Bat Survey Report for the Kings Mountain Lithium Mine, Cleveland County, North Carolina

NOVEMBER 2022

PREPARED FOR

Albemarle U.S., Inc.

PREPARED BY

SWCA Environmental Consultants

BAT SURVEY REPORT
FOR THE KINGS MOUNTAIN LITHIUM MINE, CLEVELAND COUNTY, NORTH CAROLINA

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1 INTRODUCTION

On behalf of Albemarle Corporation (Albemarle), SWCA Environmental Consultants (SWCA) conducted bat surveys at the proposed Kings Mountain Lithium Mining Project (Project) in Cleveland County, North Carolina (Figure 1). The Project area is within the known range of the northern long-eared bat (*Myotis septentrionalis*), a species currently listed as threatened under the Endangered Species Act. The U.S. Fish and Wildlife Service (USFWS) has proposed to reclassify the species as endangered, and a final rule is expected in November 2022. The USFWS has proposed listing the tricolored bat (*Perimyotis subflavus*) as endangered, with a final decision expected in fall 2023. The USFWS is also reviewing the status of little brown bat (*Myotis lucifugus*). Because northern long-eared bat, tricolored bat, and little brown bat have the potential to occur, bat surveys were conducted within the Project area.

The objective of the survey was to determine the species composition of the local bat population, document the presence or probable absence of currently listed species and those under review, and collect any other data that may be useful for Project design and development (e.g., roost locations for *Myotis* species).

2 METHODS

SWCA proposed a phased approach designed to meet or exceed all recommendations found in the USFWS's *Range-wide Indiana Bat and Northern Long-eared Bat Survey Guidelines* (USFWS Guidelines) (USFWS 2022). The intended data collection would begin with preliminary acoustic surveys and continue into mist-net and radiotelemetry studies if additional data were necessary.

2.1 Level of Effort Determination

For the purposes of this survey, SWCA has assumed that all forested habitat qualifies as suitable summer bat habitat. The USFWS Guidelines recommend 14 detector nights of survey and two detector locations for every 123 acres of suitable northern long-eared bat summer habitat but do not provide a recommendation for other species. The Project area contains 736 acres of forested habitat. Meeting the recommended level of effort in the USFWS Guidelines required a minimum level of effort of 84 detector nights. SWCA's study design included a survey level of effort of 114 detector nights, more than 33% higher than the minimum level of effort. It is presumed that the additional level of effort accounts for differences in detectability in other species that occur within the Project area and is more than sufficient to determine the presence or absence of northern long-eared bats. Fifteen acoustic deployment locations were selected throughout representative habitat across the Project area, and one detector was deployed at each for a minimum of seven nights.

Mist-net and radiotelemetry levels of effort were based on the acoustic data collection and were to be conducted only if the additional data would be useful for project design or agency consultation.

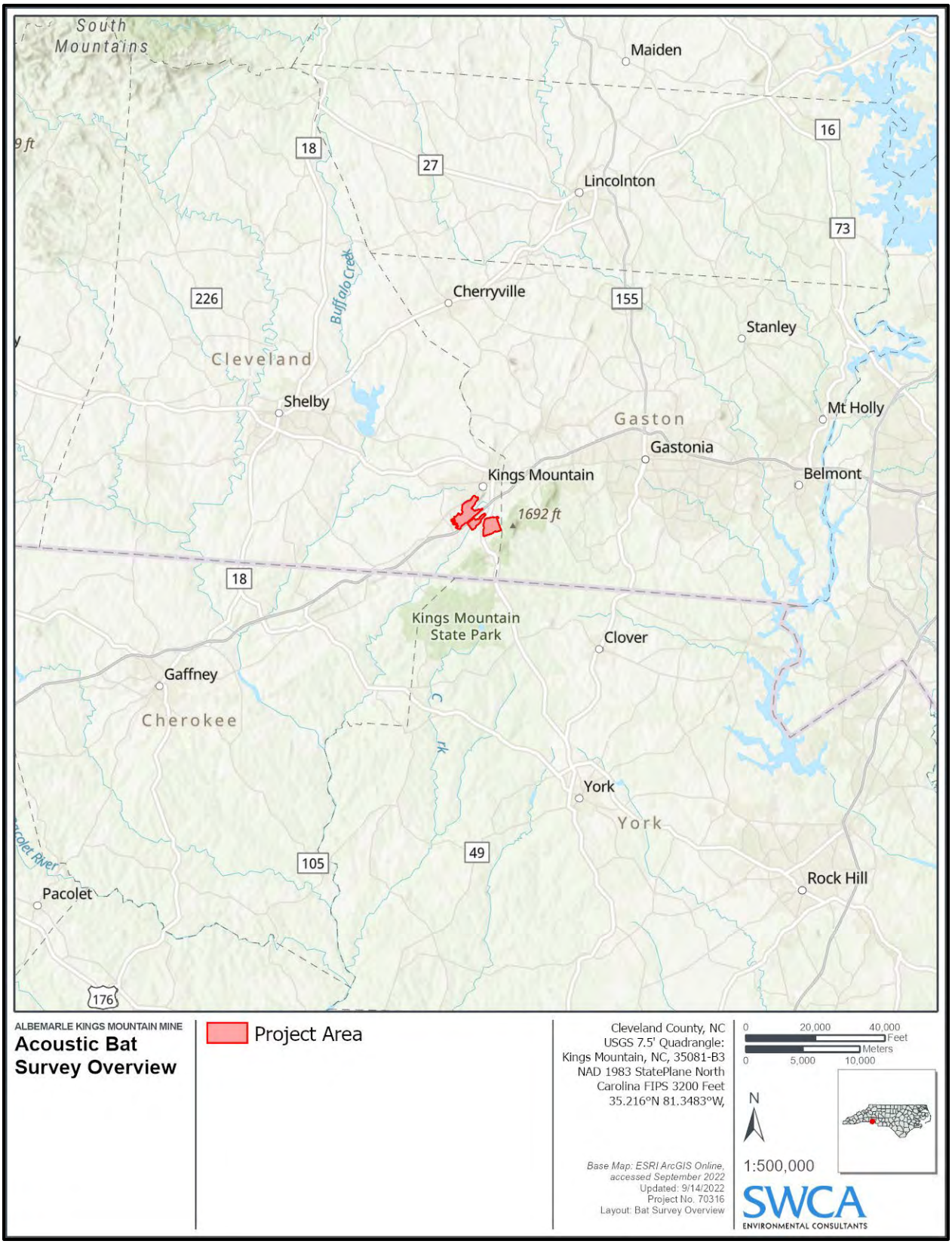

Figure 1. Kings Mountain acoustic bat survey Project area, Cleveland County, North Carolina.

2.2 Acoustic Survey

2.2.1 Detector Deployment

SWCA deployed acoustic detectors (Titley Scientific AnaBat Express) at each detector location. Detector locations were chosen on-site by a qualified bat biologist trained and experienced in acoustic survey methods. Each detector was equipped with a directional microphone atop approximately 3-meter (m) poles. No aftermarket weatherproofing was added. Photographs of detector setups and deployment locations are provided in Appendix A. Selection of detector deployment locations was based on on-site conditions with an emphasis on locations that are more likely to lead to collection of high-quality, diagnostic calls. Diagnostic bat calls are most useful from recordings collected in areas that contain little "clutter" (i.e., anything perceived by a bat that provokes it to modulate echolocate in an attempt to navigate more quickly). However, northern long-eared bats are a clutter-adapted species, and the USFWS Guidelines recommend that "…placement of detectors should be as close to clutter as possible but not in clutter." SWCA reviewed Project area maps for areas of ecological importance (e.g., water sources, foraging habitat, travel corridors) and selected a mixture of higher and lower clutter areas to place detectors. In the field, detector locations were adjusted to sample these areas while remaining at least 3 m in any direction from vegetation or other obstructions.

Fifteen detector deployment locations were recorded using handheld geographical positioning system units (Table 1). Prior to mobilization, all detectors were reviewed for firmware updates and proper functioning. Functionality was confirmed by a qualified bat biologist at the time of deployment and at the conclusion of survey.

2.2.2 Survey Conditions

Detectors were programmed to begin data collection 30 minutes prior to sunset and conclude 30 minutes after sunrise on each day of survey.

Certain weather criteria must be met for acoustic data to be valid. A survey night was considered invalid if any of the following occurred during the first 5 hours of sampling effort:

- Temperatures fell below 10 degrees Celsius
- Precipitation exceeded 30 minutes or continued intermittently
- Windspeed was greater than 4 m/second for 30 minutes or more

Hourly weather conditions were monitored using Visual Crossing's historical weather data function, which extrapolates weather data available from nearby weather stations (Visual Crossing 2022). This allows for the most accurate remotely collected data, though a known and relevant limitation is that wind speeds are calculated at 10 m above ground level, which in many scenarios will overestimate wind speed in forest interiors where many acoustic detectors were deployed.

2.2.3 Acoustic Analysis

The resultant acoustic files were analyzed using Bat Call Identification (BCID) Version 2.8b software. All default BCID settings were used, and species included for consideration were big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), little brown bat, northern long-eared bat, evening bat (*Nycticeius humeralis*), and tricolored bat.

Table 1. Summary of Acoustic Detector Deployment Locations for the Kings Mountain Acoustic Bat Survey

Detector Location	Latitude and Longitude	Valid Survey Nights	Habitat Description*
KING-1	35.20984, -81.34863	7	KING-1 was placed along a travel corridor connecting a deciduous forest patch to Executive Club Lake, which offers water resources and foraging habitat.
KING-2	35.20816, -81.35038	0	KING-2 was placed in mixed forest and scrub/shrub along a travel corridor connecting other forest with a small pond and wetland habitat.
KING-3	35.21042, -81.36811	8	KING-3 was placed in an opening near mixed hardwood (oaks, sweetgum saplings) and pine forest with numerous travel corridors.
KING-4	35.20309, -81.33539	7	KING-4 was placed in an opening at the intersection of three travel corridors through upland primarily deciduous forest.
KING-5	35.21271, -81.33075	7	KING-5 was placed in an opening along a travel corridor through mixed forest.
KING-6	35.21202, -81.35486	8	KING-6 was placed in a mowed clearing by a lake and assorted hardwoods (maples, oaks) and pines.
KING-7	35.21639, -81.35499	7	KING-7 was placed in a maintained lawn near a large impoundment with an emergent wetland fringe.
KING-8	35.21770, -81.35989	8	KING-8 was placed in old-field habitat along a network of travel corridors through upland forested habitat.
KING-9	35.22774, -81.35128	8	KING-9 was placed along a travel corridor in a kudzu (*Pueraria montana*)-dominated opening surrounded by upland deciduous forest.
KING-10	35.21104, -81.33296	7	KING-10 was placed along a travel corridor in a mixed upland forest.
KING-11	35.20798, -81.36293	8	KING-11 was placed within early successional forest dominated by mixed hard and softwood species.
KING-12	35.21414, -81.35938	8	KING-12 was placed between a pond and railroad tracks in heavily vegetated grasses and wild berry bushes.
KING-13	35.21897, -81.35398	8	KING-13 was placed in grassland/old-field habitat near patches of scrub/shrub and forest.
KING-14	35.22813, -81.34845	8	KING-14 was placed near scrub/shrub, old-field, and upland deciduous forest habitat.
KING-15	35.21616, -81.34827	0	KING-15 was placed within old-field/right-of-way habitat adjacent to upland deciduous forest.

*References to upland and wetland habitat are based on qualitative observations only and independent from regulatory definitions of either upland or wetland relative to potentially jurisdictional waters. Acoustic files are sonograms, or visual translations of specific sound characteristics. Qualitative manual analysis was conducted for each site/night where BCID software identified northern long-eared bat presence as statistically likely based on the maximum likelihood estimator. Presence of all other species was confirmed manually as well.

2.3 Mist-Net Survey and Radiotelemetry

A determination of the necessity for mist-net surveys and radiotelemetry would be conducted at the conclusion of acoustic surveys.

If determined necessary, mist-net sites would be selected during field reconnaissance by qualified bat biologists with appropriate permits allowing for survey of the target species. Site selection would be based on the presence of appropriate habitat and conditions conducive to effective mist-netting. Primary site selection criteria included presence of canopy cover and an open flyway in areas that

provided optimum chance to capture the target species. Biologists would place nets across a flight corridor where the canopy cover and vegetation created a funneling effect to facilitate capture of bats to the maximum extent possible. Biologists would remove captured bats from the nets and record the following data: species, sex (if readily obvious upon capture), time of capture, and capture height in net. Biologists would identify all bats to species based upon distinctive morphological characteristics (e.g., body size, hair color, ear length, tragus shape, presence/absence of a keeled calcar, and additional characters). If *Myotis* species are captured, it can be beneficial to determine their diurnal roost locations via radiotelemetry.

3 RESULTS

3.1 Acoustic Survey

3.1.1 Detector Deployment

In June 2022, detectors were deployed following the USFWS Guidelines in areas where bats would be expected to occur if the species were present within the Project area. Detectors were deployed at 15 detector locations to sample various habitat types throughout the Project area footprint (Figure 2). Each detector was deployed for a minimum of seven nights. The survey consisted of 99 valid detector nights (see Table 1). Detectors at locations KING 2 and KING 15 experienced equipment malfunction and did not record data.

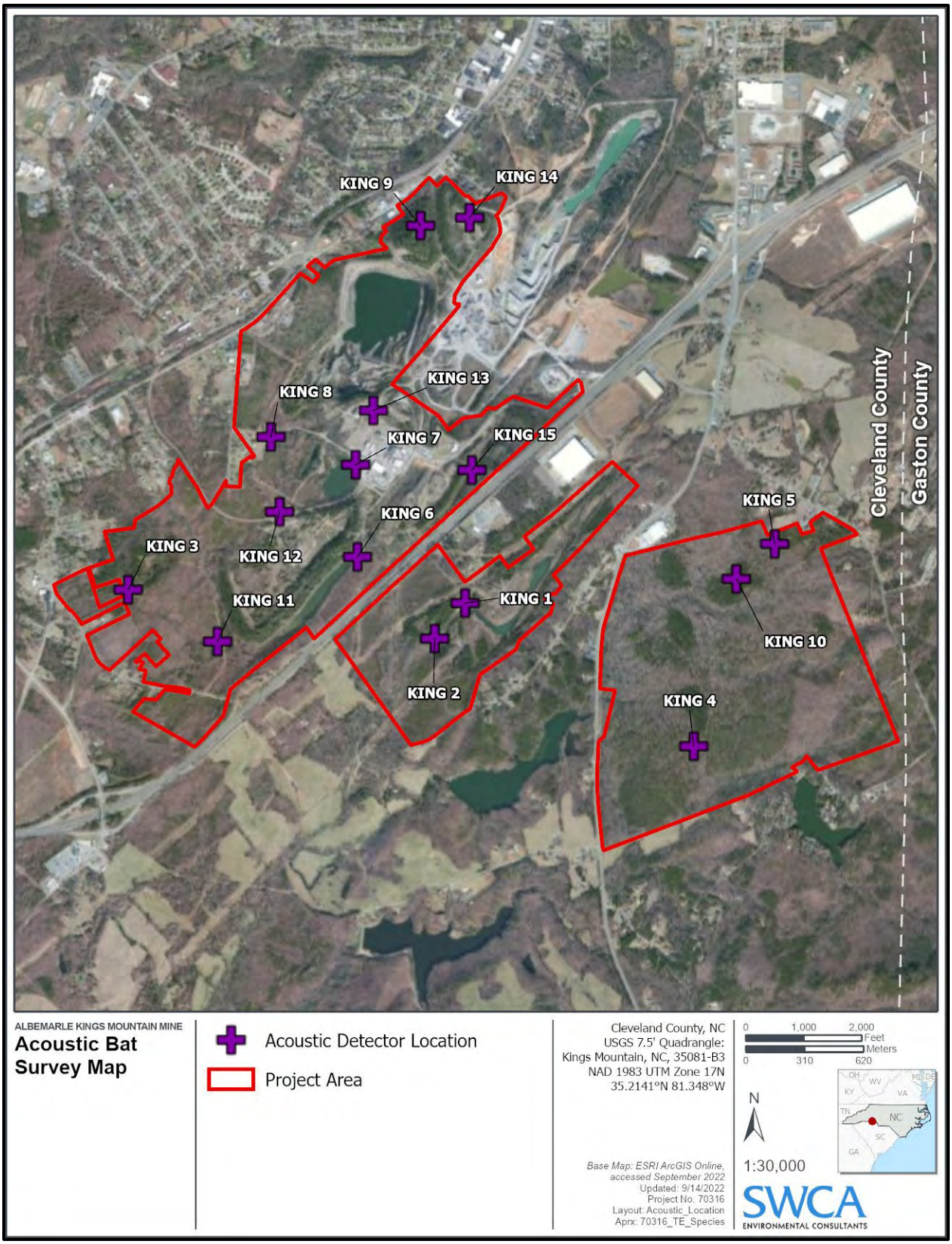

Figure 2. Detector locations used during the Kings Mountain acoustic bat survey, Cleveland County, North Carolina.

3.1.2 Survey Conditions

Acoustic data was collected between June 8 and June 30, 2022. Weather was monitored throughout the survey to confirm conditions were appropriate for recording acoustic data. A summary of hourly conditions throughout the survey is provided in Appendix B. Weather was confirmed to be valid for the duration of the survey.

3.1.3 Acoustic Analysis

A total of 10,298 bat calls were identified through analysis. BCID assigned 9,267 calls to eight different species, and 78 calls were determined to have been created by bats but were indiscernible to species (Table 2). After the automated analysis, the results were manually verified.

Table 2. Results of Automated and Manual Analysis for the Kings Mountain Acoustic Bat Survey

Detector Location	Big brown bat	Silver-haired bat	Eastern red bat	Hoary bat	Little brown bat	Northern long-eared bat	Evening bat	Tricolored bat	Unknown bat species	Total calls
KING-1	11	68	76	63	1	1	40	56	4	320
KING-2	Equipment malfunction									
KING-3	123	50	77	111	0	1	58	121	8	549
KING-4	205	655	44	239	3	0	21	110	6	1,283
KING -5	55	102	53	52	3	0	67	8	1	341
KING -6	17	110	196	167	0	0	43	137	8	678
KING -7	0	92	40	296	0	0	19	375	12	834
KING -8	0	0	5	4	0	0	2	6	0	17
KING -9	2,311	1,406	623	281	2	0	137	150	32	4,942
KING -10	57	74	24	5	2	0	41	33	1	237
KING-11	13	52	39	38	2	0	55	7	0	206
KING-12	62	47	6	21	2	1	6	12	0	157
KING-13	7	19	11	128	1	0	2	5	1	174
KING-14	28	168	18	307	0	0	23	11	5	560
KING-15	Equipment malfunction									
Automated Total	**2,889**	**2,843**	**1,212**	**1,712**	**16**	**3**	**514**	**1,031**	**78**	**10,298**
Manual Verification*	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**	**Yes**	**Yes**	**Yes**	

* Confirmed present based on manual review of calls

BCID identified a total of 19 calls it believes to have been made by *Myotis* species, consisting of 16 little brown bat calls across eight detector locations and three northern long-eared bat calls at two detector locations (see Table 2). *Myotis* calls typically have relatively consistent characteristics between pulses, maintaining a consistent characteristic frequency, slope, and time between calls. None of the calls identified by BCID demonstrated that consistency across pulses in a call, which is typical of calls made by red bats (e.g., *Lasiurus* sp.). Red bats have an extensive call repertoire with pulses that can vary significantly within and between calls, and routinely produce *Myotis*-like call sequences (e.g., three or more pulses) as a portion of an overall call. This can, and regularly does, lead to false identification by automated identification software, as is the case in this situation. Though portions of these calls may

resemble others known to have been made by *Myotis*, when reviewed in context, they are clearly most likely to have been made by red bats rather than little brown bats or northern long-eared bats.

SWCA reviewed calls from the remaining species identifications provided by BCID and confirmed that each was represented in the dataset. The big brown bat, eastern red bat, hoary bat, silver-haired bat, evening bat, and tricolored bat were documented during the course of survey.

3.2 Mist-Net Surveys and Radiotelemetry

Based on the results of the acoustic bat surveys, it was determined that additional data from mist-net and radiotelemetry studies would not be valuable for the Project. Species presence was confidently assessed through acoustic survey alone. It was determined that no additional data would be necessary for project design or agency coordination and that the value of the data that could be collected via mist-net survey and radiotelemetry would not appropriately offset the stress to the local bat population. Therefore, no mist-net survey or radiotelemetry studies were conducted.

4 DISCUSSION

Acoustic bat surveys within the proposed Project area used survey methods that met or exceeded the recommendations provided by the USFWS Guidelines to determine the presence or probable absence of the threatened northern long-eared bat. SWCA surveyed for 99 complete detector nights on nights with valid weather conditions. Automated analysis indicated potential presence of northern long-eared bats at three detector locations. After a qualitative, manual review was conducted by qualified bat biologists, it was determined that the northern long-eared bat identifications made by the software were incorrect and that there was no evidence of northern long-eared bats within the dataset collected. The data collected indicates probable absence of northern long-eared bats within the Project area. Similarly, the data collected indicate probable absence of little brown bats within the Project area.

Automated analysis indicated potential presence of tricolored bats throughout the Project area. It was confirmed via qualitative, manual analysis that tricolored bats (a proposed endangered species) were present within the Project area during the course of the study. An additional five common bat species are considered present based on the acoustic survey results: big brown bat, eastern red bat, hoary bat, silver-haired bat, and the evening bat.

Recommended management practices that may be beneficial to all bat species include minimizing forest clearing, avoiding impacts to large and intact contiguous forested blocks, and avoiding impacts to water quality by limiting stream/wetland impacts and implementing erosion and sediment controls. Additionally, revegetating with native grassland species using a pollinator mix could promote prey diversity and abundance.

4.1 Tricolored Bat (*Perimyotis subflavus*)

Tricolored bats are on the decline from white-nose syndrome in North Carolina. Whereas they used to be common from the mountains to the Coastal Plain, they are now common only in patches and uncommon everywhere else. Tricolored bats have not been documented previously in Cleveland County (Mammals of North Carolina 2022f; North Carolina Natural Heritage Program [NCNHP] 2022); however, variable survey efforts are likely to contribute to the lack of records. Some tricolored bats may migrate long distances, but most retreat to caves and mines to hibernate during winter. In the summer, tricolored bats can be found in a variety of habitats, from woodlands to small towns and farms, though

usually not heavily populated areas. They may roost in trees or sometimes in old buildings, culverts, or tunnels. Tricolored bats roost in foliage of live trees and may form small maternity colonies during the pup-rearing season (North Carolina Bat Working Group 2013). The smallest bat in North America, it flies slowly in the evening to forage over openings, water, and farm fields. Due to its decline from white-nose syndrome, tricolored bats are considered "rare or uncommon" in North Carolina (Mammals of North Carolina 2022f; White-Nose Syndrome Response Team 2021). In September 2022, the USFWS proposed to list the tricolored bat as an endangered species in response to observed population declines resulting primarily from white-nose syndrome (*Federal Register* 87:56381). A final decision regarding the listing status of the species is expected in the fall of 2023.

Should the tricolored bat become listed as endangered, consultation with the USFWS is recommended to determine suitable measures, such as habitat conservation or enhancement, to address any potential adverse effects. The tricolored bat is expected to be present in the Project area between April and October. As a forest dwelling species there is risk of direct mortality if occupied roost trees are removed during a time when they are occupied. Because the species is a habitat generalist that typically roosts in foliage of living trees, it is difficult to determine specific roost trees. Avoiding the removal of forested habitat (i.e., known occupied habitat) between April and October is likely to avoid the potential for direct mortality, and habitat modification at a small scale is unlikely to result in harm to individuals. Note that, in their final decision, the USFWS may dictate strict windows of potential occupancy that deviate slightly from that provided here.

4.2 Big Brown Bat (*Eptesicus fuscus*)

Big brown bats can be found throughout North Carolina and all lower 48 states, parts of Canada, and parts of Mexico. There are no previous records of big brown bats for Cleveland County, though they have been recorded in nearly all surrounding counties (Mammals of North Carolina 2022a; NCNHP 2022). Although big brown bats have been observed in the coastal region of North Carolina, big brown bat sightings have been concentrated in the piedmont and mountainous regions of the state as they roost in hollow trees, under bark, and occasionally around mines or caves. Big brown bats are also able to roost in chimneys and attics where they congregate in groups as large as 100 individuals. They forage at night and are often observed by city residents flying near city street lights. Big brown bats do not migrate long distances for winter but hibernate in small numbers whether in tree hollows or in warmer human-made structures. During winter warm spells, they are able to wake and forage to replenish their energy stores during the long winter season. Though big brown bats have been documented with white-nose syndrome, they are categorized as "demonstrably secure" in North Carolina (Mammals of North Carolina 2022a; White-Nose Syndrome Response Team 2021).

4.3 Eastern Red Bat (*Lasiurus borealis*)

Eastern red bats have been observed in nearly all 100 of North Carolina's counties, including Cleveland County, with a range that extends along the Atlantic Coast from Canada to Mexico and the Great Plains. It is the most abundant bat in the state, inhabiting the Outer Banks to the mountains. Although eastern red bats shift their range in the summer months through Canada, they are present in North Carolina year-round, reverting into a lower energy state similar to hibernation called torpor during the coldest times of the year. They roost in coniferous, deciduous, or shrubby vegetation close to open fields or open water. They do not typically occupy human-made structures or caves. Open areas allow them to forage for aerial insects, their main food source. Unlike many other bat species, they also take advantage of artificial light sources that attract insects, and may be observed foraging around city lights. Although eastern red bats have been rarely documented with white-nose syndrome, their life history (i.e., migration rather than

hibernation in caves and mines) leaves them relatively immune to white-nose syndrome at the population level, and they are categorized as "demonstrably secure" in North Carolina. Because they forage only around dusk and early evening, they can be easily observed and distinguished by their rusty fur color (Mammals of North Carolina 2022b; White-Nose Syndrome Response Team 2021).

4.4 Hoary Bat (*Lasiurus cinereus*)

Hoary bats have one of the largest ranges of any bat in North America. While its breeding range is farther north than North Carolina, it passes through the state in the spring and fall during its passage to and from warmer southern climes, where it can be found as far south as Chile and Argentina. There are no previously recorded occurrences for hoary bat in Cleveland County (Mammals of North Carolina 2022c; NCNHP 2022). The hoary bat is also the largest bat in North America and named after its silver-tipped fur. They roost on the edges of deciduous and coniferous forests, generally avoiding deep forests where they do not have openings in which to forage for insects. During migration seasons, hoary bats may be observed during daylight hours, unusual for bat species, which are most active at night. Hoary bats have not been observed with white-nose syndrome. However, because of their variable presence in North Carolina, they are considered "rare or uncommon" (Mammals of North Carolina 2022c).

4.5 Silver-haired Bat (*Lasionycteris noctivagans*)

Silver-haired bats are found throughout North Carolina and in all of the 48 lower states. They migrate throughout the seasons and are most common in North Carolina in the winter, when they roost in crevices of trees and clumps of leaves. They may inhabit human-made structures, usually near forested areas. They forage for aerial insects almost exclusively over permanent open water because they are slow flying compared with other bats. Because the species does not form colonies, it is more difficult to gauge its abundance in the state. No silver-haired bats have been previously recorded in Cleveland County (Mammals of North Carolina 2022d; NCNHP 2022). Silver-haired bats have been documented with white-nose syndrome in the United States but have no recorded mortality. Silver-haired bats are considered "apparently secure" in North Carolina (Mammals of North Carolina 2022d).

4.6 Evening Bat (*Nycticeius humeralis*)

Evening bats are numerous in North Carolina, especially in lower elevations like the Coastal Plain. Evening bats inhabit only the southeastern United States from New Jersey, west to Iowa, and south to Mexico. It was originally thought that evening bats migrated out of North Carolina for the winter; however, recent netting efforts have documented numerous evening bats in North Carolina in the winter. No evening bats have been previously recorded for Cleveland County (Mammals of North Carolina 2022e; NCNHP 2022). Evening bats roost in hollow trees or loose bark and occasionally in human-made structures. They forage both in openings and the forests themselves. Although evening bats are numerous in North Carolina, they are not easily recognized because they lack distinctive features and do not behave in unique patterns. Evening bats have not been documented with white-nose syndrome and are categorized as "demonstrably secure" in North Carolina (Mammals of North Carolina 2022e; White-Nose Syndrome Response Team 2021).

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APPENDIX A

Photographic Log

Photograph 1. KING 1, facing south (6/8/2022).

Photograph 2. KING 2, facing north (6/8/2022).

Photograph 3. KING 3 , facing east (6/14/2022).

Photograph 4. KING 4, facing east (6/7/2022).

Photograph 5. KING 5, facing east (6/7/2022).

Photograph 6. KING 6, facing north (6/14/2022).

Photograph 7. KING 7, facing west (6/30/2022).

Photograph 8. KING 8, facing west (6/14/2022).

Photograph 9. KING 9, facing west (6/22/2022).

Photograph 10. KING 10, facing east (6/7/2022).

Photograph 11. KING 11, facing north (6/14/2022).

Photograph 12. KING 12, facing north (6/14/2022).

Photograph 13. KING 13, facing east (6/30/2022).

Photograph 14. KING 14, facing east (6/22/2022).

Photograph 15. KING 15, facing south (6/30/2022).

APPENDIX B

Weather Log

Survey Night	Sunset	Sunrise	Date and Time	Temperature (F)	Precipitation (inches)	Wind Speed (mph)	Comment
6/8/2022	20:38	6:10	6/7, 20:00	77.9	0	3.4	Valid
			6/7, 21:00	74.9	0	2.3	
			6/7, 22:00	72.8	0	0	
			6/7, 23:00	70.5	0	0	
			6/8, 00:00	69.1	0	0.5	
			6/8, 01:00	68.6	0	1	
			6/8, 02:00	68.1	0	0	
			6/8, 03:00	67.5	0	0	
			6/8, 04:00	66.7	0	0	
			6/8, 05:00	66.7	0	0	
			6/8, 06:00	66.8	0	0	
			6/8, 07:00	67.6	0	0	
6/9/2022	20:38	6:10	6/8, 20:00	79.8	0	5.4	Valid
			6/8, 21:00	77.9	0	4.9	
			6/8, 22:00	75.8	0	5.3	
			6/8, 23:00	75.2	0	4.4	
			6/9, 00:00	75	0	6	
			6/9, 01:00	74.3	0	5.6	
			6/9, 02:00	73.9	0	3.6	
			6/9, 03:00	73.2	0	4.9	
			6/9, 04:00	72	0	1.7	
			6/9, 05:00	71.1	0	3.8	
			6/9, 06:00	70.7	0	3.6	
			6/9, 07:00	70.4	0	4.5	
6/10/2022	20:39	6:10	6/9, 20:00	80.6	0	5.6	Valid
			6/9, 21:00	77.3	0	5.3	
			6/9, 22:00	74.5	0	5.8	
			6/9, 23:00	72.2	0	4.9	
			6/10, 00:00	69.6	0	4.2	
			6/10, 01:00	66.3	0	0.6	
			6/10, 02:00	65.7	0	4.7	
			6/10, 03:00	63.3	0	4.1	
			6/10, 04:00	63.7	0	4.9	
			6/10, 05:00	62.6	0	4.2	
			6/10, 06:00	60.7	0	4.2	
			6/10, 07:00	62.9	0	5.4	
6/11/2022	20:39	6:10	6/10, 20:00	73.4	0	0.7	Valid
			6/10, 21:00	70.5	0	0	
			6/10, 22:00	67.4	0	0.7	
			6/10, 23:00	66.4	0	0	
			6/11, 00:00	65.9	0	0	
			6/11, 01:00	66.6	0	1.5	
			6/11, 02:00	66.4	0	0	
			6/11, 03:00	64.2	0	1	
			6/11, 04:00	63.6	0	0	

Survey Night	Sunset	Sunrise	Date and Time	Temperature (F)	Precipitation (inches)	Wind Speed (mph)	Comment
			6/11, 05:00	61	0	0	
			6/11, 06:00	61.9	0	0.6	
			6/11, 07:00	62.2	0	0	
6/12/2022	20:39	6:10	6/11, 20:00	79	0	0	Valid
			6/11, 21:00	74.8	0	0.6	
			6/11, 22:00	74.7	0	2.7	
			6/11, 23:00	73.6	0	6.1	
			6/12, 00:00	73	0	3.6	
			6/12, 01:00	72.5	0	4.4	
			6/12, 02:00	71.6	0	3.4	
			6/12, 03:00	70.7	0	0	
			6/12, 04:00	69.4	0	0	
			6/12, 05:00	68.5	0	0	
			6/12, 06:00	67.3	0	0	
			6/12, 07:00	68.6	0	0	
6/13/2022	20:40	6:10	6/12, 20:00	84.6	0	0.7	Valid
			6/12, 21:00	80.1	0	0.7	
			6/12, 22:00	78.2	0	0	
			6/12, 23:00	75.1	0	0.6	
			6/13, 00:00	73.7	0	0.7	
			6/13, 01:00	72.8	0	0	
			6/13, 02:00	71.5	0	0	
			6/13, 03:00	72.7	0	2.1	
			6/13, 04:00	71	0	0	
			6/13, 05:00	69.7	0	2.1	
			6/13, 06:00	69.6	0	2.1	
			6/13, 07:00	71.3	0	0	
6/14/2022	20:40	6:10	6/13, 20:00	86.7	0	1.2	Valid
			6/13, 21:00	84.6	0	0.7	
			6/13, 22:00	81.9	0	0.6	
			6/13, 23:00	80.7	0	0.7	
			6/14, 00:00	78	0	0	
			6/14, 01:00	76	0	2.1	
			6/14, 02:00	77.8	0	2.1	
			6/14, 03:00	77.2	0	0.7	
			6/14, 04:00	75.2	0	0	
			6/14, 05:00	74	0	0.6	
			6/14, 06:00	73.2	0	2	
			6/14, 07:00	76.5	0	7.5	
6/15/2022	20:41	6:10	6/14, 20:00	83.4	0	2.7	Valid
			6/14, 21:00	80.9	0	1.5	
			6/14, 22:00	78.1	0	2.1	
			6/14, 23:00	76.4	0	0.6	
			6/15, 00:00	75.5	0	2.1	

Survey Night	Sunset	Sunrise	Date and Time	Temperature (F)	Precipitation (inches)	Wind Speed (mph)	Comment
			6/15, 01:00	75.2	0	2.1	
			6/15, 02:00	73.9	0	0	
			6/15, 03:00	73.8	0	0	
			6/15, 04:00	72.9	0	0	
			6/15, 05:00	72.4	0	0	
			6/15, 06:00	71.8	0	0	
			6/15, 07:00	74.3	0	4.4	
6/16/2022	20:41	6:10	6/15, 20:00	86.1	0	0	Valid
			6/15, 21:00	83.2	0	0	
			6/15, 22:00	81	0	0	
			6/15, 23:00	81.2	0	0	
			6/16, 00:00	78.9	0	0	
			6/16, 01:00	78.2	0	1.8	
			6/16, 02:00	78.6	0	3	
			6/16, 03:00	78	0	3.7	
			6/16, 04:00	77.4	0	5.2	
			6/16, 05:00	77	0	3.5	
			6/16, 06:00	76	0	4.7	
			6/16, 07:00	76.6	0	4.3	
6/17/2022	20:41	6:10	6/16, 20:00	71.5	0.01	1.8	Valid; precipitation extremely light, stops within first hour
			6/16, 21:00	70.6	0.01	3.5	
			6/16, 22:00	70.4	0	5.7	
			6/16, 23:00	69.6	0	0.8	
			6/17, 00:00	68.9	0	0	
			6/17, 01:00	68.6	0	0.7	
			6/17, 02:00	69.3	0	3.7	
			6/17, 03:00	70.2	0	0	
			6/17, 04:00	69.9	0	3.8	
			6/17, 05:00	70.9	0	2.9	
			6/17, 06:00	71.6	0	4.8	
			6/17, 07:00	72.6	0	5.8	
6/18/2022	20:42	6:10	6/17, 20:00	76.7	0	3.8	Valid
			6/17, 21:00	73.5	0	0.5	
			6/17, 22:00	71.1	0	0	
			6/17, 23:00	70.8	0	1	
			6/18, 00:00	69.8	0	0.9	
			6/18, 01:00	68.5	0	0	
			6/18, 02:00	67.3	0	0	
			6/18, 03:00	67.9	0	0.5	
			6/18, 04:00	66.2	0	0.7	
			6/18, 05:00	65.4	0	0.5	
			6/18, 06:00	63.2	0	0.7	
			6/18, 07:00	65.6	0	1	

Survey Night	Sunset	Sunrise	Date and Time	Temperature (F)	Precipitation (inches)	Wind Speed (mph)	Comment
6/19/2022	20:42	6:11	6/18, 20:00	80.6	0	8.2	Valid
			6/18, 21:00	76.5	0	5.4	
			6/18, 22:00	74	0	5.8	
			6/18, 23:00	71.1	0	4.4	
			6/19, 00:00	68.8	0	5.2	
			6/19, 01:00	65.1	0	2.9	
			6/19, 02:00	63.2	0	5	
			6/19, 03:00	61.8	0	4.8	
			6/19, 04:00	59.4	0	4.1	
			6/19, 05:00	57.5	0	4.8	
			6/19, 06:00	55.2	0	3.2	
			6/19, 07:00	56.2	0	4.3	
6/20/2022	20:42	6:11	6/19, 20:00	74.1	0	0	Valid
			6/19, 21:00	67.9	0	0	
			6/19, 22:00	64.5	0	0	
			6/19, 23:00	63.4	0	0	
			6/20, 00:00	61.9	0	0	
			6/20, 01:00	59.4	0	0	
			6/20, 02:00	58.1	0	0.5	
			6/20, 03:00	56.7	0	0.9	
			6/20, 04:00	55.9	0	0.7	
			6/20, 05:00	56.7	0	3.1	
			6/20, 06:00	54.9	0	2.3	
			6/20, 07:00	56.4	0	1.8	
6/21/2022	20:43	6:11	6/20, 20:00	77.5	0	4.5	Valid
			6/20, 21:00	73.6	0	3.9	
			6/20, 22:00	70.7	0	3.9	
			6/20, 23:00	68.5	0	1.5	
			6/21, 00:00	65.7	0	1.5	
			6/21, 01:00	63.7	0	0	
			6/21, 02:00	62.6	0	0.7	
			6/21, 03:00	61	0	0	
			6/21, 04:00	60	0	3.4	
			6/21, 05:00	59	0	2	
			6/21, 06:00	58.7	0	0.7	
			6/21, 07:00	61.8	0	1.9	
6/22/2022	20:43	6:11	6/21, 20:00	83	0	0.5	Valid
			6/21, 21:00	76.2	0	0	
			6/21, 22:00	72.9	0	0	
			6/21, 23:00	70.1	0	0	
			6/22, 00:00	67.2	0	0	
			6/22, 01:00	65.5	0	0.5	
			6/22, 02:00	63.1	0	1.8	
			6/22, 03:00	63	0	0	
			6/22, 04:00	61.9	0	0.5	

Survey Night	Sunset	Sunrise	Date and Time	Temperature (F)	Precipitation (inches)	Wind Speed (mph)	Comment
			6/22, 05:00	61.4	0	0	
			6/22, 06:00	61.2	0	0	
			6/22, 07:00	61	0	0	
6/23/2022	20:43	6:12	6/22, 20:00	90.6	0	2.7	Valid
			6/22, 21:00	88.2	0	4.1	
			6/22, 22:00	84.2	0	1.3	
			6/22, 23:00	81	0	1.8	
			6/23, 00:00	80.3	0	0.8	
			6/23, 01:00	76	0	0	
			6/23, 02:00	73.7	0	0	
			6/23, 03:00	73.6	0	0.7	
			6/23, 04:00	74.9	0	4.3	
			6/23, 05:00	74.5	0	0.5	
			6/23, 06:00	73	0	2.5	
			6/23, 07:00	73	0	1.8	
6/24/2022	20:43	6:12	6/23, 20:00	80.1	0	4.1	Valid
			6/23, 21:00	75.7	0	0.5	
			6/23, 22:00	73	0	0	
			6/23, 23:00	72.1	0	0	
			6/24, 00:00	71	0	0	
			6/24, 01:00	70.9	0	0	
			6/24, 02:00	71.2	0	1	
			6/24, 03:00	72	0	4.1	
			6/24, 04:00	71	0	4.3	
			6/24, 05:00	70.4	0	5.2	
			6/24, 06:00	70.8	0	6.6	
			6/24, 07:00	70.7	0	5.1	
6/25/2022	20:43	6:12	6/24, 20:00	82.6	0	0	Valid
			6/24, 21:00	77	0	0	
			6/24, 22:00	75.7	0	0	
			6/24, 23:00	73.8	0	0	
			6/25, 00:00	73	0	0.5	
			6/25, 01:00	70.8	0	0.5	
			6/25, 02:00	73	0	1.8	
			6/25, 03:00	72.7	0	2.8	
			6/25, 04:00	72.5	0	2.2	
			6/25, 05:00	71.7	0	0.7	
			6/25, 06:00	70.9	0	1.3	
			6/25, 07:00	70.3	0	2.4	
6/26/2022	20:43	6:12	6/25, 20:00	80.6	0	0	Valid
			6/25, 21:00	76.8	0	0	
			6/25, 22:00	76.6	0	0	
			6/25, 23:00	73.8	0	0	
			6/26, 00:00	72.7	0	0	

Survey Night	Sunset	Sunrise	Date and Time	Temperature (F)	Precipitation (inches)	Wind Speed (mph)	Comment
			6/26, 01:00	71.2	0	0	
			6/26, 02:00	69.9	0	0	
			6/26, 03:00	71.3	0	2.5	
			6/26, 04:00	70.3	0	1.8	
			6/26, 05:00	69	0	1.8	
			6/26, 06:00	69.1	0	0.5	
			6/26, 07:00	68.7	0	1.2	
6/27/2022	20:43	6:13	6/26, 20:00	79.4	0	0	Valid
			6/26, 21:00	75.9	0	0	
			6/26, 22:00	75.3	0	0	
			6/26, 23:00	74.5	0	0.5	
			6/27, 00:00	73.7	0	0	
			6/27, 01:00	73.1	0	1.8	
			6/27, 02:00	72.9	0	0.5	
			6/27, 03:00	71.5	0	0	
			6/27, 04:00	72.6	0	3.5	
			6/27, 05:00	72.7	0	3.5	
			6/27, 06:00	72.6	0	4.1	
			6/27, 07:00	71.8	0	3.7	
6/28/2022	20:43	6:13	6/27, 20:00	72.6	0.42	0.6	Valid; rainfall stops within first hour
			6/27, 21:00	71.7	0	1.8	
			6/27, 22:00	70.8	0	0	
			6/27, 23:00	70.3	0	0	
			6/28, 00:00	70.7	0	0.9	
			6/28, 01:00	71	0	2	
			6/28, 02:00	70.6	0	3.4	
			6/28, 03:00	68.7	0	5.6	
			6/28, 04:00	67.2	0	4.9	
			6/28, 05:00	66.9	0	4.2	
			6/28, 06:00	67.1	0	5.2	
			6/28, 07:00	67.9	0	6	
6/29/2022	20:43	6:14	6/28, 20:00	76.5	0	0	Valid; rainfall occurred after first 5 hours
			6/28, 21:00	74	0	0	
			6/28, 22:00	72.9	0	0.5	
			6/28, 23:00	73.4	0	3	
			6/29, 00:00	73.2	0	1.8	
			6/29, 01:00	72.3	0	0	
			6/29, 02:00	68.1	0.05	0	
			6/29, 03:00	66.8	0	0	
			6/29, 04:00	66.8	0	0	
			6/29, 05:00	66.8	0	0	
			6/29, 06:00	66.8	0	0	
			6/29, 07:00	69.2	0	0	

Survey Night	Sunset	Sunrise	Date and Time	Temperature (F)	Precipitation (inches)	Wind Speed (mph)	Comment
6/30/2022	20:43	6:14	6/29, 20:00	80.5	0	2.2	Valid
			6/29, 21:00	78.1	0	2.2	
			6/29, 22:00	75.3	0	2.6	
			6/29, 23:00	73.6	0	0	
			6/30, 00:00	72.8	0	0	
			6/30, 01:00	70.5	0	0	
			6/30, 02:00	69.2	0	0	
			6/30, 03:00	68.2	0	0	
			6/30, 04:00	67.9	0	0	
			6/30, 05:00	67.1	0	0	
			6/30, 06:00	66.4	0	0	
			6/30, 07:00	67	0	0	