APPENDIX F

NORTH ALLEGHENY WIND FARM – NON-THREATENED AND NON-ENDANGERED BAT RESOURCES EFFECTS ANALYSIS

Operations

Disturbance/Displacement

Limited information is available regarding the disturbance/displacement of bats at wind facilities (Kunz et al. 2007a). Based on the number and frequency of documented deaths of bat species observed at wind energy facilities throughout North America, there appears to be little to no avoidance of wind facilities by bats (USFWS 2011). Indeed, some researchers have suggested that migratory tree bats (i.e., hoary bats, eastern red bats, and silver-haired bats) may be attracted to wind turbines because of their migratory and mating behavior patterns (Kunz et al. 2007b; Cryan 2008). At dawn, these tree bats may mistake wind turbines for roost trees, thereby increasing the risk of fatality (Kunz et al. 2007b). Cryan (2008) suggested that male tree bats may be attracted to wind turbines by mistaking them as tall trees used as lekking[1] sites. Bats are therefore not expected to be displaced from NAWF as a result of project operations.

Fatality

Whether bats are attracted to turbines and the exact mechanisms by which turbines cause fatality are unclear (reviewed in Kunz et al. 2007b). Recently, researchers have hypothesized and tested various elements potentially connected to bat-turbine interactions. These elements include the role of land cover and environmental conditions in attracting bats to turbine sites, behavioral factors that might make turbines attractive to bats, pressure changes from rotating blades causing "barotrauma,[2]" or collision of unsuspecting bats (Baerwald et al. 2008; Horn et al. 2008; Johnson et al. 2004; Kerns et al. 2005, reviewed in Kunz et al. 2007b). Determining the effects of wind farms on bats is of critical importance to the future conservation of these poorly understood mammals.

A total of 24 post-construction fatality surveys were conducted at 12 of the WEVCA wind farms in Pennsylvania between 2007 and 2011 (Taucher et al. 2012). Average estimated bat fatality was 25 bats/turbine/year (range 5 to 59; Taucher et al. 2012). Eighty-three percent of bat fatalities were adults, and 12 percent were juveniles. Males were more frequently killed (59 percent) than females (29 percent). The majority of all bat fatalities (76 percent) occurred between July 1 and September 30, and nearly all fatalities (98 percent) occurred between May 1 and October 31 (Taucher et al. 2012).

Migratory tree bats (hoary, red, silver-haired, and Seminole bats) constituted 76 percent of all fatalities, while cave-hibernating bats (tri-colored, little brown, big brown, northern long-eared, and Indiana bats) constituted 23 percent (table 1). Degraded condition precluded species identification for the remaining 1 percent of carcasses, and these were reported as "unknown" (Taucher et al. 2012).

TABLE 1.—*Composition of bat fatalities identified from 2007 to 2011 at operating wind turbines in Pennsylvania (Taucher et al. 2012)*

Species	Standard Searches	Incidental Finds

[1] "Lekking" is defined as a communal breeding display.
[2] "Barotrauma" is defined as injuries caused by pressure changes.

Hoary bat	31%	32%
Eastern red bat	28%	25%
Silver-haired bat	16%	13%
Tri-colored bat	8%	12%
Little brown bat	8%	12%
Big brown bat	6%	5%
Unknown	1%	1%
Northern long-eared bat	<1%	0%
Seminole bat	<1%	<1%
Indiana bat	<1%	0%

At NAWF, a total of 383 carcasses representing 7 species were found during post-construction fatality monitoring in 2010, 2011, and 2012 (Shoener 2012, 2013), and 7 additional carcasses representing 2 species were found incidentally by maintenance staff through 2016 (table 2).

TABLE 2.—*Bat species found at the NAWF*[1]

Species	**2010**	**2011**	**2012**	**Incidentals found by NAWF Staff**	**Total**
Hoary bat	63	74	10	0	147
Eastern red bat	75	42	15	3	135
Silver-haired bat	24	25	3	0	52
Big brown bat	14	10	0	0	24
Tri-colored bat	4	7	1	0	12
Little brown bat	9	2	0	1	12
Indiana bat	0	1	0	0	1
Unknown Species	2	1	1	3	7
Total	**191**	**162**	**30**	**7**	**390**

[1] 2010, 2011, and 2012 include standardized searches from April 1 to December 15, 2010, from April 1 to November 15, 2011, and from July 1 to September 30, 2012 (Shoener 2011, 2012)

After adjusting the number of carcasses found for the area searched, searcher efficiency, and carcass removal rates, it was estimated that 1,488 bats (95 percent CI: 1,170 to 1,861) were killed in 2010 (monitoring conducted between April 1 and December 15) and 690 (95 percent CI: 571 to 833) were killed in 2011 (monitoring conducted between April 1 and November 15). The 2011

data include the time period when turbines were shut down at night (September 27 to October 31), as well as the period of curtailment when turbines were feathered at 6.9 m/s when temperatures were above 38.3 ºF November 1 to November 15, which occurred after the discovery of the Indiana bat carcass on September 26, 2011. Post-construction mortality data were also collected in 2012, but only between July 1 and September 30 when turbines were feathered at 6.9 m/s when temperatures were above 38.3 ºF; during this time, it was estimated that 203 bats (95 percent CI: 148 to 270) were killed.

The bats most affected by wind facilities are believed to be migratory tree bat species (i.e., hoary bats, eastern red bats, and silver-haired bats) that mostly emit low-frequency calls (Johnson et al. 2004; reviewed by Kunz et al. 2007b). Bats that use low-frequency calls may be more inclined to forage above the tree line where there are few obstructions. Thus, tree bats may be more likely to fly in the rotor-swept zone of turbines when compared to smaller bat species that have different foraging and migration strategies. Arnett et al. (2008) compiled data from 21 studies at 19 wind facilities in the United States and Canada and found that bat fatalities have been reported for 11 of the 45 bat species known to occur north of Mexico. Of the 11 species, hoary bat, eastern red bat, and silver-haired bat have contributed nearly 75 percent of the total documented fatality at wind facilities (Kunz 2007a).

Under all three of the alternatives under consideration, migratory tree bats are expected to continue to account for the majority of bat fatalities at NAWF as eastern red bats, hoary bats, and silver-haired bats have constituted 87.2 percent of the fatalities documented to date. Other bat species documented as fatalities at the NAWF to date include the big brown bat, tri-colored bat, little brown bat, and Indiana bat (Shoener et al. 2012, 2013).

Based upon post-construction fatality data collected at the NAWF, bat fatality with no operational adjustment protocols in place (i.e., no feathering below the cut-in speed), forms the baseline against which to compare the 3 alternatives and is estimated to be 1,243 bats/year (NAW 2017). Studies at several wind energy facilities have demonstrated that turbine operational protocols (i.e., adjusting the wind speed at which turbines are allowed to begin generating power and/or feathering turbine blades to prevent freewheeling below that speed) significantly influence bat fatality (Fiedler 2004; Kerns et al. 2005; Arnett et al. 2008; Baerwald et al. 2008; Good et al. 2011, 2012). Therefore, it is expected that impacts to bat species at the NAWF will vary depending on the alternative under which the turbines are operated. For the purposes of this analysis, it was assumed that all 1,243 bats killed each year would be non-listed species, as take of listed species (i.e., Indiana bats, northern long-eared bats, and eastern small-footed bats) results in less than 1 individual per year under any scenario.

During post-construction fatality monitoring conducted at the NAWF (table 2), a total of 383 non-listed bats were found (excluding 7 unknowns but including all incidental finds through 2016). The breakdown of fatalities by non-listed bat species for all Alternatives, based upon the species composition found to date (and assuming that curtailment affects all non-listed species equally), is expected to be:

- Hoary bat – 38.4 percent of all bat fatalities
- Eastern red bat – 35.2 percent of all bat fatalities
- Silver-haired bat – 13.6 percent of all bat fatalities

- Big brown bat – 6.3 percent of all bat fatalities
- Tri-colored bat – 3.1 percent of all bat fatalities
- Little brown bat – 3.1 percent of all bat fatalities

No evening bats have been found at the NAWF during post-construction monitoring, none were captured during mist-net surveys at the site, and none were found during any post-construction monitoring of WEVCA sites in Pennsylvania between 2007 and 2011 (see section 3.2); therefore, no evening bat mortality is expected to occur. No Seminole bats have been found at the NAWF during post-construction monitoring, and none were captured during mist-net surveys at the site; however, nine Seminole bats have been found as fatalities during post-construction monitoring of WEVCA sites in Pennsylvania between 2007 and 2011, and these fatalities were located throughout the State, suggesting that Seminole bat distribution in the State may be more widespread than previously thought (Taucher et al. 2012), although Seminole bats are still considered vagrants in the State (Gannon and Bovard 2016). Based upon this, and the data collected at WEVCA sites between 2007 and 2011, it is estimated that less than 1 percent of all bat fatalities will be Seminole bats (see section 3.2).

Migratory tree bats (hoary bats, eastern red bats, silver-haired bats) have shorter life spans than other bats, and females are capable of producing multiple pups per year, as opposed to Indiana bats, which produce a single pup each year (USFWS 2013). As such, populations of these species may be capable of tolerating greater mortality than other species.

Under no operational adjustments, with 1,243 estimated non-listed bat fatalities per year, and the predicted species composition outlined above, annual expected fatalities would vary by species from approximately 12 to 477 per year (table 3). This hypothetical estimate is included for comparison only, as this is not an alternative under consideration.

TABLE 3.—*Predicted annual and cumulative (permit term) fatalities (for comparison only) by species of non-threatened and non-endangered bats for the No Operational Adjustment Scenario, along with the AMRU population estimates and the percent of the AMRU population estimate that the fatalities represent annually. This is not an alternative under consideration, but is included only for comparison for the alternatives*

Species	AMRU Population Estimate	Annual Estimated Fatalities at the NAWF (Percent of AMRU Population)	Estimated Fatalities over the 25-year Permit Term
Hoary bats	478,368	477 (0.10%)	11,925

Eastern red bats	956,735	438 (0.05%)	10,950
Silver-haired bats	478,368	169 (0.04%)	4,225
Big brown bats	1,276,840	78 (<0.01%)	1,950
Tri-colored bats	154,035	39 (0.03%)	975
Little brown bats	151,461	39 (0.03%)	975
Seminole bats	NA[1]	<12 (NA[1])	<300

[1]No population size estimate is available for Seminole bats, see discussion in section 3.2.

Results from 2010 and 2011 post-construction monitoring at the NAWF were used to estimate the bat fatality under the no operational adjustment protocols (Shoener 2012). However, both years were missing some critical time periods of data. Appendix H details how data from 2010 and 2011 were used to impute missing values and determine the site-specific fatalities by time period shown in table 4.

TABLE 4.—*Estimated distribution of bat fatalities by time period*

April 1 to July 14	**July 15 to October 15**	**October 16 to November 15**	**Total**
42.3%	56.0%	1.7%	100.0%

Predicted non-threatened and non-endangered bat fatality for each of the three alternatives under consideration is described in detail below.

Alternative 1 (No Action)

Under the No Action Alternative, all 35 NAWF turbines will be curtailed at 6.9 m/s each year for the operational life of the Project from one-half hour before sunset to one-half hour after sunrise during the period of risk to Indiana bats (July 15 to October 15) when temperatures are above 38.3 ^{0}F and turbines will be feathered below a wind speed of 6.9 m/s. Post-construction fatality monitoring at NAWF has shown an 83-percent reduction in overall bat fatality at 6.9 m/s when above 38.3 ^{0}F (NAW 2017). Fatalities occurring during the curtailment period (July 15 to October 15; 56 percent of all fatalities) would be reduced by 83 percent (Shoener 2013; 1,243 x 0.56 x 0.17=118) for a total of 118 bat fatalities. Because take of Indiana bats is not expected to occur at a cut-in speed of 6.9 m/s, it is assumed that all other bat species (i.e., non-listed bat species) will constitute 100 percent of the fatalities.

Outside of this time period, turbines would be operated at 4.0 m/s with turbine blades fully feathered below this wind speed from April 1 to July 14 and October 16 to November 15. Feathering below a cut-in speed of 4.0 m/s is expected to reduce overall bat fatality by approximately 34 percent (see table 2-1). This results in 361 additional bat fatalities (1,243 x 0.44 x 0.66), for a total of 479 fatalities per year. This is a 61.5 percent reduction overall from the 1,243 bats that would be killed under the no operational adjustment scenario. Across species, fatality ranges from fewer than 5 Seminole bats per year (fewer than 125 total over the 25-year permit term) to 182 hoary bats per year (4,550 total over the 25-year permit term; table 5).

TABLE 5.—*Predicted annual and cumulative (permit term total) fatalities by species of non-threatened and non-endangered bats for Alternative 1 (No Action), along with the AMRU population estimates and the percent of the AMRU population estimate that the annual fatalities represent*

Species	AMRU Population Estimate	Annual Estimated Fatalities at NAWF (Percent of AMRU Population)	Estimated Fatalities over the 25-year Permit Term
Hoary bats	478,368	182 (0.04%)	4,550
Eastern red bats	956,735	164 (0.02%)	4,100
Silver-haired bats	478,368	64 (0.01%)	1,600

Species	AMRU Population Estimate	Annual Estimated Fatalities at NAWF (Percent of AMRU Population)	Estimated Fatalities over the 25-year Permit Term
Big brown bats	1,276,840	30 (<0.01%)	750
Tri-colored bats	154,035	15 (0.01%)	375
Little brown bats	151,461	14 (0.01%)	350
Seminole bats	NA[1]	<5 (NA[2])	<125

[1,2] No population size estimate is available for Seminole bats, see discussion in section 3.2.

Based upon the predicted fatality rates (table 5) and the AMRU populations of non-listed bat species[3], the impact of fatalities on non-listed bat species under the No Action Alternative would be greatest on the hoary bat, with less than 0.1 percent of the AMRU population being killed each year at NAWF. The impact of fatalities on the populations of the other non-listed bat species under the No Action Alternative are expected to be even less; therefore, no population-level impacts are expected to occur for any of the non-listed bat species.

Fatality monitoring will be conducted according to the BBCS (appendix A), which includes an adaptive management framework through which NAWF will respond to high levels of fatality. No mitigation will occur under the No Action Alternative because no take of listed species is expected to occur.

Alternative 2 (Proposed Action)

Under Alternative 2 (Proposed Action, 5.0 m/s cut-in speed), all 35 NAWF turbines would employ a cut-in speed of 5.0 m/s, with turbine blades fully feathered under this wind speed when the temperature is above 50 ºF from July 15 to October 15 each year for the permit term. Additionally, all 35 NAWF turbines will be feathered below a wind speed of 4.0 m/s from April

[3] Excluding the Seminole bat, as no population size estimate is available, and fatalities are expected to impact vagrant individuals only rather than a population.

1 to July 14 and October 16 to November 15 from one-half hour before sunset to one-half hour after sunrise regardless of temperature. Feathering below a cut-in speed of 4.0 m/s is expected to reduce overall bat fatality by an average of 34 percent (Young et al. 2011; Baerwald et al. 2009). Raising cut-in speed to 5.0 m/s is expected to reduce overall bat fatality by an average of 62 percent (Arnett et al. 2010; Good et al. 2011; Young et al. 2013; Hein et al. 2013, 2014). This document uses the average reductions shown in table 2-1 because the Service believes that the average is a better representation of the reductions in bat fatality from curtailment; whereas, the NAWF HCP used 35 percent and 50 percent, respectively.

Based on post-construction fatality data collected at the NAWF, it is estimated that 56 percent of fatalities will occur during the July 15 to October 15 timeframe (Table) and 44 percent will occur outside of this time frame. Additionally, approximately 95 percent of fatalities occurred when temperatures were above 50ºF, and only 5 percent of fatalities occurred when temperatures were below 50 ºF based on the average nightly temperatures during 2010 and 2011 post-construction monitoring at the NAWF (Shoener 2012).

Fatality of non-threatened and non-endangered bats under Alternative 2 (Proposed Action) is predicted to vary under three scenarios:

- Between April 1 and July 14 and between October 16 and November 15 (44 percent of all fatalities)
    - These fatalities will be reduced by a predicted 34 percent by feathering below 4.0 m/s
- Between July 15 and October 15 (56 percent of all fatalities)
    - 95 percent of these fatalities will be reduced by 62 percent by feathering below 5.0 m/s when temperatures are above 50 ºF
    - 5 percent of these fatalities will be reduced by a predicted 34 percent by feathering below 4.0 m/s when temperatures are below 50 ºF

Thus, fatality of non-threatened and non-endangered bats under Alternative 2 (Proposed Action) is predicted to be 361 bats for the time periods April 1 to July 14 and October 16 to November 15 ([1,243 bats/year x 0.44] x 0.66 = 361 bats). Between July 15 and October 15, 56 percent of all fatality is expected to occur (696 bats). Of this, 95 percent (i.e., fatalities occurring when temperatures are greater than 50 ºF; 661 bats) will be reduced by an average of 62 percent, and 5 percent (i.e., fatalities occurring when temperatures are less than 50 ºF; 35 bats) will be reduced by an average of 34 percent. Therefore, fatality of non-threatened and non-endangered bats under Alternative 2 (Proposed Action) is predicted to be 274 bats for the time period July 15 to October 15 (661 bats x 0.38 = 251 bats when curtailed at 5.0 m/s; 35 x 0.66 = 23 bats when curtailed at 4.0 m/s below 50ºF).

Under Alternative 2 (Proposed Action), an estimated 635 bats will be killed each year (361 bats [April 1 to July 14 and October 16 to November 15] + 274 bats [July 15 to October 15] = 635 bats/year). This is a 48.9 percent reduction overall from the 1,243 bats that would be killed under the no operational adjustment scenario. Across species, fatality ranges from fewer than 6 Seminole bats/year to 244 hoary bats/year (table 6).

TABLE 6.—*Predicted annual and cumulative (permit term total) fatalities by species of non-threatened and non-endangered bats for Alternative 2 (Proposed Action), along with the AMRU population estimates and the percent of the AMRU population estimate that the fatalities represent*

Species	AMRU Population Estimate	Annual Estimated Fatalities at the NAWF (Percent of AMRU Population)	Estimated Fatalities over the 25-year Permit Term
Hoary bats	478,368	244 (0.05%)	6,100
Eastern red bats	956,735	224 (0.02%)	5,600
Silver-haired bats	478,368	86 (0.02%)	2,150
Big brown bats	1,276,840	40 (<0.01%)	1,000
Tri-colored bats	154,035	20 (0.01%)	500
Little brown bats	151,461	20 (0.01%)	500
Seminole bats	NA[1]	<6 (NA[1])	<150

[1] No population size estimate is available for Seminole bats, see discussion in section 3.2.

Based upon the predicted fatality rates and the AMRU populations of non-listed bat species[4] (table 6), the impact of fatalities on non-listed bat species under Alternative 2 (Proposed Action)

[4] No population size estimate is available for Seminole bats, see discussion in section 3.2.

will be greatest on the hoary bat, with less than 0.1 percent of the AMRU population being killed each year at the NAWF. The impact of fatalities on the populations of the other non-listed bat species under Alternative 2 (Proposed Action) are expected to be even less; therefore, no population-level impacts are expected to occur for any of the non-listed bat species.

Under this alternative, the Proposed HCP would be implemented, fatality monitoring will occur, mitigation for Indiana bats will occur, and an adaptive management framework will be in place. In addition, the Project's BBCS will be implemented (appendix A).

Alternative 3 (Feathering Below Manufacturer's Cut-in Speed [4.0 m/s])

Under Alternative 3 (Feathering Below Manufacturer's Cut-in Speed), each of NAWF's turbines will operate at a cut-in speed of 4.0 m/s from April 1 through November 15, and turbine blades will be feathered when wind speeds are below 4.0 m/s from one-half hour before sunset to one-half hour after sunrise. Feathering below a cut-in speed of 4.0 m/s is expected to reduce overall bat fatality by an average of 34 percent (see table 2-1). The estimated annual bat fatality rate of 1,243 bats would be reduced by 34 percent, for an estimated annual bat fatality rate of 820 bats (1,243 x 0.66 = 820). By species, this ranges from fewer than 8 Seminole bats/year to 315 hoary bats/year (table 7).

TABLE 7.—*Predicted fatalities by species of non-threatened and non-endangered bats per year for Alternative 3 (Feathering Below Manufacturer's Cut-in Speed [4.0 m/s]), along with the AMRU population estimates and the percent of the AMRU population estimate that the take would represent*

Species	AMRU Population Estimate	Annual Estimated Fatalities at the NAWF (Percent of AMRU Population)	Estimated Fatalities over the 25-year Permit Term
Hoary bats	478,368	315 (0.07%)	7,875
Eastern red bats	956,735	289 (0.03%)	7,225
Silver-haired bats	478,368	112 (0.02%)	2,800
Big brown bats	1,276,840	52 (<0.01%)	1,300

Tri-colored bats	154,035	25 (0.02%)	625
Little brown bats	151,461	25 (0.02%)	625
Seminole bats	NA[1]	<8 (NA[1])	<200

[1] No population size estimate is available for Seminole bats, see discussion in section 3.2.

Based upon the predicted fatality rates and the AMRU populations of non-listed bat species[5] (table 7), the impact of fatalities on non-listed bat species under Alternative 3 (Feathering Below Manufacturer's Cut-in Speed) would be greatest on the hoary bat, with less than 0.1 percent of the AMRU population being killed each year at the NAWF. The impact of fatalities on the populations of the other non-listed bat species under Alternative 3 (Feathering Below Manufacturer's Cut-in Speed) are expected to be even less; therefore, no population-level impacts are expected to occur for any of the non-listed bat species.

Under this alternative, an HCP would be prepared and implemented, fatality monitoring will occur, mitigation for Indiana bats will occur, an adaptive management framework would be in place, and the BBCS would be implemented (appendix A).

Summary of Non-listed Bat Fatalities by Alternative

Predicted fatalities of non-listed bats range from 479 to 820 bats per year under the three alternatives, compared to 1,243 bats per year that would be killed under the no operational adjustment scenario (table 8). Based upon the species composition of fatalities at the NAWF to date, the hoary bat will have the highest fatality rate under any of the three alternatives or the no operational adjustment scenario (table 9).

TABLE 8.—*Predicted annual fatalities of non-threatened and non-endangered bats by EA Alternative*

Alternative	Cut-in Speed (m/s)	Curtailment Dates	Bat Fatalities/Year	Bat Fatalities over the 25-year Permit Term
No Operational Adjustment Scenario[1]	4.0[1]	None	1,243[2]	31,075

[5] Excluding the Seminole bat, as no population size estimate is available, and fatalities are expected to impact vagrant individuals only rather than a population.

Alternative	Cut-in Speed (m/s)	Curtailment Dates	Bat Fatalities/Year	Bat Fatalities over the 25-year Permit Term
Alternative 1 (No Action)	6.9	July 15 to October 15 when above 38.3 ºF[3,4]	479	11,975
Alternative 2 (Proposed Action)	5.0	July 15 to October 15 when above 50ºF[3,4]	635	15,875
Alterative 3 (Feathering Below Manufacturer's Cut-in Speed [4.0 m/s])	4.0	April 1 to November 15[3]	820	20,500

[1]No curtailment, no feathering. Not an alternative under consideration. Included only for comparison purposes.
[2]NAW 2017.
[3]Turbine blades feathered below the cut-in speed from one-half hour before sunset to one-half hour after sunrise.
[4]Turbine blades also feathered below 4.0 m/s April 1 to July 14 and October 16 to November 15 regardless of temperature.

TABLE 9.—*Predicted annual fatalities (with permit term totals in parenthesis) by species of non-threatened and non-endangered bats by EA Alternative*

Alternative	Percent of total fatalities	No Operational Adjustment Scenario[1]	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	(Feathering Below Manufacturer's Cut-in Speed [4.0 m/s])
Hoary bats	38.4%	477 (11,925)	184 (4,600)	244 (6,100)	315 (7,875)
Eastern red bats	34.5%	438 (10,950)	169 (4,225)	224 (5,600)	289 (7,225)
Silver-	13.6%	169	65	86	112

Alternative	Percent of total fatalities	No Operational Adjustment Scenario[1]	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	(Feathering Below Manufacturer's Cut-in Speed [4.0 m/s])
haired bats		(4,225)	(1,625)	(2,150)	(2,800)
Big brown bats	6.3%	78 (1,950)	30 (750)	40 (1,000)	52 (1,300)
Tri-colored bats	3.1%	39 (975)	15 (375)	20 (500)	25 (625)
Little brown bats	3.1%	39 (975)	15 (375)	20 (500)	25 (625)
Seminole bats	<1.0%	<12 (<300)	<5 (<125)	<6 (<150)	<8 (<200)
Total per year	NA	1,243 (31,075)	479 (11,975)	635 (15,875)	820 (20,500)

[1]No curtailment, no feathering. Not an alternative under consideration. Included only for comparison purposes.

Maintenance

Maintenance activities will be required to ensure the safety and operability of the NAWF under all three of the alternatives being considered. Thus, maintenance impacts to bats will be the same for all alternatives. Maintenance activities are described in section 1.3.3. Any of the species whose range overlaps the project (see section 3.2) could potentially be affected by maintenance, particularly tree trimming activities, but because maintenance activities occur year round, it is more likely to impact the species that breed near the project, which may include the species captured during mist-netting (little brown bats, big brown bats, eastern red bats, tri-colored bats, and hoary bats), though evening bats and silver-haired bats may also be present and have just gone undetected.

The impacts on bat resources from noise, vibration, and/or increased human activity and traffic associated with maintenance activities will be temporary, occur intermittently and over short periods of time, and typically occur during daylight hours when bats are not active. Except in the case of an emergency where there is a risk to human safety (see section 1.3.3), the Applicant has

committed to completing all tree removal during the winter when bats are not active and not roosting or forming maternity colonies in trees (between November 15 and March 31), thereby avoiding impacts to bats resulting from tree trimming and removal; therefore, no impacts are expected as a result of maintenance of trees, and no population-level impacts from maintenance activities will occur.

Mitigation

No mitigation will occur under Alternative 1 (No Action), as no take of listed species is expected. Therefore, no effects of mitigation will occur. Under the two action alternatives (Alternative 2 and Alternative 3), mitigation will occur (see section 2.1) for the Indiana bat, but no specific mitigation is proposed for non-threatened and non-endangered bats. Mitigation options are described in section 2.1.2.

Effect of Summer and Winter Habitat Mitigation

Although the mitigation project has not been determined, the Applicant is providing funding to the IBCF, which may be used to protect and restore hibernacula, or protect summer and/or swarming habitat. Most, if not all, of the mitigation options have the potential to benefit at least some non-threatened and non-endangered bats, assuming that they are present in the mitigation area. If a hibernaculum protection project is funded with the mitigation funds, this would provide benefits to other cave-hibernating bat species (i.e., big brown bat, little brown bat, tri-colored bat) assuming suitable hibernating conditions are restored. If protection of Indiana bat summer and/or swarming habitat is funded with the mitigation funds, and the area protected overlaps with non-threatened and non-endangered bat habitat (e.g., roosting and foraging habitat), non-listed bats might also benefit from the habitat protection.

No direct negative effect to non-threatened and non-endangered bats will occur as a result of protection of summer, swarming, and/or winter habitat. Monitoring activities are expected to result in very minimal, if any, human disturbance due to the short duration of these activities and the limited time people will be in the vicinity of roosting/hibernating bats, and would impact only bats present in the immediate area where surveys are occurring.

Potential direct effects to cave-dwelling non-threatened and non-endangered bats from noise, vibration, and human activity during construction of a cave gate(s) are not expected because construction will not occur during the winter or fall when bats are hibernating or swarming. Other potential direct effects of cave gating could result if bats collide with gate slats, are not able to fly through the bars of the gate and have to land and crawl through, or have to expend extra energy to navigate between gate slats. However, these direct effects are not expected because if a cave gate(s) were constructed the gate(s) will be modeled after designs of other successful cave gates that have resulted in increased populations of bats and because post-gating monitoring will be conducted to be certain that the gate is not adversely affecting bat movement. Spacing between the angle irons will be sufficient to restrict human access to the cave, but not so tight as to impede bat flight through the gate or result in collisions.

Indirect effects of cave gating could include increased predation by owls, snakes, raccoons, feral cats, or other predators if the gate slows down or stops the flight of bats as they move in and out of the cave opening. Predation at the entrances of hibernacula is a relatively common and natural

phenomenon at caves with large populations of bats. However, the gate will be designed so that spacing between gate slats will be sufficient to restrict larger predators access to the cave, but not so narrow as to hinder or slow bat flight through the gates. This should minimize predators' abilities to capture bats as they are moving in and out of the cave. Furthermore, during gate construction, special attention will be paid to removing or modifying any potential overhangs, nearby branches, or other perches or structures that might provide easier access to predators.

Based on the above, neither summer nor winter habitat mitigation is expected to have any negative direct or indirect effects to non-threatened or non-endangered bats under either Alternative 2 (Proposed Action) or Alternative 3 (Feathering Below Manufacturer's Cut-in Speed [4.0 m/s]).

Literature Cited

Arnett, E.B., W.K. Brown, W.P. Erickson, J.K. Fiedler, B.L. Hamilton, T.H. Henry, A. Jain, G.D. Johnson, J. Kerns, R.R. Koford, C.P. Nicholson, T.J. O'Connell, M.D. Piorkowski, and R.D. Tankersley. 2008. Patterns of bat fatalities at wind energy facilities in North America. Journal of Wildlife Management 72: 61-78.

Arnett, E. B., M. M. P. Huso, M. R. Schirmacher, and J. P. Hayes. 2010. Effectiveness of Changing Wind Turbine Cut-in Speed to Reduce Bat Fatalities at Wind Facilities: Final Report. Annual report prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission. Bat Conservation International (BCI), Austin, Texas. May 2010.

Baerwald, E.F., G.H. D'Amours, B.J. Klug, and R.M.R. Barclay. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology 18: R695-R696.

Baerwald, E.F., J. Edworthy, M. Holder and R.M.R. Barclay. 2009. A Large-Scale Mitigation Experiment to Reduce Bat Fatalities at Wind Energy Facilities. Journal of Wildlife Management. 73(7):1077-1081.

Cryan, P.M. 2008. Mating behavior as a possible cause of bat fatalities at wind turbines. Journal of Wildlife Management 72:845-849.

Fiedler, J.K. 2004. Assessment of bat mortality and activity at Buffalo Mountain Windfarm, eastern Tennessee. Thesis, University of Tennessee, Knoxville, USA.

Gannon, M.R. and B.N. Bovard. 2016. "The Value of Bats: Keystone Species in the Keystone State". *Conservation and Ecology of Pennsylvania's Bats*. Ed. C.M. Butchkoski, D.M. Reeder, G.G. Turner and H.P. Whidden. The Pennsylvania Academy of Science.

Good, R. E., W. P. 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. (WEST), Cheyenne, Wyoming. January 28, 2011.

Good. R.E., A. Merrill, S. Simon, K.L. Murray, and K. Bay. 2012. Bat Monitoring Studies at the Fowler Ridge Wind Farm, Benton County, Indiana. Final Report: April 1 – October 31, 2011. Prepared for Fowler Ridge Wind Farm, Fowler, Indiana. Prepared by Western EcoSystems Technology, Inc. (WEST, Inc.), Bloomington, Indiana.

Hein, C. D., A. Prichard, T. Mabee, and M. R. Schirmacher. 2013. Avian and Bat Post-Construction Monitoring at the Pinnacle Wind Farm, Mineral County, West Virginia, 2012. Final Report. Bat Conservation International, Austin, Texas, and ABR, Inc., Forest Grove, Oregon. April 2013.

Hein, C. D., A. Prichard, T. Mabee, and M. R. Schirmacher. 2014. Efficacy of an Operational Minimization Experiment to Reduce Bat Fatalities at the Pinnacle Wind Farm, Mineral County, West Virginia, 2013. Final Report. An annual report submitted to Edison Mission Energy and the Bats and Wind Energy Cooperative. Bat Conservation International, Austin, Texas. February 2014.

Horn, J.W., E.B. Arnett and T.H. Kunz. 2008. Behavioral responses of bats to operating wind turbines. Journal of Wildlife Management 72(1):123-132.

Johnson, G.D., M.K. Perlik, W.P. Erickson and M.D. Strickland. 2004. Bat Activity, Composition and Collision Mortality at a Large Wind Plant in Minnesota. Wildlife Society Bulletin. 32(4): 1278-1288.

Kerns, J, W. P. Erickson, and E. B. Arnett. 2005. Bat and bird fatality at wind energy facilities in Pennsylvania and West Virginia. Pages 24–95 in E. B. Arnett, editor. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International, Austin, Texas, USA.

Kunz, T.H., E.B. Arnett, B.M. Cooper, W.P. Erickson, R.P. Larkin, T. Mabee, M.L. Morrison, M.D. Strickland, and J.M. Szewczak. 2007a. Assessing impacts of wind-energy development on nocturnally active birds and bats: a guidance document. Journal of Wildlife Management 71:2449-2486.

Kunz, T.H., E.B. Arnett, W.P. Erickson, A.R. Hoar, G.D. Johnson, R.P. Larkin, M.D. Strickland, R.W. Thresher and M.D. Tuttle. 2007b. Ecological impacts of wind energy development

on bats: questions, research needs and hypotheses. Frontiers in Ecology and the Environment 5:315-324.

North Allegheny Wind LLC (NAW). 2017. Habitat Conservation Plan for the North Allegheny Wind Facility, Blair and Cambria Counties, Pennsylvania. Prepared by North Allegheny Wind LLC, a wholly owned subsidiary of Duke Energy Renewables, Inc. Charlotte, North Carolina. Prepared in consultation with Western EcoSystems Technology, Inc., Cheyenne, Wyoming, and Bloomington, Indiana; Shoener Environmental, Dickson City, Pennsylvania; Sanders Environmental, Bellefonte, Pennsylvania; and Holland & Hart LLP, Denver Colorado.

Shoener. 2012. Post-Construction Bird/Bat Mortaltiy Monitoring Final Report (2010 and 2011), North Allegheny Wind Farm, Blair and Cambria Counties, Pennsylvania. Prepared for North Allegeheny Wind, LLC, Charlotte, North Carolina. Prepared by Shoener Environmental, Dickson City, Pennsylvania. May 14, 2012. 103 pp.

Shoener. 2013. Post-Construction Bird/Bat Mortality Monitoring Report (2012). North Allegheny Wind Farm, Blair and Cambria Counties, Pennsylvania. Prepared for North Allegeheny Wind, LLC, Charlotte, North Carolina. Prepared by Shoener Environmental, Dickson City, Pennsylvania. March 1, 2013. 89 pp.

Taucher, J., T.L. Mumma, and W. Capouillez. 2012. Pennsylvania Game Commission Wind Energy Voluntary Cooperation Agreement, Third Summary Report. Bureau of Wildlife Habitat Management. December 27, 2012. 72 pp.

U.S. Fish and Wildlife Service [USFWS]. 2011. Indiana Bat Section 7 and Section 10 guidance for Wind Energy Projects. Revised 26 October, 2011. Available online at: http://www.fws.gov/midwest/endangered/mammals/inba/pdf/inbaS7and10WindGuidanceFinal26Oct2011.pdf

USFWS. 2013. Final Environmental Assessment for Proposed Issuance of an Incidental Take Permit for the Indiana Bat Under Section 10(a)(1)(B) of the Endangered Species Act for the Criterion Habitat Conservation Plan. Garrett County, Maryland. June 2013. Prepared by USFWS and Ecology and Environment, Inc.

Young, D., S. Nomani, W.L. Tidhar, and K. Bay. 2011. NedPower Mount Storm Wind Energy Facility Post-Construction Avian and Bat Monitoring; July – October 2010. Prepared for NedPower Mount Storm, LLC. Prepared by Western EcoSystems Technology, Inc. February 10, 2011.

Young, D., C. Nations, M. Lout and K. Bay. 2013. 2012 Post-Construction Monitoring Study, Criterion Wind Project, Garrett County, Maryland, April- November 2012. Prepared for Criterion Power Partners, LLC. Prepared by Western EcoSystems Technology, Inc.