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MISSOURI PUBLIC SERVICE COMMISSION
FILE NO. EA-2019-0010

WRITTEN REBUTTAL TESTIMONY
OF
DR. KATHRYN BULLINER
ON
BEHALF OF
MISOURI DEPARTMENT OF CONSERVATION

FEBRUARY 4, 2019

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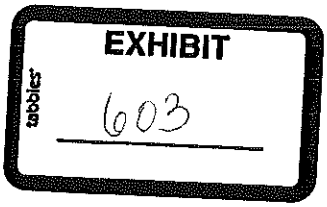

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REBUTTAL TESTIMONY OF DR. KATHRYN BULLINER

MISSOURI DEPARTMENT OF CONSERVATION

CASE NO. EA-2019-0010

I. INTRODUCTION

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

A. Kathryn (Womack) Bulliner, 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 more than 10 years and have been with the Missouri Department of Conservation ("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. Have you testified previously before the Missouri Public Service Commission?

A. Yes. I provided testimony in Case No. EA-2018-0202 which involved an application for Certificate of Convenience and Necessity filed by Ameren for a wind project.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to document MDC's conservation related concerns for bats within and near the Kings Point and North Fork Ridge proposed wind facilities ("Projects"). I am familiar with the Projects and have reviewed responses to MDC data requests. Before I describe my concerns with the Projects and recommendations, I would like to provide some background information with respect to bats in Missouri generally, and then specifically in relation to the Projects.

Q. Can you please provide a brief summary of your testimony?

A. Based upon information received to date from Empire and records maintained by the Department of Conservation, I am concerned about the potential impact of the Projects on the endangered gray bat, and the following species of state conservation concern – tri-colored bat, hoary bat, and silver-haired bat. All of these species are known to be present in at least one of the Project areas. At the conclusion of my testimony, I make several recommendations that are necessary for MDC to understand the impact of the Projects on these species and to mitigate any adverse impacts. MDC has

expended and will continue to expend substantial state resources in the protection of our threatened and endangered bat species. The protection of these state resources are in the best interest of the public and should be considered in the siting of the Projects.

II. BACKGROUND ON BATS IN MISSOURI

Q. What bat species occur in Missouri?

A. Historically, 14 bat species are known to occur in Missouri. *See* 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[1]	*Corynorhinus townsendii ingens*

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

[1] This federally endangered sub-species is presumed extirpated from Missouri. See Missouri Department of Conservation. 2018. Missouri species and communities of conservation concern checklist 2018. Jefferson City, MO. January 2018. 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.

population declines related to white-nose 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") 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. *See* Table 2.

In addition to the listing of species as endangered or threatened under federal law, MDC has a list of species of conservation concern ("SOCC"). When a species becomes a SOCC, it means that all records in Missouri are

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[2] The 4(d) Rule is one of many tools found within the Endangered Species Act ("ESA").. 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] An 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.

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]

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**	

tracked in the Natural Heritage Database ("NHD") mainly through MDC's 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: tri-colored bat, little brown bat, silver-haired bat, southeastern myotis, eastern small-footed bat, hoary bat. The tri-colored and little brown bat were listed as SOCCs due to population declines from WNS. See Table 2. The hoary bat was listed in 2019 due to recent population count projections

[5] Colatskie, S. (2017). Missouri Bat Hibernacula Survey Results from 2011-2017, Following White-nose Syndrome Arrival. *Missouri Department of Conservation, Technical Brief.*

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 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. Describe relevant bat characteristics.

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

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[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.

[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.

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.

Q. Are there particular protected bat species with which you have concerns related to this project? If so, describe.

A. Yes. The Indiana bat and northern long-eared bat both federally listed are not found within the Project areas and should not be impacted by either Project. However, gray bats will possibly be impacted by one or both Project areas. ***

[redacted]

[redacted]. ***[10]

Q. Describe the unique characteristics of the gray bat.

A. The gray bats is the largest member of the *Myotis* genus in the eastern United States with a weight range between 7-16 grams and a forearm length range between 40-47 mm.[11] The species range is limited to limestone karst areas in the Southeastern United States with the majority of the known populations residing in Alabama, northern Arkansas, Kentucky, and Missouri; however, this species is also found in parts of Kansas, Oklahoma, Mississippi, Virginia, North Carolina, and Florida.[12] Gray bats are true cave bats roosting in caves, mines and other subterranean structures year-round. During winter gray bats hibernate in cold air trap caves characterized by deep vertical features that allow cold air to be trapped which is where the species hibernates by forming large clusters of

[10] *Id.*

[11] Tuttle, M.D. 1976. Population ecology of the gray bat (*Myotis grisescens*): factors influencing growth and survival of newly volant young. *Ecology* 57:587-595.

[12] United States Fish and Wildlife Agency (USFWS). 2009. Gray bat (*Myotis grisescens*) 5-year review: Summary and Evaluation. USFWS, Midwest Region. Missouri Ecological Services Field Office, Columbia, MO. 33 pgs.

individuals.[13] At some hibernacula these aggregations can be in the hundreds of thousands. During the summer females migrate to warmer caves often along or within 1 km from major rivers that have high dome features that trap warm air to raise young. During summer males generally form bachelor colonies near maternity caves. During spring and fall gray bats use transient caves between summer maternity caves or bachelor caves and hibernacula.

During the active seasons (spring, summer, and fall) gray bats forage along forested riparian corridors and over bodies of water. This species has been documented flying over forested waterways (rivers, streams, and lake) as both foraging and flight corridors at a higher rate than would be expected by random chance.[14] This species generally feeds on emerging aquatic insects and beetles. In Missouri, gray bats have been documented to travel up to 70 km (approximately 43 miles) between foraging locations and roost locations nightly.[15] More recently a home range study of 5 gray bat maternity

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[13] United States Fish and Wildlife Agency (USFWS). 2009. Gray bat (*Myotis grisescens*) 5-year review: Summary and Evaluation. USFWS, Midwest Region. Missouri Ecological Services Field Office, Columbia, MO. 33 pgs.

[14] Moore, P.R., Risch, T.S., Morris, D.K., and Rolland, V. 2017. Habitat use of female gray bats assessed using aerial telemetry. *The Journal of Wildlife Management* 81(7):1242-1253.

[15] LaVal, R.K., Clawson, R.L., LaVal, M.L., Claire, W. 1977. Foraging behavior and nocturnal activity patterns of Missouri bats, with emphasis on the endangered species *Myotis grisescens* and *Myotis sodalis*. *Journal of Mammalogy* 58:592-599.

colonies in Arkansas that tracked using aircraft over 112 gray bats and found the maximum distance traveled nightly between the maternity site and foraging grounds was 21 km (approximately 13 miles).[16] Due to this species ability to travel large distances nightly compared to other *Myotis* species that typically range between 1-4 km (approximately 0.5 to 2.5 miles) this species maybe more susceptible to landscape changes that include deforestation along rivers and streams

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 the following Missouri bat species: northern long-eared bats, Indiana bats, tri-colored bats, little brown bats, gray bats, small-footed bats and big brown bats. White-nose syndrome is caused by a white fungus, *Pseudogymnoascus destructans*, that infects the skin of hibernating bats. The disease can be devasting to bat populations and there is no known cure. Once it appears in a cave, WNS can kill up to 90 -100 percent of bat species.[17] WNS was first

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[16] Moore, P.R., Risch, T.S., Morris, D.K., and Rolland, V. 2017. Habitat use of female gray bats assessed using aerial telemetry. *The Journal of Wildlife Management* 81(7):1242-1253.

[17] 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

documented in New York in 2006 and is now affecting bats in 33 U.S. states and 7 Canadian providences. *See* Figure 1.

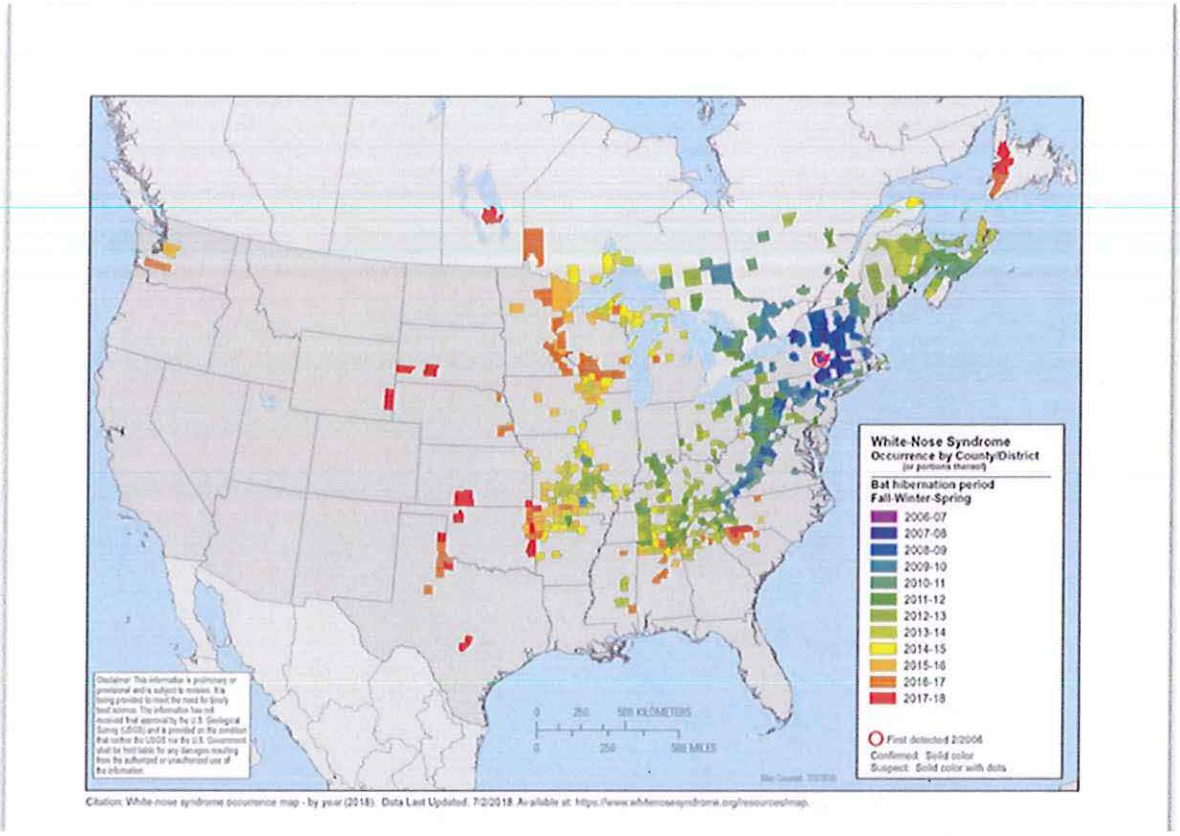

FIGURE 1. WHITE-NOSE SYNDROME SPREAD MAP CREATED BY THE U.S. FISH AND WILDLIFE SERVICE.[18]

population collapse of a common North American bat species. *Science, 329*(5992), 679-682.

[18] 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. Gray bats are susceptible to *Pd;* although, species declines related to the disease have not been documented as to date.[19] Gray bat numbers have declined (see Table 2); however, in Missouri the population is thought to be fairly stable due to cave gating at hibernacula and maternity locations.

[19] Powers, K.E., Reynolds, R.J., Orndorff, W., Hyzy, B.A., Hobson, C.S., Ford, W.M. 2016. Monitoring the status of gray bats (*Myotis grisescens*) in Virgina, 2009-2014, and potential impacts of white-nose syndrome. *Southeastern Naturalist* 15(1):127-138.

III. ECONOMIC BENEFITS AND INVESTMENTS RELATED TO BATS

Q. Describe the 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.[20] 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.[21] 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

[20] Boyles, J. G., Cryan, P. M., McCracken, G. F., & Kunz, T. H. 2011. Economic importance of bats in agriculture. *Science, 332*(6025), 41-42.

[21] *Id.*

season.[22,23] Indiana and northern long eared bats are related to little brown bats, and likely consume a similar number of insects.

Q. Describe MDC's investment of state funds related to bats.

A. Over the last ten years, MDC 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, MDC 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, MDC has also spent $116,446 protecting specific bat habitats with partners like The Nature Conservancy and the Missouri Conservation Heritage Foundation. Subject to

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[22] 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.

[23] 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.

the Conservation Commission approval annual budget process, MDC plans to conduct the following projects now and into the future:

(a) From Fiscal Year 2018-2021, the MDC anticipates spending $2.7 million on development of a Habitat Conservation Plan for the MDC's land management activities in bat habitats.

(b) The MDC also will be implementing the Habitat Conservation Plan (HCP) within that time. Because the MDC's HCP is still in development, the cost estimate associated with implementation is not yet available. According to the MDC's HCP consultant, the implementation costs for similarly sized and focused HCP will be approximately $350,000 the first year and $10 million over the 30-year life of the HCP.

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

IV. KINGS POINT AND NORTH FORK RIDGE PROJECT CONCERNS

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

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A. Studies have estimated that hundreds of thousands of bats are killed in the United States annually by wind turbine collisions.[24,25] 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 [26,27] 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 hypotheses as to why bat fatalities are so high near turbines.[28] One likely hypothesis is that bats

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[24] 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.

[25] Smallwood, K. S. 2013. Comparing bird and bat fatality-rate estimates among North American wind-energy projects. *Wildlife Society Bulletin*, *37*(1), 19-33.

[26] 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.

[27] 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.

[28] 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.

are attracted to turbines as they resemble a potential tree roost.[29] Another is that insect abundances are higher around turbines which attracts feeding bats.[30] Several videos document this behavior and provide evidence of attraction and foraging activity.[31,32,33]

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

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[29] 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.

[30] 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.

[31] 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.

[32] 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.

[33] 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.

temperatures are greater than 50°F.[34] Most bat fatalities occur in late summer and fall when bats are mating and migrating to winter grounds.[35] 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 related to the proportion of grassland within 500 m of turbines.[36] Mortality rates decreased at sites with more grasslands habitat surrounding the turbine (and other open habitat types.[37] 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?

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[34] 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.

[35] Arnett et al. (2013) supra Footnote 37 and Baerwald *et al.* (2008), *supra* n.23.

[36] 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.

[37] *Id.*

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.[38] 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.[39].

To date, hoary bats have been the primary species killed by collisions with turbines in the United States.[40] This species, like all tree bats, roost in trees year-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

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[38] Arnett and Baerwald (2013) *supra* n. 23.

[39] *Id.*

[40] *Id.*

assess the risk of wind turbines for hoary bats populations.[41] 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.[42] 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 all bat species salvaged below turbines through post-construction monitoring efforts is of extreme importance.

While tree bats are the hardest hit, there have not been any studies showing the impacts of wind turbines on gray bats. ***_____

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_____.*** Generally, bat mortality peaks late summer and during the fall when these bats are moving across the landscape and mating.[43] However, activity for gray bats is likely in at least the Kings Point Project site to be throughout the entire active season.

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[41] Frick *et al.* (2017) *supra* n. 6.

[42] *Id.*

[43] *Id.*

Determining the date of arrival in spring of foraging gray bats and the last date gray bats are detected in the fall will be critical in implementing an appropriate minimization and/ avoidance plan for the Projects.

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

A. Most bat mortalities occur on nights with low wind speeds during the active season (approximately March 15th - October 31st); therefore, curtailment (i.e., increasing the cut-in speed)[44], 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.

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

[44] The cut-in speed is the minimum wind speed (mph) at which turbine blades can start to rotate.

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.[45]

Q. What are the known bat species within and surrounding the Projects?

A. There are a number of known bat species within and surrounding the Project Areas.

Kings Point

The Kings Point Proejct is located in southwest Missouri in Barton, Dade, Jasper, and Lawrence counties. The MDC has mist-net records for gray bats (Endangered and SOCC), little brown bats (SOCC), tri-colored bats (SOCC), eastern red bats, hoary bats, and evening bats project counties.

***

[45] 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.

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1

2 ***.***

FIGURE 2.

***_____

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_____.*** This maternity cave is in the NHD and it is likely that all reproductively active gray bat females and juveniles foraging in the southeastern and central sections of the Project Areas are members of this maternity colony due to high site fidelity.

North Fork Ridge

The North Fork Ridge Project is located in southwest Missouri in Barton county. In Empire's Response to MDC Data Request 1-11 (2018 acoustic and mist-net survey report), the following species were detected by experts within the Project Area: ***_____

_____

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***Figure 3. ***_____
_____
_____
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_____***

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

A. I have several concerns related to both project areas.

(1) Gray bats have been ***_____

_____

_____.*** Further mist-netting in summer 2019 is highly recommended on North Fork Ridge to document if there is any gray bat maternity colony activity on the project area. Mist-netting in this area took place during August which is not the ideal time to document maternity activity for this species.

(2) Additionally, it is important to determine the approximate arrival dates of gray bats in the spring and the last date detected in both project areas using acoustic detectors at the expert verified acoustic locations as well at the MET tower locations on both project sites.

(3) I am concerned that turbines are proposed to be sited within a ***_____*** from known mist-net capture locations and the associated riparian corridors on Kings Point. The following turbine locations (FID) from the Empire's response to MDC Data Request 1-6 fall less than ***_____*** from these locations are listed below:

a. ***_____

b. _____

c. _____***

(4) I am concerned that turbines are proposed to be located within a ***_____*** for gray bats on North Fork Ridge and the associated riparian corridors. The following turbine locations (FID) from the Empire's response to MDC Data Request 1-6 fall less than ***_____*** from these locations:

a. ***_____

_____

b. _____***

(5) ***_____

_____

_____.*** [46] This species is a state SOCC due to high mortality rates from WNS, and additional fatalities from wind turbines could further endanger this species declining population caused by WNS.

(6) Silver-haired bats and hoary bats, both SOCCs, and the other migratory tree bat (eastern red bats) have been documented in or surrounding the proposed Project Areas. These high-flying species are most

[45] Response to MDC Data Request 1-11.

likely to be impacted by these turbines. However, all bat species are at risk within the rotor swept area.

(7) There is 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.[47] Monitoring post-construction fatality rates of this species and all bat species at the Project Areas 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.

V. KINGS POINT AND NORTH FORK RIDGE PROJECT RECOMMENDATIONS BY MDC CONCERNING BATS

Q. What is the MDC asking the Public Service Commission to do in this case with respect to bats?

A. MDC is asking that the Commission ensure that Missouri citizens' investment in conservation of bat resources is protected by requiring

that a bat Habitat Conservation Plan (HCP) for gray and tri-colored bats be a condition of the Certificate of Convenience and Necessity (CCN). MDC further asks that the following conditions be imposed so that that the MDC can adequately protect, monitor and determine the impacts of the Projects on the area's bat populations:

1. Require Empire to conduct post-construction monitoring of bat fatalities and disturbances in accordance with a Service-issued HCP that will cover gray bats and tri-colored bats. Fatality monitoring efforts involve searching for bat carcasses beneath turbines to estimate the number of fatalities.

2. Prohibit Empire from constructing or operating a turbine within one-half mile of known gray bat capture or verified acoustic sites and the associated riparian corridors. *See* Appendices A-1 - A-5.

3. Require Empire to conduct surveys as early as March 1, 2019 to determine the arrival of gray bats on both Project areas for the active season to better access species risk on Project areas.

4. Require Empire to conduct mist-netting in summer 2019 on North Fork Ridge again to document if there are gray bat maternity colonies foraging within the Project area.

5. Require Empire to report observed mortalities for all bat species of conservation concern ("SOCC") observed annually by December 31. Describe each individual species, date found, and location.

6.. Require Empire to provide MDC copies of all quarterly/annual monitoring reports submitted to the Service.

7. Require Empire to provide the Public Service Commission annual reports documenting its monitoring and any bat fatalities on the Project areas.

VI. UNITED STATES FISH & WILDLIFE SERVICE PROCESS

Q. Are you familiar with the endangered species process for which an Incidental Take Permit is issued?

A. Yes, under the Endangered Species Act ("ESA") whereby Empire may apply for Incidental Take Permit ("ITP") that allows the "taking"[48] 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 ("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. While an ITP is

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

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 Empire's response to MDC's data request and conversations with Empire, that Empire is seeking an HCP, which will cover protected gray bats. It is further my understanding that the while an HCP is not required for construction, Empire 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 Commission decides this case.

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

A. MDC has some, but limited, involvement in the HCP process. MDC is involved in the process of providing Empire with information from MDC's NHD containing known locations of federal and state listed species and SOCCs. We also participate in meetings between Empire and Stantec to provide input on pre-construction surveys and have been able to read and comment on the proposed work plans for the Project during joint meetings with the Service. However, most of the comments are based on survey locations and the known bat resources within the Project areas and surrounding areas. 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 MDC raises these concerns and makes these recommendations.

First, because the HCP is a federal process, it will not address species of state concern ("SOCC") that MDC has identified as being potentially impacted by the Project, such as silver-haired bats, tri-colored bats, and hoary bats. 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. ***_____

_____

_____

_____***Additionally, as discussed above, migratory 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.

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 Empire and the Service will be unable to agree upon terms for the HCP that meet the Service's issuance criteria.

Finally, MDC has and will continue to invest millions of dollars in the preservation, management, and protection of Missouri's bat species. As MDC strives to be a good steward of taxpayer dollars in protecting the significant investments it has already made in the species as described herein.

Q. Does this conclude your testimony?

A. Yes

Appendix A-1. ***

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Appendix A-2. ***

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Appendix A-3. ***

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Appendix A-4. ***

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Appendix A-5. ***

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BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of The Empire Electric District Electric Company for Approval and a Certificate of Convenience and Necessity Related to its Customer Savings Plan	))))	Case No. EA-2019-0010

AFFIDAVIT OF DR. KATHRYN BULLINER

STATE OF MISSOURI)
)
COUNTY OF COLE)

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

1. My name is Dr. Kathryn Bulliner. 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 apart hereof for all purposes is my Written Rebuttal Testimony (testimony) on behalf of Missouri Department of Conservation. The testimony consists of 42 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.

K Bulliner
Dr. Kathryn Bulliner

Sworn to and subscribed before me this 04 day of February, 2019.

Laura M Stickann
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