Appendix I

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U.S. Fish and Wildlife Service Summary Document for Review of Eagle Use Data and Eagle Fatality Prediction Analysis for the Chokecherry and Sierra Madre Wind Energy Project Phase 1

U.S. Fish and Wildlife Service, Region 6, Wyoming Ecological Services Field Office
and Region 6 Migratory Bird Management Office

May 27, 2014

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U.S. Fish and Wildlife Service Summary Document for Review of Eagle Use Data and Eagle Fatality Prediction Analysis for the Chokecherry and Sierra Madre (CCSM) Wind Energy Project Phase 1

EXECUTIVE SUMMARY

This document describes the data, decision criteria, and methods used by the U.S. Fish and Wildlife Service (USFWS) to calculate the estimated bald eagle and golden eagle fatalities associated with Phase 1 of the Chokecherry Sierra Madre Wind Energy Project. The methods used by the USFWS generally followed recommendations in the Eagle Conservation Plan Guidance (ECPG 2013), such as using data from points counts that fall within 1 kilometer of the project footprint (ECPG 2013, p. 57).

The number of estimated eagle fatalities was calculated using long-watch data collected from April 2011 to July 2012 and 800-meter (0.5 mile) point count data collected from August 2012 to August 2013. The data were collected over two and a half years using varying methods (i.e., observer distances, eagle flight heights, surveys periods, and number of survey points); therefore, the data could not be easily combined into a single model run. Because of the varying survey effort and volumes, the data were stratified by sampling methodology.

Data from April 2011 to July 2012 were collected using similar long-watch methods, so data from the 16 months were combined into one year of data (Year1) and were run independently of the other four survey periods (Fall 2012, Winter 2012, Spring 3013, Summer 2013). Because the eagle fatality model uses a Bayesian framework, the posterior from Year1 was used to inform Year2 as the new prior.

The second "year" (Year2, August 2012 to August 2013) was collected over 13 months from different numbers of survey points using different eagle flight heights. Data from the 13 months of Year2 were pooled and used to predict fatalities for one 12-month year; however, the code in the eagle fatality model was modified to account for different survey volumes and hazardous area volumes. In model runs for both years, daylight hours were adjusted to account for curtailment of 17 turbines during the spring.

Estimates of golden eagle fatalities and bald eagle fatalities were calculated for Chokecherry and for Sierra Madre using two different turbine sizes. Using the largest on-shore turbine anticipated (120-meter diameter blade), the 80 percent upper credible interval (80% UCI) from the USFWS peer-reviewed model predicts 14 golden eagle fatalities and 2 bald eagle fatalities annually for Phase 1 of the Chokecherry and Sierra Madre Wind Energy Project. Using a smaller turbine (103-meter blade), the model predicts the 80% UCI for 500 turbines of Phase 1 will result in 10 golden eagle and 1.4 bald eagle fatalities annually.

⁘ POINT COUNTS TO INCLUDE/EXCLUDE FROM EAGLE FATALITY MODELING

Decision Criteria

(1) Data from point counts were included in the eagle fatality model runs if the 800-meter circle overlapped turbines or if the circle occurred within 1 kilometer (km) of at least one turbine.

Rationale: This approach assumes that at a distance of 1 km, there is a close association between the sampling sites and the turbine locations such as a similarity of habitat types and/or eagle use (ECPG 2013, p. 57).

Exception to Criterion #1: Data from point counts along the eastern side of the "interior rim" of Chokecherry were excluded from the analysis even though turbines occurred within 1 km of the 800-meter circle.

Rationale: Data from point counts can be excluded if topographic features and vegetation types are not representative of the project footprint.

Exception to Criterion #1: Data from point counts on the periphery of the project footprint could be excluded if: (a) spatial coverage approached 30 percent, (b) turbines did not overlap the 800-meter circle, and (c) removing data from these point counts did not create a gap in spatial coverage.

Rationale: Eagle activity on the periphery of the project may be substantially different than within the project footprint; therefore, data from points on the periphery might not reflect project-related risk to eagles. However, without other data, points on the periphery may represent the best available information about risk to eagles and should be included.

Data from points on the periphery should only be considered for exclusion if: (a) removing the points does not substantially reduce spatial coverage from 30 percent, (b) turbines do not overlap the 800-meter circle (otherwise there is a direct relationship between turbines and eagle use within the point count); and (3) removing the points does not leave a gap in spatial coverage and data from adjacent points are representative of conditions on the periphery of the project footprint.

(2) If data from the point counts in criterion #1 provided less than 30 percent spatial coverage of the project footprint, point counts farther than 1 km were also included in the analysis if the point counts were representative of conditions within the project footprint.

Rationale: The sampling design should provide a minimum spatial coverage of at least 30 percent of the project footprint (ECPG 2013, p. 54). When available eagle use data from point counts did not meet the minimum recommendations from the ECPG, adding data from nearby point counts can be used to compensate for the lack of data, provided the points are representative of topographic features and vegetation types that characterize turbine strings within the project footprint.

Chokecherry-Specific Modifications to Decision Criteria

(See Figures 1 through 4 in Appendix A)

(A) Points RM5 and RM11 (April 2011 to March 2012) and RM21 (Summer 2012) occur along the "interior rim" and data from these points were removed from Phase 1 eagle fatality estimates for the following reasons:

(a1) **RM 5** is along eastern side of the "interior rim," away from Phase 1 development. No turbines occur within the point count or within 1 km of the 800-meter circle around RM5. While data from RM5 could be included due to less than 30 percent spatial coverage (criterion #2), the eastern face of the "interior rim" is a unique topographic feature that is not representative of the project footprint; therefore, data from RM5 were excluded.

(a2) **RM11** One turbine is located within 1 km of the 800-meter circle; therefore, data from RM11 could be included due to criterion #1; however, RM 11 is located along the eastern cliff face of the "interior rim," away from Phase 1 development. Furthermore, almost all eagle observations within the 800-meter point count occur along the eastern face of the rim, and the majority of eagle observations occur outside of Phase 1 development. Data from RM11 were excluded because the topographic feature and pattern of eagle use are not representative of the project footprint.

(a3) **RM21** was a long-watch site during May to July 2012 and replaced the points along the "interior rim" (RM5, RM6 and RM11). Five turbines occur within 1-km of the 800-meter point count, so data from RM21 could be included due to criterion #2. However, data from RM21 were excluded because the point count is located on the eastern face of a unique topographic feature and most eagle movements along the "interior rim" were north-south and did not overlap Phase 1. Data from RM21 were excluded because the topographic feature and pattern of eagle use are not representative of the project footprint.

(B) **RM 6** occurs along the western side of the "interior rim" nearest Phase 1. Even though RM6 is on the periphery of the project footprint and all eagle observations from this point count occur within the PCW avoidance area, data from RM6 were included because spatial coverage was considerably less than 30 percent and because two turbines occur within the 800-meter point count and 8 turbines are within 1 km of the circle (criterion #1).

(C) Data from RM12, CC8 and CC13 (the points are located in the SW corner of Chokecherry near Sheep Mountain) were included in the initial model runs, because turbines occur within 1 km of the 800-meter point count circles (criterion #1). In addition, kernel density analysis of the 2011 to 2012 data identified the SW corner of Chokecherry (near RM12) as a "high eagle use" area. In the current project layout, PCW removed turbines from the SW corner of Chokecherry. Because RM12, CC8 and CC13 are now on the periphery of the project footprint, they were considered for exclusion.

(c1) Data from **RM12** were included in the survey period from April 2011 to March 2012, because spatial coverage during this time was considerably less than 30 percent and because removing these data would leave only two point counts to represent eagle use for 202 turbines.

(c2) Data from **RM12** were included in the data from summer of 2012 (May to July), because spatial coverage was considerably less than 30 percent and because removing these data would leave only one point count to represent eagle use for 202 turbines.

(c3) Data from **CC8** (Aug to Nov 2012) were removed from analysis because there are eight other points in Chokecherry during this period and two survey points (CC2 and CC5) provide data for turbines near CC8.

(c4) Data from **CC13** and **RM12** (Dec 2012 to Aug 2013) were removed from analysis, because there are eleven other points in Chokecherry during this period and data from two survey points (CC2 and CC5) provide coverage for nearby turbines.

Sierra Madre-Specific Modifications to Decision Criteria

(See Figures 5 through 8 in Appendix A)

(A) Even though turbines are more than 1 km from **RM15**, data from this point were included in the period from April 2011 to March 2012, because spatial coverage during this period was considerably less than 30 percent and the habitat and features at RM15 are similar to those in the project footprint (criterion #2).

There are only four point count locations in Sierra Madre during April 2011 to March 2012, and only two of those points are on the eastern side of Miller Hill. Including data from RM15 adds a third point to the eastern side of Miller Hill and a fifth survey point to Sierra Madre, which has 298 turbines. Two turbines are within 1.25 km of RM15, and the vegetation and habitat are similar between RM15 and the eastern side of Sierra Madre.

Data from RM15 were not included in the survey periods between November 2012 and August 2013, because there are 18 other points in Sierra Madre during this time and spatial coverage approached 30 percent.

(B) **PG6** is located outside of the project footprint, east of the county road. Five turbines occur within 1 km of the 800-meter point count, so data from PG6 are included due to criterion #1. Because the point is on the eastern fringe of Phase 1, data from PG6 could be considered for exclusion, but doing so would substantially reduce the spatial coverage in the northeast portion of Sierra Madre and leave numerous turbines without nearby point count data. In addition, one of the largest and densest white-tailed prairie dog (WTPD) colonies in Sierra Madre occurs west of PG6; therefore, data from PG6 likely characterizes eagle use of the prey resource during the WTPD active period (about April through September).

(C) **PG3** is outside of the project footprint on the north side of Miller Hill, and only one turbine occurs near the edge of the 1 km buffer of the 800-meter point count; therefore, data from this point count were considered for exclusion. Four of the habitat types in and around PG3 (Open Water, Aspen-Mixed Conifer, and Montane Shrubland) are not representative of the project footprint. Other nearby points (PG10, PG6, and PG9) contain representative habitat types, and these points provide good spatial coverage of turbine locations; therefore data from PG3 were removed from the analysis.

Appendix B summarizes point count locations by survey period and phase of development.

⁂ CALCULATING EAGLE MINUTES FOR THE FATALITY MODEL

April 2011 to March 2012

In June of 2012, the Power Company of Wyoming (PCW) provided a summary spreadsheet of survey effort and eagle observations from the 15 long-watch raptor count locations that were surveyed between April 2011 and March 2012. The dataset included eagle observations out to 6.4 km (4.0 miles), but eagle observations from the long-watch data were truncated at 800-meters due to concerns about detectability falling below assumed 100% beyond 800-meters and to be consistent with survey recommendations in the ECPG (ECPG 2013, pp. 54-59). The truncated dataset (i.e., at 800-meters) for both Phase 1 and Phase 2 included 729 golden eagle minutes, 73 bald eagle minutes and 3 unidentified eagle minutes. Total survey effort included 129,750 minutes or 2,163 hours of observation. These same data were also used in PCW's draft Eagle Conservation Plan and in numerous reports from PCW.

In comparing eagle minutes in the summary spreadsheet with detailed eagle observations in the GIS data file (Raptors201104_201203), it became apparent that the summary spreadsheet had substantially more eagle minutes within 800-meters than could be accounted for in the GIS data. The GIS file included start and end times for each eagle observation, so minutes for each eagle observation could be directly calculated from the GIS file. In contrast, the summary spreadsheet only contained a single column for eagle minutes without any record of how minutes were derived. Upon further review, it was determined that the summary spreadsheet ascribed minutes from the entire flight path to each point in the path instead of just the time for that segment of the flight path. In addition, eagle minutes outside the 800-meter point count were included in the spreadsheet if part of the flight path crossed the point count.

Because the GIS file represents the best available data and because the results from the GIS file can be repeated, the summary spreadsheet and the associated data were not used in the analysis to predict eagle fatalities.

The start and end times in the GIS file were recorded in hours and minutes but did not include seconds (e.g., 08:01 to 08:02 a.m.). Recommendations in the ECPG include rounding time of each eagle observation to "the next highest integer (e.g., an eagle observed flying within the plot for about 15 seconds is 1 eagle minute, another observed within for about 1 minute 10 seconds is 2 eagle-minutes, and so on…)" (ECPG 2013, p. 56). Because seconds were not provided, the number of eagle minutes was rounded to include all minutes in which the eagles were observed. In the above example, the observation occurred at both 08:01 and 08:02, resulting in a total of two eagle minutes. In some cases, this method may inflate the number of eagle minutes, but it ensures the number of eagle minutes is not underestimated. Using this method, the dataset from the GIS file includes 198 golden eagle, 39 bald eagle, and 0 unidentified eagle minutes for Phase 1 (Table 1; GOEA Minutes; BAEA Minutes).

In GIS, eagle observations with corresponding flight paths for Phase 1 were reviewed point by point. Using best professional judgment, eagle minutes were reduced if the eagle flew out of the 800-meter point count. For example, if a three-minute observation of an eagle started at the edge of the point count (i.e., at 800-meters) and the eagle flew away from the circle, that three-minute observation became one eagle minute. This analysis reduced golden eagle minutes for Phase 1 from 198 to 189 minutes and bald eagle from 39 to 34 minutes (Table 1; Flight Adjusted).

The ECPG recommends eagle minutes be "recorded as ≤ 200 m (at or below conservative approximation of maximum height of blade tip of tallest turbine) or > 200 m" (ECPG 2013, p. 56). In the GIS file, heights of eagle observations were recorded as above or below150 meters, therefore, it is impossible to know whether an eagle minute recorded as 150+ meters was between 150 and 200 meters or above 200 meters. To address this issue, all eagle minutes with heights greater than 150 meters were removed. This adjustment reduced golden eagle minutes for Phase 1 from 189 to 145 minutes and bald eagle minutes from 34 to 32 minutes (Table 1; Height Adjusted). Because flight heights were truncated at 150 meters, the prior for exposure in the model was modified to account for sampling volume and the sampled volume term in the model code was adjusted from 200 to 150 meters.

Table 1. Summary of raw, flight-adjusted, and height-adjusted golden eagle (GOEA; orange color) and bald eagle (BAEA; blue color) minutes for Chokecherry (CC) and Sierra Madre (SM) Phase1, based on data from the GIS file.

Phase / Location	GOEA Minutes	Flight Adjusted	Height Adjusted	BAEA Minutes	Flight Adjusted	Height Adjusted
CC Phase 1	50	50	37	13	10	10
SM Phase 1	148	139	108	26	24	22
Total	198	189	**145**	39	34	**32**

<u>May 2012 to August 2013</u>

For five survey periods between May 2012 and August 2013, the PCW provided spreadsheets containing detailed descriptions of eagle observations within the 800-meter point counts, including start and end times for each eagle observation. Start and end times were recorded in hours and minutes but did not include seconds (e.g., 10:05 to 10:07 a.m.). Recommendations in the ECPG include rounding time of each eagle observation to "the next highest integer" (ECPG 2013, p. 56). Similar to treatment of the earlier GIS data, the number of eagle minutes was rounded to include all minutes in which the eagles were observed. In the above example, the observation occurred in 10:05, 10:06 and 10:07, resulting in a total of three eagle minutes. In some cases, this method may inflate the number of eagle minutes, but it ensures the number of eagle minutes is not underestimated.

For the Summer 2012 dataset and a portion of the Fall 2012 dataset, eagle minutes were recorded as above or below 150 meters instead of 200 meters as recommended (ECPG 2013, p. 56). To address this issue, all eagle minutes with heights greater than 150 meters were removed, and then sampled volume in the model code was adjusted from 200 to 150 meters. For the second half of the Fall 2012 dataset, and the Winter 2012, Spring 2013 and Summer 2013 datasets, eagle observations were recorded as above or below 200 meters.

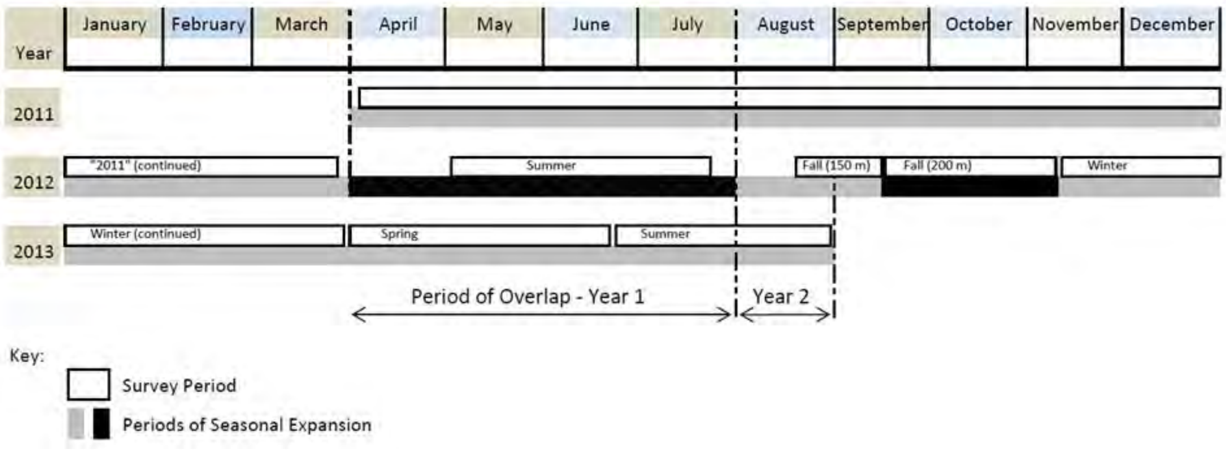
<u>Periods of Sampling Overlap for "Year1" and "Year2"</u>

Data from the first year (April 2011 to March 2012) and data from the summer of 2012 (May 2012 to July 2012) were collected using the same methods. Even though the number and location of points differed, the data from the 16 months can be combined into one year (Year1) for use in the model, because the data were collected using similar methods. Data from the 16 months of "Year 1" were pooled and used to predict fatalities for one 12-month year (Figure 1).

The second year of data (August 2012 to August 2013) was collected over thirteen months from different numbers of survey points (i.e., 40 and 60) and using different eagle flight heights (i.e., 150 and 200 meters). Because of the varying survey effort and different volumes, the data were stratified by sampling methodology. The sampling periods from Year2 are "Fall2012-150m" (40 points, 150 meters), "Fall2012-200m" (40 points, 200 meters) and "Winter2012 / Spring2013 / Summer2013" (60 points, 200 meters).

Data from the 13 months of "Year2" were pooled and used to predict fatalities for one 12-month year; however, the code in the eagle fatality model was modified to account for different survey volumes and hazardous area volumes (Figure 1).

Figure 1. Survey effort (and period of expansion) overlapped from April 2011 through July 2012 (collectively "Year 1") and from August 2012 to August 2013(collectively "Year 2").



Appendix C summarizes survey effort and eagle minutes for individual survey points during each survey period.

Appendix D summarizes total survey effort and eagle minutes for Chokecherry and Sierra Madre during each survey period based on the decision criteria whether to include or exclude survey points.

ADJUSTMENTS DUE TO AVOIDANCE AREAS

In general, eagle minutes observed at observation points that overlapped the PCW-avoidance areas were not subtracted from the model runs by USFWS. The avoidance areas are primarily a concern for the April 2011 to March 2012 dataset, because later point count locations were placed outside of the avoidance areas. Earlier attempts by USFWS and PCW to exclude eagle minutes that occurred within the avoidance areas were based on data from the summary spreadsheet (rather than GIS data), and resulted in removal of between 40 to 75 percent of eagle minutes depending on method used.

Using data from the GIS file (instead of the summary spreadsheet) for those points included in the decision criteria results in the removal of a small percentage of eagle minutes from Phase 1 survey points. One possible reason to exclude data within the avoidance areas is that they are areas where turbines will not be built and so risk to eagles should be lower; however, in most cases there are not enough eagle observations to conclude that eagle activity differs between areas within an 800-meter survey point. Furthermore, removing eagle minutes within the avoidance areas may result in a higher eagle fatality estimate due to the corresponding subtraction of survey area within the avoidance areas.

RM5, RM11, and RM21 occur within the avoidance areas. As discussed earlier, eagle minutes from RM5, RM11, and RM21 were not included, because the points occur along the eastern face of the "interior rim," a unique topographic feature that does not represent the project footprint. In addition, most eagle movements occur within the avoidance areas. All eagle minutes from RM5, RM11, and RM21 are excluded from the model.

ADJUSTMENTS TO ANNUAL DAYLIGHT HOURS

Based on the location of Teton Reservoir, which is about halfway between Chokecherry and Sierra Madre, the daylight hour function (author: M. Otto, USFWS) calculated 4,458 daylight hours on an annual basis (Appendix E). Using turbine-specific information, the percent of daylight operational periods for each of the 500 turbines ranges from 70 to 98 percent, with an annual average of 91.9 percent for all 500 turbines combined (AWS Truepower 2014). Operational hours for each turbine were provided by season; therefore, seasonal averages for Chokecherry range from 88.4 to 96.3 percent and from 85.1 to 94.5 percent for Sierra Madre (Appendix E).

Based on a project-wide average of an eight percent non-operational period, and based on the seasonal curtailment of 17 turbines near nest "162" for 89.25 days between 1 February and 30 April, the annual daylight hours were adjusted from 4,458 to 4,064 daylight hours per year (Appendix E).

Fatality estimates were also run separately for Phase 1 of Chokecherry and Phase 1 of Sierra Madre. Because there is no pre-planned curtailment within Chokecherry, the adjusted daylight hours (4,149.6) are based on the average season operational hours of turbines only within Chokecherry (Appendix E).

At Sierra Madre, 17 turbines near nest "162" will be curtailed during all daylight hours for 89.25 days between February 1st and April 30th. Subtracting the turbine-hours for the 17 turbines during the curtailment period, and using the average seasonal operational hours for the 298 turbines within Sierra Madre, there are 4,005 daylight hours per year (Appendix E).

VOLUME ADJUSTMENTS

The volume of the observed area in the model (the 200-meter high cylinder around each turbine) was adjusted for the April 2011 to March 2012 dataset, the Summer 2012 dataset (05/01/12 - 07/24/12) and part of the fall 2012 dataset (08/20/12 - 09/15/12), because eagle observations were recorded as above or below 150 meters rather than 200 meters recommended in the ECPG.

The eagle fatality model code was modified to compute the exposure prior and posterior and hazardous area in the expansion factor as volumes since some of the data collection did not use the recommended 200-m and below. These changes are indicated in the model code used in the USFWS analysis.

MODEL INPUTS AND RESULTS

Appendix F summarizes the data used as inputs into the eagle fatality model as well as the model results. Individual estimates of golden eagle fatalities and bald eagle fatalities were also run separately for Phase 1 of Chokecherry and Phase 1 of Sierra Madre. Fatalities for each species were predicted using turbines with 103-meter diameter blades and 120-meter diameter blades.

Due to similarity of data collection methods, the data from Year1 (April 2011 to July 2012) were combined into one model run for Chokecherry and one model run for Sierra Madre. Because the eagle fatality model uses a Bayesian framework, the posterior from Year1 informs Year2 as the new prior. Because the second "year" (Year2, August 2012 to August 2013) was collected over thirteen months using different methods, data from the Year2 were pooled and used to predict fatalities for one 12-month year (see prior discussion).

In the Bayesian framework, results from Year2 are actually a combination of the data from both Year1 and Year2. Therefore, while results are shown for Year1 in Appendix F, the results from Year2 are the "final" predicted eagle fatalities.

Using the largest on-shore turbine anticipated (120-meter diameter blade), the 80 percent upper credible interval (80% UCI) from the USFWS peer-reviewed model predicts 14 golden eagle fatalities and 2 bald eagle fatalities annually for Phase 1 of the Chokecherry and Sierra Madre Wind Energy Project. Using a smaller turbine (103-meter blade), the 80% UCI from the model predicts the 500 turbines of Phase 1 will result in 10 golden eagle and 1.4 bald eagle fatalities annually (7 bald eagles every 5 years).

The average (mean) fatality estimates are also provided in Appendix F; however, the Eagle Conservation Plan Guidance recommends using a risk-averse method such as the 80% UCI for calculating programmatic eagle take, rather than using the average (ECPG 2013, p. 29). However, the average number of predicted fatalities is 7 and 10 golden eagles and 1 and 2 bald eagles for 103-meter and 120-meter blades, respectively.

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Appendix A: Maps of Point Count Locations

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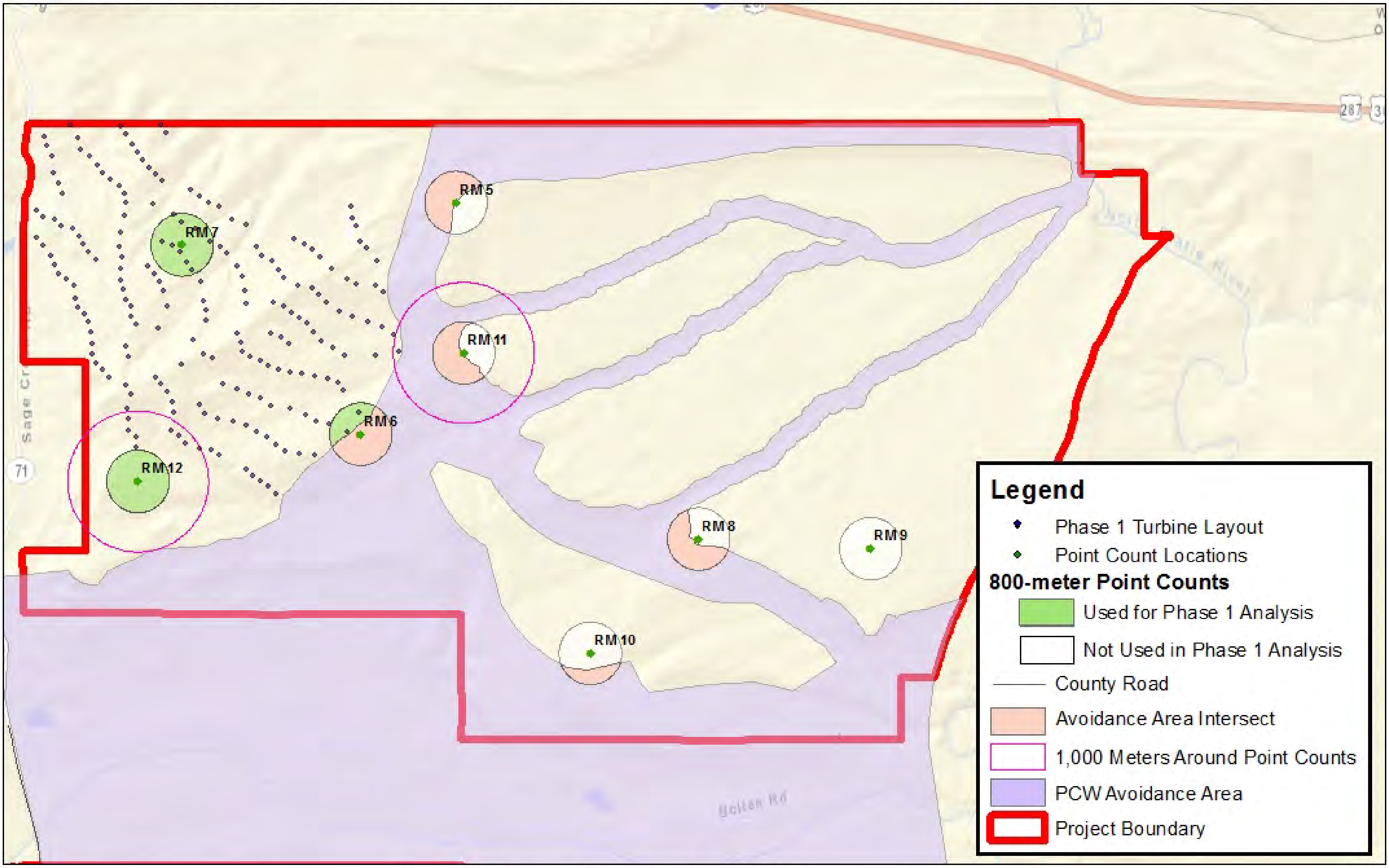
Figure 1. Chokecherry Survey Locations, April 2011 through March 2012



Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

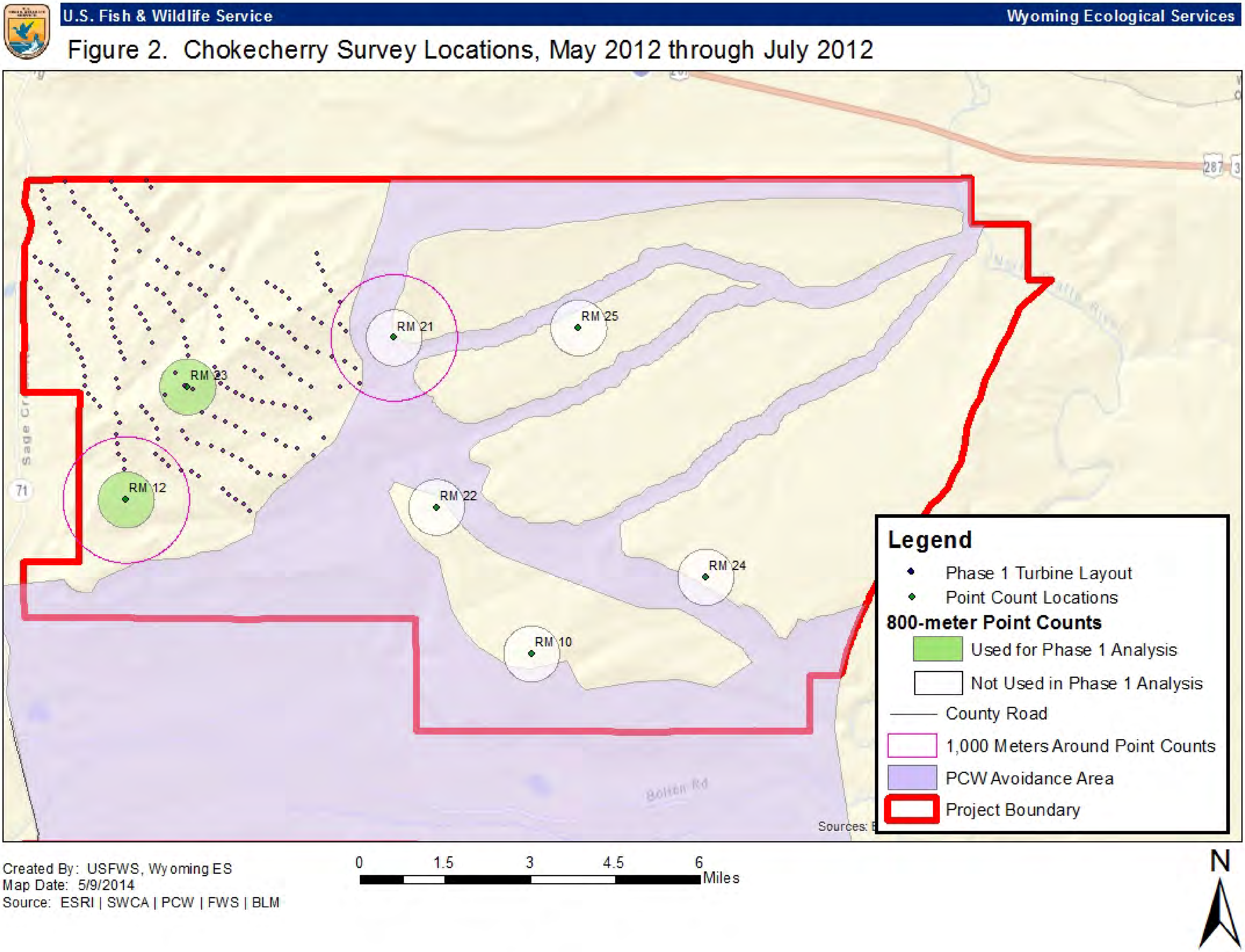


Figure 2. Chokecherry Survey Locations, May 2012 through July 2012

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Figure 3. Chokecherry Survey Locations, August through November 2012

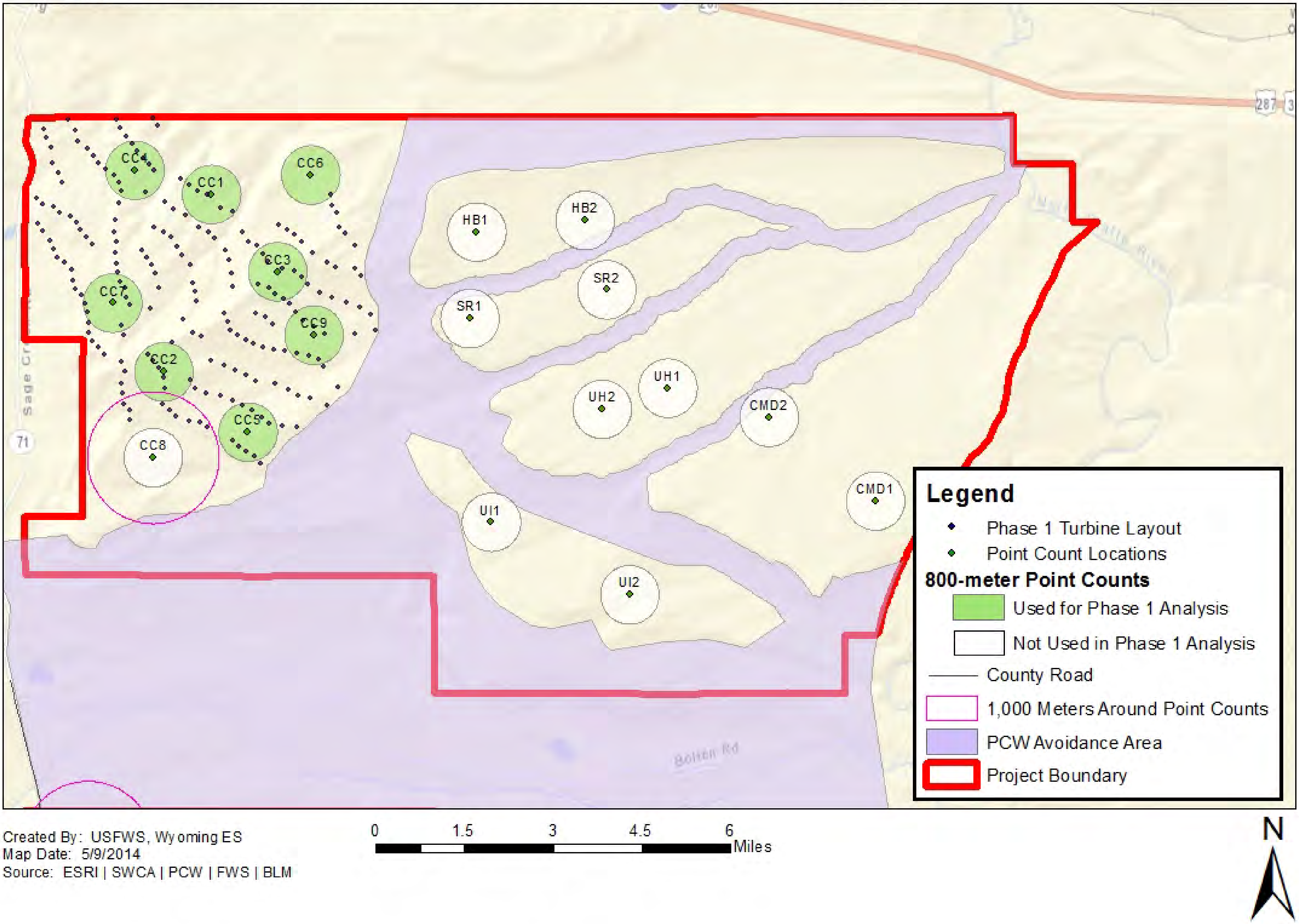

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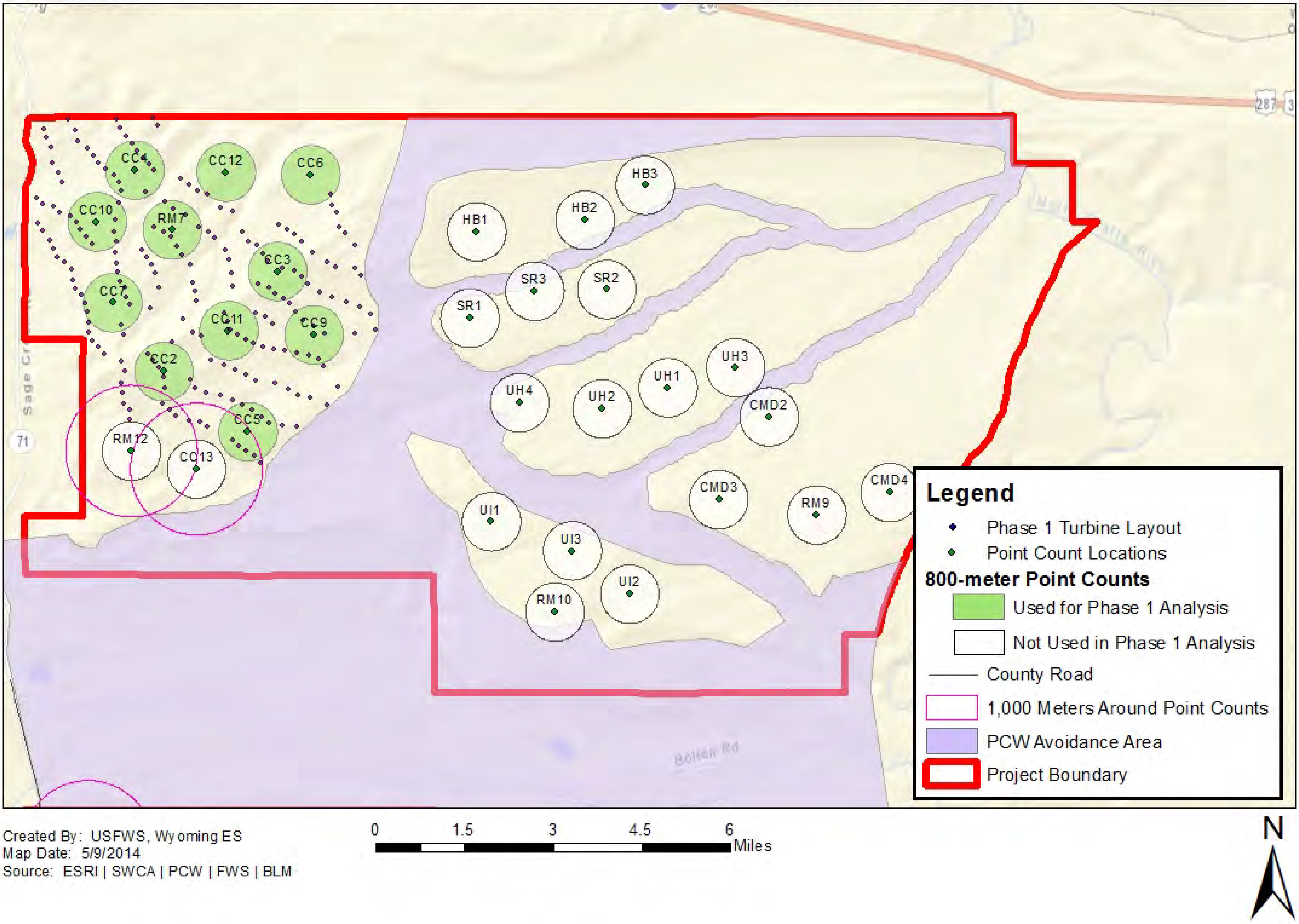
Figure 4. Chokecherry Survey Locations, November 2012 through August 2013



Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

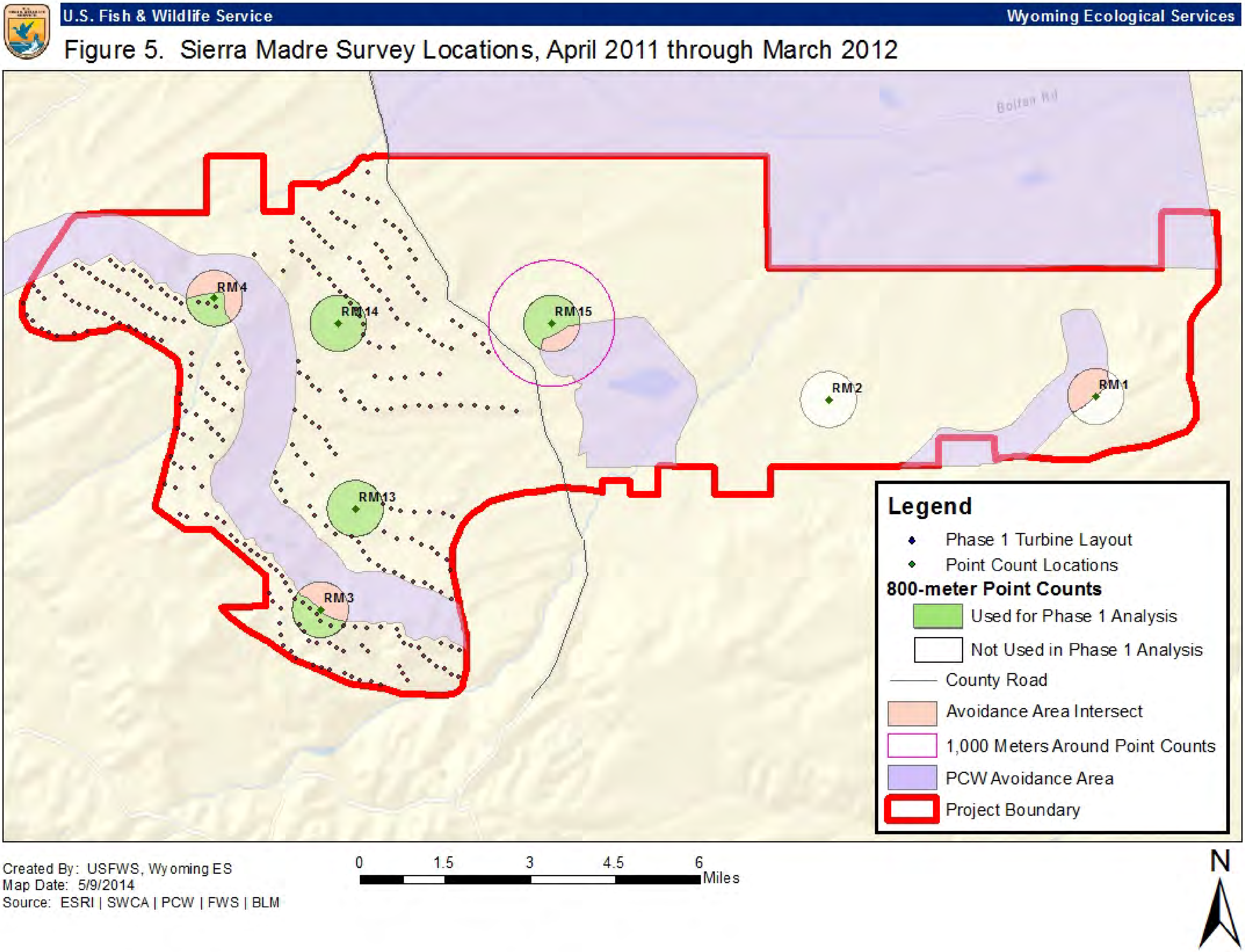

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Figure 5. Sierra Madre Survey Locations, April 2011 through March 2012
RM 4
RM 14
RM 15
RM 2
RM 1
RM 13
RM 3
Legend
Phase 1 Turbine Layout
Point Count Locations
800-meter Point Counts
Used for Phase 1 Analysis
Not Used in Phase 1 Analysis
County Road
Avoidance Area Intersect
1,000 Meters Around Point Counts
PCW Avoidance Area
Project Boundary
Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM
0
1.5
3
4.5
6
Miles
N

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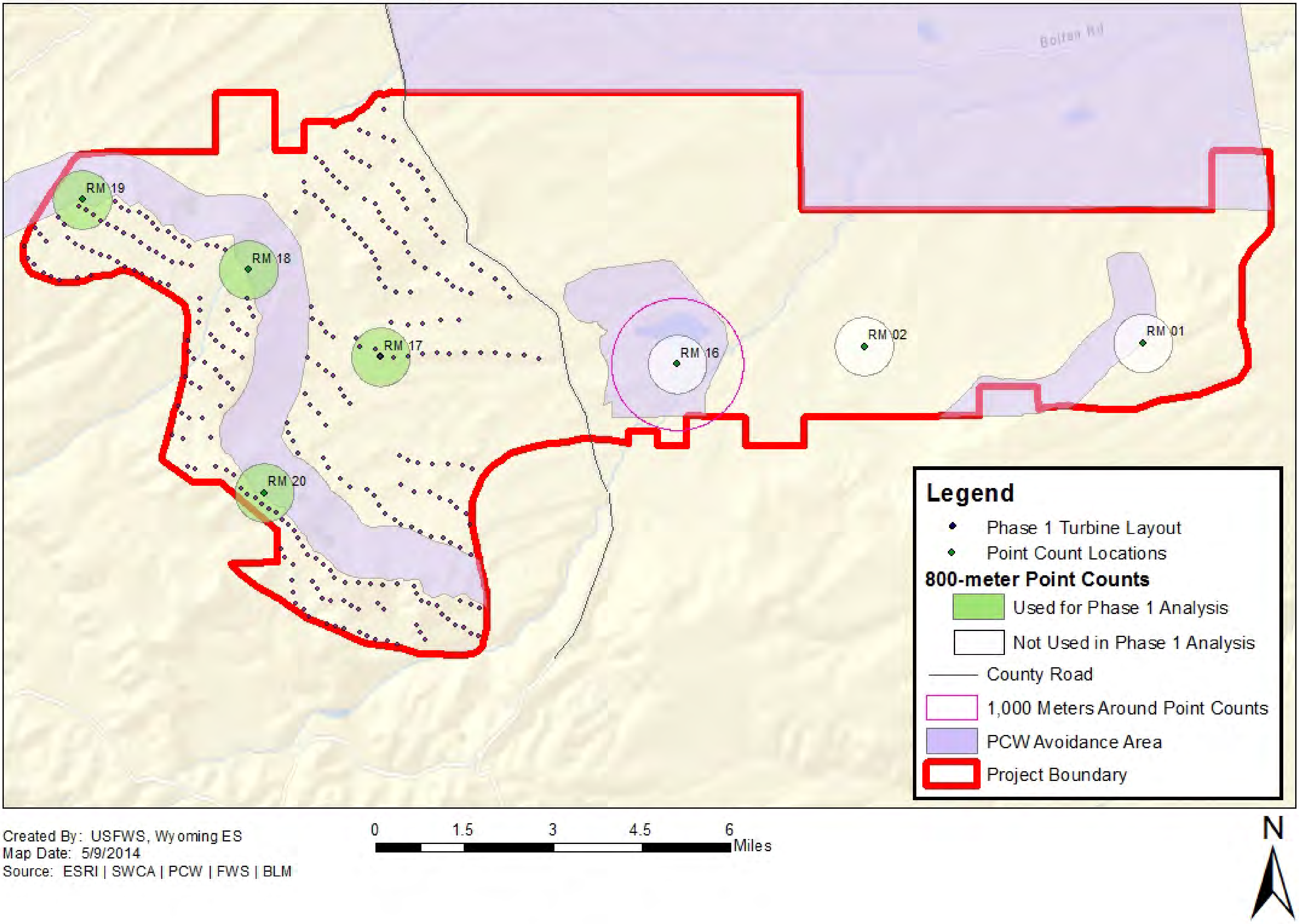
Figure 6. Sierra Madre Survey Locations, May 2012 through July 2012



Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

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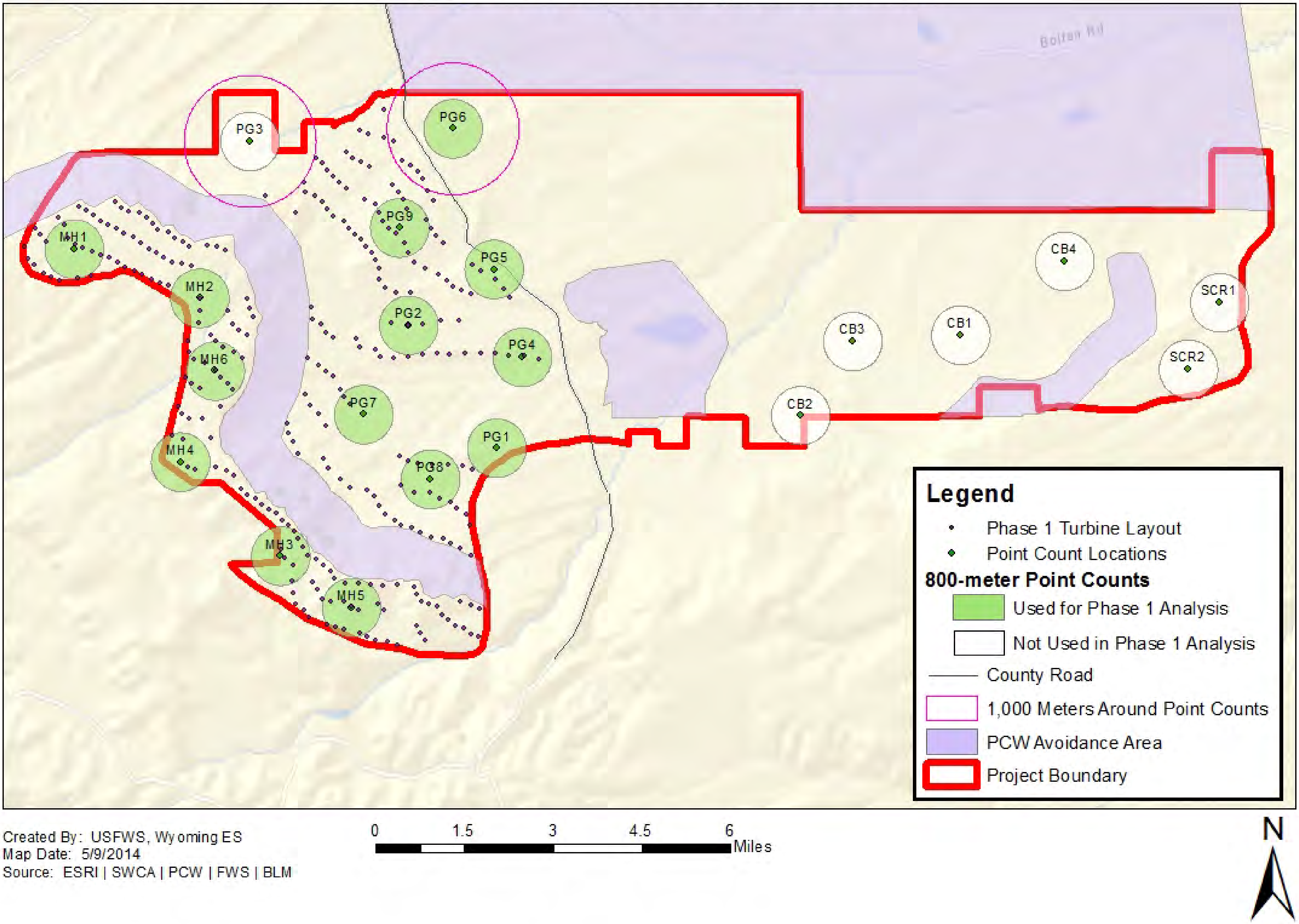
Figure 7. Sierra Madre Survey Locations, August through November 2012



Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

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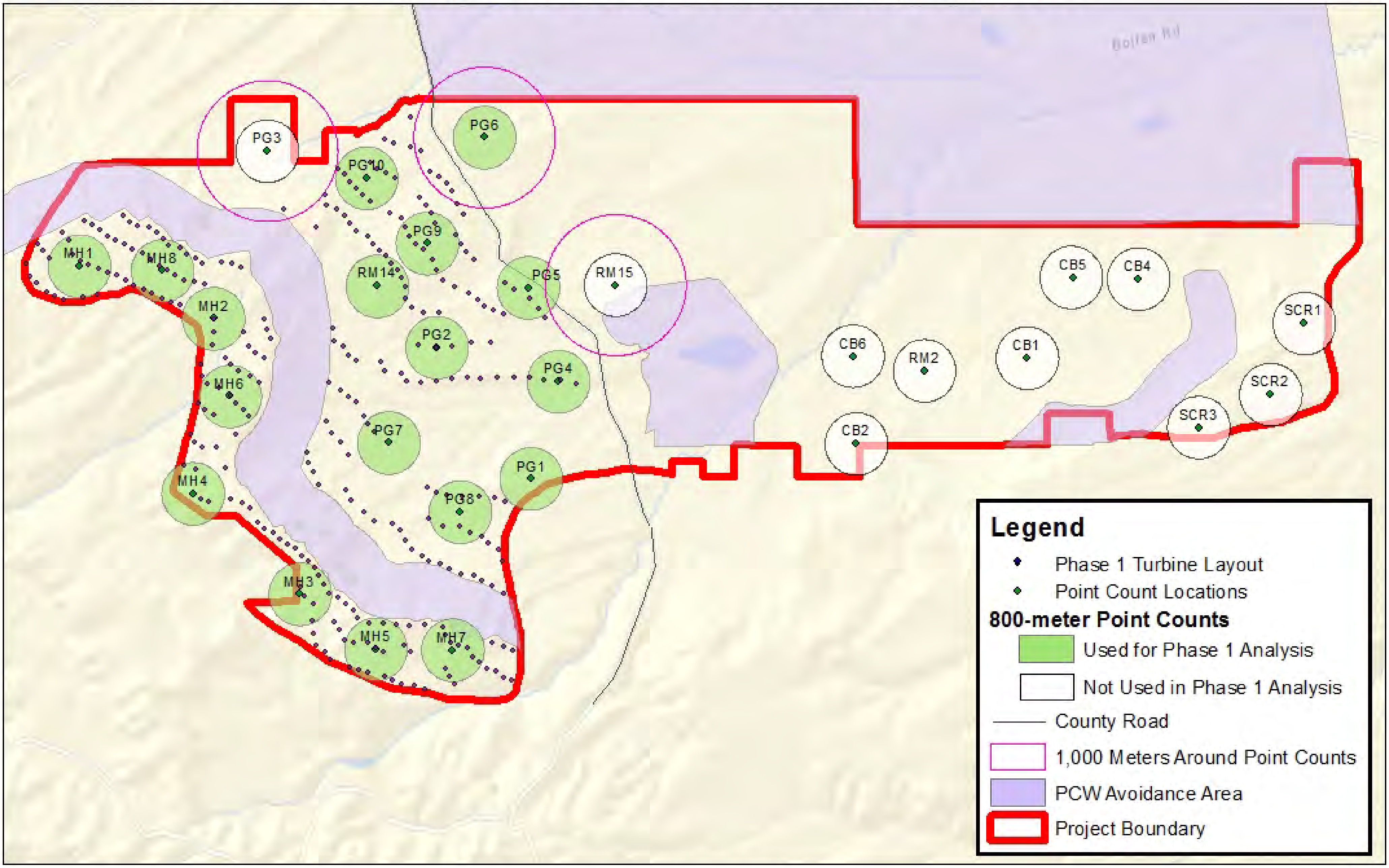
Figure 8. Sierra Madre Survey Locations, November 2012 through August 2013



Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

0 1.5 3 4.5 6 Miles

N

Appendix B: Summary Table of Point Count Locations in Phase 1 for Each Survey Period

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Geographic Location of Survey Points by Survey Period - Phase 1

15 SURVEY POINTS 04/04/11 - 03/27/12		**14 SURVEY POINTS** 05/01/12 - 07/24/12		**40 SURVEY POINTS** 08/20/12 - 11/09/12		**60 SURVEY POINTS** 11/12/12 - 08/30/13	
PHASE 1		PHASE 1		Phase 1		PHASE 1	
CC	SM	CC	SM	CC	SM	CC	SM
RM6	RM13	RM12	RM17	CC1	MH1	CC10	MH1
RM7	RM14	RM23	RM18	CC2	MH2	CC11	MH2
RM12	RM3		RM19	CC3	MH3	CC12	MH3
	RM4		RM20	CC4	MH4	CC13	MH4
	RM15			CC5	MH5	CC2	MH5
				CC6	MH6	CC3	MH6
				CC7	PG1	CC4	MH7
				CC8	PG2	CC5	MH8
				CC9	PG3	CC6	PG1
					PG4	CC7	PG10
					PG5	CC9	PG2
					PG6	RM12	PG3
					PG7	RM7	PG4
					PG8		PG5
					PG9		PG6
							PG7
							PG8
							PG9
							RM14
3	5	2	4	9	15	13	19

In this period, data from RM15 are included in Sierra Madre Phase 1

Data from CC8, CC13 and RM12 excluded from Chokecherry Phase 1 starting Fall 2012

Data from PG3 excluded from Sierra Madre starting Fall 2012

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Appendix C: Eagle Minutes and Survey Effort by Survey Point and Sampling Period

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Survey Data by Point Count by Survey Period

** GOEA = Golden Eagle; BAEA = Bald Eagle; Obs = Observation
** Eagle minutes are rounded up.
** Eagle observations recorded as 150+ meters are not included.
** Fall 2012 data are split at 9/16 due to different methods used to record eagle altitude.

2011 Spring to 2012 Spring Data (04/04/11 - 03/27/12) (<150 meters)

Phase	Survey Point	Minutes GOEA	Minutes BAEA	Minutes Obs	Area Obs*	Eagle Exposure[1]
CC - West	RM 6	24	5	9041	2.01	0.00132
CC - West	RM 7	0	5	7790	2.01	0.00000
CC - West	RM 12	13		7970	2.01	0.00081
SM - West	RM 3	1	1	7173	2.01	0.00007
SM - West	RM 4	13		8171	2.01	0.00079
SM - West	RM 13	20	4	10563	2.01	0.00094
SM - West	RM 14	50	17	8264	2.01	0.00301
SM - West	*RM 15*	24		8558	2.01	0.00140
SM-East	RM 1	29		8889	2.01	0.00162
SM-East	RM 2	49		8606	2.01	0.00283
CC - East	RM 5	41		8480	2.01	0.00241
CC - East	RM 8	59	1	8913	2.01	0.00329
CC - East	RM 9	9		9290	2.01	0.00048
CC - East	RM 10	4		8729	2.01	0.00023
CC - East	RM 11	101	5	9313	2.01	0.00540

2011 Spring to 2012 Spring
Summary of Minutes by Phase

Phase	GOEA	BAEA	Obs
CC - East	214	6	44,725
CC - West	37	10	24,801
SM - West	108	22	42,729
SM-East	78		17,495
Grand Total	**437**	**38**	**129,750**

2012 Summer Data (05/01/12 - 07/24/12) (eagle minutes <150 meters)

Phase	Survey Point	Minutes GOEA	Minutes BAEA	Minutes Obs	Area Obs*	Eagle Exposure[1]
CC - West	RM12			1080	2.01	0.00000
CC - West	RM23			1044	2.01	0.00000
SM - West	RM17	5		1082	2.01	0.00230
SM - West	RM18	3		1088	2.01	0.00137
SM - West	RM19	9		1080	2.01	0.00415
SM - West	RM20	2		1080	2.01	0.00092
CC - East	RM10			1080	2.01	0.00000
CC - East	RM21			1080	2.01	0.00000
CC - East	RM22			1082	2.01	0.00000
CC - East	RM24			1080	2.01	0.00000
CC - East	RM25	2		1083	2.01	0.00092
SM-East	RM01	4		1140	2.01	0.00175
SM-East	RM02			1140	2.01	0.00000
SM-East	RM16			1080	2.01	0.00000

2012 Summer Data
Summary of Minutes by Phase

Phase	GOEA	BAEA	Obs
CC - East	2		5,405
CC - West			2,124
SM - West	19		4,330
SM-East	4		3,360
Grand Total	**25**	**0**	**15,219**

2012 Fall Data (in part) (08/20/12 - 09/15/12) (eagle minutes <150 meters)

	Survey	Minutes			Area	Eagle
Phase	Point	GOEA	BAEA	Obs	Obs*	Exposure[1]
CC - West	CC1			240	2.01	0.00000
CC - West	CC2			240	2.01	0.00000
CC - West	CC3			240	2.01	0.00000
CC - West	CC4			240	2.01	0.00000
CC - West	CC5			240	2.01	0.00000
CC - West	CC6			240	2.01	0.00000
CC - West	CC7			300	2.01	0.00000
CC - West	CC8	0		240	2.01	0.00000
CC - West	CC9			240	2.01	0.00000
SM - West	MH1	7		240	2.01	0.01451
SM - West	MH2			240	2.01	0.00000
SM - West	MH3			300	2.01	0.00000
SM - West	MH4			240	2.01	0.00000
SM - West	MH5			300	2.01	0.00000
SM - West	MH6			240	2.01	0.00000
SM - West	PG1			240	2.01	0.00000
SM - West	PG2	2		240	2.01	0.00415
SM - West	PG3		2	240	2.01	0.00000
SM - West	PG4			240	2.01	0.00000
SM - West	PG5			300	2.01	0.00000
SM - West	PG6			240	2.01	0.00000
SM - West	PG7			240	2.01	0.00000
SM - West	PG8			240	2.01	0.00000
SM - West	PG9			240	2.01	0.00000
CC - East	CMD1			300	2.01	0.00000
CC - East	CMD2			240	2.01	0.00000
CC - East	HB1			240	2.01	0.00000
CC - East	HB2			240	2.01	0.00000
CC - East	SR1			240	2.01	0.00000
CC - East	SR2			240	2.01	0.00000
CC - East	UH1			300	2.01	0.00000
CC - East	UH2			240	2.01	0.00000
CC - East	UI1			240	2.01	0.00000
CC - East	UI2			240	2.01	0.00000
SM-East	CB1			300	2.01	0.00000
SM-East	CB2			240	2.01	0.00000
SM-East	CB3			240	2.01	0.00000
SM-East	CB4			240	2.01	0.00000
SM-East	SCR1	3		240	2.01	0.00622
SM-East	SCR2	6		240	2.01	0.01244

2012 Fall Data (in part)
Summary of Minutes by Phase

Phase	GOEA	BAEA	Obs
CC - East			2,520
CC - West	0		2,220
SM - West	9	2	3,780
SM-East	9		1,500
Grand Total	**18**	**2**	**10,020**

2012 Fall Data (in part) (09/17/12 - 11/09/12) (eagle minutes <200 meters)

Phase	Survey Point	Minutes GOEA	BAEA	Obs	Area Obs*	Eagle Exposure[1]
CC - West	CC1			480	2.01	0.00000
CC - West	CC2			480	2.01	0.00000
CC - West	CC3	3		458	2.01	0.00326
CC - West	CC4	6		480	2.01	0.00622
CC - West	CC5			480	2.01	0.00000
CC - West	CC6	4		476	2.01	0.00418
CC - West	CC7			480	2.01	0.00000
CC - West	CC8	0		480	2.01	0.00000
CC - West	CC9			480	2.01	0.00000
SM - West	MH1			480	2.01	0.00000
SM - West	MH2			480	2.01	0.00000
SM - West	MH3			480	2.01	0.00000
SM - West	MH4			480	2.01	0.00000
SM - West	MH5			480	2.01	0.00000
SM - West	MH6	5		480	2.01	0.00518
SM - West	PG1	3		480	2.01	0.00311
SM - West	PG2	2		480	2.01	0.00207
SM - West	PG3			480	2.01	0.00000
SM - West	PG4			600	2.01	0.00000
SM - West	PG5	3		480	2.01	0.00311
SM - West	PG6			360	2.01	0.00000
SM - West	PG7			480	2.01	0.00000
SM - West	PG8			600	2.01	0.00000
SM - West	PG9			360	2.01	0.00000
CC - East	CMD1			480	2.01	0.00000
CC - East	CMD2			480	2.01	0.00000
CC - East	HB1			480	2.01	0.00000
CC - East	HB2			480	2.01	0.00000
CC - East	SR1			480	2.01	0.00000
CC - East	SR2			480	2.01	0.00000
CC - East	UH1			462	2.01	0.00000
CC - East	UH2			480	2.01	0.00000
CC - East	UI1			480	2.01	0.00000
CC - East	UI2			480	2.01	0.00000
SM-East	CB1			480	2.01	0.00000
SM-East	CB2			480	2.01	0.00000
SM-East	CB3			360	2.01	0.00000
SM-East	CB4			600	2.01	0.00000
SM-East	SCR1			480	2.01	0.00000
SM-East	SCR2	9		480	2.01	0.00933

2012 Fall Data (in part) Summary of Minutes by Phase			
Phase	**GOEA**	**BAEA**	**Obs**
CC - East			4,782
CC - West	13		4,294
SM - West	13		7,200
SM-East	9		2,880
Grand Total	**35**	**0**	**19,156**

2012 Winter Data (11/12/12 - 03/29/13) (eagle minutes <200 meters)

Phase	Survey Point	Minutes GOEA	BAEA	Obs	Area Obs*	Eagle Exposure[1]
CC - West	CC10			540	2.01	0.00000
CC - West	CC11			540	2.01	0.00000
CC - West	CC12			540	2.01	0.00000
CC - West	CC13	14		540	2.01	0.01290
CC - West	CC2			540	2.01	0.00000
CC - West	CC3			510	2.01	0.00000
CC - West	CC4			540	2.01	0.00000
CC - West	CC5			420	2.01	0.00000
CC - West	CC6			480	2.01	0.00000
CC - West	CC7	8		480	2.01	0.00829
CC - West	CC9			480	2.01	0.00000
CC - West	RM12	0		540	2.01	0.00000
CC - West	RM7			540	2.01	0.00000
SM - West	MH1			300	2.01	0.00000
SM - West	MH2			480	2.01	0.00000
SM - West	MH3			480	2.01	0.00000
SM - West	MH4			300	2.01	0.00000
SM - West	MH5			480	2.01	0.00000
SM - West	MH6			540	2.01	0.00000
SM - West	MH7			480	2.01	0.00000
SM - West	MH8	3		540	2.01	0.00276
SM - West	PG1			540	2.01	0.00000
SM - West	PG10			540	2.01	0.00000
SM - West	PG5			540	2.01	0.00000
SM - West	PG2			540	2.01	0.00000
SM - West	PG3	12		540	2.01	0.01106
SM - West	PG4	7		540	2.01	0.00645
SM - West	PG6	3		540	2.01	0.00276
SM - West	PG7			480	2.01	0.00000
SM - West	PG8			480	2.01	0.00000
SM - West	PG9			480	2.01	0.00000
SM - West	RM14	9		480	2.01	0.00933
CC - East	CMD2			480	2.01	0.00000
CC - East	CMD3			400	2.01	0.00000
CC - East	CMD4			540	2.01	0.00000
CC - East	HB1			600	2.01	0.00000
CC - East	HB2			540	2.01	0.00000
CC - East	HB3	4		480	2.01	0.00415
CC - East	RM10			540	2.01	0.00000
CC - East	RM9			480	2.01	0.00000
CC - East	SR1	6		540	2.01	0.00553
CC - East	SR2			540	2.01	0.00000
CC - East	SR3			540	2.01	0.00000

2012 Winter Data
Summary of Minutes by Phase

Phase	GOEA	BAEA	Obs
CC - East	20		9,313
CC - West	22		6,690
SM - West	34		9,300
SM-East	32		5,220
Grand Total	**108**	**0**	**30,523**

CC - East	UH1			513	2.01	0.00000
CC - East	UH2			600	2.01	0.00000
CC - East	UH3			540	2.01	0.00000
CC - East	UH4	2		480	2.01	0.00207
CC - East	UI1	2		420	2.01	0.00237
CC - East	UI2	6		600	2.01	0.00498
CC - East	UI3			480	2.01	0.00000
SM-East	CB1	7		540	2.01	0.00645
SM-East	CB2			420	2.01	0.00000
SM-East	CB4	5		540	2.01	0.00461
SM-East	CB5			540	2.01	0.00000
SM-East	CB6	8		480	2.01	0.00829
SM-East	RM15	12		600	2.01	0.00995
SM-East	RM2			540	2.01	0.00000
SM-East	SCR1			540	2.01	0.00000
SM-East	SCR2			480	2.01	0.00000
SM-East	SCR3			540	2.01	0.00000

2013 Spring Data (04/01/13 - 06/21/13) (eagle minutes <200 meters)

	Survey	Minutes			Area	Eagle
Phase	Point	GOEA	BAEA	Obs	Obs*	Exposure[1]
CC - West	CC10			360	2.01	0.00000
CC - West	CC11			360	2.01	0.00000
CC - West	CC12			300	2.01	0.00000
CC - West	CC13	0		300	2.01	0.00000
CC - West	CC2			360	2.01	0.00000
CC - West	CC3	2		360	2.01	0.00276
CC - West	CC4			300	2.01	0.00000
CC - West	CC5			300	2.01	0.00000
CC - West	CC6			300	2.01	0.00000
CC - West	CC7			360	2.01	0.00000
CC - West	CC9			360	2.01	0.00000
CC - West	RM12	0		300	2.01	0.00000
CC - West	RM7			300	2.01	0.00000
SM - West	MH1			360	2.01	0.00000
SM - West	MH2			360	2.01	0.00000
SM - West	MH3			360	2.01	0.00000
SM - West	MH4			300	2.01	0.00000
SM - West	MH5			300	2.01	0.00000
SM - West	MH6			360	2.01	0.00000
SM - West	MH7			360	2.01	0.00000
SM - West	MH8			300	2.01	0.00000
SM - West	PG1			360	2.01	0.00000
SM - West	PG10			300	2.01	0.00000
SM - West	PG5			360	2.01	0.00000

2013 Spring Data Summary of Minutes by Phase			
Phase	**GOEA**	**BAEA**	**Obs**
CC - East			5,940
CC - West	2		4,260
SM - West	1		6,360
SM-East	4		3,314
Grand Total	**7**	**0**	**19,874**

SM - West	PG2		300	2.01	0.00000
SM - West	PG3		360	2.01	0.00000
SM - West	PG4		360	2.01	0.00000
SM - West	PG6		300	2.01	0.00000
SM - West	PG7		360	2.01	0.00000
SM - West	PG8		300	2.01	0.00000
SM - West	PG9		300	2.01	0.00000
SM - West	RM14	1	360	2.01	0.00138
CC - East	CMD2		360	2.01	0.00000
CC - East	CMD3		360	2.01	0.00000
CC - East	CMD4		360	2.01	0.00000
CC - East	HB1		300	2.01	0.00000
CC - East	HB2		300	2.01	0.00000
CC - East	HB3		300	2.01	0.00000
CC - East	RM10		300	2.01	0.00000
CC - East	RM9		360	2.01	0.00000
CC - East	SR1		300	2.01	0.00000
CC - East	SR2		360	2.01	0.00000
CC - East	SR3		300	2.01	0.00000
CC - East	UH1		300	2.01	0.00000
CC - East	UH2		300	2.01	0.00000
CC - East	UH3		360	2.01	0.00000
CC - East	UH4		360	2.01	0.00000
CC - East	UI1		300	2.01	0.00000
CC - East	UI2		360	2.01	0.00000
CC - East	UI3		360	2.01	0.00000
SM-East	CB1	4	300	2.01	0.00663
SM-East	CB2		270	2.01	0.00000
SM-East	CB4		360	2.01	0.00000
SM-East	CB5		360	2.01	0.00000
SM-East	CB6		360	2.01	0.00000
SM-East	RM15		360	2.01	0.00000
SM-East	RM2		300	2.01	0.00000
SM-East	SCR1		360	2.01	0.00000
SM-East	SCR2		360	2.01	0.00000
SM-East	SCR3		284	2.01	0.00000

2013 Summer Data (06/24/13 - 08/30/13) (eagle minutes <200 meters)

Phase	Survey Point	Minutes GOEA	BAEA	Obs	Area Obs*	Eagle Exposure[1]
CC - West	CC10			300	2.01	0.00000
CC - West	CC11			300	2.01	0.00000
CC - West	CC12			300	2.01	0.00000
CC - West	CC13	4		300	2.01	0.00663
CC - West	CC2			300	2.01	0.00000
CC - West	CC3	2		300	2.01	0.00332
CC - West	CC4			300	2.01	0.00000
CC - West	CC5	2		300	2.01	0.00332
CC - West	CC6			300	2.01	0.00000
CC - West	CC7			300	2.01	0.00000
CC - West	CC9			300	2.01	0.00000
CC - West	RM12	0		300	2.01	0.00000
CC - West	RM7			300	2.01	0.00000
SM - West	MH1			300	2.01	0.00000
SM - West	MH2			300	2.01	0.00000
SM - West	MH3			300	2.01	0.00000
SM - West	MH4			300	2.01	0.00000
SM - West	MH5			300	2.01	0.00000
SM - West	MH6			300	2.01	0.00000
SM - West	MH7			300	2.01	0.00000
SM - West	MH8			300	2.01	0.00000
SM - West	PG1			300	2.01	0.00000
SM - West	PG10			300	2.01	0.00000
SM - West	PG5			300	2.01	0.00000
SM - West	PG2			300	2.01	0.00000
SM - West	PG3			300	2.01	0.00000
SM - West	PG4			300	2.01	0.00000
SM - West	PG6			300	2.01	0.00000
SM - West	PG7			300	2.01	0.00000
SM - West	PG8			300	2.01	0.00000
SM - West	PG9			300	2.01	0.00000
SM - West	RM14	2		300	2.01	0.00332
CC - East	CMD2			300	2.01	0.00000
CC - East	CMD3	1		300	2.01	0.00166
CC - East	CMD4			300	2.01	0.00000
CC - East	HB1			300	2.01	0.00000
CC - East	HB2			300	2.01	0.00000
CC - East	HB3			300	2.01	0.00000
CC - East	RM10			300	2.01	0.00000
CC - East	RM9			300	2.01	0.00000
CC - East	SR1			300	2.01	0.00000
CC - East	SR2			300	2.01	0.00000
CC - East	SR3			300	2.01	0.00000

2013 Summer Data
Summary of Minutes by Phase

Phase	GOEA	BAEA	Obs
CC - East	1		5,400
CC - West	8		3,900
SM - West	2		5,700
SM-East	5		3,000
Grand Total	**16**	**0**	**18,000**

CC - East	UH1		300	2.01	0.00000
CC - East	UH2		300	2.01	0.00000
CC - East	UH3		300	2.01	0.00000
CC - East	UH4		300	2.01	0.00000
CC - East	UI1		300	2.01	0.00000
CC - East	UI2		300	2.01	0.00000
CC - East	UI3		300	2.01	0.00000
SM-East	CB1		300	2.01	0.00000
SM-East	CB2		300	2.01	0.00000
SM-East	CB4		300	2.01	0.00000
SM-East	CB5		300	2.01	0.00000
SM-East	CB6		300	2.01	0.00000
SM-East	RM15	3	300	2.01	0.00498
SM-East	RM2	2	300	2.01	0.00332
SM-East	SCR1		240	2.01	0.00000
SM-East	SCR2		300	2.01	0.00000
SM-East	SCR3		360	2.01	0.00000

Appendix D: Summary of Eagle Minutes and Survey Effort for Each Survey Period Based on the Decision Criteria

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Summary of Survey Data for Chokecherry Sierra Madre

** GOEA = Golden Eagle; BAEA = Bald Eagle; Obs = Observation; Min = Minutes

** Eagle minutes are rounded up.

** # = Eagle minutes >150 meters are not included; adjust volume to 150 meters.

** Fall 2012 data are split at 9/16 due to different methods for eagle altitude.

** Data are based on final decision criteria.

2011 Spring to 2012 Spring Data

(04/04/11 - 03/27/12) (15 points) (>150 meters are not included) #

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	Notes
CC - West	1	3	24801	37	10	
SM - West	1	5	42729	108	22	RM15 included
Total		8	67,530	145	32	

2012 Summer Data

(05/01/12 - 07/24/12) (14 points) (18 eagle minutes >150 meters not included) #

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	
CC - West	1	2	2124	0	0	
SM - West	1	4	4330	19	0	
Total		6	6,454	19	0	

2012 Fall Data (in part)

(08/20/12 - 09/15/12) (40 points) (23 eagle minutes >150 meters not included) #

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	
CC - West	1	9	1980	0	0	CC8 excluded
SM - West	1	15	3540	9	0	Exclude PG3
Total		24	5,520	9	0	

2012 Fall Data (in part)

(09/17/12 - 11/09/12) (40 points) (eagle minutes <200 meters)

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	
CC - West	1	9	3814	13	0	CC8 excluded
SM - West	1	15	6720	13	0	Exclude PG3
Total		24	10,534	26	0	

2012 Winter Data

(11/12/12 - 03/29/13) (60 points)

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	
CC - West	1	13	5610	8	0	CC13, RM12 Excluded
SM - West	1	21	8760	22	0	Exclude RM15, PG3
Total		34	14,370	30	0	

2013 Spring Data

(04/01/13 - 06/21/13) (60 points)

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	
CC - West	1	13	3660	2	0	CC13, RM12 Excluded
SM - West	1	21	6000	1	0	Exclude RM15, PG3
Total		34	9,660	3	0	

2013 Summer Data

(06/24/13 - 08/30/13) (60 points)

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	
CC - West	1	13	3300	4	0	CC13, RM12 Excluded
SM - West	1	21	5400	2	0	Exclude RM15, PG3
Total		34	8,700	6	0	

All Data Combined

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min
CC - West	1	n/a	45289	64	10
SM - West	1	n/a	77479	174	22
Total		0	122,768	238	32

"Year1 "Split (April 2011-July2012)

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min
CC - West	1	n/a	26925	37	10
SM - West	1	n/a	47059	127	22
Total			73,984	164	32

"Year2" Split (August 2012-August 2013)

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min
CC - West	1	n/a	18364	27	0
SM - West	1	n/a	30420	47	0
Total			48,784	74	0

Appendix E: Adjustments to Daylight Hours

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The following is an example of the model code used to calculate annual and seasonal daylight hours.

```
## Define seasonal strata and calculate daylight hours
LatLng<-c(41.6038693,-107.261601)

# Annual Daylight Hours
SeasonType<-"Annual"
DayLtHr<-DayLen(LatLng[2],LatLng[1],Type=SeasonType)
colnames(DayLtHr)[1]<-"Season"
DayLtHr$AveDayLen<-with(DayLtHr,DayLtHr/Days)

# Seasonal Daylight Hours (to determine total daylight hours during curtailment period)
SeasonEndDay<-c(Winter="1/31",Curtail="4/30",Spring="6/30",Summer="8/15",Fall="11/15")
DayLtHr<-DayLen(-107.128973,41.767919,Type=SeasonEndDay,
Labels=names(SeasonEndDay))
DayLtHr$AveDayLen<-with(DayLtHr,DayLtHr/Days)

# Day length based on National Oceanic and Atmospheric Administration solar calculator:
#       http://www.esrl.noaa.gov/gmd/grad/solcalc/calcdetails.html
```

Daylight Operational Hours

Percent of Daylight Operational Hours by "Season" for All Turbines

Row Labels	Average of Winter (Nov 16 - Jan 31)	Average of Curtailment Season (Feb 1 - Apr 30)	Average of Active Nest Season (May 1 - Jun 30)	Average of Summer (Jul 1 - Aug 15)	Average of Fall (Aug 16 - Nov 15)	Average of Entire Year (Jan 1 - Dec 31)
Chokecherry	96.258%	94.582%	94.049%	88.434%	91.543%	93.072%
Sierra Madre	94.468%	93.539%	92.019%	85.087%	89.543%	91.126%
Project Average	95.191%	93.960%	92.839%	86.439%	90.351%	91.912%

Percent of Daylight Operational Hours by "Season" for All Turbines with Seasonal Curtailment

Row Labels	Average of Winter (Nov 16 - Jan 31)	Average of Curtailment Season (Feb 1 - Apr 30)	Average of Active Nest Season (May 1 - Jun 30)	Average of Summer (Jul 1 - Aug 15)	Average of Fall (Aug 16 - Nov 15)	Average of Entire Year (Jan 1 - Dec 31)
Chokecherry	96.258%	94.582%	94.049%	88.434%	91.543%	93.072%
Sierra Madre	94.468%	93.496%	92.019%	85.087%	89.543%	91.126%
Project Average	95.191%	93.951%	92.839%	86.439%	90.351%	91.912%

Seasonal values are an average of percent operational time during daylight hours of individual turbines provided by AWS Truepower, May 2014.

Highlighted values include the curtailment of 17 turbines in Sierra Madre from 1 Feb to 30 April.

Daylight Hours Adjustment for Seasonal Curtailment

Location	Latitude	Longitude
Teton Reservoir	41.604	-107.261601

Season	cRange	Days	AveDayLen	DayLtHr
Annual	01/01-12/31	365.25	12.20462	4457.739
Base Annual Daylight Hours for Teton Reservoir				

Season	Day Range	Days	AveDayLen	DayLtHr	Turbines	% Operational	Turbine-Hours*
Winter	11/16-01/31	77.00	9.409873	724.5602	500	95.191%	344,858.18
Curtail	02/01-04/30	89.25	12.020020	1072.7868	500	93.960%	503,996.84
Spring	05/01-06/30	61.00	14.864888	906.7582	500	92.839%	420,911.98
Summer	07/01-08/15	46.00	14.604142	671.7905	500	86.439%	290,344.26
Fall	08/16-11/15	92.00	11.762141	1082.1170	500	90.351%	488,851.57
Calculating Annual Daylight Hours				4458.013		sum=	2,048,962.83
For 500 turbines without Curtailment							4,097.926

Season	Day Range	Days	AveDayLen	DayLtHr	Turbines	% Operational	Turbine-Hours*
Winter	11/16-01/31	77.00	9.409873	724.5602	500	95.191%	344,858.18
Curtail	02/01-04/30	89.25	12.020020	1072.7868	483	93.951%	486,810.25
Spring	05/01-06/30	61.00	14.864888	906.7582	500	92.839%	420,911.98
Summer	07/01-08/15	46.00	14.604142	671.7905	500	86.439%	290,344.26
Fall	08/16-11/15	92.00	11.762141	1082.1170	500	90.351%	488,851.57
Annual Daylight Hours for **500 Turbines** (CC & SM)						sum=	2,031,776.25
With **17 Turbines Curtailed** for 89.25 Days in Sierra Madre							4,063.552

Season	Day Range	Days	AveDayLen	DayLtHr	Turbines	% Operational	Turbine-Hours*
Winter	11/16-01/31	77.00	9.409873	724.5602	298	94.468%	203,973.84
Curtail	02/01-04/30	89.25	12.020020	1072.7868	281	93.496%	281,847.99
Spring	05/01-06/30	61.00	14.864888	906.7582	298	92.019%	248,646.83
Summer	07/01-08/15	46.00	14.604142	671.7905	298	85.087%	170,338.32
Fall	08/16-11/15	92.00	11.762141	1082.1170	298	89.543%	288,749.36
Annual Daylight Hours for **298 Turbines** (Only SM)						sum=	1,193,556.34
With **17 Turbines Curtailed** for 89.25 Days in Sierra Madre							4,005.223

Season	Day Range	Days	AveDayLen	DayLtHr	Turbines	% Operational	Turbine-Hours*
Winter	11/16-01/31	77.00	9.409873	724.5602	202	96.258%	140,884.34
Curtail	02/01-04/30	89.25	12.020020	1072.7868	202	94.582%	204,962.27
Spring	05/01-06/30	61.00	14.864888	906.7582	202	94.049%	172,265.15
Summer	07/01-08/15	46.00	14.604142	671.7905	202	88.434%	120,005.94
Fall	08/16-11/15	92.00	11.762141	1082.1170	202	91.543%	200,102.21
Annual Daylight Hours for **202 Turbines** (Only CC)						sum=	838,219.90
No pre-planned curtailment in Chokecherry							4,149.603

*TurbineHours = DayLtHr*Turbines*%Operational

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Appendix F: Eagle Fatality Model Inputs and Results

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Predicted Fatalities

Golden Eagle, Chokecherry Sierra Madre combined, 103-m blade

Golden Eagle, Chokecherry Sierra Madre combined, 120-m blade

Bald Eagle, Chokecherry Sierra Madre combined, 103-m blade

Bald Eagle, Chokecherry Sierra Madre combined, 120-m blade

Golden Eagle, Chokecherry, 103-m blade

Golden Eagle, Sierra Madre, 103-m blade

Golden Eagle, Chokecherry, 120-m blade

Golden Eagle, Sierra Madre, 120-m blade

Bald Eagle, Chokecherry, 103-m blade

Bald Eagle, Sierra Madre, 103-m blade

Bald Eagle, Chokecherry, 120-m blade

Bald Eagle, Sierra Madre, 120-m blade

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Eagle Fatality Model Inputs and Results

Model inputs and results are combined for Chokecherry and for Sierra Madre.
Posterior from Year1 becomes the prior for Year2.
Results from Year2 are a combination of data from Year1 and Year2.
Results from Year2 are the "final" predicted eagle fatalities.
Fatalities are predicted for two different turbine blade lengths: 103-meter and 120-meter diameter blades.

"Year" and Dates	GOLDEN EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	GOEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~8% non-operational period; includes data from RM15.	Chokecherry Sierra Madre	800	73,984
"Year 2" August 2012 to August 2013	GOEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~8% non-operational period; does not include RM15. Does not inlcude CC8, CC13, RM12 and PG3 starting Fall 2012.. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Chokecherry Sierra Madre	800	48,784

"Year" and Dates	GOLDEN EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	GOEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~8% non-operational period; includes data from RM15.	Chokecherry Sierra Madre	800	73,984
"Year 2" August 2012 to August 2013	GOEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~8% non-operational period; does not include RM15. Does not inlcude CC8, CC13, RM12 and PG3 starting Fall 2012.. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Chokecherry Sierra Madre	800	48,784

[redacted]

Golden Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
164	4,063.6	103/2	500	0.443	0.0345	8.7	5.7	13
74	4,063.6	103/2	500	0.346	0.0224	6.8	4.5	10

Golden Eagle annual predicted fatalities with 103-m diameter blade = 10

Golden Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
164	4,063.6	120/2	500	0.443	0.0344	12	7.8	17
74	4,063.6	120/2	500	0.347	0.0224	9.2	6.1	14

Golden Eagle annual predicted fatalities with 120-m diameter blade = 14

"Year" and Dates	BALD EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	BAEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~8% non-operational period; includes data from RM15.	Chokecherry Sierra Madre	800	73,984
"Year 2" August 2012 to August 2013	BAEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~8% non-operational period; does not include RM15. Does not inlcude CC8, CC13, RM12 and PG3 starting Fall 2012.. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Chokecherry Sierra Madre	800	48,784

"Year" and Dates	BALD EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	BAEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~8% non-operational period; includes data from RM15.	Chokecherry Sierra Madre	800	73,984
"Year 2" August 2012 to August 2013	BAEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~8% non-operational period; does not include RM15. Does not inlcude CC8, CC13, RM12 and PG3 starting Fall 2012.. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Chokecherry Sierra Madre	800	48,784

Bald Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
32	4,063.6	103/2	500	0.0886	0.0154	1.7	1.2	2.6
0	4,063.6	103/2	500	0.0478	0.0084	0.94	0.79	1.4
	Bald Eagle annual predicted fatalities with 103-m diameter blade =							**1.4**

Bald Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
32	4,063.6	120/2	500	0.0884	0.0154	2.3	1.6	3.5
0	4,063.6	120/2	500	0.0477	0.0083	1.3	0.87	1.9
	Bald Eagle annual predicted fatalities with 120-m diameter blade =							**2**

Eagle Fatality Model Inputs and Results - GOLDEN EAGLE

Model inputs and data results are run separately for Chokecherry and for Sierra Madre.
Posterior from Year1 becomes the prior for Year2.
Results from Year2 are a combination of data from Year1 and Year2.
Results from Year2 are the "final" predicted eagle fatalities.
Fatalities are predicted for two different turbine blade lengths: 103-meter and 120-meter diameter blades.

"Year" and Dates	GOLDEN EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	GOEA minutes based on observation times in GIS file, adjusted for flight paths and volume adusted for flight heights. Daylight adjusted for about 7% non-operational period, no seasonal curtailment.	Chokecherry	800	26,925
"Year 1" April 2011 to July 2012	GOEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~9% non-operational period; includes data from RM15.	Sierra Madre	800	47,059
"Year 2" August 2012 to August 2013	GOEA minutes based on 4 survey periods, adjusted for flight heights. Daylight adjusted for ~7% non-operational period; no seasonal curtailment. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume). Does not inlcude CC8, CC13 and RM12 starting Fall 2012.	Chokecherry	800	18,364
"Year 2" August 2012 to August 2013	GOEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~9% non-operational period; does not include RM15. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Sierra Madre	800	30,420

[redacted]

Golden Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
37	4,149.6	103/2	202	0.279	0.0455	2.3	1.5	3.3
127	4,005.2	103/2	298	0.540	0.0476	6.2	4.2	9.2
27	4,149.6	103/2	202	0.254	0.315	2.1	1.4	3.0
47	4,005.2	103/2	298	0.402	0.0304	4.6	3.1	6.8
Golden Eagle annual predicted fatalities with 103-m diameter blade =								**10**

Note: because Chokecherry and Sierra Madre are analyzed independently, their results are rounded up before being added together.

"Year" and Dates	GOLDEN EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	GOEA minutes based on observation times in GIS file, adjusted for flight paths and volume adusted for flight heights. Daylight adjusted for about 7% non-operational period, no seasonal curtailment.	Chokecherry	800	26,925
"Year 1" April 2011 to July 2012	GOEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~9% non-operational period; includes data from RM15.	Sierra Madre	800	47,059
"Year 2" August 2012 to August 2013	GOEA minutes based on 4 survey periods, adjusted for flight heights. Daylight adjusted for ~7% non-operational period; no seasonal curtailment. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume). Does not inlcude CC8, CC13 and RM12 starting Fall 2012.	Chokecherry	800	18,364
"Year 2" August 2012 to August 2013	GOEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~9% non-operational period; does not include RM15. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Sierra Madre	800	30,420

Golden Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
37	4,149.6	120/2	202	0.280	0.0454	3.1	2.1	4.5
127	4,005.2	120/2	298	0.540	0.0477	8.5	5.6	12
27	4,149.6	120/2	202	0.254	0.0315	2.8	1.9	4.1
47	4,005.2	120/2	298	0.402	0.0304	6.3	4.1	9.2
Golden Eagle annual predicted fatalities with 120-m diameter blade =								**15**

Note: because Chokecherry and Sierra Madre are analyzed independently, their results are rounded up before being added together.

Eagle Fatality Model Inputs and Results - BALD EAGLE

Model inputs and data results are run separately for Chokecherry and for Sierra Madre.
Posterior from Year1 becomes the prior for Year2.
Results from Year2 are a combination of data from Year1 and Year2.
Results from Year2 are the "final" predicted eagle fatalities.
Fatalities are predicted for two different turbine blade lengths: 103-meter and 120-meter diameter blades.

"Year" and Dates	BALD EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	BAEA minutes based on observation times in GIS file, adjusted for flight paths and volume adusted for flight heights. Daylight adjusted for about 7% non-operational period, no seasonal curtailment.	Chokecherry	800	26,925
"Year 1" April 2011 to July 2012	BAEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~9% non-operational period; includes data from RM15.	Sierra Madre	800	47,059
"Year 2" August 2012 to August 2013	BAEA minutes based on 4 survey periods, adjusted for flight heights. Daylight adjusted for ~7% non-operational period; no seasonal curtailment. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume). Does not inlcude CC8, CC13 and RM12 starting Fall 2012.	Chokecherry	800	18,364
"Year 2" August 2012 to August 2013	BAEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~9% non-operational period; does not include RM15. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Sierra Madre	800	30,420

[redacted]

Bald Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
10	4,149.6	103/2	202	0.0807	0.0244	0.65	0.53	0.97
22	4,005.2	103/2	298	0.0969	0.0202	1.1	0.78	1.6
0	4,149.6	103/2	202	0.0429	0.013	0.35	0.26	0.51
0	4,005.2	103/2	298	0.0528	0.0111	0.61	0.51	0.9
Bald Eagle annual predicted fatalities with 103-m diameter blade =								**2**

Note: because Chokecherry and Sierra Madre are analyzed independently, their results are rounded up before being added together.

"Year" and Dates	BALD EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	BAEA minutes based on observation times in GIS file, adjusted for flight paths and volume adusted for flight heights. Daylight adjusted for about 7% non-operational period, no seasonal curtailment.	Chokecherry	800	26,925
"Year 1" April 2011 to July 2012	BAEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~9% non-operational period; includes data from RM15.	Sierra Madre	800	47,059
"Year 2" August 2012 to August 2013	BAEA minutes based on 4 survey periods, adjusted for flight heights. Daylight adjusted for ~7% non-operational period; no seasonal curtailment. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume). Does not inlcude CC8, CC13 and RM12 starting Fall 2012.	Chokecherry	800	18,364
"Year 2" August 2012 to August 2013	BAEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~9% non-operational period; does not include RM15. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Sierra Madre	800	30,420

Bald Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
10	4,149.6	120/2	202	0.0808	0.0245	0.89	0.66	1.3
22	4,005.2	120/2	298	0.0969	0.0203	1.5	1.3	2.2
0	4,149.6	120/2	202	0.0427	0.013	0.47	0.35	0.7
0	4,005.2	120/2	298	0.0527	0.011	0.82	0.58	1.2
	Bald Eagle annual predicted fatalities with 120-m diameter blade =							**3**

Note: because Chokecherry and Sierra Madre are analyzed independently, their results are rounded up before being added together.

Appendix G: Example of Model Code Used to Predict Eagle Fatalities

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The following is an example of the model code and inputs used by the U.S. Fish and Wildlife Service to predict the number of bald eagle and golden eagle fatalities at the Chokecherry Sierra Madre Phase 1 Project. The description, inputs and results of the twelve different model runs are presented in Appendix F.

In the example below, differences between the model runs are identified. Comments and other explanatory notes that may differ between model runs are highlighted in yellow. Changes to the model inputs or the model code are identified by red, bolded text and are highlighted in yellow. These changes, which are also identified by sequential numerals surrounded by asterisks and parentheses, are further explained here:

(*1*) – Description of the model run, including area (e.g., Chokecherry) and year (e.g., Year 1)
(*2*) – Number of turbines (i.e., 500, 298, or 202)
(*3*) – Blade length (i.e., 120- or 103-meter blade)
(*4*) – Description of the run,
    Number of eagle minutes
    Number of counts (total observation minutes / 60)
    Daylight hours (see Appendix E)
(*5*) – Adjust sample volume (e.g., 150 or 200 meters / 100)
(*6*) – For all 12 runs, the priors for Year 1 were adjusted to account for non-standard volume
(*7*) – The posteriors for Year 1 were used as the priors for Year 2

```
# Example Code for Model Run
# CC & SM West for GOEA with 120-m rotor blade Yr1Pooled and Yr2Pooled
# all eagle observations were recorded up to 150-m
# requires FWS functions R2Gamma.R, FatalFcns.R, and RVSmry.R and the R packages rv and
#      maptools

### Chokecherry Sierra Madre West Yr1 - below 150m ###

cProject<-"CCSM_West_Yr1_150m"      #project ID                                                            (*1*)
nTurbine<-c(500)                     #number of turbines                                                   (*2*)
HazRadKm<-c(120/2/1000)      #radius of hazardous area around each turbine(in kilometers)     (*3*)
HzKM2<-(nTurbine*pi*HazRadKm^2)    # hazardous area will be converted to volume later
CntHr<-c(1)                          # count duration (in hours)

## Create the "ExpSvy" data frame (Eagle Minutes observed, number of counts conducted,
#          the area observed at each observation point, and the future daylight hours),
#          includes some observed EMin with no ht recorded

# (*4*)
ExpSvy<-data.frame(row.names=c("CCSM_Y1-150m"),
            EMin=c(164),
            nCnt=c(1233.067),
            CntKM2=c(pi*0.8^2),
            DayLtHr=c(4063.552))

# DayLtHr includes ~8% non-operational hours annually (17 turbines curtailed 89.25 days in spring)

AddTot<-FALSE          #Add strata for total (TRUE) or not (FALSE)
## Analysis Inputs ##
UCI<-c(0.5,0.8,0.9,0.95)
nSims<-100000
setnsims(nSim)
PlotFile<-NULL

## Survey Inputs ##
nSvy<-nrow(ExpSvy)
cSvy<-(rownames(ExpSvy))

## Modified expansion and offset calculations
# we multiply the "offset" (the sampling effort that goes with the eagle minutes observed
#      and is used to calculate the exposure) by 150-m (0.15 km) to give us eagle mins per hr*km^3
# (*5*)
Height <- c(0.15)
SmpHrKM3<- with(ExpSvy,nCnt*CntHr*CntKM2*Height)

# we multiply the "expansion factor" (the product of operational daylight hours and
```

```
#      hazardous area) by 200-m (0.2 km)
ExpFac<- ExpSvy$DayLtHr*HzKM2*.2

# Calculate the fatalities and store as a temporary object.                                   (*6*)
tmp<-with(ExpSvy,mapply(simFatal,EMin=EMin,SmpHrKM2=SmpHrKM3,ExpFac=ExpFac,
            aPriExp=0.9684375,bPriExp=0.5519703,aPriCPr=2.31,bPriCPr=396.69,
            SIMPLIFY=FALSE))

# Put the survey specific simulations in an rv vector.
Fatalities<-rvnorm(nSvy)
Exp<-data.frame(Mean=rep(NA,nSvy),SD=NA,row.names=cSvy)
for(i in 1:nSvy){
 # i<-1
 Fatalities[i]<-tmp[[i]]
 Exp[i,]<-attr(tmp[[i]],"Exp")
}
rm(tmp)
names(Fatalities)<-cSvy

# Summarize
nSvy<-length(Fatalities)
if(is.null(nSvy))nSvy<-1
FatalStats<-RVSmry(cSvy,Fatalities,probs=UCI)
if(AddTot){
 FatalStats<-rbind(
  FatalStats,
  RVSmry("Total",sum(Fatalities),probs=UCI))}
# Determine Yr2 exposure prior parameters from the Yr1 exposure posterior
Prior2<-N2Gamma(mn=Exp$Mean,sd=Exp$SD)

# define objects to pull into the simFatal function for Year2
aPriExpY2<-Prior2[1]
bPriExpY2<-Prior2[2]

### Chokecherry Sierra Madre West Yr2 ###

cProject<-"CCSM_West_Yr2"          #project ID to associate with model outputs          (*1*)
nTurbine<-c(500)                   #number of turbines                                  (*2*)
HazRadKm<-c(120/2/1000)     #radius of hazardous area around each turbine (in kilometers)  (*3*)
HzKM2<-(nTurbine*pi*HazRadKm^2)  # hazardous area will be converted to volume

# (*4*) (*5*)
## Create the "ExpSvy" data frame by pooling data
EMinPooled<-sum(9,26,30,3,6)
SmpHr<-c(5520/60,10534/60,14370/60,9660/60,8700/60)
SmpKM2<-pi*0.8^2
```

```
SmpHt<-c(0.15,0.2,0.2,0.2,0.2)
SmpHrKM3Pooled<-sum(SmpKM2*SmpHr*SmpHt)

ExpSvy<-data.frame(row.names=c("Yr2_Pooled"),
            Emin=EminPooled,
            SmpHrKM3=SmpHrKM3Pooled,
            DayLtHr=4063.552)

# DayLtHr includes ~8% non-operational hours annually (17 turbines curtailed 89.25 days in spring)

AddTot<-FALSE      #Add strata for total (TRUE) or not (FALSE)

## Analysis Inputs (if different than Year 1)##
## Survey Inputs ###
nSvy<-nrow(ExpSvy)
cSvy<-(rownames(ExpSvy))

## Modified expansion and offset calculations
ExpFac<- ExpSvy$DayLtHr*HzKM2*.2

# Calculate the fatalities and store as a temporary object.                    (*7*)
tmp<-mapply(simFatal,EMin=ExpSvy$EMin,SmpHrKM2=ExpSvy$SmpHrKM3,ExpFac=ExpFac,
        aPriExp=aPriExpY2,bPriExp=bPriExpY2,aPriCPr=2.31,bPriCPr=396.69,
        SIMPLIFY=FALSE)

# Put the survey specific simulations in an rv vector.
Fatalities<-rvnorm(nSvy)
Exp<-data.frame(Mean=rep(NA,nSvy),SD=NA,row.names=cSvy)
for(i in 1:nSvy){
 # i<-1
 Fatalities[i]<-tmp[[i]]
 Exp[i,]<-attr(tmp[[i]],"Exp")
}
rm(tmp)
names(Fatalities)<-cSvy

# Summarize the surveys, including a total if needed.
nSvy<-length(Fatalities)
if(is.null(nSvy))nSvy<-1
FatalStats<-RVSmry(cSvy,Fatalities,probs=UCI)
if(AddTot){
 FatalStats<-rbind(
  FatalStats,
  RVSmry("Total",sum(Fatalities),probs=UCI)
 )}
```

Appendix J

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EDWARD K. LOVE FOUNDATION

Date: October 14, 2014

To: Garry Miller, Vice President, Land and Environmental Affairs, Power Company of Wyoming LLC, 555 Seventeenth Street, Suite 2400, Denver, CO 80202

From: Dr. Joshua J. Millspaugh, O'Connor Distinguished Professor of Wildlife Management, Department of Fisheries and Wildlife Sciences, University of Missouri, 302 Natural Resources Building, Columbia, MO 65211

Subject: Expert Report – Estimates of Eagle Fatalities

I. Executive Summary and Expert Opinions

Using the U.S. Fish and Wildlife Service (USFWS or Service) Eagle Fatality Model, I was asked to estimate golden eagle and bald eagle fatalities for the final project design for Phase I of the Chokecherry and Sierra Madre Wind Energy Project. I also completed an evaluation of certain aspects of the model and how the Service applied eagle data collected on the site to estimate eagle fatalities. Given issues I identified with assumptions of the Service's model, as applied to the project site, which were first outlined in my report dated September 7, 2012, I modified several assumptions in the Service's model to account for site-specific characteristics of the project site to provide an estimate of eagle fatalities. I compared these eagle fatality estimates from the modified model to estimates provided by the Service for the final Phase I project design. My opinions are based upon my training, experience, education, and expertise in wildlife ecology and the application of statistical techniques and tools to address conservation issues.

The Service's Eagle Fatality Model maintains assumptions with questionable applicability to the Project. My examination of the model shows that the Service appropriately modified two assumptions I discussed in my report dated September 7, 2012, namely (1) the assumption that turbines operate during all daylight hours, all year long was modified to more accurately reflect the amount of time that turbines are operational; and (2) the assumption that eagles are at risk whether they fly above, below, or at rotor height was modified to exclude eagles flying above the rotor height. While I believe that it is also appropriate to assume that eagles flying below the rotor height are not at risk, the Service's modified assumption is more realistic than previously applied. However, while these two assumptions were improved, my present examination shows that the model continues to assume an infinite population of eagles exposed on the site, which has the effect of overestimating the number of predicted eagle fatalities for Phase I of the Chokecherry and Sierra Madre Wind Energy Project.

Further, my examination of the Service's model for the final project design reveals that: (1) the Service's approach to modeling curtailment could be refined to be more realistic and (2) there is a need to model season-specific risk of mortalities to obtain a more realistic fatality estimate. Data are available to address the infinite population assumption, the proper modeling of curtailment and the season-specific risk; therefore, my estimates of eagle fatalities detailed below incorporated these three assumptions. Further, the Service's model requires only slight modification to account for these more appropriate assumptions.

In addition to concerns regarding model assumptions, I have reservations about how the Service applied eagle use data from the site to estimate eagle fatalities using their model. I evaluated how eagle minute use data were applied in the model based on the final Phase I project design. In particular, my review determined that (1) the Service's summary of eagle minutes is biased upwards, which is acknowledged by the Service, but is not adjusted; and (2) the rules used by the Service to include and exclude data are ambiguous, which leads to the inclusion of eagle minute use data which are not appropriate.

Start and end times of eagle observations were recorded in hours and minutes and did not include seconds. The Eagle Conservation Plan Guidance recommends including rounding time of each eagle observation to the next highest integer. Thus, an eagle observed for 1 minute and 10 seconds would equate to 2 eagle minutes (U.S. Fish and Wildlife Service Summary Document for Review of Eagle Use Data and Eagle Fatality Prediction Analysis for the Chokecherry and Sierra Madre Wind Energy Project Phase 1, hereafter referred to as Summary Document, page 5). Because seconds were not provided, the number of eagle minutes was rounded to include all minutes in which eagles were observed (see Summary Document, page 5). As noted by the Service, "this method may inflate the number of eagle minutes, but it ensures the number of eagle minutes is not underestimated" (see Summary Document, page 5). Such an approach, when added to other assumptions of the Service's model, demonstrates a high emphasis on being risk averse, which causes the model to further overestimate the number of predicted eagle fatalities. To address this issue, simulations were run to address the expected bias in eagle minutes using this approach. Assuming start seconds and end seconds within an integer minute are random and that counts contain at least 2 integer minutes (e.g., 13:10 - 13:11), the straight subtraction approach (e.g., 13:10 - 13:11 = 1 minute) underestimates eagle minutes by about 1 second every time a count is conducted. The Service's approach (e.g., 13:10 - 13:11 = 2 minutes) overestimates eagle minutes by about 59 seconds every time a count is conducted. Given the level of expected bias, I adjusted eagle minutes to obtain a more realistic estimate of eagle minutes given the available data.

Last, I have general concerns related to some decisions made by the Service regarding which eagle minute data to include or exclude. My main concern is related to the inclusion of eagle use data recorded in areas that do not have turbines in the final Phase I project layout. Because turbines were not placed in these avoidance areas, due to potentially high eagle activity within those areas, eagle minutes within those areas should not contribute to estimated mortality. As currently applied, the estimated fatalities will be the same whether or not turbines are actually placed within avoidance areas with relatively high eagle activity. Although there are actually fewer eagle minutes when eagle minute data from these areas are removed, the exposure rate is greater because many point counts outside the project footprint did not have any observed eagle minutes, thus estimated fatalities increase by excluding these data in the model.

Using the Service's model as a basis for estimating annual eagle fatalities, I modified the Service's model to provide a more realistic estimate of eagle fatalities. I maintained the structure and general approach taken by the Service in developing the model, but made biologically reasonable and supportable modifications. To more appropriately reflect the final Phase I project conditions: (1) I modified the Service's Model to directly account for abundance on the site rather than assuming an infinite population (the number of fatalities is a function of the number of eagles at risk); (2) I modeled curtailment by removing minutes from point counts within 800 m of turbines that will be shut down during the curtailment season; (3) I modeled season-specific risk of fatality by estimating fatalities for each season instead of annually; (4) I applied a bias correction to eagle minute use data; and (5) I removed eagle minutes recorded within areas that do not have turbines in the final layout.

I produced eagle fatality estimates, for both golden eagles and bald eagles separately, by modifying all assumptions simultaneously. I then compared the model output based on more appropriate assumptions for the project site and available eagle minute use data to eagle fatality estimates generated by the Service at the 80% quantile, which is used by the Service to estimate risk to eagles. The median number of estimated fatalities is also provided. The interpretation of a value at the 80% quantile means there is an 80% chance that *x* number of eagles *or fewer* are predicted to be removed at the wind energy site each year. The value at the 80% quantile should not be interpreted to mean that value equates to the number of eagle fatalities that will occur each year. Reliance on the 80% quantile value is very conservative and model results suggest the actual number of eagle fatalities is likely to be fewer than the 80% quantile value in most model runs. This conservative benchmark is added on top of the already risk-averse approach taken to develop the model.

Assuming a 120 meter turbine blade, and the more appropriate modifications of the data and assumptions described above, the 80% quantile value was 9 *or fewer* golden eagle fatalities. The median estimated number of annual fatalities was 7 golden eagles. The Service estimated 14 golden eagle fatalities, at the 80% quantile, using the same scenario. Using the same assumptions, the 80% quantile value was 2 *or fewer* bald eagle fatalities, with a median estimated number of annual fatalities of 1. The Service estimated 2 bald eagle fatalities, at the 80% quantile, using the same scenario. In my opinion, model estimates when assumptions are modified to reflect project conditions results in a more realistic estimate of eagle fatalities for the Phase I project site.

II. Relevant Experience and Expertise

My experience and expertise are in wildlife ecology and the application of statistical techniques and models to address conservation issues. I am providing a summary here of my relevant experience and expertise. Currently, I am a full professor and the Pauline O'Connor Distinguished Professor of Wildlife Management in the School of Natural Resources, Department of Fisheries and Wildlife Sciences, University of Missouri. I have a Ph.D. in

Wildlife Ecology from the College of Forest Resources, University of Washington, Seattle. I did postdoctoral studies in quantitative ecology at the School of Aquatic and Fishery Sciences, University of Washington. Selected honors and awards include being named a Fellow of The Wildlife Society in 2014, a 2008 award from the U.S. Department of Agriculture for National Teacher of the Year, a 2007 award from the Wildlife Society for Best Article (with Steve Buskirk), and a 2005 award from the Missouri Department of Conservation for "Outstanding Research Collaborator of the Year." In 2013, I was the inaugural recipient of the Southeastern Athletic Conference Faculty Achievement Award at the University of Missouri which "honors professors with outstanding records in teaching and scholarship who serve as role models for other faculty and students."

I have obtained about 60 grants and contracts as either PI or Co-PI since starting my faculty position in 1999 from diverse funding sources such as the U.S. Fish and Wildlife Service, National Fish and Wildlife Foundation, National Science Foundation, U.S. Forest Service, National Park Service, and the National Renewable Energy Lab. One recent grant is for the period 2011-2016 to study the *Ecology of Greater Sage-grouse in Relation to Wind Energy Development in Wyoming*. This study is being funded by the U.S. Forest Service, National Renewable Energy Lab, National Fish and Wildlife Foundation, Power Company of Wyoming (PCW), Wyoming Game and Fish Department, Bureau of Land Management, Western Association of Fish and Wildlife Agencies, and National Wind Coordinating Collaborative.

I have published 4 books and about 185 peer-reviewed journal articles and book chapters. Three books are directly applicable: (1) *Models for Planning Wildlife Conservation in Large Landscapes*, 2009, Millspaugh, J.J. and F.R. Thompson, III, editors, Academic Press, 674 pages; (2) *Design and Analysis of Long-Term Ecological Monitoring Studies*, 2012, Gitzen, R.A., J.J. Millspaugh, A.B. Cooper, and D.S. Licht, editors. Cambridge University Press, 600 pages; and (3) *Wildlife Demography: Analysis of Sex, Age, and Count Data*, 2005, Skalski, J.R., K.E. Ryding, and J.J. Millspaugh, Elsevier Science, 656 pages. In addition to these publications, I have been an invited plenary speaker at national and international conferences to discuss the application of statistical techniques and models in wildlife ecology and management.

I have applied and evaluated statistical techniques and models in addressing conservation issues for a broad range of species, including mammals, avifauna, reptiles, and amphibians. For example, at the request of the Wisconsin Department of Natural Resources, I chaired an international panel of experts in evaluating data and models the agency uses to monitor and estimate white-tailed deer population demographics. Specifically, we evaluated the validity of the assumptions of their population reconstruction model, assessed adjustments made in the model by state personnel, and offered guidance on future applications. I was the senior author on a paper published in the *Journal of Wildlife Management* in 2009 that summarized our findings. A second example relates to my continued development of animal movement and habitat models. In addition to applying these statistical models to diverse taxa ranging from hellbenders to elephants, I have collaboratively developed new statistical approaches to analyzing such data and rigorously evaluated methodology. Specifically, my colleagues and I were among the first to apply discrete choice models in a wildlife context and we pioneered the development of resource utilization functions, both of which have become standard modeling tools for ecologists over the past decade. Thus, my experience and expertise are directly applicable to the analysis I was asked to perform.

III. Review and Critical Analysis of the Assumptions and Estimates of the Eagle Fatality Model for the Chokecherry and Sierra Madre Wind Energy Project

In September 2014, I was asked to perform a review and critical analysis of the assumptions of U.S. Fish and Wildlife Service's (USFWS or Service) Eagle Fatality Model and the eagle fatality estimates for the Chokecherry and Sierra Madre Wind Energy Project derived by the Service. Given issues I identified with the data used in the Service's model and the assumptions of the Service's model, as applied to the project site, I modified the input data and the Service's model to make the assumptions more appropriate and reflective of project conditions to estimate eagle fatalities. I then generated eagle fatality estimates and compared the estimates from the modified model to the Service's estimates created using the Service's data and assumptions.

My current review estimates golden eagle and bald eagle fatalities for the final project design. My opinions are based upon my training, experience, education and my expertise in wildlife ecology and the application of statistical techniques and tools to address conservation issues.

A. Documents and Data Examined and Scope of Review

In this review, I examined several documents, site-specific data used in the model, and the Service's model which has been modified since my last review. Further, I considered my firsthand knowledge of the site and discussions with SWCA personnel. Below I detail the specific materials I reviewed and considered in my evaluation.

(1) Draft Eagle Conservation Plan Guidance released by the Service in January 2011 that describes a process for wind energy developers when preparing an Eagle Conservation Plan (ECP) to assess the risk of projects to eagles and assess how siting, design, and operational modifications can mitigate that risk, specifically, Appendix D, Description of the Service's Model;
(2) Eagle Conservation Plan Guidance Module 1 Land-based Wind Energy Technical Appendices released by the Service in August 2012 that updated the technical appendices in the Draft Eagle Conservation Plan Guidance;
(3) U.S. Fish and Wildlife Service Summary Document for Review of Eagle Use Data and Eagle Fatality Prediction Analysis for the Chokecherry and Sierra Madre Wind Energy Project Phase 1 produced by the U.S. Fish and Wildlife Service, Region 6,Wyoming Ecological Services Field Office and Region 6 Migratory Bird Management Office dated May 27, 2014 (hereafter referred to as Summary Document);
(4) Power Company of Wyoming's Eagle Conservation Plan (draft dated August 2014);
(5) The site-specific eagle data collected at the project site;
(6) Service's model and their list of assumptions used in the model;
(7) Service's model as applied to the final project design;

(8) Discussions with SWCA about data collection and data analysis; and
(9) Papers that were cited by the Service as support for model development and assumptions.

B. Experience with the Project and Eagle Data Collected

I am familiar with the Chokecherry and Sierra Madre Wind Energy Project, how the eagle data were collected by SWCA, and how the data were analyzed by SWCA. I have previously reviewed the Service's eagle fatality model and provided a report to PCW and the Service in September 2012.

I am currently leading a study at the Chokecherry and Sierra Madre Wind Energy Project that investigates the ecology of male Greater sage-grouse in relation to construction of the wind energy facility. I have also been collaborating on a companion female Greater sage-grouse project on the site since the spring of 2010 and leading the habitat component of that project. Given my role in these sage-grouse projects, I have made extensive site visits across the project site. I recently completed one graduate student, and currently supervise one graduate student and one research associate in association with this sage-grouse research. I have also made a few separate trips to Denver, Colorado to meet and discuss my collaborative sage-grouse research with SWCA and PCW personnel.

Because of site visits and my research activities at the project site, I am knowledgeable of the topography, landscape, and location where the eagle data were collected. I was accompanied by SWCA personnel during most of my time on the project site and we discussed how and where the eagle data were collected.

I reviewed the raptor survey program implemented by SWCA including the long watch raptor survey methodology.

C. Assumptions and Data Used in the Service's Eagle Fatality Model

My September 12, 2012 report to PCW and the Service described the Service's eagle fatality model, its assumptions, and implications of applying those assumptions to estimating eagle fatalities for the Chokecherry and Sierra Madre Wind Energy Project. Since that report, the Service has modified their model to account for two issues that I raised. Specifically, the Service modified their model for current estimates of eagle fatalities to address the assumption (1) that eagles are not vulnerable to collision when their flight height is above the turbine blades and (2) that turbines do not rotate all daylight hours, for 365 days per year. These modifications were appropriate, resulting in more realistic estimates of fatality than were previously presented. My present examination has shown that the model continues to assume an infinite population of eagles exposed on the site. Further, my examination revealed that modifications to the project design required the Service to modify their model to account for curtailment of turbine activity.

In addition to evaluating model assumptions in light of the current project design, I evaluated how the Service applied eagle minute use data in their eagle fatality model with emphasis on two key areas including (1) how data were summarized and (2) which data were included and excluded by the Service to estimate eagle fatalities for the project.

Set out below is a discussion of the assumptions of the Service's model that should be modified to more appropriately model eagle fatalities at the site. Further, I discuss how data were summarized and rules for including and excluding eagle minute data as applied by the Service to estimate eagle fatalities for Phase I. This section identifies modifications to the Service's Model that are required to ensure the model is more appropriately applied to the project.

i. *Assumptions*

(1) *There is an infinite population of eagles exposed on the site*. The Service assumes an open population in the Model. It is more accurate to state that the Model assumes an infinite number of eagles at the site, and immediate replacement of an eagle with another eagle after a fatality event, because in the Model fatality due to turbine collision does not reduce eagle abundance. The open population assumption might provide a mechanism for the assumption of an infinite population, and immediate replacement due to a fatality, but what matters in the model is that eagle abundance, or more specifically potential eagle exposure, does not decline as a result of eagle fatalities. This assumption has the practical influence of each eagle fatality resulting in immediate replacement by another eagle (i.e., the exposure rate does not change with an eagle fatality). The stated open population assumption assumes we know the process that leads to an infinite population and immediate replacement due to an eagle fatality. The implication of this assumption is that it is possible to predict more eagle fatalities on the site than eagles that exist currently on the site.

(2) *The daylight hours used to calculate exposure rate are accurately represented by a mean value for each turbine across the entire year* (Summary Document, page 40). This assumption relates to the methods applied by the Service to model proposed curtailment of turbine activities. This approach accounts for reduced daylight hours due to 17 turbines shut down near nest 162 for 89.25 days, but it further spreads the reduction in daylight hours equally among all turbines. To fully account for decreased risk, any surveys that overlap with these 17 turbines both spatially and temporally should be treated as 'unrepresentative' habitat.

(3) *The model assumes that risk of fatality is the same across the year*. Given available eagle minute use data, it is apparent that risk of fatality is not equal across the year, but the model assumes an average value of risk across the year. Information is lost when eagle minutes are pooled across the entire year. For example, the peak number of golden eagle minutes in year 2 occurs in winter (Summary Document, page 35). This time coincides with the greatest percent daylight operational hours (see Summary Document, page 39). It would be more appropriate to consider distinct seasonal conditions of both eagle use and daylight operational hours rather than spreading that risk out across the entire year.

(4) *The Service assumes that the 80% quantile is an appropriate measure of the risk of eagle fatalities on a site*. Output of the Service's Model is a probability distribution of predicted

eagle fatalities on an annual basis. The Service has used the 80% quantile as a basis for interpretation. In August 2012, the Service acknowledged that focus on the 80% quantile is conservative and was a policy decision. Most importantly, the interpretation of a value at the 80% quantile means there is an 80% chance that *x* number of eagles *or fewer* are predicted to be removed at the wind energy site. The value at the 80% quantile should not be interpreted to mean that value equates to the number of eagle fatalities. This conservative benchmark is added on top of the already risk averse approach taken to develop the Model.

In conclusion, my examination of the Service's Eagle Fatality Model revealed that although some of the previous assumptions have been appropriately modified in current estimates of eagle fatalities (i.e., eagles are not considered at risk when flight height is above the rotor swept region and it is not assumed turbines rotate during all daylight hours, 365 days per year), there remain a few questionable assumptions given the final project design and currently available data. This report, however, focuses on 3 specific assumptions made by the Service's Model (1) that there is an infinite population of eagles exposed on the site each year; (2) how curtailment activities are modeled; and (3) that risk to eagles is constant across the year. By not verifying the validity and reasonableness of these assumptions, the Model might result in an unrealistic number of predicted eagle fatalities for Phase I of the Chokecherry and Sierra Madre Wind Energy Project. I focused on these 3 assumptions because (1) they are questionable; (2) data are available to address these assumptions; and (3) the Service's model requires only slight modification to account for these assumptions so that they more appropriately reflect the project conditions, resulting in a more realistic estimate of eagle fatalities for Phase I.

ii. *Data Used*

1. *How eagle minute data were summarized to estimate eagle fatalities*. A primary issue related to the eagle minute data relates to the "rounding up" of eagle use minutes to estimate eagle fatalities. Start and end times of eagle observations were recorded in hours and minutes and did not include seconds. The Eagle Conservation Plan Guidance recommends including rounding time of each eagle observation to the next highest integer. Thus, an eagle observed for 1 minute and 10 seconds would equate to 2 eagle minutes (see Summary Document, page 5). Because seconds were not provided, the number of eagle minutes was rounded to include all minutes in which eagles were observed (see Summary Document, page 5). So, if an observation was recorded at 08:01 and 08:02, the total number of minutes would be 2. As noted by the Service, "this method may inflate the number of eagle minutes, but it ensures the number of eagle minutes is not underestimated" (see Summary Document, page 5). Such an approach, when added to other assumptions of the Service's model, demonstrates a high emphasis on being risk averse and highly conservative, which errs on the side of overestimating the number of predicted eagle fatalities. The degree of risk that is tolerable should be made transparent, not embedded repeatedly in a non-quantifiable way in the building of a model to predict outcomes. The best scientific practice would be to develop the most realistic model possible, apply the model, and explain to the policy makers how to interpret and use model output as they determine the acceptable degree of risk. It is important to avoid confusing best scientific practices with policy when developing a model.

To address this issue, simulations were run to address the expected bias in eagle minutes using this approach (Appendix A). Assuming start seconds and end seconds within an integer minute are random and that counts contain at least 2 integer minutes (e.g., 13:10 - 13:11), the straight subtraction approach (e.g., 13:10 - 13:11 = 1 minute) underestimates eagle minutes by about 1 second every time a count is conducted. The Service approach (e.g., 13:10 - 13:11 = 2 minutes) overestimates eagle minutes by about 59 seconds every time a count is conducted. Given the level of expected bias and the available data, it is possible to adjust eagle minutes based on this level of bias to obtain a more realistic estimate of eagle minutes.

2. *Which data were included and excluded by the Service to estimate eagle fatalities for the project*. The rules used by the Service to include and exclude data seem ambiguous and non-repeatable. It would be appropriate to provide rules that a third party could objectively apply and arrive at the same conclusion about which data to include or exclude. Further, it would be appropriate to apply the rules in the same manner across years. Below are examples of concerns regarding the inclusion and exclusion of some point-count data:

(A) It is unclear why data from point-counts conducted in turbine avoidance areas are not treated as “unrepresentative” habitat. Because turbines were not placed in these avoidance areas, due to potentially high eagle activity within those areas, eagle minutes within those areas should not contribute to estimated mortality. This approach seems counter-intuitive if a goal is to reduce eagle fatalities. As currently applied, the estimated fatalities will be the same whether or not turbines are actually placed within high avoidance areas or not.

(B) There is ambiguity related to the definition of the project footprint from which “30% spatial coverage” is required. Without a clear understanding of how the Service defines the project footprint it becomes difficult to apply the rules established by the Service.

(C) There is no clear statistical or biological justification for the 30% spatial coverage rule.

(D) The 30% spatial coverage rule is being applied to justify excluding data from some point-counts in some years, but not others. For example, data from point count RM12 (Summary Document, pages 3, 4, 13, 14, 16) were used in some years but not in other years. Data should either be used in all years or not used in any years.

In conclusion, my examination of the data used by the Service to model estimated eagle fatalities revealed some questions in how data were summarized and which data were included or excluded. This report focuses on two specific modifications that were made to more appropriately reflect the data available to estimate eagle fatalities on the site including (1) a bias correction to the summary of eagle minute use data and (2) exclusion of eagle use data recorded outside areas where turbines will be located.

IV. Eagle Fatality Modeling for the Chokecherry and Sierra Madre Wind Energy Project: Consideration of Assumptions and Data Used

Given the discussion above about model assumptions and data used to estimate eagle fatalities, I used the Service's Model as a basis for estimating annual eagle fatalities, but I produced fatality estimates by modifying questionable assumptions. Further, I modified how data were summarized and which data were included in my estimates of eagle fatalities. I maintained the structure and general approach taken by the Service in developing the model, but made biologically reasonable and supportable modifications to address these assumptions.

A. Overview, Scope of Analysis and Background

I focused on the following 3 specific assumptions made by the Service's model (1) that there is an infinite population of eagles exposed on the site each year; (2) that the daylight hours used to calculate exposure rate are accurately represented by a mean value for each turbine across the entire year; and (3) the model assumes that risk of fatality is the same across the year.

To address these assumptions, I did the following: (1) to account for the infinite population assumption, I modified the Service's Model to directly account for abundance on the site (the number of fatalities is a function of the number of eagles at risk); (2) to account for the mean exposure rate, I treated the area around the 17 turbines that were curtailed as 'unrepresentative' habitat; and (3) to account for the same risk of fatality throughout the year, I modeled estimates of fatality using distinct seasonal conditions of both eagle use and daylight operational hours rather than spreading that risk out across the entire year. All of these assumptions were integrated in one model run.

In addition to addressing these 3 specific assumptions of the Service's model, I also (1) adjusted eagle minutes to obtain a more realistic estimate of eagle minutes given the available data by applying a bias correction and (2) treated turbine avoidance areas as "unrepresentative" habitat.

B. Eagle Fatality Estimates

I produced eagle fatality estimates, for both golden eagles and bald eagles separately, by modifying all assumptions simultaneously. I then compared model output when assumptions were made more realistic for the project site and available eagle minute use data to eagle fatality estimates generated by the Service. Modifications to the model and data are described below.

1. Eagle fatality estimates for the project accounting for a finite population of eagles

To account for the infinite population assumption, the Service's model was directly modified to directly consider abundance. More specifically, the Service's model was made to explicitly make the number of fatalities a function of the number of eagles at risk of death. Define the following variables:

λ = the expected number of eagle minutes per hour per km^2
C = collision probability per eagle minute spent in hazardous areas
A = abundance of eagles in the project site
DH = the total number of daylight hours in a year
HA = the total hazardous area in units of km^2
F = number of eagle fatalities
π = proportion of time turbines are rotating
α = proportion of time flying at rotor height

Both λ and C are specified by the same distributions outlined in Appendix D – Stage 3 document of the ECP Guidance report. A can be specified as a distribution or as a constant. For purposes of this report, we have assumed a mean abundance of 30 golden eagles and 8 bald eagles, which was estimated by SWCA during their monitoring program.

The probability a single eagle collides with a turbine per eagle-minute spent in hazardous areas is:

$$\gamma = 1 - (1 - C)^{\frac{\lambda}{A}}.$$

Note that the expected number of eagle minutes per hour per km^2 is divided by the total abundance so the collision probability is represented on a per-eagle basis. Assuming the collision probability is constant across space and time, the annual probability of a single eagle colliding with a wind turbine is:

$$\psi = 1 - (1 - \gamma)^{DH \times HA}.$$

Finally, assuming a constant annual collision probability across all eagles:

$$F \sim binomial(A, \psi).$$

In addition to other assumptions made in the Service's model, our binomial model assumes that eagle minutes are evenly spread among all eagles in the project site. The abundance is assumed to be known or is known with some level of certainty. Specifying an unreasonably large abundance (e.g., infinite population) will overestimate fatality risk, while specifying an unreasonably small abundance (e.g., 1 eagle) will underestimate fatality risk.

In summary, this approach is identical to the Service's model but this modification allows an explicit representation of the number of eagles at risk of death. Using the Service's model which assumes an infinite number of trials, it was modified as an equivalent binomial model without altering any other aspect of the Service's model except for the mean abundance which is made explicit. Such an approach allows for the evaluation of the effect of a more realistic value of abundance on estimated eagle fatalities rather than assuming an infinite population of eagles exposed on the site and immediate replacement of an eagle with another eagle after a fatality event.

2. The daylight hours used to calculate exposure rate are accurately represented by a mean value for each turbine across the entire year

This assumption relates to the methods applied by the Service to model proposed curtailment of turbines. This approach accounts for reduced daylight hours due to 17 turbines shut down near nest 162 for 89.25 days, but it further spreads the reduction in daylight hours equally among all turbines. To fully account for decreased risk, surveys that overlap with these 17 turbines both spatially and temporally should be treated as ‘unrepresentative’ habitat, resulting in the exclusion of eagle minute data and modification to the exposure rate.

Thus, I excluded eagle minutes and observation hours from point counts within 800 meters of any of the 17 turbines scheduled to be shut down during the curtailment period. Specifically, I excluded eagle minutes and observation hours from point counts MH3, MH5, RM3 during the curtailment season, defined as February 1 – April 30 (see Summary Document, p. 39). Finally, I reduced the number of turbines to 483 during the curtailment season.

3. *The model assumes that risk of fatality is the same across the year*

To accommodate for differential risk of fatality across the year, I considered distinct seasonal conditions of both eagle use and daylight operational hours rather than spreading that risk out across the entire year.

I summarized eagle minutes and observation hours by the seasons defined in the Summary Document, page 39. I included observations from “Year 1” and “Year 2” (see Summary Document pages 6-7). I calculated season-specific daylight hours as the product of seasonal daylight hours and the percent of time each turbine is expected to operate (see Summary Document, page 40).

4. *How eagle minute data were summarized to estimate eagle fatalities.*

The primary issue here relates to the “rounding up” of eagle use minutes to estimate eagle fatalities. As discussed above in Section C, ii, 1, the Service’s method for recording eagle minutes (e.g. observing an eagle from 13:10 – 13:11 = 2 eagle minutes) introduces an average bias of 59 seconds every time a count is conducted (0.98 minutes). Rounding minutes to 1 when they start and stop within the same integer minute (e.g. observing an eagle from 13:10 – 13:10 = 1 eagle minute) introduces an average bias of 40 seconds (0.67 minutes). Thus, I subtracted 0.98 minutes for every observation that lasted ≥2 minutes and 0.67 minutes for every observation that lasted 1 minute to correct this bias.

5. *Which data were included and excluded by the Service to estimate eagle fatalities for the project.*

It is unclear why data from point-counts conducted in turbine avoidance areas are not treated as “unrepresentative” habitat. Because turbines were not placed in these avoidance areas, due to potentially high eagle activity within those areas, eagle minutes within those areas should not contribute to estimated mortality. This approach seems counter-intuitive if a goal of these avoidance areas is to reduce eagle fatalities. As currently applied, the estimated fatalities will be the same whether or not turbines are actually placed within these avoidance areas or not.

To accommodate this issue, I included only eagle minutes and observation hours from point counts within 800 meters of an active turbine. Specifically, I only included eagle minutes and observation hours from the following point count stations: CC1, CC2, CC3, CC4, CC5, CC6, CC7, CC9, CC10, CC11, CC12, MH1, MH2, MH3, MH4, MH5, MH6, MH7, MH8, PG2, PG4, PG5, PG7, PG8, PG9, PG10, RM3, RM4, RM6, RM7, RM13, RM14, RM17, RM18, RM19, RM20, and RM23.

Based on the available data, I applied the following correction: at point count RM4, during 2011 Spring to 2012 Spring, the Service recorded 13 golden eagle minutes (Summary Document, page 25). My review suggested there should be 17 minutes: a 1-minute and a 2-minute count of May 23, 2011, a 9-minute count on June 23, 2011, a 2-minute count on July 10, 2011, and a 3-minute count on July 24, 2011. Thus, I used 17 minutes in the model.

I produced eagle fatality estimates, for both golden eagles and bald eagles separately, by modifying all assumptions simultaneously. I then compared Model output when assumptions were made more appropriate for the project site and available eagle minute use data to eagle fatality estimates generated by the Service. Further, I considered eagle fatality numbers at the 80% quantile, which is used by the Service to estimate risk to eagles. The median number of estimated fatalities is also provided. The interpretation of a value at the 80% quantile means there is an 80% chance that *x* number of eagles *or fewer* are predicted to be removed at the wind energy site each year. The value at the 80% quantile should not be interpreted to mean that value equates to the number of eagle fatalities that will occur each year. Reliance on the 80% quantile value is very conservative and model results suggest the actual number of eagle fatalities is likely to be fewer than the 80% quantile value in most model runs. This conservative benchmark is added on top of the already risk-averse approach taken to develop the model.

Assuming a 120 meter turbine blade, the 80% quantile value was 9 *or fewer* golden eagle fatalities (Table 1 and Figures 1 and 2). The median estimated number of annual fatalities was 7 golden eagles. The Service estimated 14 golden eagle fatalities, at the 80% quantile, using the same scenario. Using the same assumptions, the 80% quantile value was 2 *or fewer* bald eagle fatalities, with a median estimated number of annual fatalities of 1 (Table 2 and Figures 3 and 4). The Service estimated 2 bald eagle fatalities, at the 80% quantile, using the same scenario. A complete summary of these modeling results, including a summary of the data used, is presented in Tables 1 and 2 and Figures 1-4 below.

V. Conclusion

In conclusion, it is my opinion that:

- There are a number of assumptions inherent in the Service's eagle fatality Model that are questionable for the project site and modification of these assumptions as used in the Model results in a more realistic estimate of eagle fatalities. In particular, the Service's model assumes there is an infinite population of eagles exposed on the site, which has the effect of overestimating the number of predicted eagle fatalities for Phase I of the Project. Further, my examination of the Service's model for the final project design has revealed that their approach to modeling curtailment should be refined and there is a need to model season-specific risk of estimated mortalities. Both adjustments to the model result in a more realistic estimate of eagle fatalities at the site.

- Further, there were general concerns and uncertainty related to some decisions made by the Service regarding which eagle minute data to include or exclude and how data were summarized. A main concern related to the inclusion of eagle use data recorded in the turbine avoidance areas. Because turbines were not placed in these avoidance areas, due to potentially high eagle activity within those areas, eagle minutes within those areas should not contribute to estimated mortality. Second, the rounding of minute data as conducted by the Service overestimates eagle minutes. Consideration of these issues results in a more realistic estimate of eagle fatalities at the site.

- The Service's model can be modified to reflect more appropriate assumptions for the project site. Doing so maintains the structure and general approach taken by the Service in developing and applying the Model. However, doing so makes the model a more realistic reflection of project conditions.

- When considering the final project design, assuming a 120 meter turbine blade, and consideration of the assumptions and modifications to input data as described above, the 80% quantile value was 9 *or fewer* golden eagle fatalities. The median estimated number of annual fatalities was 7 golden eagles. The Service estimated 14 golden eagle fatalities, at the 80% quantile, using the same scenario. Using the same assumptions, the 80% quantile value was 2 *or fewer* bald eagle fatalities, with a median estimated number of annual fatalities of 1. The Service estimated 2 bald eagle fatalities, at the 80% quantile, using the same scenario. In my opinion, model estimates when assumptions are modified and input data are modified to reflect project conditions results in a more realistic estimate of eagle fatalities for Phase I of the Chokecherry and Sierra Madre Wind Energy Project.

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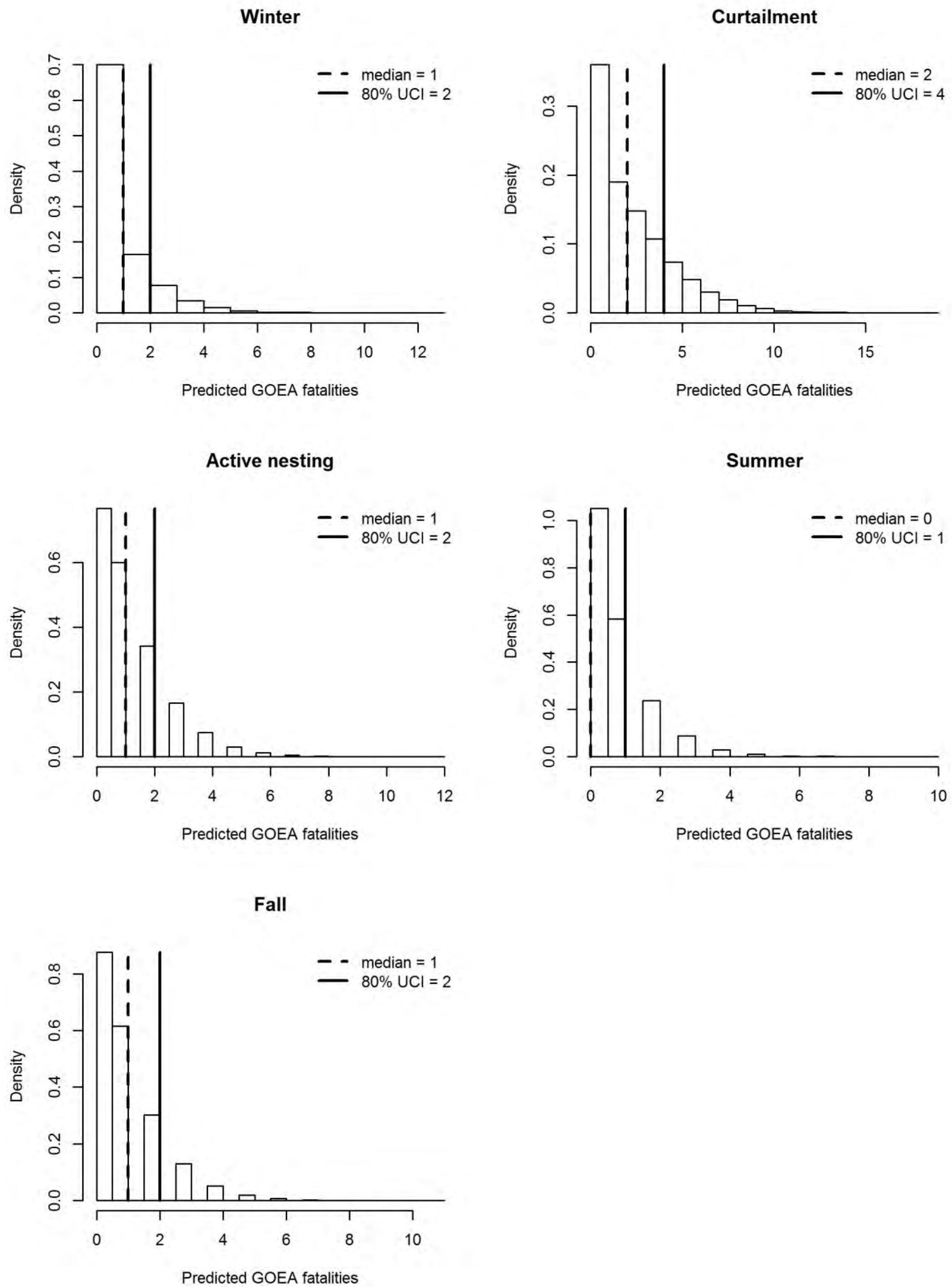

Figure 1: Summary of season-specific posterior distribution of golden eagle fatalities.

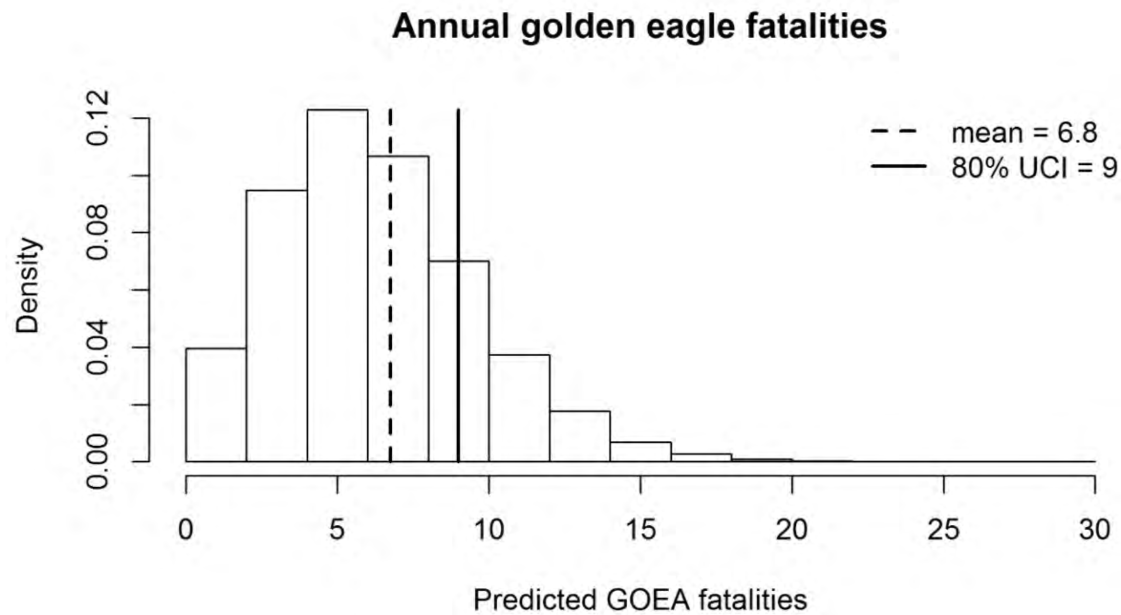

Figure 2: Summary of annual posterior distribution of golden eagle fatalities.

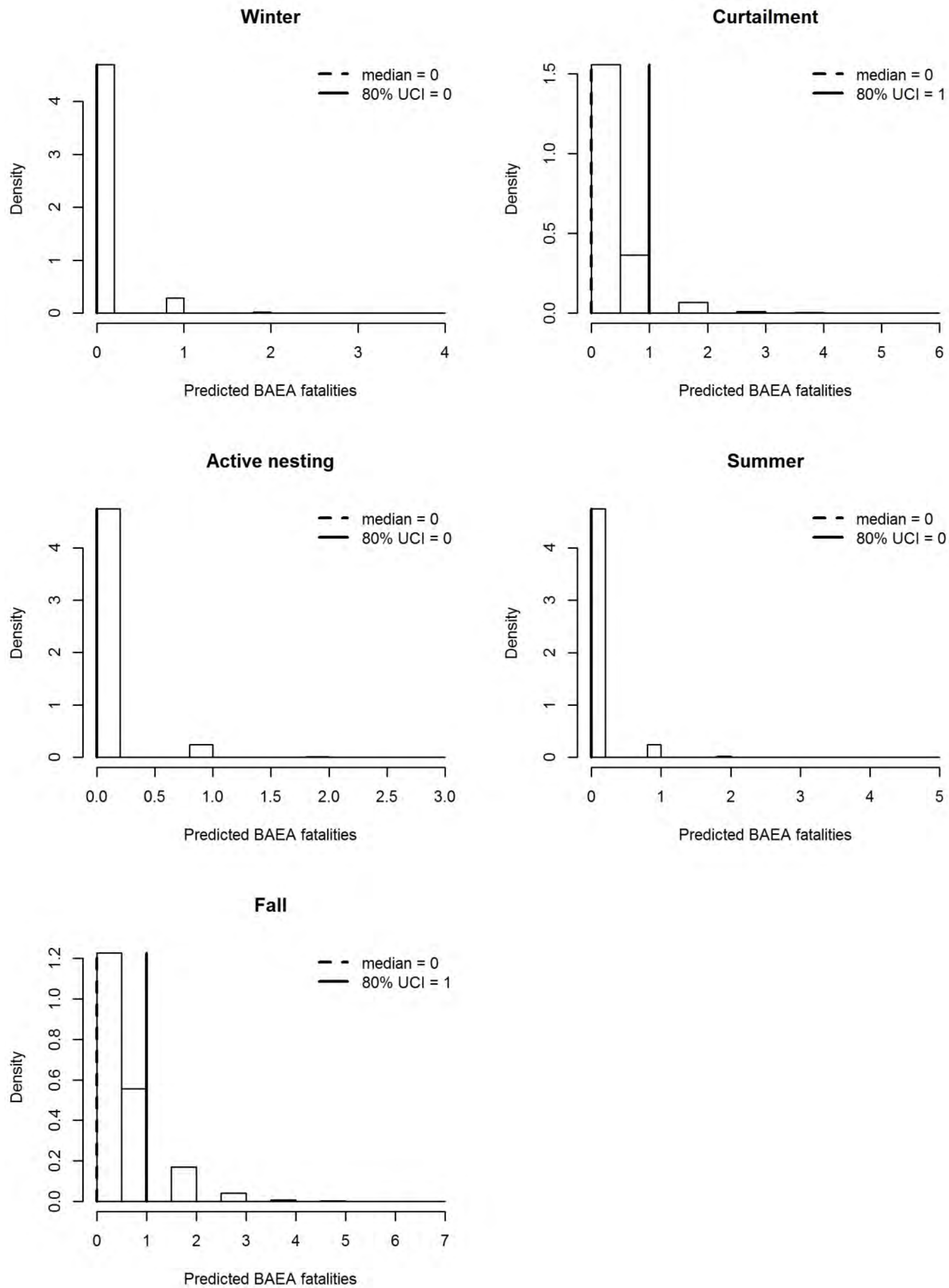

Figure 3: Summary of season-specific posterior distributions of bald eagle fatalities.

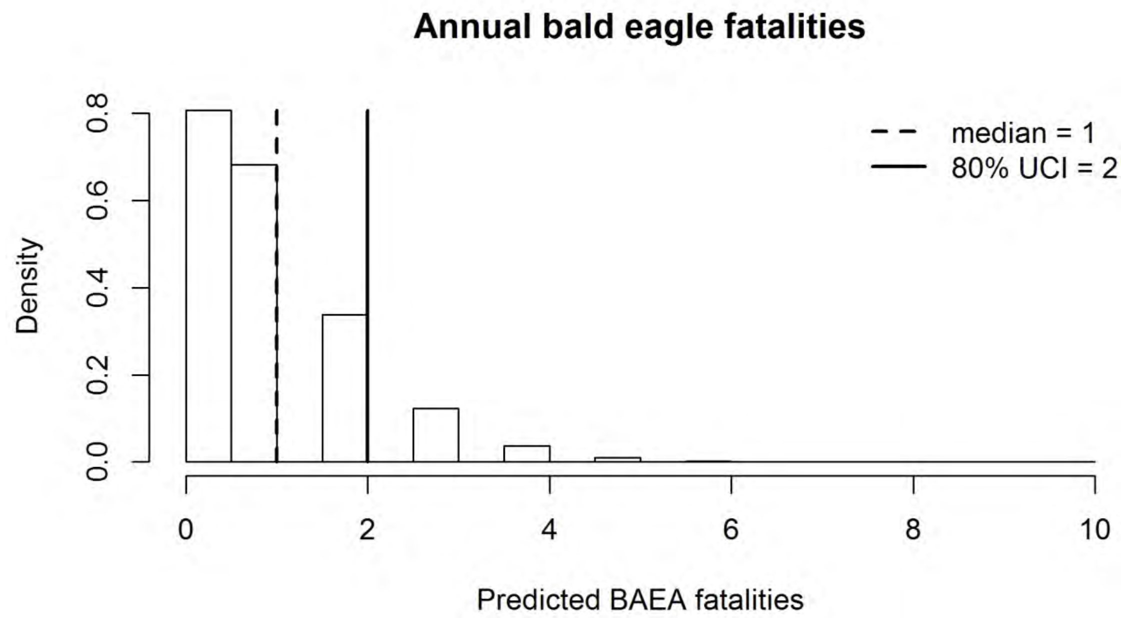

Figure 4: Summary of annual posterior distribution of bald eagle fatalities.

Table 1: Summary of predicted golden eagle fatalities and data used in the model.

Season	Golden Eagle Minutes	Survey hours per km^3	Daylight Hours	Blade Length (m)	No. Turbines	Eagle Exposure	Exposure SD	Avg. Fatality	Fatality SD	80% UCI Fatality
Winter	15.7	64.3	689.7	120	500	0.2575	0.063	1.13	1.29	2
Curtailment	44.6	99.8	1008.0	120	483	0.4545	0.067	2.72	2.31	4
Active Nest	28.2	132.1	841.8	120	500	0.2198	0.041	1.18	1.32	2
Summer	12.5	66.4	580.7	120	500	0.2008	0.055	0.75	1.00	1
Fall	31.3	205.6	977.7	120	500	0.1564	0.028	0.98	1.17	2
Annual	-		-	-	-	-	-	6.76	3.34	9

Table 2: Summary of predicted bald eagle fatalities and data used in the model.

Season	Bald Eagle Minutes	Survey hours per km^3	Daylight Hours	Blade Length (m)	No. Turbines	Eagle Exposure	Exposure SD	Avg. Fatality	Fatality SD	80% UCI Fatality
Winter	0.0	64.3	689.7	120	500	0.0149	0.015	0.07	0.27	0
Curtailment	3.4	99.8	1008.0	120	483	0.0434	0.021	0.27	0.55	1
Active Nest	0.3	132.1	841.8	120	500	0.0098	0.009	0.05	0.24	0
Summer	0.0	66.4	580.7	120	500	0.0145	0.015	0.05	0.24	0
Fall	16.8	205.6	977.7	120	500	0.0860	0.020	0.52	0.77	1
Annual	-		-	-	-	-	-	0.97	1.05	2

Appendix A. R code used to assess bias in "rounding up" eagle minutes.

```
# Bias (in seconds) when not rounding up.  Assumes eagle minutes
consist of two
# complete integer minutes (e.g., 13:10 - 13:11)

# Total seconds in integer minute 1
sta <- 60 - sample(0:59, 100000, T)
# Total seconds in integer minute 2
end <- 60 - sample(0:59, 100000, T)


# mean bias from SWCA approach (in seconds)
# SWCA would treat this as 1 minute
mean(60 - (sta + end))

# mean bias from FWS approach (in seconds)
# FWS would treat this as 2 minutes
# mean bias approximately 59 seconds
mean(120 - (sta + end))


# Bias (in seconds) for 1-minute surveys (e.g., 13:10 - 13:10)
# assume 1-second minimum survey length - e.g., if a survey starts
at 13:10:59,
# it will end at 13:11:60 at the earliest.  Thus, all surveys start
by 13:10:58

# assume all time intervals equally likely
# e.g., second 0 - 1 is as likely as second 11 - 45
# total number of possibilities is sum of integers 1:59.
# calculate like this: 1-s intervals can be 0-1, 1-2, ..., 58-59 (59
total)
# 2-s intervals can be 0-2, 1-3, ..., 57-59 (58 total), etc.
# mean bias approximately 40 seconds

# initializing a vector where each element is 1 equally-likely time
interval.
total.possibilities <- sum(1:59)

# each element of total.possibilities is the total length of the
time interval.
# i.e. there are 59 possible 1-s intervals, 58 possible 2-s
intervals, etc.
sec.ind <- numeric(total.possibilities)
for(i in 1:59){
  s <- sum(sec.ind > 0) + 1
  e <- (59:1)[i] + sum(sec.ind > 0)
  sec.ind[s:e] <- rep(i, (59:1)[i])
}
```

```
# randomly sampling survey lengths
len.s <- sample(sec.ind, 100000, T)
hist(len.s, main = '', xlab = 'Survey length (s)', freq = F);
mean(len.s)
bias <- 60 - len.s; mean(bias)
```

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Appendix K

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APPENDIX K

Summary of BLM Environmental Constraints, Applicant Committed Measures, Applicant Committed Best Management Practices, and Proposed Mitigation Measures

This appendix contains a copy of Appendix D from the Chokecherry and Sierra Madre (CCSM) Wind Energy Project Record of Decision (ROD) published in 2012. *See BLM 2012a*. This appendix identifies the Bureau of Land Management (BLM) environmental constraints, Applicant committed measures, Applicant committed best management practices, and proposed mitigation measures for the CCSM Project. This appendix is included in this Phase I ECP for ease of reference to the design features and mitigation measures incorporated into the CCSM Project, including Phase I.

Appendix D

Summary of BLM Environmental Constraints, Applicant Committed Measures, Applicant Committed Best Management Practices, and Proposed Mitigation Measures

Appendix Table D-1 Summary of BLM Environmental Constraints

Resource Area	Resource Concern	Protection Measure	Application to Jurisdiction[1]			Mitigation Type[2]	Authority/Source
			Private Land[3]	State Land	Public Land		
Cultural – Historic Trails	Within either 0.25-mile or the visual horizon (whichever is closer) of a cultural property/ historic trails.	No surface disturbing activities. Management actions resulting in visual elements that diminish the integrity of the property's setting will be managed in accordance with the Wyoming State Protocol and BMPs.	Yes[4]	Yes	Yes	1	2008 Rawlins RMP ROD; Wyoming BLM Mitigation Guidelines; Wind Energy Programmatic EIS ROD Policies and BMPs.
Recreation Sites	Within 0.25-mile of developed and undeveloped recreation sites.	Lands closed to operation of public land laws.	Yes[4]	Yes[4]	Yes[4]	1	2008 Rawlins RMP ROD.
Soils – Slopes	Steep slopes >25 percent.	Surface disturbance will be prohibited. No turbines, staging or substations.	Yes[5]	Yes[5]	Yes[5]	1	Wyoming BLM Mitigation Guidelines.
Special Management Areas – Designated Areas	Designated areas part of the National Landscape Conservation System (e.g., Continental Divide National Scenic Trail [CDNST]).	Lands will be excluded from wind energy site monitoring and testing and development on lands on which wind energy development is incompatible with specific resource values. *(0.25-mile swath centered on the trail)*	n/a	Yes[4]	Yes	1	Wind Energy Programmatic EIS ROD Policies and BMPs.
Water – Ephemeral Channels	Within 100 feet from the inner gorge of ephemeral channels.	Avoidance areas for surface-disturbing and disruptive activities and linear crossings. Only those actions within areas that cannot be avoided and that provide protection for the resource identified will be approved.	No[5]	No[5]	Yes[5]	1	2008 Rawlins RMP ROD.
Water – Floodplains	Identified 100-year floodplains.	Surface disturbing activities will be avoided. Only those actions within areas that cannot be avoided and that provide protection for the resource identified will be approved.	No	No	Yes	1	2008 Rawlins RMP ROD.
Water – Perennial Waters, Springs, Wetlands, Riparian	Within 500 feet of perennial waters, springs, and wetland and riparian areas.	Surface disturbing activities will be avoided. Only those actions within areas that cannot be avoided and that provide protection for the resource identified will be approved.	No[4,5]	No[4,5]	Yes[5]	1	2008 Rawlins RMP ROD; Wyoming BLM Mitigation Guidelines; Executive Orders (EOs) 11990 and 11988.
Water – Unstable Areas	Unstable areas (such as landslides, slopes >25 percent, slumps, and areas exhibiting soil creep).	Surface disturbing activities will be avoided. Reclamation practices and BMPs will be applied as appropriate for surface disturbing activities.	No	No	Yes	1	2008 Rawlins RMP ROD.
Water – Wetlands	Wetlands identified on National Wetlands Inventory (NWI) or proper functioning condition (PFC).[6]	No disturbance.	No	No	Yes	1	EOs 11990 and 11988.
Wildlife – Amphibians	Identified 100-year floodplains; within 500 feet of perennial waters, springs, wells, and wetlands; and within 100 feet of the inner gorge of ephemeral channels.	Surface disturbing and disruptive activities will be avoided.	No	No	Yes	1	2008 Rawlins RMP ROD.
Wildlife – Fish	Waterbodies that potentially support fish for a portion of the year.	Design road crossings to simulate natural stream processes.	No	No	Yes	1	2008 Rawlins RMP ROD.
Wildlife – Raptors	825 feet of active raptor nests (ferruginous hawks, 1,200 feet).	Well locations, roads, ancillary facilities, and other surface structures requiring a repeated human presence will not be allowed. Distance may vary depending on factors such as nest activity, species, natural topographic barriers, and line-of-sight distances.	Yes	Yes	Yes	1	2008 Rawlins RMP ROD.
Wildlife-Columbian Sharp-tailed Grouse	0.25 mile to 1 mile of an occupied or undetermined Columbian sharp-tailed grouse lek.	High-profile structures (e.g., buildings, storage tanks, overhead powerlines, wind turbines, towers, and windmills) would be authorized on a case-by-case basis from one-quarter mile to 1 mile of an occupied greater sage-grouse and sharp-tailed grouse lek.	No	No	Yes	1	2008 Rawlins RMP ROD.
Wildlife – Greater Sage-grouse	Inside Core Areas: 0.60 mile NSU from lek perimeter (includes occupied and undetermined leks). Outside Core Areas: 0.25 mile NSU from lek perimeter (includes occupied and undetermined leks).	Surface disturbing activities or surface occupancy is prohibited or restricted.	Yes	Yes	Yes	1	BLM IM No. WY-2012-019

Appendix Table D-1 Summary of BLM Environmental Constraints

Resource Area	Resource Concern	Protection Measure	Application to Jurisdiction[1]			Mitigation Type[2]	Authority/Source
			Private Land[3]	State Land	Public Land		
Wildlife – Greater Sage-grouse	Inside Core Areas.	Limit development to one disturbance location per 640 acres. Cumulative value of one location and existing disturbance to not exceed 5 percent of sagebrush habitat within 640 acres	No	No	Yes	1	BLM IM No. WY-2012-019
Wildlife – Greater Sage-Grouse	0.25-mile to 1 mile of an occupied sage-grouse lek.	High-profile structures (e.g., buildings, storage tanks, overhead power lines, wind turbines, towers, and windmills) will be authorized on a case-by-case basis.	No	No	Yes	1	2008 Rawlins RMP ROD.
Wildlife – Greater Sage-grouse	<u>Inside Core Areas</u>: Within 0.60-mile of the perimeter of an occupied or undetermined greater sage-grouse lek. <u>Outside Core Areas</u>: Within 0.25-mile of the perimeter of an occupied or undetermined greater sage-grouse lek.	Disruptive activities are restricted between 6:00 p.m. and 9:00 a.m. from March 1 to May 20.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD; BLM IM No. WY-2012-019.
Wildlife – Greater Sage-grouse	<u>Inside Core Areas</u>: In suitable greater sage-grouse nesting and early brood-rearing habitat. <u>Outside Core Areas</u>: In suitable greater sage-grouse nesting and early brood-rearing habitat within 1) mapped habitat important for connectivity, or 2) within 2 miles of any occupied or undetermined lek.	Surface disturbing and/or disruptive activities are prohibited or restricted from March 1 – July 15.	No[7]	No[7]	Yes	2	BLM IM No. WY-2012-019; 2008 Rawlins RMP ROD.
Wildlife – Greater Sage-grouse	Greater sage-grouse delineated winter concentration areas.	Surface disturbing and/or disruptive activities in mapped or modeled greater sage-grouse winter habitats/concentration areas that support Core Area populations, are prohibited or restricted from November 15 – March 14.	No[7]	No[7]	Yes	2	BLM IM No. WY-2012-019; 2008 Rawlins RMP ROD.
Wildlife – Columbian Sharp-tailed Grouse	Within 0.25-mile of the perimeter of an occupied or undetermined Columbian sharp-tailed grouse lek.	Surface disturbing activities or occupancy are prohibited. Disruptive activities are prohibited between 6:00 p.m. and 9:00 a.m. from March 1 to May 20.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Barn Owl	Within 0.75-mile of barn owl nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited February 1–July 15.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Big Game	Big game crucial winter range.	Surface disturbing and disruptive activities will not be allowed during the period of November 15 to April 30. Disruptive activities will require the use of BMPs designed to reduce the amount of human presence and activity during the winter months.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD; Wyoming BLM Mitigation Guidelines.
Wildlife – Big Game	Big game parturition areas.	Surface disturbing and disruptive activities will not be allowed during the period of May 1 to June 30.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD; Wyoming BLM Mitigation Guidelines.
Wildlife – Burrowing Owl	Within 0.75-mile of burrowing owl nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited April 15–September 15.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Cooper's Hawk	Within 0.75-mile of Cooper's hawk nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited April 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Ferruginous Hawk	Within 1-mile buffer of ferruginous hawk nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited March 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Golden Eagle	Within 1-mile buffer of golden eagle nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited February 1–July 15.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Goshawk	Within 0.75-mile of Goshawk nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited April 1–August 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Great-Horned Owl	Within 0.75-mile of great-horned owl nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited February 1–July 15.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Kestrel	Within 0.75-mile of kestrel nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited April 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Long-Eared Owl	Within 0.75-mile of long-eared owl nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited March 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.

Power Company of Wyoming LLC

Appendix Table D-1 Summary of BLM Environmental Constraints

Resource Area	Resource Concern	Protection Measure	Application to Jurisdiction[1]			Mitigation Type[2]	Authority/Source
			Private Land[3]	State Land	Public Land		
Wildlife – Merlin	Within 0.75-mile of Merlin nests.	Seasonal wildlife stipulation April 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Mountain Plover	Potential and occupied habitat Mountain plover.	Habitat will be avoided where practical. All surface-disturbing activities will be restricted from April 10 to July 10. Additional protection measures will be applied if this area is later determined to be within occupied habitat. Occupied habitat is defined as areas where broods and adults have been found.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Northern Harrier	Within 0.75-mile of northern harrier nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited April 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Osprey	Within 0.75-mile of osprey nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited April 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Peregrine Falcon	Within 0.75-mile of peregrine falcon nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited March 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Prairie Falcon	Within 0.75-mile of prairie falcon nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited April 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Raptor	Defined raptor and game bird winter concentration areas.	Activities or surface use will not be allowed from November 15 to April 30.	No[7]	No[7]	Yes	2	Wyoming BLM Mitigation Guidelines.
Wildlife – Raptor	Raptor nesting habitat.	Activities or surface use will not be allowed from February 1 to July 31.	No[7]	No[7]	Yes	2	Wyoming BLM Mitigation Guidelines.
Wildlife – Raptors	Within 0.75-mile of other raptor nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited February 1–July 15.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Red-Tailed Hawk	Within 0.75-mile of red-tailed hawk nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited February 1–July 15.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Screech Owl	Within 0.75-mile of screech owl nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited March 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Sharp-Shinned Hawk	Within 0.75-mile of sharp-shinned hawk nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited April 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Short-Eared Owl	Within 0.75-mile of short-eared owl nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited March 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Swainson's Hawk	Within 0.75-mile of Swainson's hawk nests.	Surface disturbing and disruptive activities potentially disruptive are prohibited April 1–July 31.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.
Wildlife – Western Yellow-billed Cuckoo	Within 0.5 mile radius yellow-billed cuckoo nest.	Seasonal wildlife stipulation April 15–August 15.	No[7]	No[7]	Yes	2	2008 Rawlins RMP ROD.

[1] Sources of information for application of stipulations for private and state lands include *Applicant Proposed Alternative and BLM Response Letter* (April 23, 2010), *PCW Response and Data on BLM Alternatives* (December 2009), and the *Plan of Development for the Chokecherry and Sierra Madre Wind Energy Project* (January 12, 2012).

[2] 1 = Restriction; 2 = Seasonal.

[3] As indicated in PCW's submittal entitled *Applicant Proposed Alternative and BLM Response Letter* (April 23, 2010).

[4] Applicant imposes more restrictive measures or applies measure to a specific area, see summary table of PCW ACMs.

[5] Per the *PCW Response and Data on BLM Alternatives* (December 2009) footnotes to Alternatives Summaries #18, "No Surface Uses (NSUs), as provided by BLM, were avoided to the extent practicable; however, some NSUs could not be completely avoided in a small number of discreet instances (mainly ephemeral streams, slope, and perennial streams/springs/wetlands/riparian). An example of an exception to the NSUs is where a turbine is located in an area that cannot be accessed without crossing an ephemeral stream. If it is determined that the stream is a Water of the U.S., then a Section 404 permit will be obtained thereby allowing an access road to be constructed. Another example is the slope criteria. The accuracy of the digital terrain model used for this analysis is insufficient for micro-siting. Engineering judgment was used to determine in a limited number of cases that it may be possible to grade a resource road to design criteria."

[6] See Chapter 8.0, Glossary.

[7] Per the *PCW Response and Data on BLM Alternatives* (December 2009) footnotes to Alternatives Summaries #10, "seasonal timing restrictions were not applied to construction activities on private land."

Appendix D. Applicant Committed Measures

Appendix Table D-2. Summary of Applicant Committed Measures

Item	Environmental Resource	Applicant Committed Measure
A-1-01	ESA, sensitive species, and other wildlife and fish species	Site-specific surveys and/or monitoring for ESA threatened and endangered species, BLM sensitive species and other wildlife and fish species will take place during each phase of construction. Survey and monitoring approaches will be developed in coordination with USFWS, BLM, and WGFD and will be identified in the site-specific PODs developed for each construction right-of-way grant.
A-1-02	Avian and Bat Species, Golden and Bald Eagles	PCW will develop an Avian Protection Plan (APP), a Bat Protection Plan (BPP) and an Eagle Conservation Strategy (ECS) to identify measures to avoid, minimize, and mitigate project impacts through siting, operations, and monitoring.
A-1-03	Greater Sage-grouse	PCW will comply with EO 2011-5 and commit to no construction activities within Wyoming's SGCA as they are identified in EO 2011-5 (Core Area Version 3 Map).
A-1-04	Wildlife Habitat Management Areas	PCW will not construct any facilities within portions of the Red Rim-Grizzly WHMA and Upper Muddy Creek Watershed-Grizzly WHMA that are within the Wyoming Sage-Grouse Core Management Area Version 3 Map (EO 2011-5).
A-1-05	Mule Deer	PCW will continue to coordinate with WGFD on ongoing mule deer monitoring efforts on the Ranch.
A-1-06	Colorado River Fishes – bluehead sucker, flannelmouth sucker, roundtail chub, Colorado River cutthroat trout	PCW will continue to work with WGFD and BLM to develop conservation and monitoring strategies for native fish species in the Upper Muddy Creek watershed.
A-1-07	Fish species, amphibian species, other stream obligates; water quality	PCW will monitor watershed and stream conditions throughout the Application Area to document hydrologic conditions and stream channel characteristics (see Appendix H – Watershed Monitoring Plan).
A-1-08	Other wildlife species	PCW will continue to incorporate the outcome of site-specific surveys to microsite infrastructure in order to avoid, minimize, or mitigate impacts to wildlife species.
A-1-09	Wildlife Stipulations	PCW will adhere to the timing and spatial stipulations and exception processes as they are described in the Project ROD.
A-1-10	Wildlife Stipulations	Timing and spatial stipulations will be used on public lands.
A-1-11	Avian and Bat Monitoring	PCW will develop a project Avian Protection Plan, Bat Protection Plan and Eagle Conservation Strategy that will each describe post-construction monitoring efforts for avian and bat species.

Item	Environmental Resource	Applicant Committed Measure
A-1-12	Wildlife Monitoring and Survey	PCW will continue to incorporate the outcome of site-specific surveys to microsite infrastructure in order to avoid, minimize, or mitigate **impacts** to sensitive wildlife species.
A-1-13	Vegetation	Vegetation datasets developed by PCW will be used during project design to identify sensitive vegetation types for avoidance, minimization or mitigation and to optimize the reclamation plans for each construction phase.
A-1-14	Colorado butterfly plant and Ute ladies'-tresses orchid	Site-specific surveys for both plant species will be completed prior to surface disturbing activities in suitable habitat.
A-1-15	Revegetation and Reclamation	PCW will develop detailed reclamation plans for each of the construction phases and right-of-way grants. These plans will consider site-specific conditions and design considerations to maximize reclamation success.
A-1-16	Wetland Resources	Facilities would be sited to avoid and/or minimize impacts.
A-1-17	Wetland Resources	Any construction that occurs in or adjacent to wetlands and streams would use BMPs to protect surface water quality and minimize impacts to those resources.
A-1-18	Cultural Resources	Class III inventories of all proposed disturbance areas associated with the site-specific POD will be conducted prior to construction.
A-1-19	Cultural Resources	All cultural resource identification, evaluation, and treatment, including as a result of unexpected discovery at such time that construction has been permitted, will follow the stipulations of the Programmatic Agreement (PA) established for the project.
A-1-20	Paleontological Resources	In the event that fossils are discovered on public lands during construction activities, PCW will suspend work in that area, have an on-call paleontologist review the fossils, and notify the BLM. PCW expects the significance of the discovery and the resulting course of action to be determined within 48 hours of discovery.
A-1-21	Watershed Resources	PCW has implemented a watershed monitoring program to evaluate potential impacts of project construction and operations. PCW commits to continue watershed monitoring efforts for three years post-construction.
A-1-22	Greater Sage-Grouse	PCW will work cooperatively with BLM and WGFD to perform annual lek monitoring within the Ranch in accordance with approved WGFD protocols during pre-construction, construction and for five years post-construction.

Item	Environmental Resource	Applicant Committed Measure
A-1-23	Greater Sage-Grouse	PCW will work with BLM and private landowners to identify fences that pose a significant collision risk to sage-grouse. Identified fences will be removed or marked as practicable. To date PCW and TOTCO have removed over 10 miles of fence and have marked an additional 16 miles of fence with reflective bird diverters.
A-1-24	Greater Sage-Grouse	PCW will work with BLM and private landowners to evaluate proposed new fences and determine the risk of such fences to sage-grouse. If significant risk exists, new fence construction will be deferred where possible; if fences must be constructed they will be marked with reflective bird diverters.
A-1-25	Avian Species including Bald and golden Eagles and Greater Sage-Grouse	Guy wires on meteorological towers will be marked with reflective bird diverters. To date PCW has marked all guy wires on Project meteorological towers with reflective bird diverters.
A-1-26	Wildlife including Greater Sage-Grouse, Other Avian Species and Small Mammals	PCW will work with private landowners to install metal mesh escape ladders in water tanks that pose a risk to wildlife species. To date, PCW and TOTCO have installed metal mesh escape ramps on many Ranch water tanks.
A-1-27	Wildlife including Greater Sage-Grouse and Bald and Golden Eagles	PCW will work with BLM and private landowners to stabilize and rehabilitate burned areas to promote the biological integrity of the site and limit expansion of invasive species. In 2010 PCW and TOTCO pursued stabilization and recovery of a burned area in the Chokecherry site with an emphasis on rapid recovery and use of the area by sage-grouse and other species.
A-1-28	Wildlife including Greater Sage-Grouse and Bald and Golden Eagles	PCW will work with private landowners and water right owners to pursue water improvement conservation projects to benefit greater sage-grouse and other wildlife species in accordance with all applicable rules and regulations.
A-1-29	Wildlife including Greater Sage-Grouse and Bald and Golden Eagles	PCW will work with private land owners to enhance fallow agricultural fields on the Ranch located east of the North Platte River. Enhancements include vegetation treatments to improve forage and cover for greater sage-grouse.
A-1-30	Wildlife including Greater Sage-Grouse and Bald and Golden Eagles	To minimize habitat fragmentation PCW will work with BLM and private landowners to close unnecessary roadways and reclaim such roads where practicable.
A-1-31	Wildlife including Greater Sage-Grouse and Bald and Golden Eagles	PCW will work with BLM and private landowners to control the spread of noxious and invasive plant species.
A-1-32	Greater Sage-Grouse	PCW will work with private landowners to suspend the hunting of sage-grouse on private lands within the Ranch

Item	Environmental Resource	Applicant Committed Measure
A-1-33	Greater Sage-Grouse	PCW will cooperate with agencies and private land owners to evaluate and implement predator control techniques to benefit sage-grouse as appropriate.

Appendix Table D-2. Summary of Applicant Committed Measures

			Jurisdiction			Applies To			
Item	Resource Concern	Restriction Distance	Private	State	BLM	WTGs	Subs	Roads Collection T-Line	Notes
A-2-01	Cultural Historic Trails	1 mile WTGs, 0.25 mile surface of the Overland Trail	Y	Y	Y	Y	Y	No, minimize crossings, cross at right angles	1 mile setback from the center of the Overland Trail as presently mapped (2008 RMP/ROD) in all areas except the following sections, where the BLM's RMP requirement of 0.25 miles were used: T18N R87W S6; T18N R88W S1; T18N R88W S2; T18N R88W S4; T18N R88W S7; T18N R88W S9; T18N R89W S11; T18N R89W S12; T18N R89W S13; T18N R89W S14; and the unmapped Overland Trail alternative route located in T18N R88W S6, T18N R89W S1, T18N R89W S2, T18N R89W S11, and T18N R89W S10.
A-2-02	Lands and Realty - City/Town Limits	Structure base 0.5 mile setback	Y	Y	Y	Y	Y	No	Setback only applies to "towers," term not defined in Act; PCW to apply setback to WTGs, overhead
A-2-03	Lands and Realty Homes/ Occupied Buildings	Greater of 5.5 times total structure height or 1,000 ft. setback	Y	Y	Y	Y	N	No	Setback only applies to "towers," term not defined in Act; PCW to apply setback to WTGs, overhead collection, and transmission structures based on the height of each structure
A-2-04	Lands and Realty - ROW Setback	5D from ROW boundary	N	N	Y	Y	N	No	Waiver may be granted

			Jurisdiction			Applies To			
Item	**Resource Concern**	**Restriction Distance**	**Private**	**State**	**BLM**	**WTGs**	**Subs**	**Roads Collection T-Line**	**Notes**
A-2-05	Lands and Realty - Subdivisions	Greater of 5.5 times total structure height or 1,000 ft. setback	Y	Y	Y	Y	Y	Yes, except undergrou nd	Setback applies to all above-ground construction, underground appears permissible within setback
A-2-06	Lands and Realty - WTGs	Tower base 1.1 times total structure height from external property lines	Y	Y	Y	Y	N	No	Setback only applies to "towers," term not defined in Act; PCW to apply setback to WTGs, overhead collection, and transmission structures based on the height of each structure
A-2-07	Lands and Realty - WTGs	Tower base 1.1 times total structure height from any public ROWs	Y	Y	Y	Y	N	No	Setback only applies to "towers," term not defined in Act; PCW to apply setback to WTGs, overhead collection, and transmission structures based on the height of each structure
A-2-08	Recreation - Teton Reservoir	1 mile boundary WTGs of Teton Reservoir	Y	Y	Y	Y	N	No	WTG placement would be prohibited within one mile of the Teton Reservoir Recreation Site.
A-2-09	Water - North Platte River	1 mile high water mark WTGs of the North Platte River	Y	Y	Y	Y	Y	No, avoid if possible	WTG placement would be prohibited within one mile of the ordinary high water mark of the North Platte River.

			Jurisdiction			Applies To			
Item	Resource Concern	Restriction Distance	Private	State	BLM	WTGs	Subs	Roads Collection T-Line	Notes
A-2-10	Wildlife - Red Rim Grizzly Wildlife Habitat Area (WHMA)	No development within Red Rim-Grizzly WHMA within the Wyoming Sage-Grouse Core Management Areas Version 3 Map (finalized June 29, 2010)	Y	Y	Y	Y	Y	Yes	The Wyoming Game and Fish Department's (WGFD) Red Rim-Grizzly WHMA is approximately 37,630 acres in total, of which approximately 1,200 acres (3%) lie outside Sage-Grouse Core Management Areas Version 3. The area outside Sage-Grouse Core Management Areas Version 3 is located in the northeast corner of the Grizzly WHMA and is a part of or adjacent to Miller Hill. PCW may locate facilities within this area of the Grizzly WHMA.
A-2-11	Wildlife- Sage-Grouse Core Breeding Area	No facilities within the Wyoming Sage-Grouse Core Management Area Version 3 Map (finalized June 29, 2010)	Y	Y	Y	Y	Y	Yes	No construction of any facilities (WTGs, roads, transmission lines, collector lines, substations, staging areas, etc.) in Wyoming's Sage-Grouse Core Management Areas Version 3 (finalized June 29, 2010).

Appendix Table D-3. Applicant Committed Best Management Practices

Item	Resource Concern	Measure
A-3-01	Air – Dust Control	Water would be applied twice per day, or as deemed necessary by the Environmental Inspector, to all disturbed surfaces (i.e., exposed, dry, and unfrozen) during construction. During operation, dust control would occur twice per day in those areas where vehicular traffic exceeds normal operational needs. If, for example, heavy equipment is brought on site for maintenance or if vehicular traffic exceeds a few vehicles per day, additional dust control watering would be initiated.
A-3-02	Air – Dust Control	Magnesium chloride may be applied, if necessary, for adequate dust suppression. These treatments would occur on an as-needed basis, depending on weather conditions and the amount of traffic on the road.
A-3-03	Air – Dust Control	The driving surface of all roads constructed for project access would be surfaced with gravel to further reduce potential dust emissions.
A-3-04	Air – Dust Control	Dust abatement techniques would be used on unpaved, unvegetated surfaces to minimize airborne dust. Dust abatement techniques would be employed on construction materials and stockpiled soils if they are a source of fugitive dust. Dust abatement techniques would be used before and during surface clearing, excavation, or blasting activities.
A-3-05	Air – Dust Control	Speed limits (e.g., 25 miles per hour [mph] [40 kilometers per hour [km/h]) would be posted along all access roads and enforced during construction and maintenance activities and enforced to reduce airborne fugitive dust.
A-3-06	Air – Vehicle Emissions	All construction equipment would be maintained in good working condition and would contain appropriate pollution control devices to minimize trace gas emissions.
A-3-07	Cultural and Paleontological Resources	Unexpected discovery of cultural or paleontological resources during construction would be brought to the attention of the responsible BLM authorized officer immediately. Work would be halted in the vicinity of the find to avoid further disturbance to the resources while they are being evaluated and appropriate mitigation measures are being developed.
A-3-08	General – Decommissioning	Prior to the termination of the right-of-way authorization, a decommissioning plan would be developed and approved by the BLM. The decommissioning plan would include a decommissioning impact analysis, site reclamation plan and monitoring program. All management plans, BMPs, and stipulations developed for the construction phase would be applied to similar activities during the decommissioning phase as agreed to between BLM and PCW.
A-3-09	General – Decommissioning	All turbines and ancillary (above-ground) structures would be removed from the site.

Item	Resource Concern	Measure
A-3-10	General – Avoidance of sensitive areas	PCW would work with the BLM to mitigate for environmentally sensitive areas. Marshy soils, drainage bottoms, and riparian areas would be avoided to the extent practicable.
A-3-11	General – Electrical Lines	All underground electrical collector lines would be buried in a manner that minimizes additional surface disturbance (e.g., along roads or other paths of surface disturbance when possible).
A-3-12	General – Environmental Compliance	An Environmental Compliance Plan (ECP) would be developed and implemented to monitor implementation of mitigation measures during project construction. An Environmental Inspector would be on-site to oversee the implementation of the Project ECP.
A-3-13	General – Maintenance	The transmission lines would be inspected two times per year by ground or aerial patrols, and maintenance would be performed as necessary. Substation maintenance activities would include routine, scheduled equipment maintenance and grounds keeping. Once reclamation is complete and vegetation is stable, noxious weed surveys of the Project areas would be conducted on a regular basis. Inspection of the Project access roads and internal resource roads would include weed monitoring and treatment, as outlined in the Weed Management Plan.
A-3-14	General – Maintenance	Inoperative turbines would be repaired, replaced or removed in a timely manner.
A-3-15	General – Mitigation Measures	All control and mitigation measures established for the Project in the POD and the resource-specific management plans that are part of the POD would be maintained and implemented throughout the operational phase, as appropriate. These control and mitigation measures would be reviewed and revised, as needed, based on the mutual agreement of PCW and BLM, to address changing conditions or requirements within the Project area, throughout the operational phase. This dynamic approach would help ensure that impacts from operations are kept to a minimum.
A-3-16	General – Project Disturbance	The number and size/length of roads, temporary fences, lay-down areas, and borrow areas would be minimized.
A-3-17	General – Project Footprint	The area disturbed by construction-related activities (i.e., footprint) would be kept to a minimum.
A-3-18	General – Project Footprint	The area disturbed by operational-related activities (i.e., footprint) would be kept to a minimum.
A-3-19	Geology – Seismic Considerations	All structures will be built to appropriate seismic requirements for the local geology.
A-3-20	Hazardous Materials – SPCC Plan	A Spill Prevention, Control, and Countermeasures (SPCC) Plan would be implemented during the construction and operation phases of Project. The SPCC would define procedures to be used in the event of an accidental spill from vehicles or other equipment.

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Item	Resource Concern	Measure
A-3-21	Hazardous Materials – Accidental Release	In the event of an accidental release of hazardous materials to the environment, the operator would document the event, including a root cause analysis, appropriate corrective actions taken, and a characterization of the resulting environmental or health and safety impacts. Documentation of the event would be provided to the BLM authorized officer and other federal and state agencies, as required.
A-3-22	Hazardous Materials – ESA	A Phase I Environmental Site Assessment would be required prior to the purchase of a property and would be conducted by a trained and experienced environmental professional. If the Phase I Environmental Site Assessment identifies potential hazardous substances, a Phase II Environmental Site Assessment is usually conducted to confirm the presence and extent of contamination.
A-3-23	Hazardous Materials – Handling	Pursuant to the Project's Hazardous Materials Management Plan, all personnel handling hazardous materials would be trained appropriately on the dangers of, and safety precautions to be taken, when working with hazardous materials. Any hazardous materials used on-site would be documented and properly labeled. Material Safety Data Sheets (MSDS) and proper handling procedures would be located on-site. In the event a significant chemical spill occurs, personnel should evacuate the immediate area (as required) and report the release. The Emergency Response Team would be called to the area to assess the extent of the emergency and would determine appropriate response actions based on the Emergency Response Plan.
A-3-24	Hazardous Materials – Secondary Containment	Secondary containment would be provided for all on-site hazardous materials and waste storage, including fuel. In particular, fuel storage (for construction vehicles and equipment) would be a temporary activity occurring only for as long as is needed to support construction activities.
A-3-25	Hazardous Materials – Storage, Handling, and Disposal	Safety measures would be implemented in accordance with Occupational Safety and Health Administration (OSHA) standards and operator requirements. Petroleum products (e.g., lubricating oils and greases) and items such as touch-up paint and fiberglass blade repair materials would be stored on-site for maintenance operations. All such wastes/substances would be handled, stored in a secured location, and disposed of in accordance with applicable federal, state, and local regulations.
A-3-26	Health and Safety – Crane Operation	Crane safety training would be conducted to ensure riggers and ground workers understand the hazards of working around mobile cranes and that they watch for signs of problems at all times, especially if power lines are nearby. Standard operating procedures would be developed and implemented for safely lifting loads. A written engineered lift plan for all critical lifts would be developed and followed.

Item	Resource Concern	Measure
A-3-27	Health and Safety – Crane Operation	Crane operators would take the following steps to protect themselves and other workers when operating mobile cranes on the Project Sites: 1) the minimum clearance between power lines and the crane or load would be 10 ft. for lines rated 50-kV or below; 2) for lines over 50-kV, the minimum clearance would be 10 ft. plus 0.4 foot for each 1-kV over 50-kV; 3) operation of a crane outside of design limitations, manufacturer's specifications, or without the load charts would be prohibited; 4) cranes would be operated only when wind velocities are under the maximum speeds stipulated for safe operation (these velocities are generally stated in the manufacturer's specifications); 5) cranes would be inspected daily prior to each use, monthly, and annually, and the records of these inspections would be available on the machine; 6) rigging equipment would be inspected daily; 7) all operators of mobile cranes would have, and be familiar with, the additional requirements in the ANSI standard; 8) the latch in the hook throat opening would never be tied back; and 9) employees would not be suspended from the cranes and the use of cranes for suspended personnel platforms would be avoided.
A-3-28	Health and Safety – Crane Operation	Meteorological stations would monitor wind speeds on the job site to support safe crane operating standards.
A-3-29	Lands and Realty – Foreign Lines, Monuments, and Markers	All foreign lines would be marked. Monuments and markers (i.e., General Land Surveys and BLM Cadastral Survey Corners, reference corners, U.S. Coastal and Geodetic benchmarks) would be protected during the construction and operational phases of the Project. In the event that a monument or marker is disturbed, the employee would report the incident in writing to the Authorized Officer. PCW, in consultation with the BLM or other appropriate agency, would be responsible for re-surveying and replacing any markers that are disturbed.
A-3-30	Noise – Blasting and Noisy Activity	If blasting or other noisy activities are required during the construction period, nearby residents would be notified in advance.
A-3-31	Noise – Construction Equipment	All equipment would have sound-control devices no less effective than those provided on the original equipment. All construction equipment used would be adequately muffled and maintained.
A-3-32	Noise – Construction Equipment	All stationary construction equipment (i.e., compressors and generators) would be located as far as practicable from nearby residences.
A-3-33	Noise – Road Use	Road use specifications designed to keep traffic to a minimum would be implemented to the maximum extent practical.
A-3-34	Noise – Turbine Noise	All WTGs would be properly maintained to prevent excessive noise.

Item	Resource Concern	Measure
A-3-35	Public Health and Safety – Construction Practices	A Project Health and Safety Plan would be implemented in accordance with OSHA standards. Hard hat requirements and "authorized personnel only" signs would be posted at the entrance to the main access points during construction. Permanent signs would be posted at gates on the main access roads. Safety signs (e.g., speed limits, steep grades, etc.) would be placed along the main access roads in accordance with local, state, and federal regulations. Safety signing would be posted on all transformers, at high-voltage facilities, along roads, and around towers (if necessary) in conformance with applicable state and federal regulations.
A-3-36	Public Health and Safety – Construction Practices	A comprehensive and continuous occupational Injury and Illness Prevention Program (IIPP) would be implemented and enforce a code of safe practices (CSP) for all employees. A designated field safety person would be responsible for on-site management and administration of the IIPP and CSP. Occupational safety and health matters would be communicated to employees by written documentation, staff meetings, formal and informal training, weekly safety meetings, and posted information. Communication from employees to supervisors or safety representatives about unsafe or unhealthy conditions would be encouraged and may be verbal or written. Results of investigations of any employee safety suggestion or report of hazard would be distributed to all employees affected by the hazard or posted, as appropriate.
A-3-37	Public Health and Safety – Construction Practices	Each supervisor would conduct an inspection to identify unsafe working conditions and practices, as follows: 1) weekly in all areas; 2) whenever new substances, procedures, or equipment that may represent a new safety or health hazard are introduced to the job site; and 3) whenever a supervisor is made aware of a new or previously unrecognized hazard. A hazard checklist or hazard assessment form would be used to document inspections. Employees may not enter a hazard area without appropriate protective equipment, training, and prior specific approval by the IIPP and CSP administrator.
A-3-38	Public Health and Safety – Fire Management	Fire control would be provided pursuant to the Project's Fire Safety Plan.
A-3-39	Public Health and Safety – Fire Management	Fire prevention standards would be followed to reduce the risk of a fire, in accordance with 36 CFR 261 and the Wyoming Interagency Fire Restriction Plan. All hot work that is to occur on site would be done in accordance with OSHA Regulation 29 CFR 1910.252(a).
A-3-40	Reclamation	All areas of disturbed soil would be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities would be undertaken as early as possible on disturbed areas not required for operation.
A-3-41	Reclamation – Roadways	Access roads would be regraded, the topsoil replaced, and all disturbed areas would be re-vegetated. Any roadway damage due to the transport of the heavy equipment would be repaired on the public roadways upon the completion of Project construction and decommissioning.

Item	Resource Concern	Measure
A-3-42	Reclamation – Topsoil	Topsoil from all decommissioning activities would be salvaged and reapplied during final reclamation.
A-3-43	Reclamation – Vegetation	All areas of disturbed soil would be reclaimed using weed-free native shrubs, grasses, and forbs. The vegetation cover, composition, and diversity would be restored to values commensurate with the ecological setting.
A-3-44	Recreation – Public Access	Temporary fencing would be installed around staging areas and storage yards during construction to limit public access. Public access to open excavations would be limited by either installation of locked gates at public access points, or utilization of other approved means of limiting public access.
A-3-45	Recreation – Public Access	Permanent fencing would be installed and maintained around electrical substations, and turbine tower access doors would be locked to limit public access during operations.
A-3-46	Roads – General Design	DELETED[1]
A-3-47	Roads – General Design	Access roads and on-site roads would be surfaced with aggregate materials, wherever appropriate.
A-3-48	Roads – General Design	Access roads would be located to follow natural contours where possible and minimize side hill cuts.
A-3-49	Roads – General Design	DELETED[1]
A-3-50	Roads – General Design	Roads would be located upwind from WTG rows, where possible, such that drifting caused by towers or transformers is not likely to accumulate on roads.
A-3-51	Roads – General Design	Roads are designed in accordance with the BLM Gold Book (BLM 2007a) design criteria as well as the BLM Manual 9113: Roads (BLM 1985).
A-3-52	Roads – General Design	Existing roads would be used, but only if in safe and environmentally sound locations. If new roads are necessary, they would be designed and constructed to the appropriate BLM road design standards where practical and be no higher than necessary to accommodate their intended functions (e.g., traffic volume and weight of vehicles).
A-3-53	Roads – General Design	Final roadway alignments will include erosion control measures to stabilize steeper slopes and to prevent loss of soil. These measures will include hay bales, shallow swales and ditches, rock/rip rap embankments, and culvert outlet protection. Final alignments will be ground-verified using BLM Rawlins Field Office knowledge of potentially problematic areas for road construction and/or maintenance.

[1] Power Company of Wyoming (PCW). 2012. Memorandum from G. Miller (PCW) to P. Murdock (BLM) dated April 10, 2012.

Item	Resource Concern	Measure
A-3-54	Roads – General Design	Where road intersection improvements are required to accommodate extra long vehicles, potential upgrades could include placement of relocating signs, placement of temporary paving, and use of flaggers, as needed. All intersection improvements would be restored to their original condition upon the completion of construction.
A-3-55	Roads – General Design	Where road-cattle guard intersection improvements are required to accommodate overweight vehicles, potential road profile upgrades may be required to allow travel safely over the cattle guards. All damaged cattle guards would be replaced upon the completion of construction.
A-3-56	Roads – General Design	All existing roads that would be used as primary access locations to the Project area would need to be upgraded to accommodate the anticipated extra traffic generated by the Project. Most of these roads are county roads or two-track roads that would need to be widened to accommodate the construction traffic. All necessary federal, state, and local permits would be obtained to complete this work prior to construction.
A-3-57	Roads – General Design	During the course of construction, if excessive wear and tear to the existing roadway surface is evident, these road surfaces would be restored to their original condition upon the completion of construction. Where necessary, consultation with the UPRR would be required to change the roadway profile at specific at-grade railroad crossings to smooth the existing hump for low-profile vehicles; consultation with various utility companies would be required to elevate the risk of oversized vehicles in relation to low-hanging power lines.
A-3-58	Roads – General Design	Due to crest and sag vertical curves in the roadway profile, select locations would require re-grading prior to hauling extra long loads. Any grades greater than 10 percent would require assist vehicles on-hand for the large tractor-trailers hauling WTG components. Any grades greater than 7 percent would require assist vehicles on-hand. These locations would be verified during the final design process. In addition, any construction site with grades ranging from 5 to 7 percent on non-paved roadways would require an assist vehicle on stand-by during adverse weather or road conditions.
A-3-59	Roads – General Use	Traffic would be restricted to the roads developed for the Project. Use of other unimproved roads would be restricted to emergency situations. Signs would be placed along construction roads to identify speed limits, travel restrictions, and other standard traffic control information.
A-3-60	Roads – Maintenance	Most road maintenance would be performed on an as-needed basis. The frequency and type of maintenance that would be required would be determined by routine inspections. The inspections would be performed on a regular basis and following snowmelt or heavy or prolonged rainfall. Inspections would identify maintenance needs for reduction of ruts and holes, maintenance of crowns and outslopes to keep water off the road, replacement of surfacing materials, clearing of sediment blocking ditches and culverts, maintenance of interim reclamation, and noxious weed control.

Item	Resource Concern	Measure
A-3-61	Roads – Maintenance	All roads would be maintained in a safe and environmentally responsible manner.
A-3-62	Roads – Operation Access	Project operation would require the use of the new roads for equipment and personnel to reach the WTGs. In addition, an access road that runs adjacent to each WTG site and the project substations would be used.
A-3-63	Roads – Operation Access	Internal resource roads would be located within the project boundaries and would provide access to each WTG. All internal resource roads would be surfaced with gravel. As part of routine maintenance activities, internal resource roads would be maintained in a condition that allows for continued access to the WTGs.
A-3-64	Roads – Reclamation	Abandoned roads and roads that are no longer needed would be recontoured and revegetated.
A-3-65	Soils and Geology – Slopes	Operators would identify unstable slopes and local factors that can induce slope instability. Operators also would avoid creating excessive slopes during excavation and blasting operations. Special construction techniques would be used where applicable in areas of steep slopes, erodible soil, and stream channel crossings.
A-3-66	Soils – Erosion Control	Erosion control measures would be employed as described in the Master Reclamation Plan
A-3-67	Soils – Erosion Control	Permanent erosion control devices would be installed during project construction and may include, but are not limited to, waterbars, roadside ditches with subsurface culverts, berms, trash racks on culverts, energy-dissipating structures, mulches, and establishment of permanent vegetation. Erosion controls that comply with county, state, and federal standards would be applied. Practices such as jute netting, silt fences, and check dams would be applied near disturbed areas. The Environmental Inspector would monitor construction to ensure that erosion control devices are functioning properly.
A-3-68	Soils – Erosion Control	Final roadway alignments would include erosion control measures to stabilize steeper slopes and to prevent loss of soil. These measures would include hay bales, shallow swales and ditches, rock/rip rap embankments, and culvert outlet protection.
A-3-69	Soils – Erosion Control	If, during operation, it is determined that snow accumulation causes significant accelerated erosion, appropriate mitigation measures (e.g., snow fence construction) would be developed and implemented.
A-3-70	Soils – Excavation and Blasting Activities	Foundations and trenches would be backfilled with originally excavated material as much as possible. Excess excavation materials would be disposed of only in approved areas or, if suitable, stockpiled for use in reclamation activities.
A-3-71	Soils – Excavation and Blasting Activities	Borrow material would be obtained only from authorized and permitted sites. Existing sites would be used in preference to new sites when possible.

Item	Resource Concern	Measure
A-3-72	Soils – Topsoil Handling	Topsoil from all excavations and construction activities would be salvaged and reapplied during reclamation.
A-3-73	Soils – Topsoil Handling	Topsoil material suitable for site reclamation would be removed in conjunction with clearing and grading and reserved in local stockpiles. Topsoil storage areas would generally be located within staging areas and alongside roadways during construction.
A-3-74	Soils – Wet Soils During Construction	Construction activities would be suspended when soils are wet. Construction would resume when soils become dry enough to support construction equipment. The Environmental Inspector (EI) would determine when conditions are too wet to continue.
A-3-75	Transportation – Traffic Considerations	To minimize impacts on local commuters, consideration would be given to limiting construction vehicles traveling on public roadways during the morning and late afternoon commute time. Consideration would also be given to opportunities for busing of construction workers to the job site to reduce traffic volumes.
A-3-76	Transportation – Transportation Planning	Ongoing ground transportation planning would be conducted to evaluate road use, minimize traffic volume, and ensure that roads are maintained adequately to minimize associated impacts.
A-3-77	Transportation – Transportation Planning	Following the finalization of site access locations and proposed roadways, a Traffic Management Plan would be developed for traffic both on and off-site. The Traffic Management Plan would discuss flagging guidelines on and off site, specifics of auxiliary lanes if needed, requirements for signage during construction of the project, passing zone and striping details for the existing public roadways, and other details specific to the individual approved access locations leading to and from, and on, the Project area.
A-3-78	Vegetation – Noxious Weed	Noxious weed surveys would be conducted to evaluate the presence and aerial extent of noxious weed and invasive species populations within the Project area. Preventative management measures would be applied as warranted pursuant to the Project's Weed Management Plan.
A-3-79	Visual Resources	Operators would reduce visual impacts during construction by clearly delineating construction boundaries and minimizing areas of surface disturbance; preserving vegetation to the greatest extent possible; utilizing undulating surface disturbance edges; stripping, salvaging and replacing topsoil; contoured grading; controlling erosion; using dust suppression techniques as required; and restoring exposed soils as closely as possible to their original contour and vegetation.
A-3-80	Visual Resources	Operators would monitor and maintain visual mitigation measures for the approved project in accordance with a visual monitoring and compliance plan. The operator would maintain revegetated surfaces until a self-sustaining stand of vegetation is reestablished and visually adapted to the undisturbed surrounding vegetation.

Item	Resource Concern	Measure
A-3-81	Waste Management – Disposal	Wastes would be properly containerized and removed periodically for disposal at appropriate off-site permitted disposal facilities.
A-3-82	Waste Management – Wastewater	Any wastewater generated in association with temporary, portable sanitary facilities would be periodically removed by a licensed hauler and introduced into an existing municipal sewage treatment facility or otherwise disposed of in accordance with applicable state and local laws and regulations. Temporary, portable sanitary facilities provided for construction crews would be adequate to support expected on-site personnel and would be removed at completion of construction activities.
A-3-83	Water – SWPPP	The Project's SWPPP would be implemented in accordance with the Wyoming Department of Environmental Quality (WDEQ) requirements to obtain National Pollutant Discharge Elimination System (NPDES) compliance under Wyoming's NPDES permit WYR10-0000. The SWPPP would describe site-specific erosion control and stream crossing measures that would be implemented during the construction and operation phases of the Project. The Environmental Inspector would direct activities to ensure compliance with the SWPPP.
A-3-84	Water – Excavation and Blasting Activities	DELETED[2]
A-3-85	Water – Excavation and Blasting Activities	Operators would avoid creating hydrologic conduits between two aquifers during foundation excavation and other activities.
A-3-86	Water – Road Design	DELETED[2]
A-3-87	Water – Road Drainage	Whenever possible, existing drainage systems would not be altered, especially in sensitive areas such as erodible soils or steep slopes. Potential soil erosion would be controlled at culvert outlets with appropriate structures. Catch basins, roadway ditches, and culverts would be cleaned and maintained regularly.
A-3-88	Water – Road Locations	Roads would be located away from drainage bottoms and avoid wetlands, if practicable.
A-3-89	Water – Stream Crossings	Access roads would be located to minimize stream crossings. All structures crossing streams would be located and constructed so that they do not decrease channel stability or increase water velocity. Operators would obtain all applicable federal and state permits.

[2]Power Company of Wyoming (PCW). 2012. Memorandum from G. Miller (PCW) to P. Murdock (BLM) dated April 10, 2012.

Item	Resource Concern	Measure
A-3-90	Water – Waterbodies and Wetlands	Waters of the U.S., including wetlands, will be avoided to the maximum extent practicable. Where these features cannot be completely avoided, impacts will be minimized through design modification, as necessary. Facilities (e.g., turbines, substations, staging areas) would be sited to avoid and/or minimize impacts; however, where impacts are anticipated (e.g., use of Project roads), minimization measures would be employed to minimize impacts (e.g., use of culverts to maintain downstream flow/drainage).
A-3-91	Water – Waterbodies and Wetlands	All impacts would be the minimum necessary to accomplish the Project, would be mitigated, and the appropriate Section 404 permit would be obtained from the U.S. Army Corps of Engineers (USACE) Wyoming Regulatory Office prior to the start of construction. To complete the Section 404 permit, a delineation of all Waters of the U.S. (WUS), including wetlands, would be performed by qualified wetland scientists to obtain current site-specific data regarding the location and extent of aquatic features within the Project area. Current resource mapping (e.g., U.S. Geological Survey (USGS) topographic maps, U.S. Fish and Wildlife Service (USFWS) NWI maps, Federal Emergency Management Agency (FEMA) floodplain maps, Natural Resources Conservation Service (NRCS) soils data, etc.) would be used to guide this future delineation effort. All aquatic features delineated in the field would be recorded using Global Positioning System (GPS) with sub-meter accuracy.
A-3-92	Water – Waterbodies and Wetlands	Any construction that occurs in or adjacent to wetlands and streams would use Applicant Committed BMPs listed in Appendix D to protect surface water quality and to minimize impacts to those resources.
A-3-93	Wildlife – Department of the Interior (DOI) Wind Turbine Guidelines	Although strictly voluntary on non-federal lands, PCW will review the DOI Wind Turbine Guidelines Advisory Committee Wind Turbine Guidelines (anticipated in late summer 2010) once they are finalized with the intention of complying with them as applicable and appropriate and to the extent they do not conflict with any requirements set out by the BLM in its ROD, any agreements entered into between PCW and the USFWS, or other controlling laws, permits, or regulations.
A-3-94	Wildlife – Disturbance and Harassment	All employees, contractors, and site visitors would be instructed to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons. During construction, pets would not be permitted on site; during operation, pets would be controlled to avoid harassment and disturbance to wildlife.
A-3-95	Wildlife – Excavation and Blasting Activities	Explosives would be used only within specified times and at specified distances from sensitive wildlife or streams and lakes, as established by the BLM or other federal and state agencies.
A-3-96	Wildlife – Habitat Restoration	In accordance with the habitat restoration plan, restoration would be undertaken as soon as practical after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.

Item	Resource Concern	Measure
A-3-97	Wildlife – Vehicle Collisions	Project personnel and contractors would be instructed and required to adhere to speed limits commensurate with road types, traffic volumes, vehicle types, and site-specific conditions, to ensure safe and efficient traffic flow and to reduce wildlife collisions and disturbance and airborne dust.
A-3-98	Wildlife – Yellow-billed Cuckoo	Yellow-billed cuckoo habitat (i.e., riparian areas) would be avoided to the maximum extent possible.

Appendix Table D-4 Proposed Mitigation Measures

Resource	Proposed Mitigation Measure
General	**GEN-1**: Phased Construction Sequencing. Limit surface disturbance to areas where turbines would be constructed within 12 months with a goal to mitigate impacts from surface disturbance to wildlife, soils, water, and vegetation (e.g., weeds). Four ROW grants would be issued for the project: 1) internal haul road; 2) transmission line between the two sites; 3) Sierra Madre development; and 4) Chokecherry development.
	GEN-2: Off-site Compensatory Mitigation. Off-site compensatory mitigation may be considered through future consultations between the BLM, Cooperating Agencies, and PCW if mitigation measures established through the project-wide EIS are later determined to not be adequate.
Air	No additional mitigation measures proposed.
Cultural	**CR-1**: To minimize unauthorized collecting of archaeological material or vandalism to known archaeological sites, PCW and its contractors, and all construction personnel, shall attend mandatory training and be educated on the significance of cultural resources and the relevant federal regulations intended to protect them.
	CR-2: Additional mitigation measures will be included in the Programmatic Agreement, which will be developed in coordination with the BLM, SHPO, ACHP, PCW; Indian tribes; and other interested parties.
Geology and Mineral Resources	No additional mitigation measures proposed.
Land Use	No additional mitigation measures proposed.
Paleontology	**PALEO-1**: If any vertebrate fossils or scientifically important fossils are discovered during construction operations on federal lands, the permittee shall cease activities immediately and notify the BLM so the agency can determine the significance of the discovery. The BLM shall evaluate or have evaluated such discoveries and shall notify PCW what action shall be taken with respect to such discoveries. Additionally, PCW also would contract with a qualified paleontologist approved by the BLM who shall be on call during all construction periods and available to travel to the site within 24 hours following notice of a discovery, and that the on-call paleontologist shall consult with the BLM to reach agreement on the significance of the discovery within 24 hours following arrival at the site by the on-call paleontologist. The BLM will then promptly notify PCW as to what actions shall be taken.
	PALEO-2: Any fossils recovered during the assessment of paleontological resources will be prepared in accordance with standard professional paleontological techniques. The fossils will be curated in a BLM-approved facility. A report on the findings and significance of the salvage program, including a list of the recovered fossils, will be prepared following completion of the program. A copy of this report will accompany the fossils, and a copy will be submitted to the Wyoming Museum, University of Wyoming.
Range	**RANGE-1**: Coordinate construction schedules and ranching operations to allow sequencing of pasture use to the extent practicable within the Pine Grove/Bolten allotment and other affected allotments (Cottonwood Draw, Middlewood Hill, Grizzly, McCarty Canyon, and Sage Creek) in a manner to minimize conflicts between grazing and construction activities.

Appendix Table D-4 Proposed Mitigation Measures

Resource	Proposed Mitigation Measure
Recreation	No additional mitigation measures proposed.
Socioeconomics	No additional mitigation measures proposed.
Soils	**SOIL-1**: Road fabric, or equivalent base stabilization as determined by the BLM, will be applied where roads cross sensitive soils (wet, severely erodible soils, and soils with low soil strength).
	SOIL-2: Excess subsoil excavated from tower foundations will not be used as topsoil or spread on top of topsoil without further laboratory testing of the subsoil physical and chemical characteristics, and agency approval. PCW will identify the acceptable disposal method for excess subsoil in the final reclamation plan.
	SOIL-3: Areas identified as having limited reclamation potential (as defined in the Rawlins Instruction Memorandum No. WYD-03-2011-002) will be avoided during construction unless an acceptable site-specific reclamation plan is approved by the BLM.
	SOIL-4: To reduce impacts related to road density in the Application Area, roads that are no longer needed will be effectively reclaimed.
	SOIL-5: PCW will be required to submit a snow removal plan as part of the ROW grant application. The snow removal plan will include measures to ensure protection of soil and water resources.
	SOIL-6: Drainages, vegetated sand dunes, salt flats, steep slopes, and gullied areas will be avoided for towers, laydown areas, facilities, and roads (to the extent possible). Towers, laydown areas, and other facilities will be re-located to areas of generally stable soils. These avoidances shall be taken into consideration during site specific analyses.
Transportation	**TRANS-1**: To the extent that all governmental entities are willing to participate, PCW shall participate in a coordinated transportation planning process with the BLM, WYDOT, Carbon County, the Town of Sinclair and the City of Rawlins, to identify and develop measures to avoid, manage or mitigate transportation impacts of construction. The BLM shall coordinate with affected local governments to solicit input from the Sinclair Refinery, the CIG compressor station, affected grazing operators, and other major property owners (including the operator of the truck stop just north of I-80 Exit 221) in the affected area. The group shall meet prior to and during the construction phase of the project and in the initial year of project operations, as needed.
	TRANS-2: PCW shall develop measures to inform and update Carbon County residents and travelers on I-80 near Sinclair and WY 71 about potential delays during peak months and especially during peak hours. In coordination with WYDOT, electronic signage shall be used near I-80 Exit 221 to encourage I-80 travelers to use alternate access to Sinclair during peak hours.
	TRANS-3: PCW shall coordinate with WYDOT to identify measures to control traffic and enhance traffic flows in the vicinity of I-80 Exit 221 during shift changes and at times when oversized vehicles will be crossing the bridge over I-80, and along WY 71 within the City of Rawlins if the WY 71/CR 407 (Sage Creek Road) workforce commuting option is selected.
	TRANS-4: PCW shall implement incentives for carpooling and/ or other workforce transportation measures to reduce traffic and congestion during shift changes.

Appendix Table D-4 Proposed Mitigation Measures

Resource	Proposed Mitigation Measure
Vegetation	**VEG-1**: Survey and mark the disturbance boundary to minimize unintentional surface disturbance. Actively monitor construction to ensure construction and staff stays within the defined limits.
	VEG-2: Salvage vegetative debris and redistribute to reclaimed surface areas in order to reduce erosion and preserve native organic material and seed sources.
	VEG-3: In areas where excavating soil is not necessary, such as temporary laydown areas or temporary access roads, avoid disturbing native soil and root zones where possible to preserve soil structure and soil biology and improve the success for reclamation.
Visual	**VR-1:** Monopole and H-frame transmission structures and overhead collector line structures would be treated to have a muted, darker color than conventional galvanized steel or laminated wood to reduce color contrasts. The recommended paint color for transmission structures is Shadow Gray from the BLM Standard Environmental Colors Chart CC-00 or an equivalent color. Steel pole equivalents used in the installation of the overhead electric collector lines should be finished with paint or a self-weathering finish that will harmonize with colors of the surrounding landscape (i.e., approximate the color of wood when used with wood overhead collector lines). When not used with wood poles, the recommended paint color for powerline structures is Shadow Gray from the BLM Standard Environmental Colors Chart CC-00. Conductors would have a non-reflective finish.
	VR-2: Place vegetative debris on cut-and-fill slopes to vary texture and color of cut-and-fills until vegetation has been re-established.
	VR-3: Lighting for ancillary facilities shall be motion-activated and shielded downward to limit night lighting impacts beyond the site.
	VR-4: Audio Visual Warning System (AVWS) for aircraft detection and warning may be required to reduce day and night lighting impacts from WTGs if technologies become available that are approved by FAA, are proven reliable at the scale of CCSM, and BLM determines that systems are cost effective.
	VR-5: Substation components and fencing would be Shadow Gray from the BLM Standard Environmental Colors Chart CC-00 or a similar color in a dark gray color range. Color mitigation would not be required on facilities that are treated in accordance with safety and engineering concerns.
Wetlands	**WET-1:** Conduct on-site delineations of all waters of the U.S., including wetlands and waterbodies within the Alternative Development Area prior to construction. The surveys would be performed and documented by qualified wetland scientists to determine the types and spatial extent of site-specific wetland and riparian features. Current resource mapping (e.g., USGS topographic maps, USFWS NWI maps, FEMA floodplain maps, AECOM wetland and riparian data, NRCS soils data, etc.) would be used to guide this future delineation effort. All features would be recorded using a GPS unit with sub-meter accuracy, in addition to photographic and written documentation of each feature according to standardized USACE delineation data requirements and any additional BLM data requirements. Subsequent NEPA tiering would include the site-specific waters of the U.S. delineation results.

Appendix Table D-4 Proposed Mitigation Measures

Resource	Proposed Mitigation Measure
Water	**WR-1**: Stream water quality monitoring sites will be identified by the BLM. Stream monitoring shall continue through construction, operation, and decommissioning of the project by PCW to monitor for changes in water quality.
	WR-2: PCW will be required to submit the site-specific SWPPP as part of the ROW grant application for approval by the BLM.
Wildlife and Fisheries	**WFM–1**: Workers, with the exception of security personnel, will not be allowed to possess firearms during work activities and will attend mandatory training (provided by WGFD) on wildlife regulations and ways to reduce disturbance to wildlife.
	WFM–2: Snow fences, if used, will be limited to segments of one-quarter mile or less. In addition, escape openings will be provided along roads, every one-quarter mile or less, to facilitate exit of big game animals from snowplowed roads.
	WFM–3: : If measured bat mortality is determined to be above levels of concern for the project (as presented in section 4.14 of the EIS), measures appropriate to avoid, minimize, and mitigate impacts to bat species will be identified in the Bat Protection Plan for the Project. Thresholds of impacts to bats and appropriate responses to exceeding such impact thresholds will be determined by BLM in coordination with the WGFD, and if appropriate, the USFWS, as part of the conservation, avoidance, minimization and mitigation measures identified in the Bat Protection Plan.
	WFM-4: Instream construction (stream crossings and stream construction activities) will occur during the low flow period (July 15 to September 30).
SSS	**SSS–1**: Prior to construction activities in suitable pygmy rabbit habitat, presence/absence surveys would be conducted following appropriate protocols. Areas within 0.25 mile of proposed disturbance that show characteristics of pygmy rabbit habitat will be surveyed in accordance with the Interagency Pygmy Rabbit Working Group Survey Protocols (Ulmschneider et al. 2004). If the surveys conclude that the pygmy rabbits occur, the "Habitat Preservation and Restoration" conservation measures will apply (Keinath and McGee 2004).
	SSS–2: Prior to construction activities in suitable Wyoming pocket gopher habitat, presence/absence surveys will be conducted following appropriate protocols. If active Wyoming pocket gopher mounds are identified by the presence/absence survey, the proposed surface disturbing activities will avoid the active pocket gopher mounds by 75 m (BLM 2009f). However, if PCW does not wish to avoid the active pocket gopher mounds by 75 m, classification surveys (via live capture) must be completed to identify the pocket gopher to the species level responsible for the mounds. If the results conclude that the Wyoming pocket gopher is responsible for the mounds, the "Occupied Wyoming Pocket Gopher Habitat Protection Measures" will apply (BLM 2009f). If the results conclude that the associated species is a Northern pocket gopher, then the proposed surface disturbance may proceed without mitigation. If the classification survey fails to conclusively identify the associated pocket gopher to the species level, then it will be assumed that the species is a Wyoming pocket gopher and the "Occupied Wyoming Pocket Gopher Habitat Protection Measures" will apply (BLM 2009f).

Appendix Table D-4 Proposed Mitigation Measures

Resource	Proposed Mitigation Measure
SSS (con't)	**SSS-3:** To protect potential mountain plover habitat, prior to any surface disturbance, a presence/absence survey for active mountain plover nests will be conducted in all potential habitat within the area proposed for surface disturbance. Surveys are to be performed by a wildlife biologist familiar with mountain plover and their associated habitat. If evidence of mountain plovers is found during the preconstruction survey, then additional stipulations may apply (BLM 2009a).
Noise	**N-1**: USEPA guidance stipulates the threshold for residential noise impacts resulting from construction activities, including blasting, is reached at 55 dB(A) at 1,600 feet (USEPA 1974). When a residence is within 1,600 feet of construction activities, construction activities exceeding 55 dB(A) would only be allowed to occur between the hours of 7 a.m. and 10 p.m., and on weekdays.
	N-2: Whenever feasible, multiple construction activities (e.g., blasting and earthmoving) shall be scheduled to occur concurrently to minimize the length of time residences within 1,600 feet may be affected.

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