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MISSOURI PUBLIC SERVICE COMMISSION

FILE NO. EA-2018-0202

WRITTEN REBUTTAL TESTIMONY

OF

DR. KATHRYN WOMACK

ON

BEHALF OF

MISSOURI DEPARTMENT OF CONSERVATION

*****DENOTES HIGHLY CONFIDENTIAL INFORMATION*****

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REBUTTAL TESTIMONY OF KATHRYN WOMACK

MISSOURI DEPARTMENT OF CONSERVATION

CASE NO. EA-2018-0202

I. INTRODUCTION

Q. Please state your name, title, and business address.

A. Kathryn Womack, Ph.D., Resource Scientist, Missouri Department of Conservation's Agricultural Systems Field Station, 3500 S. Baltimore Street, Kirksville, MO 63501.

Q. What are your qualifications and experience?

A. I have a Ph.D. in Natural Resources from the University of Missouri where my dissertation focused on multi-scale factors that affected bat and insect abundance in savannas, woodlands, and forests throughout the Ozark Highlands of Missouri. My Master's thesis focused on the foraging and roosting ecology of female Indiana bats during the maternity season in northeast Missouri. I have worked in bat ecology for over 10 years and have been with the Missouri Department of Conservation ("Department" or "MDC") since June 2017 as a Resource Scientist. My specific job duties include being the Missouri's bat biologist and white-nose syndrome ("WNS") response lead.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to respond to Ameren Missouri's witness, Ajay Arora, and his testimony that describes "conservation of endangered species" as of one the five main risks associated with the High Prairie Wind Project

(the "Project"), and further describes how Ameren has mitigated this risk. (Arora Direct17: 4-13, 23: 11-22). I am familiar with the Project site and have reviewed Ameren's testimony and responses to MDC data requests. Before I describe my concerns with the Project, Ameren's proposed mitigation of risk for the Project, and my recommendations, I would like to provide some background information with respect to bats in Missouri generally, and then specifically in relation to the Project.

Q. Will you be providing recommendations as part of your testimony?

A. As I will describe later, I believe that the Project poses significant risks to Missouri's bat resources, most notably to the endangered Indiana bat. If constructed, these risks should be mitigated through operational measures, and robust post-construction monitoring and reporting should be required to determine the scope of the impact to Missouri's bat resources and the Department's investment in those resources. My recommendations are further described on pages 38-42.

II. BACKGROUND ON BATS IN MISSOURI

Q. What bat species occur in Missouri?

A. Historically, 14 bat species are known to occur in Missouri (Table 1).

Table 1. Missouri's bat species.

Common Name	**Scientific Name**
Indiana bat	*Myotis sodalis*
Northern long-eared bat	*Myotis septentrionalis*

Gray bat	*Myotis grisescens*
Little brown bat	*Myotis lucifugus*
Eastern small-footed bat	*Myotis leibii*
Southeastern myotis	*Myotis austroriparius*
Big brown bat	*Eptesicus fuscus*
Evening bat	*Nycticeius humeralis*
Eastern red bat	*Lasiurus borealis*
Tri-colored bat	*Perimyotis subflavus*
Hoary bat	*Lasiurus cinereus*
Silver-haired bat	*Lasionycteris noctivagans*
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*
Ozark big-eared bat*	*Corynorhinus townsendii ingens*

* This federally endangered sub-species is presumed extirpated from Missouri.[1] Presumed extirpation in this use means that a species has not been located despite intensive search efforts of historic sites and other appropriate habitat, and virtually no likelihood that the species will be rediscovered in Missouri.

Q. Are there any bat species that are federally listed as threatened or endangered in Missouri?

A. There are three federally listed species found in Missouri. The Indiana bat and gray bat are federally endangered; the Indiana bat was listed in 1967 and the gray bat was listed in 1976. Both species were listed due to human disturbance during hibernation. The northern long-eared bat was listed as federally threatened under the 4D rule in April 2015 due to population declines related to white-nose

[1] Missouri Department of Conservation. Missouri species and communities of conservation concern checklist 2018. Jefferson City, MO. January 2018.

syndrome.[2] An additional bat species, the tri-colored bat (formerly known as the eastern pipistrelle bat) was petitioned to be listed and is under a 12-month Species Status Assessment ("SSA")[3] by the United States Fish and Wildlife Service ("Service" or "USFWS") after an affirmative 90-Day Finding.[4] The tri-colored bat has been proposed to be federally protected due to population declines related to WNS. A population crash in Missouri has resulted in listing it as a Missouri species of conservation concern ("SOCC"). See Table 2.

In addition to the listing of species as endangered or threatened under federal law, the Missouri Department of Conservation (Department) has a list of species of conservation concern (SOCCs).

[2] The 4(d) Rule is one of many tools found within the Endangered Species Act ("ESA") and is found in Section4(d) of the act. Typically, the Service uses the 4(d) rule to issue regulations to incentivize positive conservation practices and to help streamline the regulatory process for minor impacts to threatened species under the ESA. This rule also describes what forms of take are or are not prohibited by the Service to protect listed species.

[3] A SSA is a thorough review of literature and often a request for updated data from state and federal agencies, universities, and other parties that may have relevant information regarding the species and potential threats to the species to determine whether the species warrants listing.

[4] A 90-Day Finding is the result of a quick review of a petition to the Service that determines if the petition presents substantial scientific or commercial information indicating that the petition action may be warranted.

Species	2012/2013	2014/2015	2016/2017	% change 2012 - 2017
Big brown bat	1,539	1,567	1,292	-16%
Eastern small-footed bat	2	0	0	-
Evening bat	0	0	1	-
Gray bat	67,053	50,565	60,239	-10.2%
Indiana bat	138,554	184,953	215,107	55.3
Little brown bat	5,624	9,478	748	-86.7%
Northern long-eared bat	4,591	2,281	2	-99.9%
Silver-haired bat	0	0	1	-
Tri-colored bat	24,105	24,318	11,147	-53.8%
Unknown bat	1,011	1,996	97	-
Totals	**242,479**	**275,158**	**288,634**	

Table 2. Population counts between 2012/2013 and 2016/2017 at 183 Missouri hibernacula for all documented bat species post-discovery of WNS in Missouri.[5]

When a species becomes a SOCC, it means that all records in Missouri are tracked in the Natural Heritage Database ("NHD") mainly through our Wildlife Collector Permit process but also Missourians can submit new records for species on the MDC website. Species are listed as SOCCs for a variety of reasons, from population declines to rare occurrences. With respect to bats, Missouri's SOCCs include these federally listed species as well as five additional bat species: tri-colored bat, little brown bat, silver-haired bat, southeastern myotis, and eastern small-footed bat. The tri-colored and little brown bat were listed as SOCCs due to population declines from WNS. See Table 2. The hoary bat is not currently listed as a state SOCC but will be listed in 2019 due to recent population count projects and the increased interest in wind energy within Missouri.[6] Hoary bats are also on the Service's radar for potential listing as one study has estimated up to a 90 percent

[5] Colatskie, S. (2017). Missouri Bat Hibernacula Survey Results from 2011-2017, Following White-nose Syndrome Arrival. *Missouri Department of Conservation, Technical Brief*.
[6] Frick, W. F., Baerwald, E. F., Pollock, J. F., Barclay, R. M. R., Szymanski, J. A., Weller, T. J., ... & McGuire, L. P. (2017). Fatalities at wind turbines may threaten population viability of a migratory bat. *Biological Conservation*, *209*, 172-177.

decline in hoary bat populations in the next 50 years due to wind turbine strikes.[7] Hoary bats are the primary species killed by turbine collisions mainly in late summer through fall migration. [8,9]

Q. Please describe relevant bat characteristics, especially for protected bats potentially impacted by the Project.

A. All bats have some common characteristics. Bats are slow reproducing (one to four pups per year depending on the species) and are long-lived (up to 20 years or more). All Missouri bat species mate in the fall and start gestation in early spring (approximately a 60-day gestation period). Female bats have offspring in late May through early June, depending on the weather. Missouri bats use two general life history strategies to survive winter: (1) hibernation (cave bats) or (2) migration (tree bats). Cave bats include the Indiana bat, northern long-eared bat, gray bat, tri-colored bat, little brown bat, big brown bat, small-footed bat, southeastern Myotis, Ozark big-eared bat, and Rafinesque big-eared bat. Tree bats include the eastern red bat, silver-haired bat, and hoary bat. Both life history strategies require migration in the spring and fall between summer (maternity grounds) and winter habitats. Migratory distances range from 50 to 1,000 miles depending on the species. Tree bats are thought to migrate longer distances than cave bats.

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[7] Frick *et al.* (2017), *supra* n. 6.
[8] Kunz, T. H., Arnett, E. B., Erickson, W. P., Hoar, A. R., Johnson, G. D., Larkin, R. P., ... & Tuttle, M. D. (2007). Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. *Frontiers in Ecology and the Environment*, *5*(6), 315-324.
[9] Arnett, E. B., Brown, W. K., Erickson, W. P., Fiedler, J. K., Hamilton, B. L., Henry, T. H., ... & Nicholson, C. P. (2008). Patterns of bat fatalities at wind energy facilities in North America. *The Journal of Wildlife Management*, *72*(1), 61-78.

Indiana Bat

The Indiana bat (*Myotis sodalis*) is a federally-endangered hibernating bat species found throughout much of the eastern United States. The range-wide population has decreased by 20 percent in the last ten years from 636,846 to 530,705.[10] This decline is directly and indirectly linked to WNS. See Figure 1. However, the Missouri Indiana bat population is estimated at 217,884 individuals in 2017 and shows a 0.9 percent increase.[11] Missouri's population estimates make up 41.1 percent of the entire population. See Figure 2. Almost 198,000 of Missouri's Indiana bats hibernate in a mine at Sodalis Nature Preserve ("SNP") in Hannibal, Missouri.[12]

[10] United States Fish and Wildlife Service (USFWS) .2017. 2017 Indiana bat (*Myotis sodalis*) population status update. Compiled by Andy King. Indiana Ecological Services Field Office, Bloomington, IN. 9 pgs. https://www.fws.gov/midwest/Endangered/mammals/inba/pdf/2017IBatPopEstimate5July2017.pdf

[11] Arnett *et al.* (2008), *supra* n. 9.

[12] Colatskie (2017), *supra* n. 5.

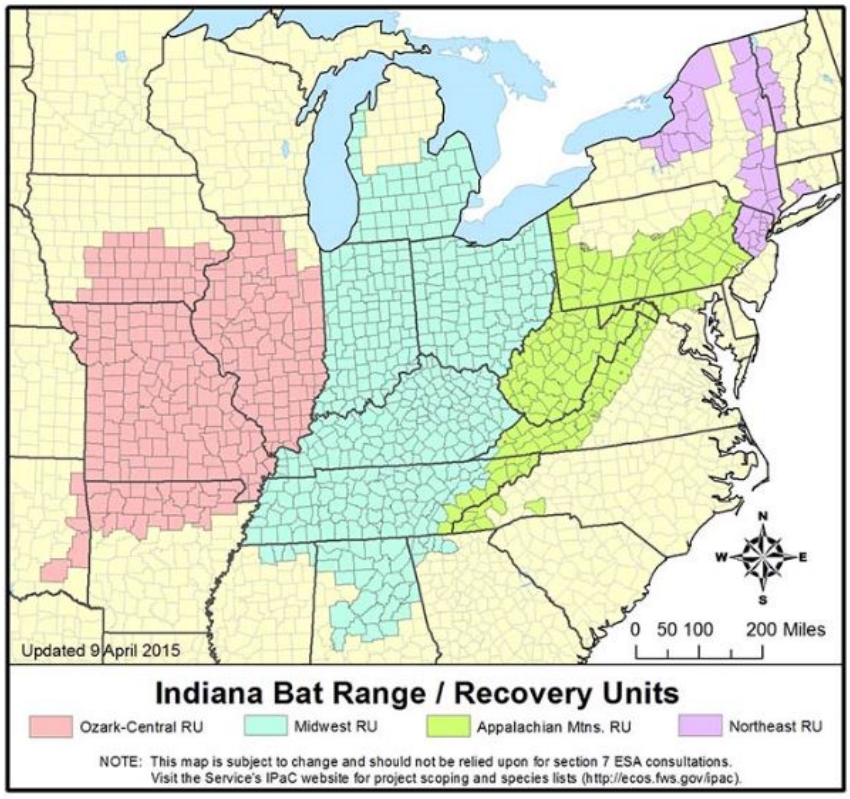

Figure 1. Indiana bat range and USFWS recovery units. [13]

[13] United States Fish and Wildlife Service (USFWS) 2018. Indiana bat range map. U.S. Fish and Wildlife Services Endangered Species, available at https://www.fws.gov/midwest/endangered/mammals/inba/RangeMapINBA.html.

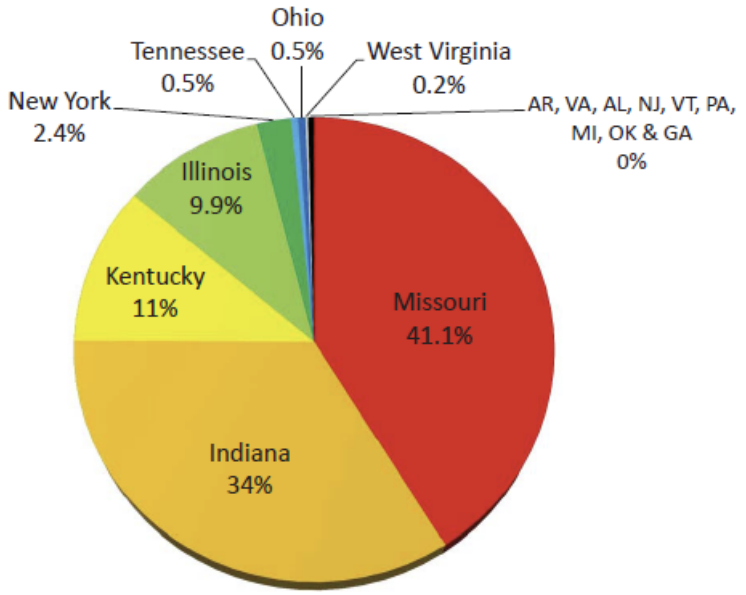

Figure 2. Percentage of the 2017 range-wide Indiana bat population estimated during hibernation (approximately 530,705 bats) within each state.[14]

Wing band recovery studies reveal that Indiana bat females migrate up to 290 miles from hibernation sites to maternity sites. Maternity sites for Indiana bat females are called roost trees. Females have 1 pup per year in late May or early June. Maternity colonies are generally comprised of multiple roost trees and can average 50-80 individuals.[15] The Department has records of 100 or more female Indiana bats exiting a single maternity roost tree in northeastern Missouri.[16] Female Indiana bats show high site fidelity to the same maternity sites and sometimes even the same roost trees, year after year. The northeastern part of Missouri is the core

[14] USFWS 2017), *supra* n. 10.
[15] Whitaker Jr, J. O., Brack Jr, V., & Cope, J. B. 2002. Are bats in Indiana declining?. In *Proceedings of the Indiana Academy of Science*. 111(1): 95-106.
[16] Missouri Department of Conservation (MDC). Unpublished data. Indiana bat maternity roost emergence data in northeast Missouri.

maternity habitat in Missouri and falls within the "high-likelihood" zone for Indiana bats.[17] See Figures 3 and 4. Indiana bat location data from the NHD with important summer (maternity) and winter (hibernaculum).

Indiana bats feed on flying insects. They tend to forage among and adjacent to tree canopies and in forest corridors. Indiana bats usually forage in riparian and floodplain forest, but also may use upland forest, forest edges, old fields, and openings over ponds. Indiana bat home range sizes vary depending on the method used to calculate home range size, geographic location, and habitat within and surrounding study locations. A study in northern Missouri found that on average pregnant Indiana bats had a 50 percent core home range size of approximately 417 acres and 600 acres on average for lactating bats.[18] Other home range studies using a variety of methods to calculate home range size found mean home range to be 205 acres in Vermont,[19] 398 acres in Illinois,[20] and 524 acres in Ohio.[21] In Missouri the average maximum distance females traveled nightly from roost trees to forage was 2.3 miles for pregnant individuals and 3 miles for lactating bats.[22]

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[17] Missouri Department of Conservation (MDC). 2016. Guidelines for Avoiding and Minimizing Impacts to
Federally-Listed Bats on Missouri Department of Conservation Lands. Jefferson City, MO.
[18] Womack, K. M., S. K. Amelon, and F. R. Thompson III. 2013.Summer home range size of female Indiana bats (*Myotis sodalis*) in Missouri, USA. *Acta Chiropterologica* 152:423–429.
[19] Watrous, K. S., Donovan, T. M., Mickey, R. M., Darling, S. R., Hicks, A. C., & Von Oettingen, S. L. (2006). Predicting minimum habitat characteristics for the Indiana bat in the Champlain Valley. *The Journal of Wildlife Management*, *70*(5), 1228-1237.
[20] Menzel, J.M., Ford, W.M., Menzel, M.A., Carter, T.C., Gardner, J.E., Garner, J.D., Hofmann, J.E., 2005. Summer habitat use and home-range analysis of the endangered Indiana bat. *Journal of Wildlife Management*. 69, 430–436.
[21] Kniowski, A.B., and S.D. Gehrt. 2014. Home range and habitat selection of the Indiana bat in an agricultural landscape. *Journal of Wildlife Management* 78: 503-512.
[22] Womack *et al.* (2013), *supra* n. 18.

Indiana bats can be found flying in a wide range of habitats during summer but wooded lots are necessary for roost locations. During the active season (March 15 – October 31), Indiana bats roost primarily under the loose bark of living or dead trees with a diameter-at-breast-height (DBH) over 9 inches with high solar exposure. Male Indiana bats may roost singly or in small groups during summer; some males may be found with females in maternity colony areas although others remain near their hibernation caves.

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[23] Missouri Department of Conservation (MDC). 2016. Guidelines for avoiding and minimizing impacts to federally-listed bats on Missouri Department of Conservation lands. Jefferson City, MO.

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Northern Long-Eared Bat

Another protected bat species that could be impacted by the Project is the northern long-eared bat. The northern long-eared bat was once found across much of North America. See Figure 5. The species hibernates in underground sites throughout the winter and uses a variety of wooded habitats during the summer maternity season. Northern long-eared bats were listed as threatened under the Endangered Species Act on April 2, 2015.[24] Prior to its listing, the northern long-eared bat had been considered relatively common throughout much of its North American range. As such there are no known maternity trees within the Project area, although maternity activity (reproductive females) were captured within the Project site in 2011.[25] ***

[26]*** While other negative influences on the population (i.e., habitat destruction and modification, overutilization, regulatory inadequacy, and collisions with wind turbines) have varying levels of local impacts, the leading reason for Federal listing is population declines due to WNS. Hibernacula counts indicate declines of 98–99 percent for northern long-eared bat across eight states in the

[24] United States Fish and Wildlife Service (USFWS). 2015. Endangered and threatened wildlife and plants; Threatened species status for the northern long-eared bat with 4(d) rule. Final Rule and Interim Rule. 50 CFR Part 17. 80(63). 61 ps.2 April 2015.
[25] Robbins, L.W., B.T. Hale, S. Romeling and J.R. Lemen. 2012. Evaluation of Myotis activity: Capture, telemetry, and acoustic analysis of potential interactions at a wind energy facility. Prepared by Missouri State University for Normandeau Associates. March 7, 2012.
[26]***

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northeastern United States.[27] MDC has documented over a 99.9 percent reduction of this species in Missouri at repeatedly visited sites since winter 2012/2013. See Table 2.

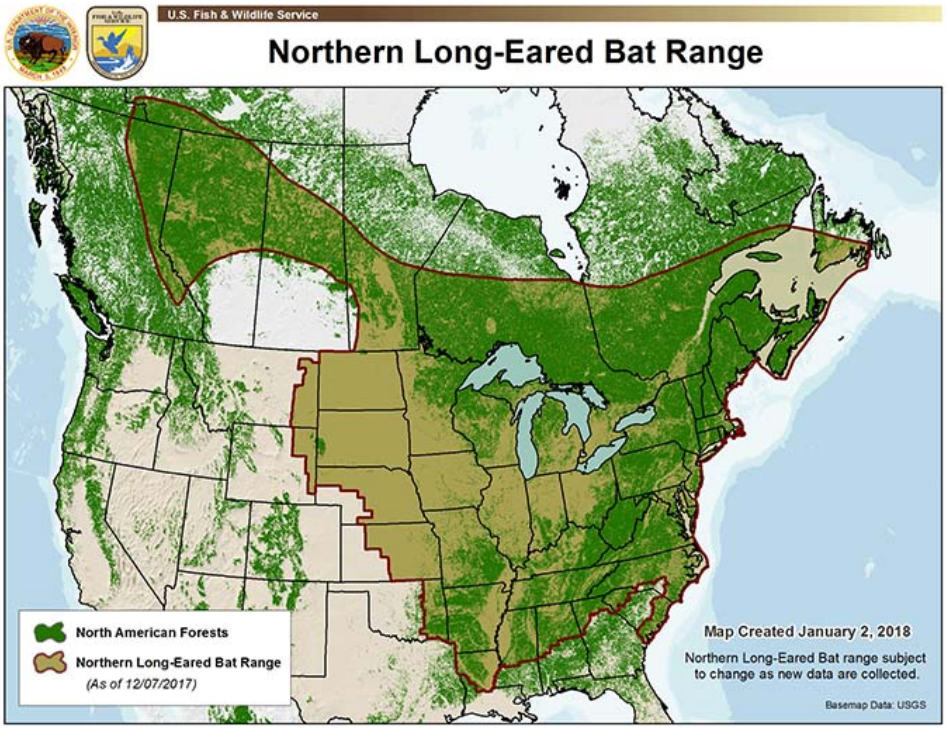

Figure 5. Northern long-eared bat range map from U.S. Fish and Wildlife Service.[28]

[27] Turner G.G., Reeder D.M., Coleman J.T.H.2011.A five-year assessment of mortality and geographic spread of white-nose syndrome in North American bats and a look to the future. Bat Research News 52(3):13–27.

[28] U.S. Fish and Wildlife Service (USFWS). 2018. Northern long-eared bat range map. U.S. Fish and Wildlife Services Endangered Species. https://www.fws.gov/midwest/endangered/mammals/nleb/nlebrangemap.html

During winter, northern long-eared bats hibernate in caves and mines. Nearly 300 northern long-eared bat hibernacula are documented across Missouri, primarily in the eastern and central Ozarks. See Figure 6. Hibernating individuals have been found in Missouri as far southwest as McDonald County and as far northeast as Marion County at SNP.[29]

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[29] Missouri Department of Conservation (MDC). 2016. Guidelines for avoiding and minimizing impacts to federally-listed bats on Missouri Department of Conservation lands. Jefferson City, MO.

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The northern long-eared bat is presumed to occur throughout most of Missouri during the active season (i.e., non-hibernation period) and has been found to roost in cracks and crevices of rock bluffs, under loose bark of trees, or in man-made structures. Mist-net captures of this species have been reported from counties at or near all four corners of the state (Newton, Nodaway, Clark, and Cape Girardeau counties). However, due to WNS Missouri's population has decreased by 99.9 percent in 183 hibernacula that were surveyed biennially since winter 2012/2013. See Table 2. Compared to Indiana bats, maternity colonies of northern long-eared bats are generally smaller (30 to 50 individuals), and they often use smaller diameter trees. The structure of the roost tree and its immediate surroundings appears to be more important in roost site selection than tree species. Northern long-eared bat roost trees may occur in the forest understory and are often located on side slopes or ridge tops. Northern long-eared bats also show high maternity site fidelity and return to the same location annually although different trees may be used as roosts each year.[30,31]

Q. Are there any additional threats to that Missouri's bat species are facing?

A. Yes, one of the most significant threats facing Missouri's cave bat species is white-nose syndrome ("WNS"). The disease has been documented in

[30] Sasse, D. B. and P. J. Perkins. 1996. Summer roosting ecology of northern long-eared bats (Myotis septentrionalis) in the White Mountain National Forest, p. 91-101. In: Barclay, R. M. R. and R. M. Brigham (eds.). Bats and forests. Ministry of Forests, Victoria, British Columbia.
[31] Timpone, J. C., Boyles, J. G., Murray, K. L., Aubrey, D. P., & Robbins, L. W. (2010). Overlap in roosting habits of Indiana bats (Myotis sodalis) and northern bats (Myotis septentrionalis). *The American Midland Naturalist*, *163*(1), 115-123.

northern long-eared bats, Indiana bats, tri-colored bats, little brown bats, and big brown bats could be impacted by the Project as described below. White-nose syndrome is caused by a white fungus, *Pseudogymnoascus destructans*, that infects the skin of hibernating bats. The disease can be devastating to bat populations and there is no known cure. Once it appears in a cave, WNS can kill 90-100 percent of bat species.[32] WNS was first documented in New York in 2006 and is now affecting bats in 33 U.S. states and 7 Canadian providences. See Figure 7.

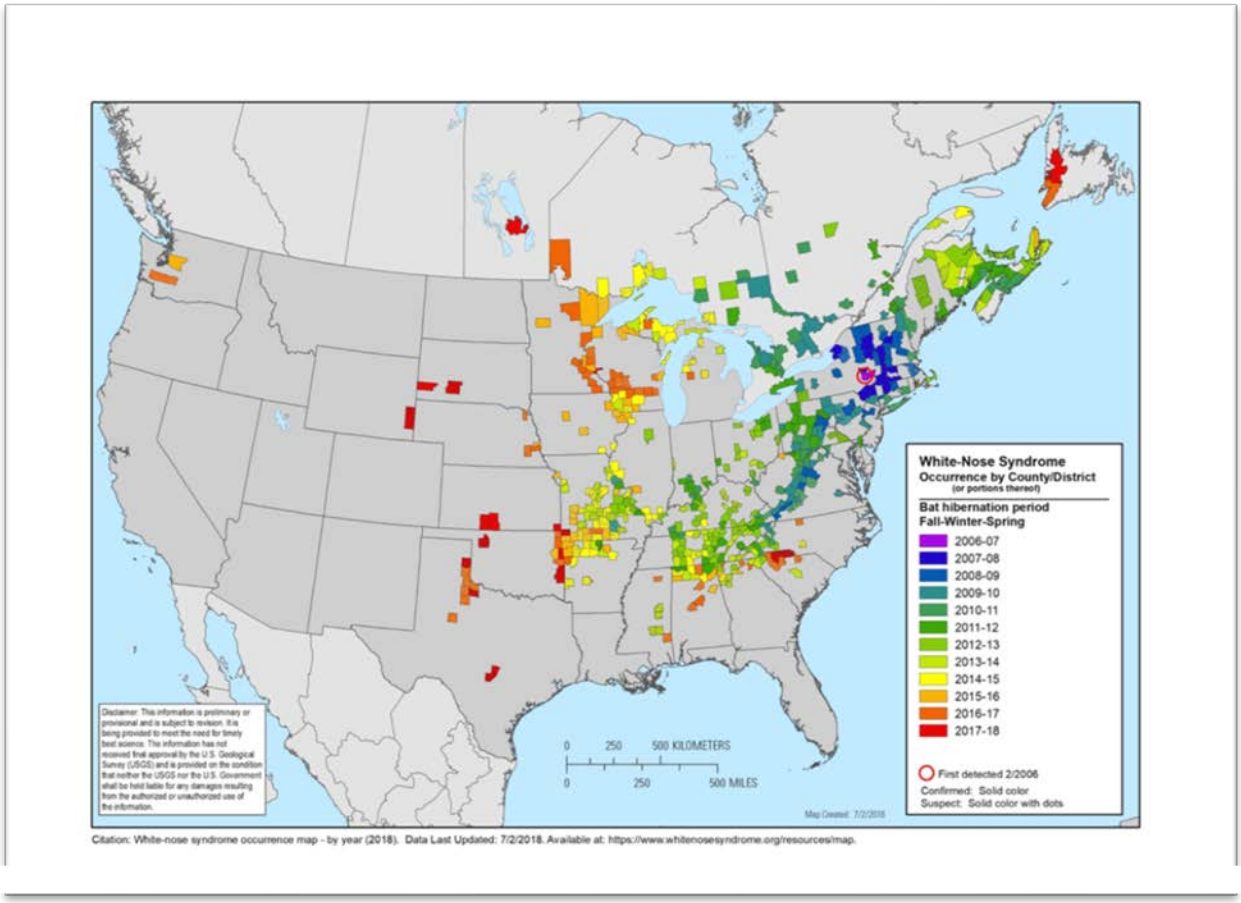

Figure 7. White-nose syndrome spread map created by the U.S. Fish and Wildlife Service.[33]

[32] Frick, W. F., Pollock, J. F., Hicks, A. C., Langwig, K. E., Reynolds, D. S., Turner, G. G., ... & Kunz, T. H. (2010). An emerging disease causes regional population collapse of a common North American bat species. *Science*, *329*(5992), 679-682.

[33] U.S. Fish and Wildlife Service (USFWS). 2018. White-nose syndrome spread map. U.S. Fish and Wildlife Service's *White-nose syndrome response team*. www.whitenosesyndrome.org.

The presence of *Pseudogymnoascus destructans* (*Pd*) was documented in Missouri in April 2010, and the first WNS positive bat was found in March of 2012. *Pd* is the fungus associated with the WNS disease. MDC has coordinated and led WNS and *Pd* surveillance efforts along with partners from other state and federal agencies, non-profit partners, and private citizens to document the arrival and spread of WNS in Missouri. Although there is little pre-WNS data for the majority of Missouri bat hibernacula, 183 hibernacula were surveyed during winters 2012/2013, 2014/2015, and 2016/2017. See Table 2. Northern long-eared bats, little brown bats, and tri-colored bats have seen the steepest decline in hibernacula population estimates similar to the declines seen in other states. See Table 2. The numbers for Indiana bats increased during this time likely due to additional locations within SNP being mapped and surveyed so these numbers do not necessarily reflect an actual change in population size. SNP is the largest Indiana bat hibernacula in the world. SNP is also a hibernaculum for the gray bat, northern long-eared bat, tri-colored bat, and little brown bat. All other major Indiana bat hibernacula sites in Missouri have seen a decline in numbers since the winter of 2012/2013 (Table 3), further highlighting the importance of SNP for Indiana bats.

As described above, reproductive rates are generally low for bats. Consequently, protecting critical summer maternity habitat resources and sites is one of primary mitigation strategies for addressing WNS, in hopes that any resistant individuals will reside and breed.

Year	Onyx - Crawford	Bear - Crawford	Copper Hollow Sinkhole - Franklin	Brooks - Pulaski	Great Spirit - Pulaski	Ryden - Pulaski	Bat Cave - Shannon	Martin - Shannon	Great Scott - Washington	Pilot Knob Mine - Iron	Scotia Hollow - Washington	Totals
1979	11,100	3,250	8,850	19,375	549	10,550	42,821	8,100	68,700	139,000	2,750	**176,045**
1981	5,325	1,750	5,200	11,850	1,792	5,800	32,800	2,425	72,350	125,130	3,100	**142,392**
1983	3,267	1,100	3,150	11,150	1,171	4,950	30,750	5,350	85,700	111,262	4,550	**151,138**
1985	2,250	650	1,050	5,500	500	2,000	30,450	3,550	77,950	97,391	3,400	**127,300**
1987	2,050	525	600	4,900	40	700	4,150	4,900	60,650	83,521	5,300	**83,815**
1989	1,575	400	250	5,200	35	1,359	4,275	2,600	38,875	69,652	5,150	**59,719**
1991	1,275	300	160	2,700	8	160	4,275	2,975	32,125	55,782	6,225	**50,203**
1993	700	225	125	1,550	625	80	6,175	2,250	22,750	41,912	4,550	**39,030**
1995	325	190	140	750	450	40	941	2,125	14,850	28,042	3,600	**23,411**
1997	260	95	175	600	195	14	450	1,500	11,875	14,173	1,615	**16,779**
1999	155	80	155	400	175	14	6,175	1,000	9,100	303	2,375	**19,629**
2001	265	105	185	235	285	10	89	2,460	8,250	647	450	**12,334**
2003	210	90	250	130	160	13	1,020	2,100	8,875	991	290	**13,138**
2005	180	100	250	70	40	10	0	1,300	6,450	1,334	150	**8,550**
2007	180	110	380	65	60	3	16	950	5,100	1,678	90	**6,954**
2009	118	106	323	21	1	2	2	913	4,674		41	**6,201**
2011	90	120	457	50	0	3	327	781	3,936		30	**5,794**
2013	113	125	706	41	120*	2	136	1,268	3,556		21	**5,968**
2015	58	9	354	0	63	0	703	2,986	2,824		15	**7,012**
2017	40	0	161	0	15	0	297	1,684	2,483		11	**4,691**

Table 3. Indiana bat population estimates in 11 major Missouri hibernacula from 1979-2017. The Sodalis Nature Preserve (SNP) is a large limestone mine complex in Hannibal, Missouri. SNP is a Priority 1 Indiana Bat hibernaculum with a 2017 survey yielding an estimated 198,000 +/- individuals. This table was adapted from Elliott and Clawson 2007.

Q. Before discussing impacts to bats from wind turbines and the Project, please describe what economic benefits bats convey to Missouri citizens?

A. Several studies have quantified ecosystem services of bat species found in Missouri. Ecosystem services are the economic valuation of the benefits obtained from the environment that increase overall human well-being. As insectivores, Missouri bats are the primary predators to night time insects which include both agriculture and forest pest species. One study asserts that bats are likely one of the most economically important non-domesticated animals in North America.[34] This study modeled the economic importance of bat species in the United States and estimated the value of bats to the agriculture industry to be on average approximately $22.9 billion per year.[35] Two studies have estimated that female little brown bats consume over 100 percent of their body weight in insects each night during lactation, and 50 percent of their body weight during the rest of the active season.[36,37] Indiana and northern long eared bats are related to little brown bats, and likely consume a similar number of insects.

Q. Please describe the Department's investment of state funds in Bats.

[34] Boyles, J. G., Cryan, P. M., McCracken, G. F., & Kunz, T. H. 2011. Economic importance of bats in agriculture. *Science*, *332*(6025), 41-42.
[35] Boyles *et al*., *supra* n. 33.
[36] Kurta, A., Bell, G. P., Nagy, K. A., & Kunz, T. H. 1989. Energetics of pregnancy and lactation in freeranging little brown bats (Myotis lucifugus). *Physiological Zoology*, *62*(3), 804-818.
[37] Anthony, E. L., & Kunz, T. H. 1977. Feeding strategies of the little brown bat, Myotis lucifugus, in southern New Hampshire. *Ecology*, *58*(4), 775-786.

A. The Department's investment in bats has been significant. Over the last ten (10) years, the Department has spent almost $1 million on several direct management efforts related to bats. This figure includes but is not limited to: $136,761 to install cave gates (protection devices) and evaluate caves on public land; $220,935 to inventory cave wildlife and plants; $235,929 on estimating occupancy of bats in northern Missouri where wind development was anticipated; and $26,596 estimating occupancy (species presence) and activity of bat communications at different elevations above the ground surface. Since 2007, the Department has spent $187,183 on bat research that included winter ecology, the effects of fire, maternity habitat range and forest management efforts.

Through Memorandums of Understanding, the Department has also spent $116,446 protecting specific bat habitats with partners like The Nature Conservancy and the Missouri Conservation Heritage Foundation. Subject to the Conservation Commission approval through the annual budget process, the Department plans to conduct the following projects now and into the future:

1. From Fiscal Year 2018-2021, the Department anticipates spending $2.7 million on development of a Habitat Conservation Plan for the Department's land management activities in bat habitats. This includes the surveys in northern Missouri to support this effort.
2. The Department also will be implementing the Habitat Conservation Plan (HCP) within that time. Because the Department's HCP is still in development, the cost estimate associated with implementation is not yet

available. According to the Department's HCP consultant, the implementation costs for similarly sized and focused HCPs is anticipated to be approximately $350,000 the first year and $10 million over the 30-year life of the HCP.

3. From Fiscal Years 2018 through 2026, the Department anticipates spending almost $3 million for bat research on summer habitat and physiological responses and population monitoring throughout the state.

III. HIGH PRAIRIE PROJECT CONCERNS AND RECOMMENDATIONS

Q. Please explain how bats can be adversely impacted by wind turbines.

A. Studies have estimated that hundreds of thousands of bats are killed in the United States annually by wind turbine collisions.[38,39] Most of these species are migratory tree bats which are not federally listed and, in most cases, not protected by states in which they occur. The primary way bats are killed is by direct impact from turbine blades or by barotrauma when they fly close to blades [40,41] Barotrauma is an injury caused by low pressure air pockets created by the rotating turbine blades that causes a decompression of the bats internal organs, a change in air pressure typically it involves the ear or lungs. There have been several

[38] Arnett, E. B., & Baerwald, E. F. 2013. Impacts of wind energy development on bats: implications for conservation. In *Bat evolution, ecology, and conservation* (pp. 435-456). Springer, New York, NY.
[39] Smallwood, K. S. 2013. Comparing bird and bat fatality-rate estimates among North American wind-energy projects. *Wildlife Society Bulletin*, *37*(1), 19-33.
[40] Baerwald, E. F., D'Amours, G. H., Klug, B. J., & Barclay, R. M. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. *Current biology*, *18*(16), R695-R696.
[41] Grodsky, S. M., Behr, M. J., Gendler, A., Drake, D., Dieterle, B. D., Rudd, R. J., & Walrath, N. L. 2011. Investigating the causes of death for wind turbine-associated bat fatalities. *Journal of Mammalogy*, *92*(5), 917-925.

hypotheses as to why bat fatalities are so high near turbines.[42] One likely hypothesis is that bats are attracted to turbines as they resemble a potential tree roost.[43] Another is that insect abundances are higher around turbines which attracts feeding bats.[44] Several videos document this behavior and provide evidence of attraction and foraging activity.[45,46,47]

Q. Are there specific conditions that make wind turbines more lethal to bats?

A. The periods of greatest risks to bats occur during relatively low wind conditions when there is no inclement weather (e.g., periods of rain) and temperatures are greater than 50ºF.[48] Most bat fatalities occur in late summer and fall when bats are mating and migrating to winter grounds.[49] However, fatality rates vary temporally and annually based on environmental conditions, between turbines, and between wind facilities. A study synthesized mortalities from turbine collisions throughout the United States and found that the risk of bat mortality was

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[42] Kunz, T. H., Arnett, E. B., Erickson, W. P., Hoar, A. R., Johnson, G. D., Larkin, R. P., ... & Tuttle, M. D. 2007. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. *Frontiers in Ecology and the Environment*, *5*(6), 315-324.
[43] Cryan, P. M. 2008. Mating behavior as a possible cause of bat fatalities at wind turbines. *The Journal of Wildlife Management*, *72*(3), 845-849.
[44] Rydell, J., Bach, L., Dubourg-Savage, M. J., Green, M., Rodrigues, L., and Hedenström, A. 2010. Mortality of bats at wind turbines links to nocturnal insect migration?. *European Journal of Wildlife Research*, *56*(6), 823-827.
[45] Horn, J. W., Arnett, E. B., and Kunz, T. H. 2008. Behavioral responses of bats to operating wind turbines. *The Journal of wildlife management*, *72*(1), 123-132.
[46] Cryan, P. M., Gorresen, P. M., Hein, C. D., Schirmacher, M. R., Diehl, R. H., Huso, M. M., Hayman D.T., Fricker P.D., Bonaccorso F.J., Johnson D.H., and Heist K. 2014. Behavior of bats at wind turbines. *Proceedings of the National Academy of Sciences*, *111*(42), 15126-15131.
[47] Foo, C. F., Bennett, V. J., Hale, A. M., Korstian, J. M., Schildt, A. J., & Williams, D. A. 2017. Increasing evidence that bats actively forage at wind turbines. *PeerJ*, *5*, e3985.
[48] Weller, T. J., & Baldwin, J. A. 2012. Using echolocation monitoring to model bat occupancy and inform mitigations at wind energy facilities. *The Journal of Wildlife Management*, *76*(3), 619-631.
[49] Arnett *et al.* (2013) *supra* n. 37 and Baerwald *et al*. (2008) *supra* n. 39.

related to the proportion of grassland within 500 meters of turbines.[50] Mortality rates decreased at sites with more grasslands habitat surrounding the turbine (and other open habitat types.[51] This decrease is likely because all bat species except gray bats roost in trees during summer, and their foraging habitat is associated with forests or openings over water sources.

Q. Are there bat species that are more likely to be killed by wind turbines?

A. Yes, according to a chapter describing the impacts of wind energy on bats in *Bat Evolution, Ecology, and Conservation* nearly 80 percent of fatalities are migratory tree bats.[52] The wind facilities in this paper had fatality rates of 38 percent hoary bats, 22 percent eastern red bats, and 19 percent silver-haired bats (tree bats), and 6 percent fatality rates for little brown bats and tri-colored bats (cave bats). However, some facilities in the eastern U.S. had 25 percent tri-colored bat fatalities, highlighting that species mortality rates vary between facilities and depend on the bat species and populations present or moving through the area during migration.[53] See Table 4. While tree bats are the hardest hit, there have not been any studies showing the impacts of wind turbines on Indiana bat maternity colonies. Due to the high numbers of known maternity colonies (up to 15 colonies possible with an upper estimate of 1,200 female Indiana bats assuming 80 females

[50] Thompson, M., Beston, J. A., Etterson, M., Diffendorfer, J. E., & Loss, S. R. (2017). Factors associated with bat mortality at wind energy facilities in the United States. *Biological Conservation*, *215*, 241-245.
[51] *Id.*
[52] Arnett and Baerwald (2013) *supra* n.37.
[53] *Id.*

per colony) within the Project area, the potential to impact Indiana bat is high. We are not aware of any operating wind facilities that contain known Indiana bat maternity colonies. Generally, bat mortality peaks late summer and during the fall when these bats are moving across the landscape and mating.[54]

Scientific name	Common name	% of total fatalities	Lower range	Upper range
Eptesicus fuscus	Big brown bat	4	26,004	52,255
Lasiurus blossevillii	Western red bat	<0.01	69	143
Lasiurus borealis	Eastern red bat	22	143,023	287,403
Lasiurus cinereus	Hoary bat	38	247,040	633,822
Lasiurus cinereus semotus	Hawaiian hoary bat	<0.001	4	8
Lasiurus ega	Southern yellow bat	<0.01	69	143
Lasiurus intermedius	Northern yellow bat	<0.01	553	1,145
Lasionycteris noctivagans	Silver-haired bat	18	148,839	308,322
Lasiurus seminolus	Seminole bat	<0.01	1,106	2,290
Lasiurus xanthinus	Western yellow bat	<0.01	622	1,288
Myotis evotis	Long-eared myotis	<0.01	3,731	7,730
Myotis lucifugus	Little brown myotis	6	51,617	106,925
Myotis septentrionalis	Northern myotis	<0.01	1,175	2,433
Myotis sodalis	Indiana bat	<0.01	69	143
Myotis velifer	Cave myotis	<0.01	69	143
Myotis volans	Long-legged myotis	<0.01	69	143
Nyctinomops femorosacca	Pocketed free-tailed bat	<0.01	69	143
Nycticeius humeralis	Evening bat	<0.01	1,589	3,292
Perimyotis subflavus	Tricolored bat	6	45,260	93,756
Parastrellus hesperus	Canyon bat	<0.01	69	143
Tadarida brasiliensis	Brazilian free-tailed bat	3	21,282	44,087
Unknown spp.	Unknown spp.	2	20,036	41,505
Total	Total		650,104	1,306,378

Table 4. Estimates of cumulative bat fatalities from 2000 to 2011 for the U.S. and Canada. Migratory tree bat species found in the study area are outlined in blue and cave bat species found in the study area are outlined in orange. It is important to note that no wind facility has been built with known Indiana bat maternity colonies.[55]

To date, hoary bats have been the primary species killed by collisions with turbines in the United States.[56] This species, like all tree bats, roost in trees year-

[54] *Id.*
[55] *Id.*, Table 21-3.
[56] *Id.*

round, are highly migratory, and are often not state or federally listed so they are not frequently studied. Population for most of these species is lacking, however, to understand the impact of wind energy estimating the impact of wind strikes on each species in necessary to assess of the species should be state or federally protected. One study created population prediction models using expert opinion and some occurrence data to try to assess the risk of wind turbines for hoary bats populations.[57] This study estimated up to a 90 percent population decline in hoary bats in the next 50 years with a starting population of 2.5 million bats, acknowledging that this starting population number is likely incorrect.[58] These projected population models demonstrate several points: (1) other bat species that are currently not federally and, in most cases, not state protected are being killed in large numbers, and (2) collection and tracking demographic information from mist-net captures and bats salvaged below turbines through post-construction monitoring efforts is of extreme importance.

Q. Are there ways to minimize these negative impacts to bats?

A. Most bat mortalities occur on nights with low wind speeds; therefore, curtailment (i.e., increasing the cut-in speed[59]) ,when the blades would start spinning to generate energy, could greatly reduce bat mortality from collisions with turbines. Additionally, there are other options in development that have potential to reduce turbine collisions for bats and other wildlife species.

[57] Frick *et al.* (2017) *supra* n. 5.
[58] *Id.*
[59] The cut-in speed is the minimum wind speed (mph) at which turbine blades can start to rotate.

The following list was adapted from the National Renewable Energy Laboratory's report discussing the effectiveness of multiple strategies to reduce impacts of wind energy facilities on wildlife, including bats:

- Detect-and-curtail approaches: (informed or smart curtailment) Using either an automated way (acoustic detectors) or human detections of target species within a certain area around a turbine or wind facility to initiate a curtailment cut-in speed and/or feathering of blades to reduce the risk to the species of interest.
- Detect-and-deter approaches: Also uses automated or human detections of target species, but the detection triggers some kind of deterrent such as lighting, noise, or a combination.
- Wildlife operational curtailment: Rotor rotation rate is stopped or greatly reduced by increasing the cut-in speed based on a variety of factors (temperature, time of day, weather conditions, time of year, etc.). This can be done several ways and various scenarios are in development.
- Wildlife seasonal curtailment: Increasing the cut-in speeds during high risk periods of time (migration, maternity season, etc.) based on species life history or from post-construction fatalities on-site.
- Blade-painting schemes: Paint turbine blades in contrasting color schemes that allow for the turbine blades to be more visible and/or changing the surface texture of the blades so that they do not appear smooth.

- Deterrents: For bats these are mostly acoustic devices that broadcast high frequency sound waves, or UV lights, that deter bats from approaching the turbine.
- Wind turbine design modifications: Changing the turbine design in some way to reduce the risk of wildlife entering the strike zone of turbines. Possible methods could utilize deterrents, blade painting schemes, or a combination of other strategies.[60]

Q. What are the known bat species within and surrounding the High Prairie Project area?

A. The High Prairie Project area is located in Northeast Missouri in Schulyer and Adair counties. The Department has acoustic and mist-net records for Indiana bats (Endangered and SOCC), northern long-eared bats (Threatened and SOCC), little brown bats (SOCC), tri-colored bats (SOCC), silver-haired bats (SOCC), big brown bats, eastern red bats, hoary bats, and evening bats in Schuyler and Adair counties. This data was collected during April – October from 2013- 2017 by the Department as part of a 5-year research study to determine the bat community in areas with high wind development potential versus low wind development potential in north Missouri. We documented species presence within the Project area from April – October annually. This study was designed to collect

[60] Sinclair, K., & DeGeorge, E. 2016. *Framework for testing the effectiveness of bat and eagle impact-reduction strategies at wind energy projects*. Tech. Rep. NREL/TP-5000-65624. US Department of Energy, National Renewable Energy Laboratory, Golden, CO USA.

reference data before wind developments to more fully understand the impact on Missouri bat species.

Within the Project area, there are at least five maternity colonies recorded in the Natural Heritage Database from the northern portion of the Project area. See Figure 8**.** There were 23 Indiana bats and 6 northern long-eared bats captured on the proposed Project area during 2016. See Figure 4 and 6; respectively. The additional area within the Project boundary could contain up to 10-15 additional Indiana bat maternity colonies based on suitable habitat (woodlots or trees); however, the exact number is still unknown as the entire project area has just been surveyed (ending in August 2018) and data has not been shared with MDC as permit reports are not due until the end of the calendar year. Many maternity colonies have on average 50 – 80 individuals.[61] Therefore, we would estimate that on the low end there could potentially be 250 female Indiana bats roosting within the project area (5 known colonies with 50 females in each) and possibly as many as 1,200, assuming new colonies are found in previously unsurveyed areas (15 colonies with 80 bats per colony). This many female bats could produce up to 600 juvenile bats start to fly and forage during June and July. These juveniles would be at greater risk of being killed by turbines than adults.

In addition to bats roosting within the proposed Project area, there are also bat resources that could be impacted because of where the project is located. As

[61] Whitaker JO Jr, Brack V Jr. 2002. Distribution and summer ecology in Indiana. In: Kurta A, Kennedy J (eds). *The Indiana bat, biology and management of an endangered species*. Bat Conservation International, Austin, TX. pp 48–54.

previously explained, the largest known Indiana bat hibernacula occurs in Hannibal, Missouri at Sodalis Nature Preserve (SNP) with almost 198,000 Indiana bats observed in winter 2016/2017). See Figure 4. The proposed Project area is between SNP and tree roosts where many female Indiana bats in northern Missouri raise their young. See Figure 4. Indiana bats have high site fidelity and return to the same maternity colony annually. See Figure 8 through 10. The proposed project area will likely have high numbers of Indiana bats traveling across it during spring and fall migration. See Figure 4.

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Finally, there are a number of bat resources within 10 miles of the Project area. In the past 5 years, the Department conducted summer mist-net surveys for both Indiana and northern long-eared bats on Sugar Creek, Rebel's Cove, Big Creek, Union Ridge, and Indian Hills Conservation Areas in Schuyler, Adair, and Scotland Counties. See Figure 10. There are records for northern long-eared and Indiana bats on all areas except for Indiana bats on Big Creek and most areas had maternity colonies.

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Q. Based upon the above information, what specific concerns do you have about this project location in regard to Missouri's bat resources?

A. I have several concerns related to this project and Missouri's bat species:

(1) The Project area is in the high-likelihood zone for Indiana bat maternity colony occurrence. See Figure 2 and 3 (above).

(2) The proposed Project threatens the population that hibernates at SNP, the largest known hibernaculum. We have band records of an Indiana bat captured in Nodaway County being re-sighted in SNP during hibernation.

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Therefore, Indiana bats raising young west of the project area are potentially at risk when they migrate between maternity sites and SNP. See Figures 3, 9, and 11.

(3) We have Natural Heritage Database records of Indiana bats, northern long-eared bats, and little brown bats in the Project area. See Figure 4, 6, and 10. There are at least 5 maternity colonies based on distances and landscape features associated with capture locations on a portion of the proposed Project area. The Project area expanded in 2017. With the increase project footprint, there could be up to 10-15 colonies within the new Project boundaries based on suitable habitat (woodlots or trees); however, the exact number is still unknown as the entire project area has not been surveyed. Ameren and its agents are completing summer surveys on the entire project area this summer.

(4) Little brown bats and tri-colored bats were also documented within the greater Project area in 2016. This species is a state SOCC due to high mortality rates from WNS, and additional fatalities from wind turbines could further endanger this declining population. Natural Heritage Database records are historic to current records; however, both species have seen declines in population size since WNS was discovered in Missouri. See Table 2 and Figure 10 and 11.

(5) Silver-haired bats, an SOCC and the other migratory tree bats (eastern red bats and hoary bats) have been documented in or surrounding the

proposed Project area. These high-flying species are most likely to be impacted by these turbines with ***

***However, all bat species are at risk within the rotor swept area. Only silver-haired bats are currently being tracked through the NHD, but hoary bats will be added in 2019. See Figure 11.

(6) Increased interest by both MDC and the Service on hoary bat mortality rates at wind facilities from turbine strikes. As described above, a paper estimated a 90 percent population reduction over the next 50 years for this species with some very loose assumptions on the current population size of this species across the species range.[62] Monitoring post-construction fatality rates of this species and all bat species at the Project area will be critical to understand the impacts on Missouri's bat resources. Hoary bats and the other migratory tree bats have been documented to travel longer distances annually so it is reasonable that hoary bats killed in northern Missouri could use southern portions of the state during other times of the year.

[62] Frick *et al.* (2017), *supra* n. 5.

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Q. What can be done to minimize potential negative impacts to all protected bat species and state species of concern?

A. Below are my recommendations for protecting our bat species. These recommendations are specific to the High Prairie Project and are a result of the known species and resources within the Project area. I have broken down ways to reduce the negative impacts to bats species within each stage of the wind facility development process.

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1. <u>Pre-Construction of High Prairie Project</u>

(a) A minimum of 1-year full active season (March 15- October 31) pre-construction monitoring for all bats, including both acoustic and mist net surveys with radio telemetry to find roost trees for Indiana bats and northern long-eared bats.

(b) Submit a Natural Heritage Review Request (NHRR) to the Department of Conservation for the Project area. The NHRR will provide any known records of Missouri SOCCs and threatened or endangered species on the Project area and within a buffered distance from the location.

(i) Site turbines should be greater than 1,000 ft from known maternity roost trees and capture locations for federally listed species

(ii) Avoid tree removal that would fragment the landscape.

2. <u>Construction of High Prairie Project</u>

(a) Avoid tree clearing and fragmentation of habitat where possible. Any tree clearing associated with construction should occur outside the active season for bats (March 15– October 31). No known maternity trees identified during pre-construction surveys or by the NHRR should be cleared during construction of project.

3. <u>Operation of High Prairie Project</u>

(a) Curtailment (cut-in speed) to 6.9 m/s wind speed should be fully implemented during the active season whenever temperatures are above 50 degrees Fahrenheit from 30 minutes before sunset until 30 minutes after

dawn. This could potentially reduce bat mortality between 73 and 89 percent based on data collected in West Virginia.[63]

(b) Turbine blades should be feathered during maternity colony break up and fall migration (August 1 through October 31) in addition to the 6.9 m/s curtailment to further reduce collision risk.

4. **Operational Monitoring for High Prairie Project** To date, no wind farm has had multiple Indiana bat maternity colonies within its project area. The monitoring recommended below is in addition to the 6.9 m/s cut-in speed, as the Department needs data to determine if 6.9 m/s is effective in reducing bat mortalities for Indiana and northern long-eared bats in areas with known maternity colonies. Monitoring is critical no matter what operational measures are put in place in order to determine the actual impact of the project for all bat species.

(a) For the first year of the Project, conduct carcass persistence study during the active season (March 15-October 31). A carcass persistence study is when carcasses are left on the landscape and monitored daily or at a certain time interval to determine how quickly scavengers will find and remove carcasses. Ameren should search 100 percent of a mowed radius around each turbine daily to estimate carcass persistence and searcher efficiency at each turbine location. The search area should be a mowed 90 m radius

[63] Tidhar, D., M. Sonnenburg, and D. Young. 2013. 2012 Post-construction carcass monitoring study for Beech Ridge Wind Farm, Greenbrier County, West Virginia – Final Report, April 1 – October 28, 2012. Prepared for Beech Ridge Wind Farm, Beech Ridge Energy, LLC. 18 January 2013.

around the turbine. If carcass persistence is greater than one day, re-evaluate the search interval using adaptive management to determine the most efficient interval for detecting all bat carcasses.

(b) For six years following construction, Ameren should conduct operational monitoring by the evidence of absence approach at G-level of 0.3, which means the probability of detecting a killed bat of 30 percent. Monitoring should be conducted during the entire active season (March 15 to October 31) as follows:

(i) Mow a 90 m radius search area around each turbine every two weeks from April 1 to August 31. All mowing must occur after the plot has been searched that same day.

(ii) If additional species are federally listed during the life of the project, an additional 2 years of monitoring should occur from listing date for that species.

(c) Identify all dead bats found under turbines and report as described under the Reporting section.

(d) Ameren should monitor existing bat colonies within the project area during the life of the project to detect impacts. Monitoring should include radio tracking, migration work, and emergence counts of roost trees during the maternity season (March 15-August 15). Monitoring should rotate throughout the project area with at least one-quarter of the project area with known maternity activity being surveyed annually.

(i) For example, monitoring could be to conduct emergence counts at known roost trees. If bats are counted leaving these roost trees, then that would count as the monitoring for that colony. However, if no bats are counted, then do a mist-net survey in the area to see if the colony is still there and to identify their new roost trees.

5. <u>Reporting for High Prairie Project</u>

(a) Report all bat mortalities to MDC as follows:

- Report all current and future bat species of conservation concern (SOCC) carcasses observed within 48 hours on a form provided by the Department. Verify SOCC annually from the MDC checklist.
- Annually, report mortalities for all bat species by December 31 on the same form.

(b) Annually, report all monitoring activities and bat mortalities to Public Service Commission by December 31.

IV. UNITED STATES FISH & WILDLIFE SERVICE HCP PROCESS

Q. On p. 23, lines 17-22, of his Direct Testimony, Mr. Arora states that in order to mitigate risks associated with endangered species concerns, Ameren is working with the United States Fish & Wildlife Service. Are you familiar with the endangered species process being referred to?

A. I believe he is referring to the process under the ESA whereby Ameren, or its contractor, may apply for Incidental Take Permit that allows the "taking"[64] of endangered species when it is incidental to an otherwise lawful activity. As part of the permit application, the applicant must submit a Habitat Conservation Plan or "HCP" to the Service that describes the anticipated effects of the proposed taking of the endangered, how those impacts will be minimized or mitigated; and how the HCP is to be funded. See ESA, Section 10(a)(2)(B); 16 U.S.C. sec. 1539(a)(2). While an Incidental Take Permit is not required by law, without one an entity could face enforcement under the ESA from the Services for the taking of protected species.

It is my understanding from Ameren's response to MDC's data request, that Ameren is seeking a short-term HCP, which will cover a six-year period, for protected bat species, and that it will later seek a long-term HCP. It is further my understanding that the while an HCP is not required for construction, Ameren needs one in place prior to operation in order to avoid enforcement under the ESA if there is take of an endangered species. I do not know when the Service will issue the HCP in this instance but have reason to believe it will not be until sometime next year, after the PSC case is decided.

Q. What is the Department's involvement in the HCP process?

A. The Department has some, but limited, involvement in the HCP process. The Department is involved in the process of providing Ameren with information from the Department's Natural Heritage Database containing known

[64] "Take" is defined by the ESA as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any threatened or endangered species.

locations of federal and state listed species and SOCCs. We also participate in meetings between Terra-Gen and the Service, when invited, to provide input on pre-construction surveys. The Department has been able to read and comment on the draft HCP for the Project during these joint meetings. However, most of the comments are based on survey locations and the known bat resources within the Project area and surrounding area. MDC does not have an official role to play in the HCP process.

Q. Why should the PSC consider your concerns and recommendations when there is a separate federal process to address endangered species through the Service?

A. There are several reasons why the Department raises these concerns and makes these recommendations. First, because the HCP is a federal process, it will not address species of state concern (SOCCs) that MDC has identified as being potentially impacted by the Project, such as silver-haired bats, little brown bats, tri-colored bats, and hoary bats (will be listed as SOCC in 2019). The HCP offers no protections or monitoring requirements for these species that are of concern to the state. As explained above, some of these species have been devastated by WNS. Providing high quality summer habitat is one strategy to try to recover WNS affected species. ***

*** Also discussed above, migratory

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tree bats (silver-haired bat, hoary bat, and eastern red bat) are the species with the greatest fatality percentages from turbine strikes. Protecting these species through the offered recommendations is of great importance to their long-term survival. Also, of great importance is intensive monitoring for all bat species, not just those required through the HCP, during post-construction surveys to determine fatalities for this Project area, as fatality rates vary between wind facilities.

Second, the HCP has not been issued and will not be issued until after this CCN case is concluded. Consequently, the terms and conditions to be included in the HCP process are unknown. It is also possible that Ameren and the Service will be unable to agree upon terms for the HCP that meet the Service's issuance criteria or that Ameren will decide to not get an HCP, since it is not required by law.

Third, it is unclear what would happen if the Project exceeds the take limit. From conversations with the Service regarding the short-term HCP process, my understanding is that if a project exceeds the take limit agreed to in the HCP the project has to practice "full-avoidance" which is a cut-in speed of 6.9 m/s. However, it is unclear whether Ameren would be obligated through the HCP to continue post-construction monitoring at the Project area. The Service's full avoidance measure is based from data collected at Beech Ridge Wind Facility in West Virginia where fatalities were reduced between 73 – 89 percent.[65] This reduction does not guarantee that no Indiana bats or other bat species will not be killed by turbines at

[65] Good, R.E., W. Erickson, A. Merrill, S. Simon, K. Murray, K. Bay, and C. Fritchman. 2011. Bat Monitoring Studies at the Fowler Ridge Wind Energy Facility, Benton County, Indiana, April 13 – October 15, 2010. Prepared for Fowler Ridge Wind Farm. Prepared by Western EcoSystems Technology, Inc. 28 January 2011.

this cut-in speed as there has not been any documentation of fatality rates for Indiana bats when maternity colonies are present in the project area. In short, there are a number of unknowns associated with the HCP and there is a state interest separate and apart from the interest of the Service and the federal HCP process.

Finally, as explained further in my testimony above, the Department has and will continue to invest millions of dollars in the preservation, management, and protection of Missouri's bat species. Conservation desires to be a good steward of taxpayer dollars in protecting the significant investment it has already made in the species as described herein.

Q. With regard to the second point in the previous section, has the Service ever issued a take permit for a proposed project in such a high-risk area for Indiana bats?

A. To my knowledge, there has never been a take permit issued by the Service where there are known Indiana bat maternity colonies and documented roost trees within the proposed project area. This Project area has at least five maternity colonies with identified roost trees although the entire Project area has not been completely surveyed. ***

***As discussed above, MDC has not received any data from Terra-Gen regarding 2018 survey results as state permit reports are due at the end of the calendar year. However, just assuming five colonies for the entire Project area with

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an average of 50-80 female Indiana bats per colony and potentially 40 juveniles annually, assuming a 50 percent survivorship rate. At a minimum, there would likely be 250 reproductively active female Indiana bats and 125 juveniles per year (assuming 50 females and a 50 percent survivorship rate). ***

*** If a take permit is issued, it will be critical to have rigorous post-construction monitoring to document fatalities at turbine locations for Indiana bats and all bat species.

Q. What happens if a wind farm takes a more individuals of a federally protected species under the ESA than the facility is permitted to take?

A. That's an important question. The Service has authority over federal laws. It is my understanding that exceeding the take permit could result in renegotiation of the HCP and/or enforcement under the ESA. The USFWS' Columbia Missouri Ecological Services Office (the local office) would be an appropriate source for a direct response to this question.

Q. Does the draft High Prairie Wind Energy Facility HCP include take provisions for non-listed (e.g., state SOCC and other) bats?

A. No. According to the responsive document to MDC Data Request No. 6, Attachment-38), ***

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[66] United States Fish and Wildlife Service (USFWS). 2016. Midwest Wind Energy Multi-Species Habitat Conservation Plan. Public Review Draft. U.S. Fish and Wildlife Service Midwest Region, in collaboration with the states Iowa, Illinois, Indiana, Michigan, Minnesota, Missouri, and Wisconsin and the American Wind Energy Association. April 2016. Available at: https://www.fws.gov/Midwest/endangered/permits/hcp/r3wind/DraftHCPandEIS.html.

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Q. Ameren's draft HCP (Response to MDC Data Request 16, Attachment-38) estimates the number of bat fatalities annually based on studies from other states as follows: *

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***** Are you comfortable with these estimates? Are the assumptions reasonable given the bat resources in this area, and in the referenced study areas?**

A. No, I am not comfortable with the estimates. Specifically, I believe they are based on flawed assumptions. ***

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My major concern with both assumptions is that the take limit for Indiana bat will be exceeded due to low estimates of fatalities, resulting in a cut-in speed increase to 6.9 m/s or "full avoidance" according to the Service. At this time, it is uncertain if Ameren would still be required to continue post-construction monitoring at the Project area. Post-construction monitoring is critical even at 6.9 m/s to document fatalities since this Project would be the first to have multiple known Indiana bat maternity colonies within the Project boundaries.

Additionally, these estimates of take for all species are based on studies not in the region and are often based on the specific bat community within or surrounding wind facilities. There are no known wind facilities with the same bat community and numbers of individuals in operation. This Project area is unique and is of great conservation concern for MDC as the stewards of Missouri's fish, forest, and wildlife.

Q. Does this conclude your testimony?

A. Yes.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Union Electric Company d/b/a Ameren Missouri for Permission and Approval and a Certificate of Convenience and Necessity Authorizing it to Construct a Wind Generation Facility	))))	Case No. EA-2018-0202

AFFIDAVIT OF DR. KATHRYN WOMACK

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

Dr. Kathryn Womack, being first duly sworn on her oath, states:

1. My name is Dr. Kathryn Womack. I work in Kirksville, Missouri, and am employed at the Missouri Department of Conservation as a Resource Scientist.

2. Attached to this affidavit and made a part hereof for all purposes is my Written Rebuttal Testimony (testimony) on behalf of Missouri Department of Conservation. The testimony consists of 51 pages, which have been prepared in the appropriate format to be introduced into evidence in the case above.

3. I hereby swear and affirm that my answers contained in the attached testimony to the questions promulgated therein are true and correct.

DR. KATHRYN WOMACK

Sworn to and subscribed before me this 16th day of August, 2018.

Notary Public

My commission expires: November 24, 2021

LAURA M. STICKANN
Notary Public - Notary Seal
State of Missouri
Commissioned for Cole County
My Commission Expires: November 24, 2021
Commission Number: 13551367