop Rec.
52383	500	Off	4 Sec.	Yes	Yes	Medium	45	160	0	Rel. Time 0	Rel. Time 0
52380	500	Off	4 Sec.	Yes	Yes	Medium	45	160	0	Rel. Time 0	Rel. Time 0

The Weather for each night the detectors were deployed was within the acceptable parameters of the 2020 Indiana Bat Survey Guidelines (USFWS, 2020). While there was a small amount of intermittent rain on the night of May 21st, the rain did not start within the first five hours of the survey and therefore would be considered an acceptable survey night. The weather for each night is shown below in Table 2. Weather information was collected from the Weather Underground Weather Station KMOGRAND4 located approximately 1.71 miles northeast of the project area.

Table 2. Weather Per Detector Night

Detector Night	Low Temp. (°F)	Wind Speed AVG. (MPH)	Precipitation Inches	Precipitation Time
5/21/21-5/22/21	67	3-6	0.06	1:49am-4:04am
5/22/21-5/23/21	63	0-1	0.00	N/A
5/23/21-5/24/21	67	0-1	0.00	N/A
5/24/21-5/25/21	67	0-1	0.00	N/A

The Level of Effort for the passive acoustic survey was to obtain a minimum of eight detector nights with the use of two detectors at two different locations over four nights. Recordings took place on the nights and following mornings of May 21st, May 22nd, May 23rd, and May 24th, 2021. Each passive detector unit was programmed to turn on at sunset and turn off at sunrise and run all-night. The rational for this survey schedule was to ensure the entire night when bats are active was recorded while avoiding the day time when bats are not active. This resulted in approximately nine hours and thirty-one minutes of recording per survey night, per survey site for a total of approximately seventy-six hours and eight minutes of survey time. This level of effort meets recommended survey protocols for an aerial survey based on the 2020 Indiana Bat Summer Survey Guidelines (USFWS, 2020).

4.4 Data Analysis Methods

All bat calls were downloaded from the detectors into an archive folder with separate subfolders for each recording site. These files are generally known as the 'raw' data and will be kept on file for a minimum of seven years. The files were then copied and re-named with a set prefix of the survey type 'PAS' (passive detector), the project name 'I49Ind' (I-49 Industrial Center), the location 'Sit1' or 'Sit2' (Site 1 or Site 2), the detector type 'D500' (Petterson D500x), and the recording date and time 'YYYYMMDD_hhmmss' using the SonoBat Data Wizard software. An example of nomenclature is 'PAS_I49Ind_Sit1_D500-20210521_203822.wav' The SonoBat Data wizard was also used to attribute the files with the following metadata for each recording:

- State
- County
- Town
- Project Name
- Loc Position
- Recorded By
- Mic Model

- Mic Height
- Mic Orientation
- Mic Weatherproofing
- Weather

Please note the SonoBat Wizard was used solely to rename and attribute the files with metadata and is not used to classify any of the recorded bat calls, nor does it modify the calls in any way.

All bat calls were then subjected to USFWS-approved automated acoustic bat ID software program Kaleidoscope Pro to determined which species of bats were recorded at the project area. Automated software type and settings are shown below in Table 3.

Table 3. Software and Settings

Software	Version	Classifier	Region	Setting
Kaleidoscope Pro	5.4.0	B.N.A. 5.4.0	Missouri	0 Bal. (Neutral)
Signal Parameters				
(kHz) Minimum and Maximum Frequency Range:				8-120
(ms) Minimum and Maximum Length of Detected pulses:				2-500
(ms) Maximum inter-syllable gap:				500
Minimum number of pulses:				2
When zero crossing for conversion or analysis, enhance with advanced signal processing:				Yes

Within the Kaleidoscope Pro software, setting the correct classifier and region is critical in getting accurate identifications. Not only because only certain classifiers are approved by USFWS, but also because the classifier is programmed to determine which species of bats could be present in a certain location. Thus, by using the Bats of North America Classifier with the Missouri region, the software will only analyze for and identify bat species which are found in Missouri. This prevents the automated ID from generating false positives or false negatives for species having similar calls but with ranges that do not overlap at the location of the project. For the classifier 'Bats of North America' and Region 'Missouri', the species included are:

- *Eptesicus fuscus* - Big Brown Bat
- *Lasiurus borealis* – Eastern Red Bat
- *Lasiurus cinereus* – Hoary Bat
- *Lasionycteris noctivagans* – Silver Haired Bat
- *Myotis austroriparius* – Southeastern Myotis
- *Myotis grisescens* – Gray Bat

- *Myotis leibii* – Eastern Small-Footed Myotis
- *Myotis lucifugus* – Little Brown Bat
- *Myotis septentrionalis* – Northern Long Eared Bat
- *Myotis sodalis* – Indiana Bat
- *Nycticeius humeralis* – Evening Bat
- *Perimyotis subflavus* – Tricolored bat

The software utility uses a decision engine based on the quantitative analysis of known recordings of bat echolocation calls (exact number varies by species). During the analysis process, call pulses within a file were automatically recognized and sorted, then processed to extract unique parameters that describe the time-frequency and time-amplitude trends of each call.

The quality and accuracy of this call classification depends upon the quality of the recorded signals. While derived from a robust data set acquired from a variety of environments and conditions, the data set nevertheless encompasses a finite set of vocalizations from each species covered. Bats exhibit considerable plasticity in their vocalizations and considerable overlap in call parameters among species; this coupled with complications from noise and weak signals (as from bats at a greater distance from the detector) can potentially result in a recording from one species with parameters that match the expected parameter space of another species, resulting in a misclassification. With most passive recordings, many of the call sequences obtained will be of insufficient quality to render an unambiguous classification result. This is largely due to stationary microphones (as those deployed in any passive monitoring activity) and their inability to follow bats as they echolocate past the recording device. As a result, only a portion of the call will be well within the microphone's best cone of reception throughout the duration of the call. This often results in shorter call sequences and suboptimal signal to noise ratios. Both situations can confound accurate call classification. A bat's behavior may also impact the call types produced. As bats approach an object (*i.e.*, an insect, potential prey item, or obstacle, such as a bat detector on a stick), calls often become shorter in duration and higher in frequency, thus becoming more difficult to accurately classify.

In order to address the possibility of misclassifications or what is also described as false positives and false negatives, the software utilizes a maximum-likelihood-estimator (MLE) P-value approach to determine the accuracy of each species determination. As described by Wildlife Acoustics:

> *"The method described takes two inputs. First, there are the classification results* e.g. *How many detections of each bat did the classifier find? Second, there is the confusion matrix representing the known error rates across all the classifiers. For example, 70% of MYLU [Myotis lucifugus] calls are correctly classified as MYLU while 3% of MYLU calls are misclassified as MYSO [Myotis sodalis],* etc.
>
> *The maximum likelihood estimator determines what the most likely distribution of different species are that would result in the observed classifications given the classifier error rate. Then, to calculate P-values, a given species is clamped as absent and the most likely distribution is recalculated. The ratio of the clamped likelihood divided by the original likelihood is the P-value.*
>
> *In layman's terms, if we run an automated classifier on a data set, we will end up with a number of classifications for each species found in the data. From this, we want to determine the likelihood of presence or absence by calculating the P-value corresponding to the null hypothesis of absence. A low (near zero) p-value would therefore suggest presence." (Agranat 2018).*

Per the 2020 Indiana Bat Summer Survey Guidelines, calls identified by the software as Indiana Bats or NLEBs, must have an MLE of 0.05 or less per site per night for the species to be determined present. If the MLE is greater than 0.05 per site per night, then the probability that the targeted species was actually recorded is too low and presence cannot be confirmed.

Several main call parameters were extracted from every sound file processed by the automatic classification software. These parameters were saved in a Microsoft Excel spreadsheet and were referenced back to the original recording via filename, which included the date/time-stamp for each recording location. Parameters written to the Excel spreadsheet that are relevant to this report included the following:

- Data and time
- Auto-id species decision
- Number individual call pulses
- Number of matching call pulses
- Match ratio

- Alternate id 1
- Alternate id 2
- Average characteristic frequency of pulses in the sequence
- Characteristic slope of the call
- Average duration of the call pulses in the sequence,
- Frequency with the greatest power (kHz)
- Many other measurements of the call sequence.

A summary Excel spreadsheet is also created by the automatic classification software. This spreadsheet summarizes the automatic classification of the calls by site by night. The summary info includes the following:

- Site #1 and Site #2
- Each night
- Bat Species
- Number of Calls Identified to species
- Number of Calls that were not Identified
- Number of Noise files
- The MLE Value per site per night

Finally, it is important to recognize all classifications rendered in this report are "suggested classifications" and refer to call sequences that approximate, with varying degrees of certainty (as identified by the MLE assigned by the software), the typical call characteristics identified for the known species that where documented during the development of the automated analysis software. Bat echolocation call sequences identified to species during this analysis are those which share characteristics identical to those recorded for that species under controlled conditions where sequences were collected from species identified with 100% confidence. Many species of bats can exhibit similar call characteristics under certain field conditions. This can prevent reliable identification absent visual confirmation of the bat in flight and/or physical capture of the individual allowing morphological characteristics to be viewed in the hand. The species suggested by the echolocation sequences recorded during this project approximate, to varying degrees of certainty (as recorded by the MLE identified for each sequence), characteristics of echolocation call parameters known for those species. The classifications rendered by the software used for analysis are robust, but by no means provide infallible results to determine absolute species presence.

5.0 RESULTS AND ANALYSIS

A total of 558 files were recorded by the two Petterson D500x full-spectrum detectors at two different locations over the eight acceptable detector nights for this project. The 558 files were then processed using the Kaleidoscope Pro software; and 437 were recognized as bat calls and identified to species, 107 files were recognized as bat calls but were not identified to species, and 14 files were determined to be noise. Photographic documentation of detector deployment can be found in Appendix A and Acoustic Survey Data Sheets are provided in Appendix B.

Of the calls identified to species, none were identified as Indiana Bat or NLEB. Of the calls identified to species, 271 were identified as big brown bat, 51 were identified as eastern red bat, 90 were identified as hoary bat, 9 were identified as silver haired bat, 9 were identified as little brown bat, 6 were identified as evening bat, and 1 was identified as tricolored bat. Table 4 below shows the totals calls per site per night and the MLE values for the identified calls per night. The original outputs from the software can be found in Appendix C.

Table 4. Identified Calls

Date	Identified Calls									MLE Value							
	EPTFUS	LASBOR	LASCIN	LASNOC	MYOLUC	NYCHUM	PERSUB	NOID	Noise	EPTFUS	LASBOR	LASCIN	LASNOC	MYOLUC	MYOSEP	NYCHUM	PERSUB
Site 1																	
5/21	74	4	18	0	0	1	0	14	3	0	0.0002724	0.0000017	1	1	1	1	1
5/22	32	6	9	1	0	0	0	21	0	0	0.0000006	0.0004844	1	1	1	1	1
5/23	80	12	25	7	0	2	0	21	2	0	0	0	1	1	1	1	1
5/24	33	16	25	0	0	0	0	14	1	0	0	0	1	1	1	1	1
Site 2																	
5/21	3	2	3	0	1	0	0	6	4	0.013819	0.0129638	0.005555	1	0.493477	1	1	1
5/22	39	6	1	0	3	2	0	14	0	0	0.0000138	1	1	0.204324	1	1	1
5/23	6	4	7	1	2	1	1	12	2	0.0004593	0.0003328	0.0000023	1	0.3662356	1	1	0.3662356
5/24	4	1	2	0	3	0	0	5	2	0.0008965	0.3291773	0.0812162	1	0.0058678	1	1	1
Total	**271**	**51**	**90**	**9**	**9**	**6**	**1**	**107**	**14**								

As shown above by the highlighted cells, the big brown bat, the eastern red bat, the hoary bat, and the little brown bat had MLE values less than 0.05 and therefore have a high probability of being present at the project area. The remaining species identified, had an MLE value greater than 0.05 and therefore have a low probability of being present, and presence cannot be confirmed. Below are visual examples of the calls recorded for the species determined to be present (MLE less than 0.05). Please note, the examples below are calls from this project which were identified by the software: they were not manually vetted to confirm species.

Image 1. EPTFUS Example

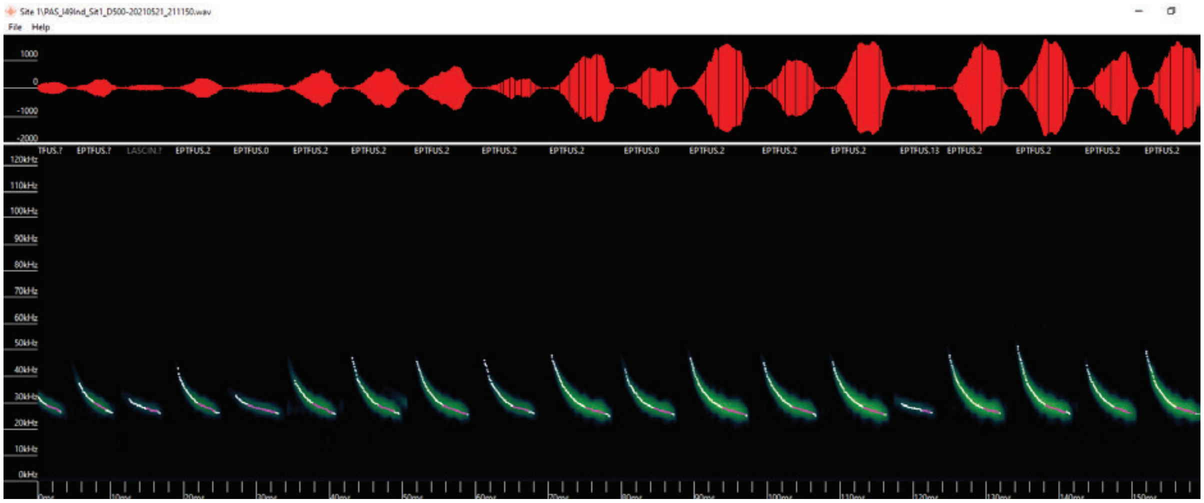


Image 2. LASBOR Example

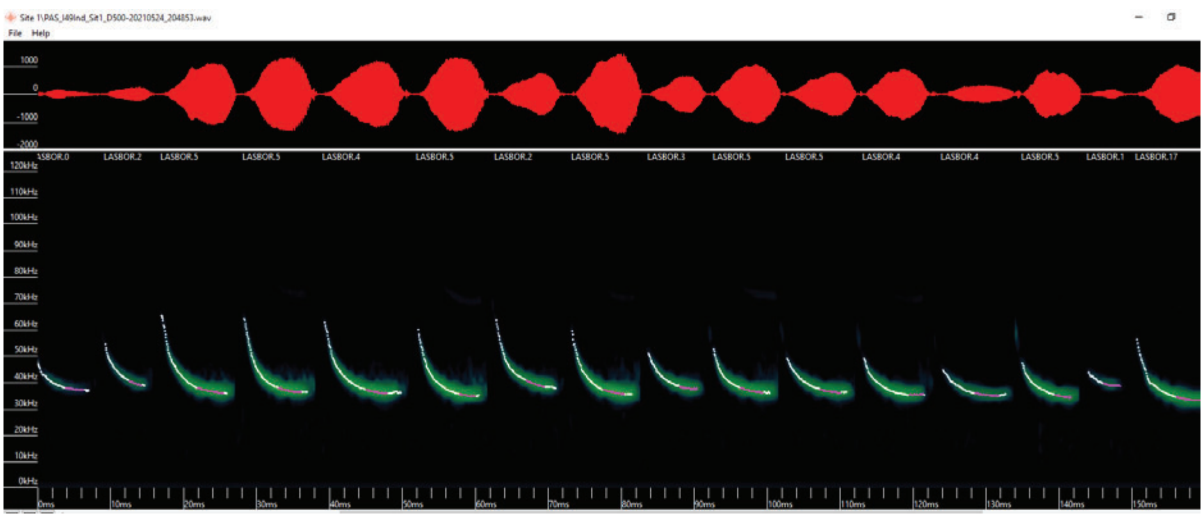


Image 3. LASCIN Example

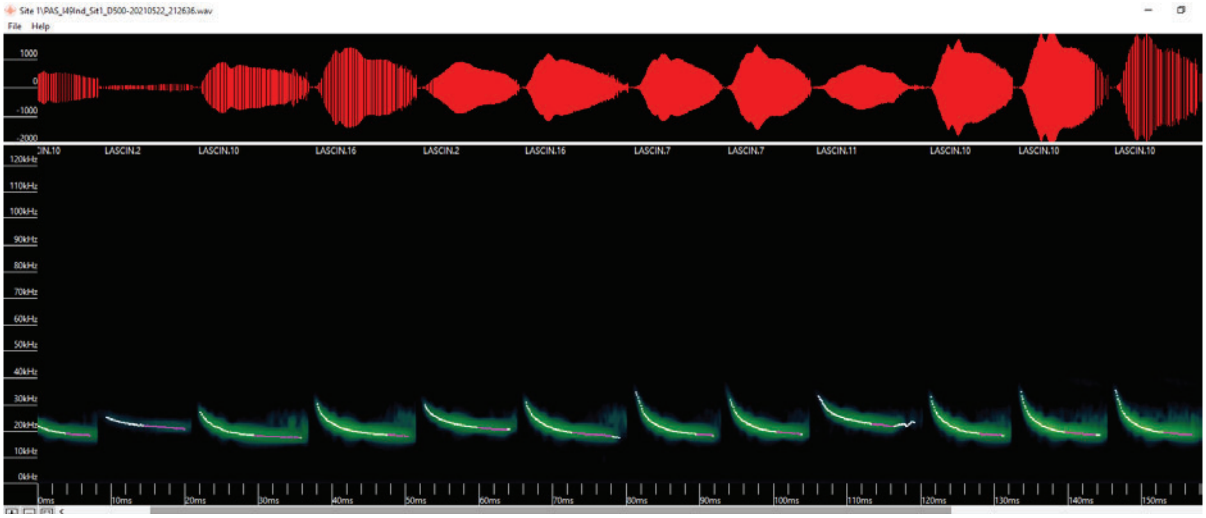
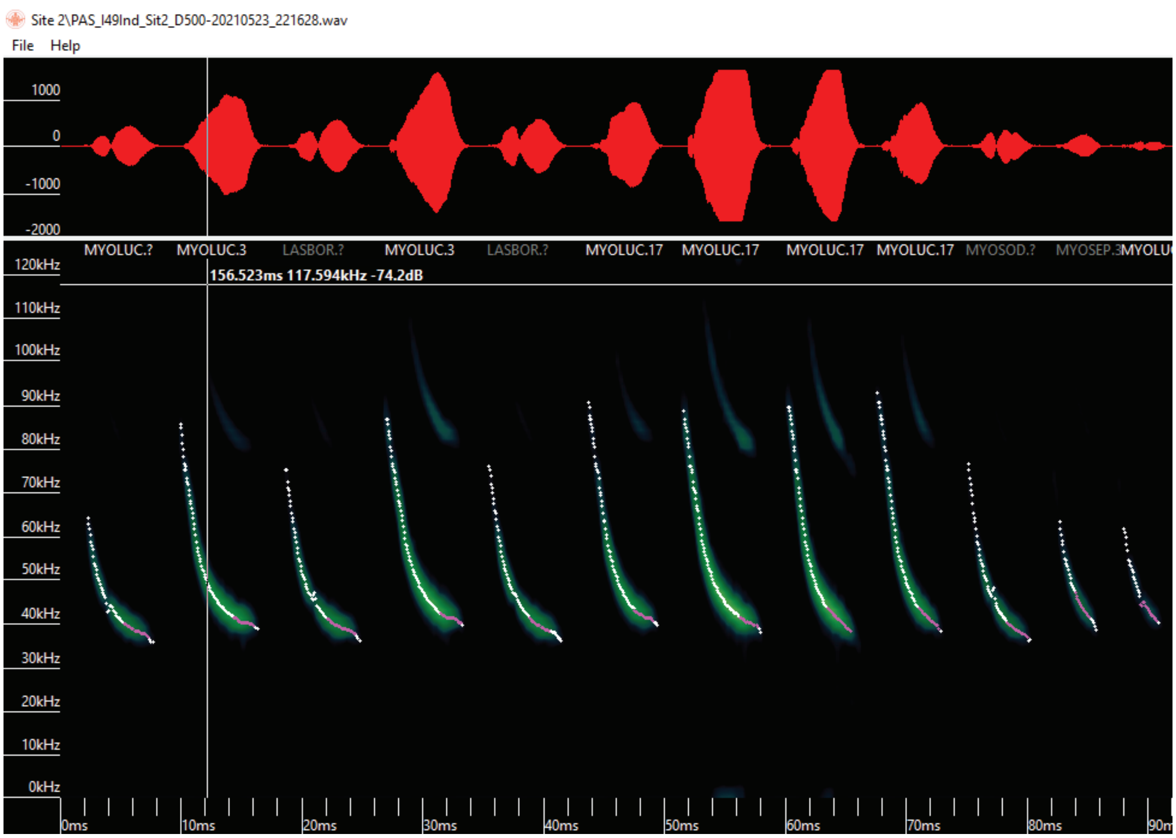


Image 4. MYOLUC Example



6.0 CONCLUSIONS

There is a low probability Indiana Bats or NLEBs are present at the project area as no Indiana Bat or NLEB calls were identified by the software. Therefore, both Indiana bats and NLEBs did not have an MLE of 0.05 or less. While no Indiana Bat or NLEB calls were identified, calls from big brown bats, eastern red bats, hoary bats, silver haired bats, little brown bats, evening bats, and tricolored bats were identified by the software, though only big brown bats, eastern red bats, hoary bats, and little brown bats had an MLE low enough to confirm the presence of those species. Because the software used indicates the absence of Indiana bats and NLEBs, no further qualitative analysis (manual vetting) is required.

Because the project area is not within a known Indiana Bat or NLEB maternity home range, is not at a known Indiana Bat or NLEB hibernacula or their surrounding spring-staging and fall-swarming zones, and because the acoustic survey indicates a high probability the target species are absent from the project area, it is likely the USFWS will determine that the mechanical clearing of approximately 33.77 acres of forested land at the project area will not adversely affect the regulated species.

7.0 REFERENCES

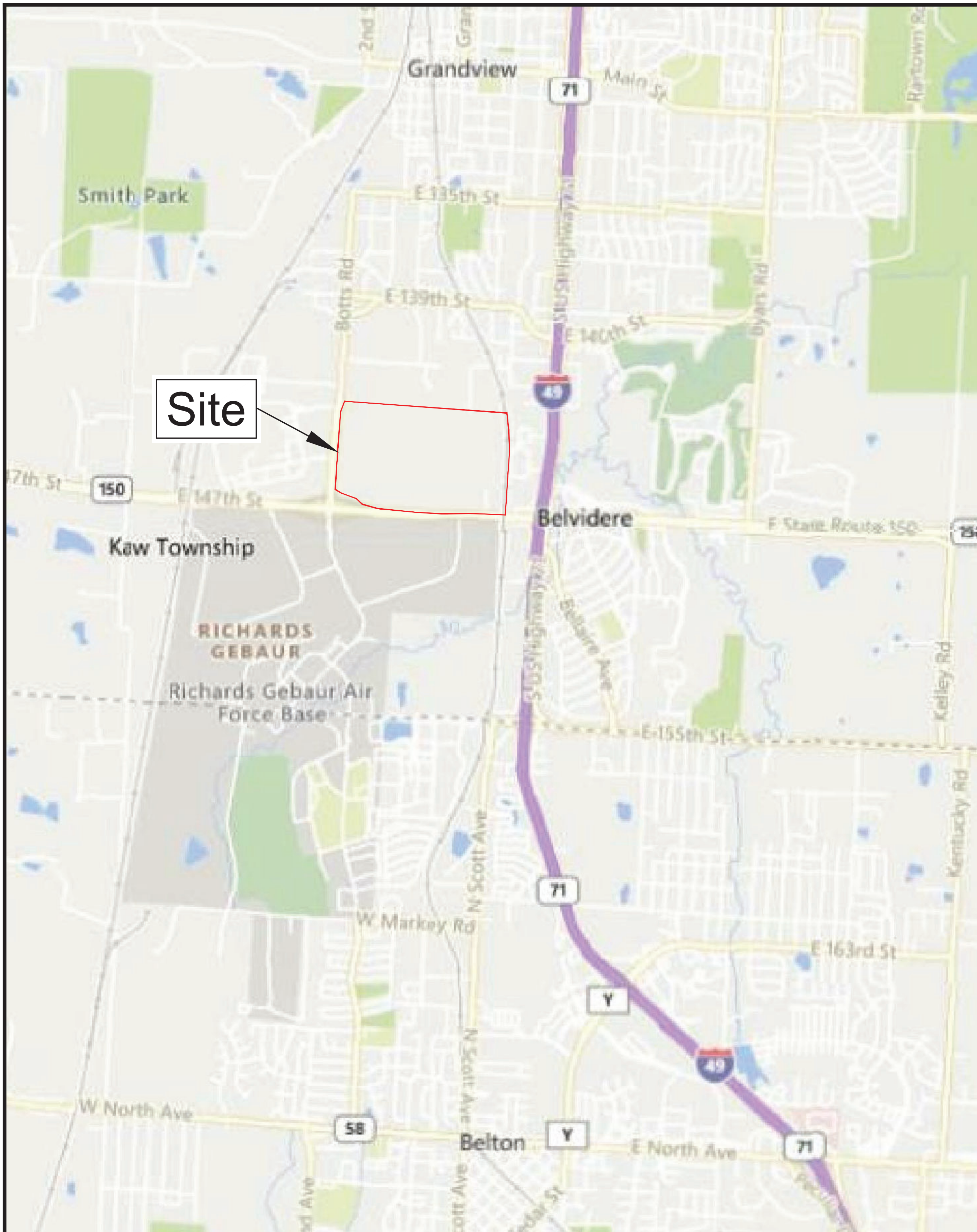
Agranat, Ian July 19, 2018; Wildlife Acoustics. Explaining Maximum Likelihood Estimators (MLE) and P-Values Used in Kaleidoscope. Accessed on June 11, 2019 https://www.wildlifeacoustics.com/blog/home/explaining-maximum-likelihood-estimators-mle-and-p-values-used-in-kaleidoscope

Google Inc. 2019. Google Earth (Version 7.3.2.5776) [Software]. http://www.google.com/earth/download/ge/agree.html

U.S. Fish and Wildlife Service (USFWS). 2020. Range-Wide Indiana Bat Survey Guidelines. Retrieved from: https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/FINAL%20Range-wide%20IBat%20Survey%20Guidelines%203.23.20.pdf Accessed on: April 27, 2020.

Sincerely,
TERRA TECHNOLOGIES INC.

Danny DeAngelo
Senior Environmental Scientist



Revisions		
No.	Description	Date

Terra Technologies

6240 West 135th Street, Suite 100, Overland Park, KS 66223

I-49 Industrial Center
Kansas City, Jackson County, Missouri

Site Location Map

DRAWING	DATE
FIG 1a	JUN 2021

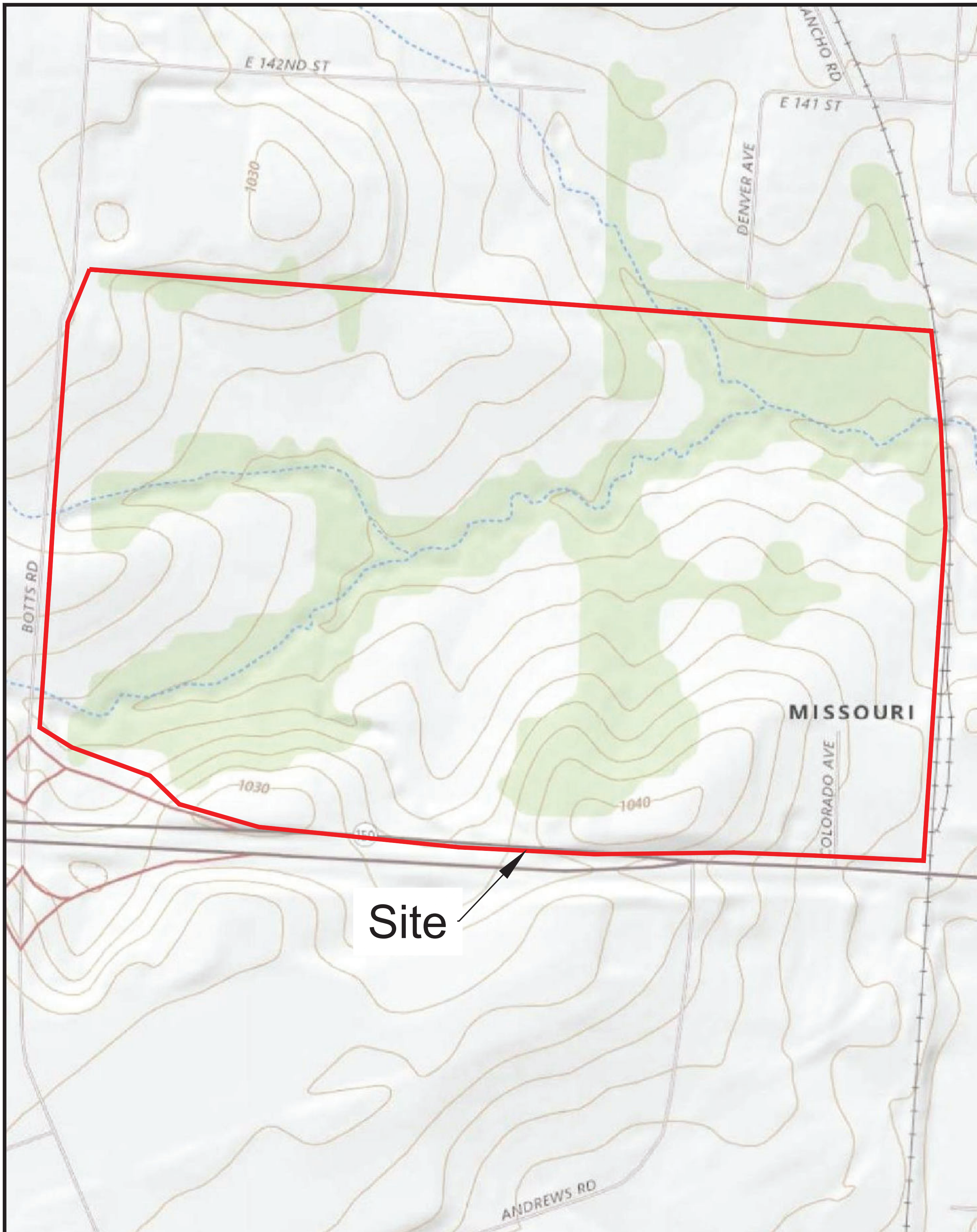
Revisions		
No.	Description	Date

Terra Technologies
6240 West 135th Street, Suite 100, Overland Park, KS 66223

I-49 Industrial Center
Kansas City, Jackson County, Missouri

Section, Township, Range

DRAWING	DATE
FIG 1b	JUN 2021



Revisions		
No.	Description	Date

Terra Technologies

6240 West 135th Street, Suite 100, Overland Park, KS 66223

I-49 Industrial Center
Kansas City, Jackson County, Missouri

USGS Topography

DRAWING	DATE
FIG 1c	JUN 2021

Revisions		
No.	Description	Date

Terra Technologies

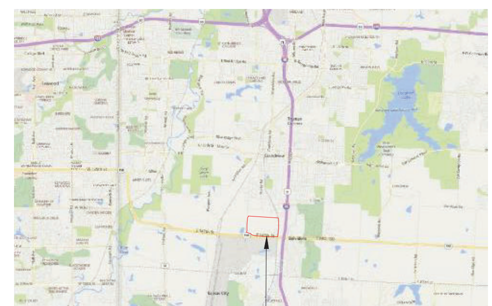
6240 West 135th Street, Suite 100, Overland Park, KS 66223

I-49 Industrial Center
Kansas City, Jackson County, Missouri

Aerial Photograph

DRAWING	DATE
FIG 1d	JUN 2021

Please note that the features shown are the features determined to be jurisdictional waters by the USACE. Additional non-jurisdictional waters are present at the site but were not included on this map as Terra Technologies did not perform the delineation and therefore does not have the linework/extents of all the site features.



Site Location
T47N-R33W-S26
Kansas City, Jackson County, Missouri
258.25 Acres
Lat. 38.86113
Long. -94.53828

GRAPHIC SCALE
250 0 125 250 500 1,000
(IN FEET)
1 inch = 250 ft.

Terra Technologies
6240 W. 135th St., Ste. 100
Overland Park, Kansas
66223
Tel 913.385.9560 Fax 913.385.5295

FIGURE 2

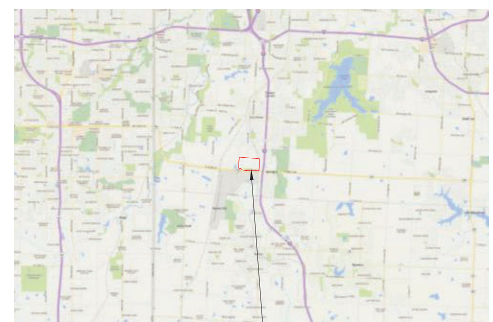
SHEET TITLE: SITE FEATURES
PROJECT: I-49 INDUSTRIAL CENTER
CLIENT: PLATFORM VENTURES

REVISIONS	
DATE	DESCRIPTION

DATE 06/7/21
CHECKED BY JMK DRAWN BY DTD
SHEET NO. SF
JOB NO. XXX

Habitat Assessment

Suitable Indiana Bat and Northern Long Eared Bat Habitat
85.86 Acres



Site Location
T47N-R33W-S26
Kansas City, Jackson County, Missouri
258.25 Acres
Lat. 38.86113
Long. -94.53828

GRAPHIC SCALE
250 0 125 250 500 1,000
(IN FEET)
1 inch = 250 ft.

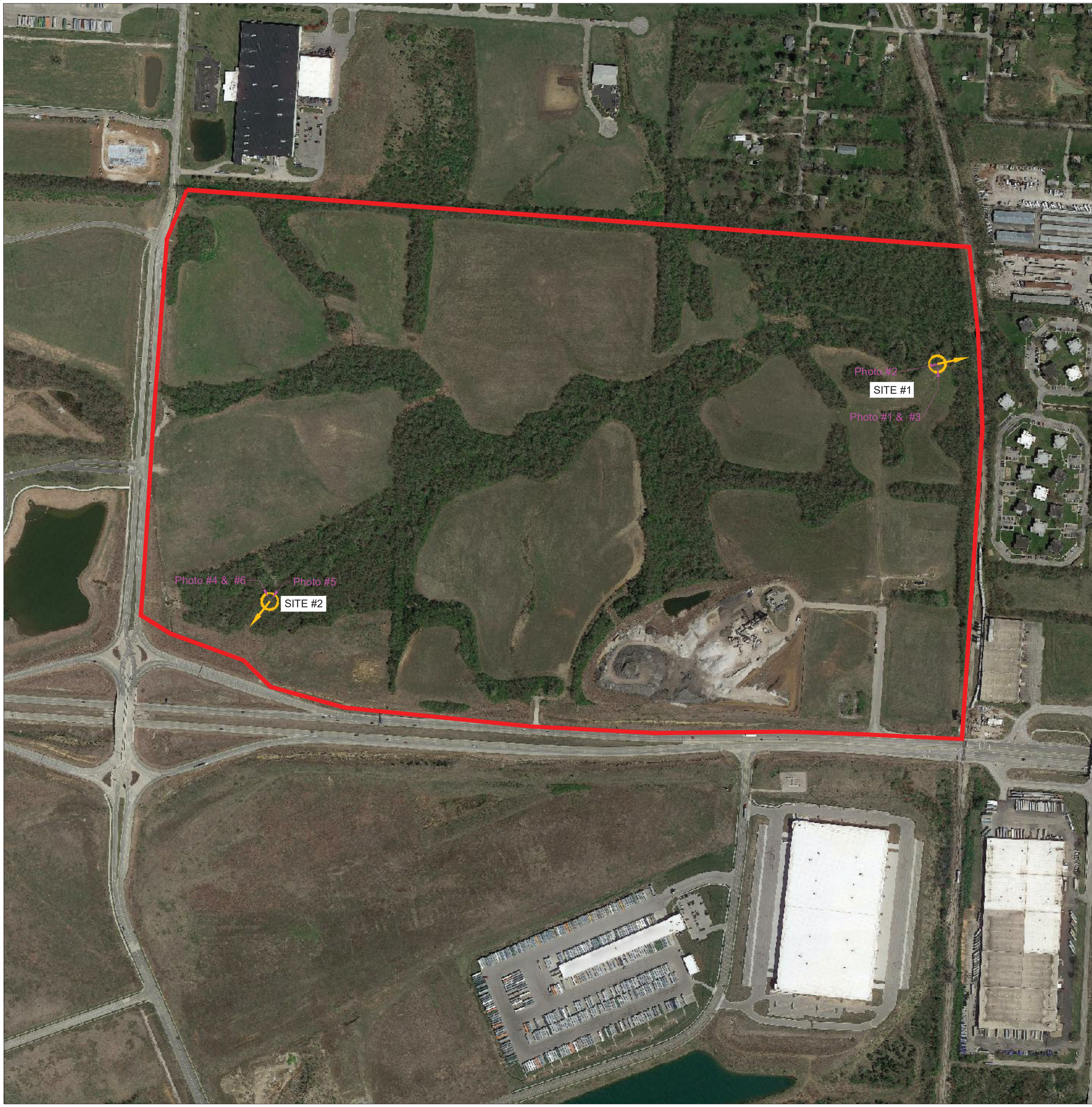
Terra Technologies
6240 W. 135th St., Ste. 100
Overland Park, Kansas
66223
Tel 913.385.9560 Fax 913.385.5295

FIGURE 3

SHEET TITLE: HABITAT ASSESSMENT
PROJECT: I-49 INDUSTRIAL CENTER
CLIENT: PLATFORM VENTURES

REVISIONS	
DATE	DESCRIPTION

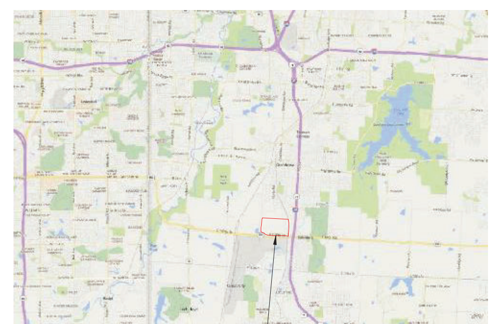
DATE 6/7/21
CHECKED BY JMK DRAWN BY DTD
SHEET NO. HA
JOB NO. XXX



ACOUSTIC SURVEY

Site #1
Petterson D500x
Four Detector Nights
Located along Forested Edge overlooking a stream channel.
Microphone pointing along edge of forested area and over stream.

Site #2
Petterson D500x
Four Detector Nights
Located in linear forested opening.
Microphone pointing along linear opening.



Site Location
T47N-R33W-S26
Kansas City, Jackson County, Missouri
258.25 Acres
Lat. 38.86113
Long. -94.53828

GRAPHIC SCALE
250 0 125 250 500 1,000
(IN FEET)
1 inch = 250 ft.

Terra Technologies
6240 W. 135th St., Ste. 100
Overland Park, Kansas
66223
Tel 913.385.9560 Fax 913.385.5295

FIGURE 4

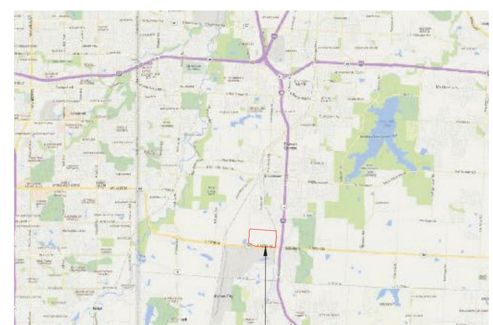
SHEET TITLE	STUDY PLAN
PROJECT	I-49 INDUSTRIAL CENTER
CLIENT	PLATFORM VENTURES
DATE	6/7/21
CHECKED BY	JMK
DRAWN BY	DTD
SHEET NO.	SP
JOB NO.	XXX

REVISIONS
DATE	DESCRIPTION

Forested Areas and Clearing

Suitable Habitat Clearing
45.33 Acres

Suitable Habitat Reserve (No Clearing)
40.53 Acres



Site Location
T47N-R33W-S26
Kansas City, Jackson County, Missouri
258.25 Acres
Lat. 38.86113
Long. -94.53828

GRAPHIC SCALE
250 0 125 250 500 1,000
(IN FEET)
1 inch = 250 ft.

Terra Technologies
6240 W. 135th St., Ste. 100
Overland Park, Kansas
66223
Tel 913.385.9560 Fax 913.385.5295

FIGURE 5

SHEET TITLE FORESTED AREAS AND CLEARING
PROJECT I-49 INDUSTRIAL CENTER
CLIENT PLATFORM VENTURES

REVISIONS	
DATE	DESCRIPTION

DATE 6/7/21
CHECKED BY JMK DRAWN BY DTD
SHEET NO. FC
JOB NO. XXX

PHOTO LOG

<table>
<tr><td>DATE: 5/21/21</td><td rowspan="2">SITE NAME: I49 INDUSTRIAL CENTER</td></tr>
<tr><td>TAKEN BY: DD</td></tr>
<tr><td>COMMENTS:

Photograph facing north showing the detector setup at Site #1.</td><td rowspan="2"></td></tr>
<tr><td>PHOTO #: 1</td></tr>
</table>

<table>
<tr><td>DATE: 5/21/21</td><td rowspan="2">SITE NAME: I49 INDUSTRIAL CENTER</td></tr>
<tr><td>TAKEN BY: DD</td></tr>
<tr><td>COMMENTS:

Photograph facing east northeast showing the area the microphone is pointing towards.</td><td rowspan="2"></td></tr>
<tr><td>PHOTO #: 2</td></tr>
</table>

PHOTO LOG

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<tr><td>DATE: 5/25/21</td><td rowspan="2">SITE NAME: I49 INDUSTRIAL CENTER</td></tr>
<tr><td>TAKEN BY: DD</td></tr>
<tr><td>COMMENTS:

Photograph facing north showing Site #1 was in good working order before it was taken down at the conclusion of the survey.</td><td rowspan="2"></td></tr>
<tr><td>PHOTO #: 3</td></tr>
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<table>
<tr><td>DATE: 5/21/21</td><td rowspan="2">SITE NAME: I49 INDUSTRIAL CENTER</td></tr>
<tr><td>TAKEN BY: DD</td></tr>
<tr><td>COMMENTS:

Photograph facing southeast showing the detector setup at Site #2.</td><td rowspan="2"></td></tr>
<tr><td>PHOTO #: 4</td></tr>
</table>

PHOTO LOG

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<tr><td>DATE: 5/21/21</td><td rowspan="2">SITE NAME: I49 INDUSTRIAL CENTER</td></tr>
<tr><td>TAKEN BY: DD</td></tr>
<tr><td>COMMENTS:

Photograph facing southwest from behind the microphone showing the linear forested opening it is pointed towards.</td><td rowspan="2"></td></tr>
<tr><td>PHOTO #: 5</td></tr>
</table>

<table>
<tr><td>DATE: 5/25/21</td><td rowspan="2">SITE NAME: I49 INDUSTRIAL CENTER</td></tr>
<tr><td>TAKEN BY: DD</td></tr>
<tr><td>COMMENTS:

Photograph facing southeast showing Site #2 was in good working order before it was taken down at the conclusion of the survey.</td><td rowspan="2"></td></tr>
<tr><td>PHOTO #: 6</td></tr>
</table>

Acoustic Survey Datasheet

Site Deployment

Project Name:	I49 Industrial Center		
Site:	#1	Surveyor:	D. DeAngelo
Latitude:	38 . 86368	Detector ID:	52383
Longitude:	– 94 . 53174	Positional Accuracy:	±5m
Start Date:	5 / 21 / 2021	Start Time (military):	20 : 32
End Date:	5 / 25 / 2021	End Time (military):	06 : 03

Detector Settings

Detector Brand:	Petterson
Detector Model:	D500x
Weatherproofing:	None on Microphone
Sensitivity Setting:	N/A to D500x

Microphone

Model:	D500x External
Height:	6 m
Vert. Orientation:	68 °
Horiz. Orientation:	0 °

Habitat

Habitat Type:	Forest
Habitat Features:	Forested edge and stream

☐ Flyway ☑ Water ☑ Edge ☐ Canopy Gap ☐ Other:

Distance to nearest vegetation

N:	4 m	S:	100+ m	Canopy Openness (%):	90
E:	60 m	W:	30 m	Basal Area:	2

Acoustic Survey Datasheet

Site Deployment

Project Name:	I49 Industrial Center		
Site:	#2	Surveyor:	D. DeAngelo
Latitude:	38 .86025	Detector ID:	52380
Longitude:	– 94 .54407	Positional Accuracy:	±5m
Start Date:	5 / 21 / 2021	Start Time (military):	20 : 31
End Date:	5 / 25 / 2021	End Time (military):	06 : 03

Detector Settings

Detector Brand:	Petterson
Detector Model:	D500x
Weatherproofing:	None on Microphone
Sensitivity Setting:	N/A to D500x

Microphone

Model:	D500x External
Height:	6 m
Vert. Orientation:	207 °
Horiz. Orientation:	0 °

Habitat

Habitat Type:	Forest
Habitat Features:	Linear Forested Opening

☑ Flyway ☐ Water ☑ Edge ☑ Canopy Gap ☐ Other:

Distance to nearest vegetation

N:	30 m	S:	50 m	Canopy Openness (%):	60
E:	4 m	W:	10 m	Basal Area:	3

KALEIDOSCOPE 5.4.0

Bats of North America 5.4.0	S/A: 0	EPTFUS	LASBOR	LASCIN	LASNOC	MYOAUS	MYOGRI	MYOLEI	MYOLUC	MYOSEP	MYOSOD	NYCHUM	PERSUB	NOID	NOISE
*	*	271	51	90	9				9			6	1	107	14
Site 1	*	219	38	77	8							3		70	6
	20210521	74	4	18								1		14	3
	20210522	32	6	9	1									21	0
	20210523	80	12	25	7							2		21	2
	20210524	33	16	25										14	1
Site 2	*	52	13	13	1				9			3	1	37	8
	20210521	3	2	3					1					6	4
	20210522	39	6	1					3			2		14	0
	20210523	6	4	7	1				2			1	1	12	2
	20210524	4	1	2					3					5	2

		Presence P EPTFUS	LASBOR	LASCIN	LASNOC	MYOAUS	MYOGRI	MYOLEI	MYOLUC	MYOSEP	MYOSOD	NYCHUM	PERSUB
*	*	0	0	0	1	1	1	1	0.4535087	1	1	1	1
Site 1	*	0	0	0	1	1	1	1	1	1	1	1	1
	20210521	0	0.0002724	0.0000017	1	1	1	1	1	1	1	1	1
	20210522	0	0.0000006	0.0004844	1	1	1	1	1	1	1	1	1
	20210523	0	0	0	1	1	1	1	1	1	1	1	1
	20210524	0	0	0	1	1	1	1	1	1	1	1	1
Site 2	*	0	0	0.0000498	1	1	1	1	0.0012348	1	1	1	1
	20210521	0.013819	0.0129638	0.005555	1	1	1	1	0.493477	1	1	1	1
	20210522	0	0.0000138	1	1	1	1	1	0.204324	1	1	1	1
	20210523	0.0004593	0.0003328	0.0000023	1	1	1	1	0.3662356	1	1	1	0.8434976
	20210524	0.0008965	0.3291773	0.0812162	1	1	1	1	0.0058678	1	1	1	1

INDIR	OUTDIR	FOLDER	IN FILE	CHANNEL	OFFSET	DURATION	OUT FILE FOLD	OUT FILE ZI	DATE	TIME	HOUR	DATE-12	TIME-12	HOUR-12	AUTO ID*	PULSES	MATCHING	MATCH RA	MARGIN	ALTERNATE	ALTERNATE	Fc	Sc	Dur	Fmax	Fmin	Fmean	TBC	Fk	Tk	S1	Tc	Qual	FILES	MANUAL ID	ORGID	USERID	REVIEW OR	REVIEW US	INPATHMD	OUTPATHMD	OUTPATHMDSZC

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Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210522_010417.wav	0	0	3.99872	5/22/2021	1:04:17	1	5/21/2021	13:04:17	13	EPTFUS	9	5	0.556	0.253543	LASCIN	LASNOC	9	26.015	25.18	5.324	30.238	25.46	27.149	343.467	27.168	2.418	147.61	4.74	2.07	1	d/fRKsEMnLUvvtndj9PEZg==
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Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210525_053944.wav	0	0	3.99872	5/25/2021	5:39:44	5	5/24/2021	17:39:44	17	LASBOR	31	25	0.806	0.244268			31	34.553	19.48	7.379	49.164	34.132	37.652	128.147	35.877	3.707	258.01	6.626	4.92	1	FFiYAO0mLaa3bt8Pa/Nz/g==
Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210524_053643.wav	0	0	3.99872	5/24/2021	5:36:43	5	5/23/2021	17:36:43	17	LASBOR	24	23	0.958	0.210014	NYCHUM		24	33.629	8.59	8.731	41.813	33.338	35.413	167.843	34.646	4.465	261.1	8.081	3.67	1	q0ibtmKDFNIq72Bg2oEBWg==
Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210524_034418.wav	0	0	3.99872	5/24/2021	3:44:18	3	5/23/2021	15:44:18	15	LASBOR	26	23	0.885	0.215196	NYCHUM		26	36.415	19.84	8.857	47.326	36.176	39.11	148.496	38.367	4.228	251	8.188	3.99	1	ExQ4n1n+XMJun7f70otgHQ==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_215951.wav	0	0	3.99872	5/22/2021	21:59:51	21	5/22/2021	9:59:51	9	LASBOR	23	22	0.957	0.266213	NYCHUM		23	34.031	17.69	5.561	39.918	33.83	35.339	137.983	35.088	2.74	202.89	4.986	4.07	1	ey3LXK7oBYP0EJelev/UjQ==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_235700.wav	0	0	3.99872	5/22/2021	23:57:00	23	5/22/2021	11:57:00	11	LASBOR	25	22	0.88	0.257932	NYCHUM		25	34.696	24.2	4.845	44.609	34.439	36.798	138.976	35.828	2.442	293.7	4.479	4.81	1	ZPjXgmbAFEJvG2ZXsa/TBA==
Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210524_205234.wav	0	0	3.99872	5/24/2021	20:52:34	20	5/24/2021	8:52:34	8	LASBOR	24	21	0.875	0.180094	NYCHUM		24	34.462	17.15	6.733	43.953	34.048	36.41	167.715	35.369	3.728	287.09	6.073	4.59	1	bPpYUTO/60sT7RvOgaG0dw==
Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210524_034432.wav	0	0	3.99872	5/24/2021	3:44:32	3	5/23/2021	15:44:32	15	LASBOR	23	20	0.87	0.183818	NYCHUM		23	34.708	12.71	9.401	44.719	34.381	37.027	177.302	36.007	5.057	234.85	8.727	2.94	1	fizDIOcIBdCsTCVso1lSLQ==

Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210525_053848.wav	0	0	3.99872	5/25/2021	5:38:48	5	5/24/2021	17:38:48	17	NoID	14	0	0	0		14	32.298	25.26	9.28	38.798	31.823	33.946	192.851	33.87	4.172	184.86	8.373	2.46	1	cxxPT9EXl+S1NdeVHGqCLQ==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210521_211818.wav	0	0	3.99872	5/21/2021	21:18:18	21	5/21/2021	9:18:18	9	NoID	6	0	0	0		6	24.364	3.99	9.613	33.365	24.017	26.453	190.686	24.917	6.865	197.61	8.819	1.59	1	20/ghX+/1qchmdQ9BQXuSQ==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210521_231418.wav	0	0	3.99872	5/21/2021	23:14:18	23	5/21/2021	11:14:18	11	NoID	27	0	0	0		27	28.02	86.15	4.143	50.602	27.243	34.165	149.291	29.779	2.969	476.79	3.918	6.58	1	fb2wtdEn2Mz2UN0/RWZLzg==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210521_233454.wav	0	0	3.99872	5/21/2021	23:34:54	23	5/21/2021	11:34:54	11	NoID	3	0	0	0		3	41.816	51.77	2.976	50.858	41.39	44.374	94.841	43.49	1.65	262.58	2.72	0.56	1	HGiXGcPK8Op8zAX1omQvSA==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210521_233827.wav	0	0	3.99872	5/21/2021	23:38:27	23	5/21/2021	11:38:27	11	NoID	14	0	0	0		14	38.777	181.63	3.248	68.31	37.857	47.936	153.525	45.923	1.763	580.73	3.152	2.2	1	zFvTciP9vyjdhHg22zrGYg==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_030818.wav	0	0	3.99872	5/22/2021	3:08:18	3	5/21/2021	15:08:18	15	NoID	11	0	0	0		11	37.349	37.54	3.471	46.419	37.172	39.782	236.336	38.708	2.003	285.9	3.394	2.28	1	6+keWye0LmdGLVWI0QkUvw==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_033401.wav	0	0	3.99872	5/22/2021	3:34:01	3	5/21/2021	15:34:01	15	NoID	13	0	0	0		13	36.309	36.08	5.321	49.303	36.044	39.287	102.317	37.963	2.823	331.25	4.763	2.48	1	zIkxzaREqEGuWD2liMjqOA==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_205559.wav	0	0	3.99872	5/22/2021	20:55:59	20	5/22/2021	8:55:59	8	NoID	10	0	0	0		10	38.627	68.75	4.817	73.514	37.677	47.122	72.663	41.717	2.984	490.53	4.614	2.81	1	S4inyY3UYaHUnbmaPbFWkg==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_205630.wav	0	0	3.99872	5/22/2021	20:56:30	20	5/22/2021	8:56:30	8	NoID	20	0	0	0		20	38.005	59.1	3.98	53.085	37.773	42.225	122.125	40.638	2.284	350.96	3.887	3.69	1	kcB4cYjtl8y3WkX2hyMEmg==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_205646.wav	0	0	3.99872	5/22/2021	20:56:46	20	5/22/2021	8:56:46	8	NoID	14	0	0	0		14	38.287	39.48	4.877	67.748	36.401	44.761	57.32	40.654	2.985	375.37	4.401	2.95	1	QdkI76wLfzfzSWTrspJLcQ==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_205659.wav	0	0	3.99872	5/22/2021	20:56:59	20	5/22/2021	8:56:59	8	NoID	15	0	0	0		15	38.602	46.13	6.125	69.867	37.094	44.997	117.892	41.326	3.55	569.52	5.72	3	1	IzPUJaY99oKCCsEU5+1gTQ==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_205806.wav	0	0	3.99872	5/22/2021	20:58:06	20	5/22/2021	8:58:06	8	NoID	15	0	0	0		15	37.048	25.7	4.116	47.344	36.835	39.772	209.794	38.142	2.471	320.8	3.802	4.3	1	VlqmpYxgd8VVTb195EoVig==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_220344.wav	0	0	3.99872	5/22/2021	22:03:44	22	5/22/2021	10:03:44	10	NoID	24	0	0	0		24	36.795	32.56	5.512	46.588	36.633	39.489	166.895	39.026	2.728	260.67	5.338	3.24	1	fsb+qA3UNv4j5X15v1FMLg==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_220752.wav	0	0	3.99872	5/22/2021	22:07:52	22	5/22/2021	10:07:52	10	NoID	5	0	0	0		5	39.789	35.55	4.373	59.691	39.705	44.277	104.926	41.412	2.688	477.47	4.254	0.97	1	v7xLWhbyEDmT0fy3KifiAw==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_221428.wav	0	0	3.99872	5/22/2021	22:14:28	22	5/22/2021	10:14:28	10	NoID	14	0	0	0		14	38.743	92.09	4.781	75.809	38.356	49.552	62.973	41.487	3.332	350.44	4.533	2.81	1	dsWGsBCO/xyXh4JfbnPTMg==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_223305.wav	0	0	3.99872	5/22/2021	22:33:05	22	5/22/2021	10:33:05	10	NoID	9	0	0	0		9	42.104	84.62	3.593	62.616	41.827	48.134	91.463	45.576	2.067	444.07	3.458	1.72	1	BFkpS5sbzqEf6FlYIxz5Gw==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_223251.wav	0	0	3.99872	5/22/2021	22:32:51	22	5/22/2021	10:32:51	10	NoID	12	0	0	0		12	39.933	65.02	5.815	75.314	38.886	49.46	91.908	42.472	3.82	318.95	5.268	2.61	1	fULSzUGXFJkS9do9XMn84w==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_225955.wav	0	0	3.99872	5/22/2021	22:59:55	22	5/22/2021	10:59:55	10	NoID	6	0	0	0		6	40.955	81.36	3.943	74.887	40.756	49.973	95.827	44.416	2.504	550.12	3.909	1.39	1	Y4JmUad2SR51H59Kg84GTw==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_231434.wav	0	0	3.99872	5/22/2021	23:14:34	23	5/22/2021	11:14:34	11	NoID	5	0	0	0		5	39.368	36.55	5.451	60.024	39.03	44.024	136.178	41.243	3.393	445.55	5.058	1.21	1	jletX5BbOcqUUHBznMSA0Q==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_224849.wav	0	0	3.99872	5/22/2021	22:48:49	22	5/22/2021	10:48:49	10	NoID	33	0	0	0		33	41.653	33.65	6.334	72.687	41.112	49.217	109.808	44.075	4.066	449.97	6.047	5.99	1	NuRm8Rppe5fNKVYu6DupKw==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_004755.wav	0	0	3.99872	5/23/2021	0:47:55	0	5/22/2021	12:47:55	12	NoID	2	0	0	0		2	41.264	198.21	3.663	83.93	39.27	52.878	58.036	47.404	2.243	562.13	3.253	0.99	1	/z6nzbu4oXoBSayblKGHKw==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_221424.wav	0	0	3.99872	5/23/2021	22:14:24	22	5/23/2021	10:14:24	10	NoID	16	0	0	0		16	39.783	66.23	5.998	75.475	39.113	49.06	100.281	43.691	3.413	405.8	5.728	3.45	1	BtzZp2B0FaqvquNhB0nyqA==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_221555.wav	0	0	3.99872	5/23/2021	22:15:55	22	5/23/2021	10:15:55	10	NoID	19	0	0	0		19	38.757	206.35	3.285	74.403	37.366	49.201	43.294	46.122	1.827	609.46	3.11	3.71	1	zlFWeHrtcf8gsZ1sTsiJYg==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_221614.wav	0	0	3.99872	5/23/2021	22:16:14	22	5/23/2021	10:16:14	10	NoID	9	0	0	0		9	40.436	58.18	4.753	77.776	39.573	49.577	93.006	42.746	3.243	527.22	4.532	2.16	1	tUooVgkwOw12y/UAYkza2w==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_221654.wav	0	0	3.99872	5/23/2021	22:16:54	22	5/23/2021	10:16:54	10	NoID	19	0	0	0		19	39.426	207.32	3.632	80.962	36.533	51.079	58.273	47.182	1.966	563.67	3.314	3.49	1	Z+B5GqbrB1ZE7IGw1JCtlA==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_222448.wav	0	0	3.99872	5/23/2021	22:24:48	22	5/23/2021	10:24:48	10	NoID	11	0	0	0		11	40.289	54.94	4.395	65.448	39.704	46.771	117.012	42.916	2.676	386.88	4.051	3.11	1	t3OgfTfnWAMffggwsxZA3A==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_222458.wav	0	0	3.99872	5/23/2021	22:24:58	22	5/23/2021	10:24:58	10	NoID	32	0	0	0		32	38.508	39	4.023	50.852	38.02	41.736	109.128	40.276	2.328	257.24	3.892	8.8	1	BikQRtJdkh/Gauwn1/ZX1A==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_222513.wav	0	0	3.99872	5/23/2021	22:25:13	22	5/23/2021	10:25:13	10	NoID	15	0	0	0		15	40.447	64.8	4.495	69.283	39.8	48.101	73.384	43.296	2.755	483.51	4.289	4.08	1	afKGDC/ZNe3bYx5KW0raDQ==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_222619.wav	0	0	3.99872	5/23/2021	22:26:19	22	5/23/2021	10:26:19	10	NoID	15	0	0	0		15	39.487	45.08	5.505	69.746	38.62	46.97	93.963	41.706	3.381	262.56	5.067	3.34	1	BdIRMNB+37DxYmpS5aCPxQ==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_223323.wav	0	0	3.99872	5/23/2021	22:33:23	22	5/23/2021	10:33:23	10	NoID	18	0	0	0		18	37.841	43.48	5.333	49.827	37.479	40.619	222.675	40.074	2.92	467.48	4.992	2.96	1	v0szKD/KRstUlqn4uj/rwA==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_233001.wav	0	0	3.99872	5/23/2021	23:30:01	23	5/23/2021	11:30:01	11	NoID	16	0	0	0		16	39.22	69.29	5.008	73.341	38.346	47.517	72.749	42.404	3.085	449.61	4.713	3.52	1	jW9uoPJPPO00YhRT4+NXIw==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_233016.wav	0	0	3.99872	5/23/2021	23:30:16	23	5/23/2021	11:30:16	11	NoID	11	0	0	0		11	39.947	-3.32	5.327	71.134	38.503	46.609	78.802	41.431	3.224	422.1	4.772	2.48	1	a7//pO0Tir93uwAdm+RPYw==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_233026.wav	0	0	3.99872	5/23/2021	23:30:26	23	5/23/2021	11:30:26	11	NoID	27	0	0	0		27	38.72	16.09	4.375	53.018	37.76	41.992	113.235	40.172	2.426	300.05	3.884	8.39	1	GfzaVRwoj2AAeiCT8Ie1KA==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210525_003159.wav	0	0	3.99872	5/25/2021	0:31:59	0	5/24/2021	12:31:59	12	NoID	5	0	0	0		5	41.432	110.36	4.069	78.046	41.207	52.586	82.705	46.783	2.421	424.42	4.012	1.36	1	5PH4ZnKDj9Owb79PCrivUA==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210525_010318.wav	0	0	3.99872	5/25/2021	1:03:18	1	5/24/2021	13:03:18	13	NoID	5	0	0	0		5	41.181	159.34	4.341	90.646	41.062	57.178	63.352	48.47	2.817	346.66	4.3	1.13	1	F6ehfgKzz8XkTcprK98euw==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210525_021519.wav	0	0	3.99872	5/25/2021	2:15:19	2	5/24/2021	14:15:19	14	NoID	3	0	0	0		3	39.634	221.57	3.169	88.891	39.634	56.892	44.841	47.895	2.193	389.24	3.169	0.7	1	cwYShA+2qesh4tLk3KCk7g==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210525_031658.wav	0	0	3.99872	5/25/2021	3:16:58	3	5/24/2021	15:16:58	15	NoID	2	0	0	0		2	40.552	52.44	3.54	51.501	40.552	43.692	539.549	43.514	1.622	353.67	3.54	0.36	1	s1Er+p4XxJOq8vyk+yPlBA==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210525_040903.wav	0	0	3.99872	5/25/2021	4:09:03	4	5/24/2021	16:09:03	16	NoID	16	0	0	0		16	23.434	17.35	12.078	33.314	23.119	25.856	238.8	24.345	8.652	206.99	11.288	1.93	1	gXEmGDsPTI6JvQXJ79iaow==
Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210521_203822.wav	0	0	3.99872	5/21/2021	20:38:22	20	5/21/2021	8:38:22	8	Noise																			1	HtQ1kYjCv/7nQwcn3VPVoA==
Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210521_204603.wav	0	0	3.99872	5/21/2021	20:46:03	20	5/21/2021	8:46:03	8	Noise																			1	QhnWh1vls/vnf+7JHf9NJQ==
Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210522_034430.wav	0	0	3.99872	5/22/2021	3:44:30	3	5/21/2021	15:44:30	15	Noise																			1	a0bU48MktPR5LoiJk+5vgQ==
Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210524_020121.wav	0	0	3.99872	5/24/2021	2:01:21	2	5/23/2021	14:01:21	14	Noise																			1	RzNCSvoXWrk+Bj20FwZlRQ==
Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210524_020655.wav	0	0	3.99872	5/24/2021	2:06:55	2	5/23/2021	14:06:55	14	Noise																			1	GiW2dMsYoRwy3De2HZBW1g==
Y:\My Docu	Y:\My Docu	Site 1	PAS_I49Ind_Sit1_D500-20210525_032835.wav	0	0	3.99872	5/25/2021	3:28:35	3	5/24/2021	15:28:35	15	Noise																			1	jjn3VvXlz6UQ7UrhvyyN9A==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210521_221158.wav	0	0	3.99872	5/21/2021	22:11:58	22	5/21/2021	10:11:58	10	Noise																			1	wjRVckonOBiM6pAyJcMDrA==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_000632.wav	0	0	3.99872	5/22/2021	0:06:32	0	5/21/2021	12:06:32	12	Noise																			1	qt7hBjqb8Ax6X7fb9cDEEw==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_055420.wav	0	0	3.99872	5/22/2021	5:54:20	5	5/21/2021	17:54:20	17	Noise																			1	uKIrv4U538oLTRndC7tDDA==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210522_055808.wav	0	0	3.99872	5/22/2021	5:58:08	5	5/21/2021	17:58:08	17	Noise																			1	eqfgXhLocFiTZFEgA/orkw==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210524_053541.wav	0	0	3.99872	5/24/2021	5:35:41	5	5/23/2021	17:35:41	17	Noise																			1	knG2FqyeaV7CGObBGdeE6g==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210524_055448.wav	0	0	3.99872	5/24/2021	5:54:48	5	5/23/2021	17:54:48	17	Noise																			1	fxXFe/G9DArfwZ0fCmldfQ==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210525_055156.wav	0	0	3.99872	5/25/2021	5:51:56	5	5/24/2021	17:51:56	17	Noise																			1	5LaydUGcrTGFiChKFp15qg==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210525_055845.wav	0	0	3.99872	5/25/2021	5:58:45	5	5/24/2021	17:58:45	17	Noise																			1	8NVOAcTi/+Vzmwz/XOuheA==
Y:\My Docu	Y:\My Docu	Site 2	PAS_I49Ind_Sit2_D500-20210523_221534.wav	0	0	3.99872	5/23/2021	22:15:34	22	5/23/2021	10:15:34	10	PERSUB	4	2	0.5	0.139858	MYOLUC	4	41.744	61.27	4.157	74.183	41.416	50.149	111.644	44.249	2.754	410.41	3.991	1.17	1	gZP9DDXi9Dn/Je7RCLWcdg==

TERRA TECHNOLOGIES

DANNY DEANGELO Senior Environmental Scientist

Mr. DeAngelo performs wetland and stream system jurisdictional assessments, assists with Clean Water Act Section 404 and 401 permitting, endangered species habitat surveys, and endangered species surveys. He also helps design large scale wetland and riparian restoration projects as well as biotechnical engineering stream stabilization projects. Additionally, Mr. DeAngelo performs construction oversight on stream stabilization projects and wetland restorations.

Mr. DeAngelo brings extensive biotechnical and natural resources construction experience to Terra Technologies.
In his previous positions he assisted in the design and creation of over a thousand acres of wetlands, riparian areas and prairies. Mr. DeAngelo also took part in many forest restoration projects.

PROFESSIONAL CERTIFICATIONS

- *Member, Society of Wetland Scientists*
- *Approved Special Inspector for Major Land Disturbance Projects in St. Louis County*
- *Certified in Wildland Fire Suppression*

EDUCATION

- *B.S. Environmental Science, Greenville College, 2003*

BACKGROUND

- *Environmental Manager, Parisi Ecoworks Inc.*
- *Prairie and Wetland Restoration Manger, Encap Inc.*
- *Forest Restoration Intern, Zahniser Institute for Environmental Studies*
- *Prairie Management Intern, Illinois Department of Natural Resources*

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Mr. DeAngelo has worked on hundreds of projects in Kansas, Missouri, Ohio, Illinois, and Tennessee delineating 10,000+ acres of land for Clean Water Act wetland and stream jurisdiction, performed endangered species surveys, and endangered species habitat surveys on 1,000+ acres, and has designed many mitigation banks in Kansas and Missouri.

Bat Acoustic Survey Methods Course

Mr. DeAngelo completed the Bat Acoustic Survey Methods Training Course in April 2019 which was provided by a partnership between Bat Conservation Management and Bat Survey Solutions, LLC. This course provided extensive training in the different monitoring types of surveying (active, mobile, and passive), the use of bat detectors (Wildlife Acoustics and Petterson) and their different microphones, the deployment of the detectors, the siting and placement of detector locations. The course also went into great depth in the use of the software Kaleidoscope Pro and Sonobat. In addition to the detectors and software, the course trained Mr. DeAngelo the skills and knowledge to manually identify bat calls. Find more information on this course at: <https://batsurveysolutions.com/pages/bat-acoustic-survey-training>

Evaluating Acoustic Bat Surveys for ESA Compliance

Mr. DeAngelo completed the Evaluating Acoustic Bat Surveys for ESA Compliance Training Course in May 2019 which was provided by the United States Fish and Wildlife Service. This training course provided the knowledge and skills to properly follow the 2019 Range-wide Indian bat (*Myotis sodalis*) Summer survey Guidelines for acoustically assessing presence/probable absence of bats, critically evaluate acoustic surveys and reports for scientific integrity and compliance, describe the advantages and disadvantages of sampling bats using acoustics, properly set up and utilize bat detectors to maximize detectability, and to properly process and analyze acoustic data using each of the USFWS-approved software programs. Find more information on this course at:
https://training.fws.gov/courses/descriptions/CSP2111-Evaluating-Acoustic-Bat-Surveys-for-ESA-Compliance.pdf

Acoustic Bat Surveys

Mr. DeAngelo has been approved by the United States Fish and Wildlife Service to conduct acoustic bat surveys and has completed many acoustic bat surveys within Missouri. Surveys completed include small 10-acre projects to larger 300+-acre projects. All acoustic surveys conducted by Mr. DeAngelo were completed within the timeframes allotted by the regulations and were accepted by the United States Fish and Wildlife Service.