

APPENDIX G

**UPDATED TAKE ESTIMATE FROM MONITORING DATA AND NEW
INFORMATION**

Updated Take Estimate from Monitoring Data and New Information

Consultation on the Criterion Wind Project (Project) began in June of 2010 and started with an assessment of the potential take from the Project. A model using a surrogate species (little brown bat) was developed and used values found in regional studies to estimate potential take of Indiana bat (described in Section 4.1.2 of the HCP). The initial estimate of total take during the 20-year functional life of the turbines was 14 Indiana bats, after implementation of the turbine operational adjustments (i.e., the on-site minimizations measures). Since the original estimate of potential take from the Project was prepared, there has been on-site monitoring studies conducted which provide site-specific data and there are also new estimates for some of the variables that reflect changes in bat populations due to the on-set of White Nosed Syndrome (WNS). The following provides a new analysis of the potential take from operation of the Project turbines using these new data. The analysis provides an assessment of how well the original estimate of take matches the site-specific data and provides the most current estimate of take for use in the Incidental Take Permit.

Changes in the Exposure of *Myotis* Bats Due to Population Declines

The amount of take that occurs is a product of the *exposure* of bats to turbines (number of bats encountering turbines) and the *collision risk* or lethality of interacting with a turbine. As *Myotis* bat populations decline due to WNS, it is expected that there will be reduced total numbers of *Myotis* bats killed because fewer bats occur on the landscape and fly in the turbine air-space and potentially interact with turbine blades. For bats that do enter the turbine risk zone, the collision risk remains the same; however, as the total number of bats in a population declines, the total number killed would decline if mortality is related to their abundance on the landscape or is density dependent. The total number of *Myotis* bats killed by turbine interactions would eventually reach zero if *Myotis* bat populations reach zero.

The assumption that *Myotis* mortality is related to their abundance on the landscape is supported by regional data from wind projects that have been monitored for multiple years within the range of WNS impacts. For example, the Maple Ridge wind project in New York was monitored over the three-year period from 2006 to 2008, which is the period when WNS was first affecting bats in New York. During this period the total estimated number of little brown bat fatalities declined from 500 in 2006 to 331 in 2007 and to 273 in 2008, despite the number of turbines in the project increasing from 120 to 195 over that period (see Jain et al. 2007, 2008, 2009). The Mount Storm wind project in West Virginia was monitored from the fall of 2008 through the fall of 2011. WNS was first documented in West Virginia in 2009. During the monitoring at Mount Storm the percent of *Myotis* in the pool of fatalities declined from 9% in 2009, to 3% in 2010, to zero in 2011 (see Young et al. 2009, 2010a, 2010b, 2011a, 2011b, 2012a). The third annual

report from the Pennsylvania Game Commission (PGC) for the wind project cooperative agreement (Taucher et al. 2012) reports that the percent of little brown bats in the fatality pool declined from 17% in 2009 to 4% in 2011. At the Locust Ridge project in Pennsylvania, the number of little brown bats in the pool of recovered fatalities dropped from 62 (24%) in 2009 to 10 (4%) in 2010 (Arnett et al. 2011). This corresponds to the period when WNS was affecting bats in Pennsylvania. At the Criterion Wind Power project specifically, 4.5% of all bat carcasses found were *Myotis* in 2011 and 0% in 2012 (Young et al. 2012b, 2013).

In addition, WNS appears to have changed the relative proportion of bat species on the landscape as the species composition within hibernacula has apparently changed (Turner et al. 2011, Stihler 2013). Some species may be more susceptible to WNS as the proportion of decline by species appears to be variable (Turner et al. 2011). The model used to estimate Indiana bat take uses the proportion of Indiana bats to little brown bats on the landscape (as identified from mist-net survey data) to scale the estimated take based on the relative proportions of the two species recorded during the surveys. Because the bat species compositions may be changing as a result of WNS, more recent post-WNS data from mist net surveys shows a somewhat different proportion of the two species on the landscape (Table 1).

Table 1. Number of little brown bats and Indiana bats captured in mist-net surveys in West Virginia where Indiana bats had not been known prior to the first survey¹.

Year	Number of Little Brown Bats	Number of Indiana Bats	Ratio of Indiana Bats to Little Brown Bats
Pre-WNS			
2003	373	3	0.80
2004	266	13	4.88
2005	446	5	1.12
2006	559	0	--
2007	827	3	0.36
2008	996	4	0.40
Total: Average	3467	28	0.81
Post-WNS			
2009	356	7	1.96
2010	196	7	3.57
2011	79	1	1.26
2012	420	10	2.38
Total: Average	631	15	2.38

¹Based on more than 600 mist-net surveys of sites where the species composition of bats was unknown prior to the survey but which occurred in areas considered suitable habitat for Indiana bat.

WNS was first detected in the AMRU in winter of 2008/2009. Based on information from the Northeast Recovery Unit where WNS was first documented in 2006, it appears to takes from 3 to 7 years for the full effects of the disease to manifest (Turner et al. 2011). Large population declines were first seen in some hibernacula in the AMRU in 2011. The estimated number of Indiana bats in Pennsylvania dropped by about 50% between 2009 and 2011 (USFWS 2012). Severe declines were documented in the AMRU in 2013 (Stihler 2013). Based on more recent monitoring studies the post-WNS proportion of little brown bat carcasses to all bat carcasses in the pool of recovered bat fatalities is now in the range of approximately 0 to 4 percent (Table 2), versus approximately 3 to 13 percent pre-WNS (see Table 4.4 in HCP). The ratio of Indiana bats to little brown bats in mist net data also now averages approximately 2.38 percent post-WNS (Table 1) versus an average of 0.81 percent pre-WNS (see HCP p. 30).

Table 2. Annual number of bat carcasses found by species at wind project monitoring studies in the Appalachian Mountain Recovery Unit, 2010 – 2012.

Species	Locust Ridge, PA (2010)	Mount Storm, WV (2010)	Mount Storm, WV (2011)	Laurel Mountain, WV (2011- 2012)	Criterion, MD (2011)	Pinnacle, WV (2012)	Total
Hoary bat	78 (35.3%)	133 (28.9%)	90 (49.2%)	68 (36.6%)	236 (33.4%)	79 (34.8%)	684(34.5%)
Eastern red bat	64 (29.0%)	238 (51.6%)	54 (29.5%)	62 (33.3%)	244 (34.6%)	86 (37.9%)	748 (37.7%)
Tri-colored bat	22 (10.0%)	23 (5.0%)	12 (6.6%)	18 (9.7%)	47 (6.7%)	21 (9.3%)	143 (7.2%)
Silver-haired bat	26 (11.8%)	32 (6.9%)	23 (12.6%)	17 (9.1%)	103 (14.6%)	23 (10.1%)	224 (11.3%)
Big brown bat	21 (9.5%)	17 (3.7%)	2 (1.1%)	12 (6.5%)	38 (5.4%)	16 (7.1%)	106 (5.3%)
Seminole bat	0	2 (0.4%)	0	0	1 (0.1%)	1 (0.4%)	4 (0.2 %)
Unknown	0	1 (0.2%)	2 (1.1%)	4 (2.2%)	5 (0.9%)	1 (0.4%)	14 (0.7%)
<i>Myotis</i> species							
Little brown bat	10 (4.5%)	15 (3.3%)	0	4 (2.2%)	31 (4.4%)	0	60(3.0 %)
N. long-eared bat	0	0	0	0	0	0	0
Indiana bat	0	0	0	1 (0.5%)	0	0	1 (0.05%)
Unknown Myotis	0	0	0	0	1 (0.1%)	0	1 (0.05%)
Total <i>Myotis</i>	10	15	0	5	32	0	62
Total bats	221	461	183	186	706	227	1,984
Estimated bat fatalities/turbine/year at control turbines	32.2 (CI: 27.7-37.0)	32.4 (CI: 26.6-43.5)	14.9 (CI:11.9-18.3)	23.4 (CI: 17.6-30.2)	39.0 (CI: 34.6-46.5)	96.5 (CI 68.6-146.4)	

Revised Take Assessment

Overall bat mortality at wind projects in the AMRU based on post-WNS monitoring studies averaged approximately 39.7 and ranged from approximately 15 to 96 bats per turbine per year (Table 2). This is higher than pre-WNS monitoring results which averaged approximately 32.5 and ranged from approximately 24 to 48 bats per turbine per year (see Table 4.3 in the HCP). The post-WNS average is close to the site specific monitoring study at the Project from 2011 which resulted in approximately 39.0 bats per turbine (Young et al. 2012). Using the site specific data for estimating the total annual bat mortality at the Project and the percent of little brown bats expected in the overall bat mortality post-WNS it is estimated that the total estimated number of little brown bat fatalities would be approximately 48. Use the percent of Indiana bats to little brown bats from the post-WNS mist-net surveys from West Virginia (Table 1), it is estimated that on average approximately 1.14 Indiana bat fatalities would occur annually at the Project (Table 3), in the absence of any turbine operational adjustment (on-site minimization measures). Over the 20-year operational life of the turbines this would result in approximately 23 total Indiana bat fatalities.

Table 3. Results of a model estimating take of Indiana Bats within the Criterion Wind Project.

Data Sources	Annual Estimate of Total Bat Mortality	Percent of Fatalities that are Little Brown Bats	Annual Estimate of Little Brown Bat Mortality	Percent that are Indiana Bats	Annual Estimate of Indiana Bat Mortality
Original Take Estimate in HCP	1,344 (max regional value)	12.9% (max regional value)	173	0.81% (average pre-WNS)	1.40
Revised Take Estimate	1,092 (site specific results)	4.4% (site specific results)	48	2.38% (average post-WNS)	1.14

Estimated Take With Minimization Measures

As described in the HCP, to minimize potential Indiana bat mortality at the site to the maximum extent practicable, CPP will implement turbine operational changes that include adjusting the blade pitch for the turbines at wind speeds below 5.0 m/s to minimize rotation of the rotor from sunset to sunrise during the period from July 15 to October 15 each year. Based on the post-construction monitoring result from 2012 when this measure was implemented, bat mortality at the site was reduced by 51% (Young et al. 2013). Assuming overall take of Indiana bat over the

20-year operational life of the turbines (i.e., 23 bats) will be reduced by at least 50%, the estimated take from the project with implementation of the on-site minimization measures is 12 Indiana bats. This is the level of take for which CPP will request coverage in the incidental take permit.