

TECHNICAL MEMORANDUM

To South Dakota Public Utilities Commission
Cc South Dakota Game, Fish and Parks (SDGFP); U.S. Fish and Wildlife Service (USFWS)
From Crowned Ridge Wind, LLC
Contributors Crowned Ridge Wind, LLC; SDGFP; and Western EcoSystems Technology, Inc.(WEST)
Date December 6, 2019
Subject Permit Condition 45 Crowned Ridge I: In Lieu Mitigation Plan

PURPOSE

The purpose of this Crowned Ridge Wind, LLC (Crowned Ridge Wind I) Grouse In Lieu Mitigation Plan (Mitigation Plan) is to address Permit Condition No. 45 in the July 26, 2019 South Dakota Public Utilities Commission (Commission) Order granting a facility permit to Crowned Ridge Wind I that requires Crowned Ridge Wind I and Commission Staff to work together to develop a mitigation plan that will be incorporated into the Wildlife Conservation Strategy (WCS) to address potential impacts on prairie grouse. Therefore, by reference, this memorandum is included into the Crowned Ridge Wind I WCS.

Crowned Ridge Wind I has collaborated with South Dakota Game, Fish, and Parks (SDGFP) to develop an alternate approach to mitigation that aligns with the intention of the Commission to provide scientific information about potential wind impacts on prairie grouse. Crowned Ridge Wind I believes this alternate approach to mitigation, referred to as in lieu mitigation throughout this document, satisfies Permit Condition No. 45 because it was developed in collaboration with SDGFP and provides a unique opportunity to pursue a scientific study that addresses both a gap in scientific knowledge that SDGFP identifies as high priority and a gap in information pertinent to siting future wind projects that is of value to the Commission. The combined benefits for both SDGFP and the Commission highlight the value of this In Lieu Mitigation Plan.

BACKGROUND

Crowned Ridge Wind I, an indirect, wholly owned subsidiary of NextEra Energy Resources, LLC (NEER), is constructing the Crowned Ridge I Wind Energy Facility (CRI) in Grant and Codington counties, South Dakota (Figure 1). Construction began on CR1 in August 2019. In accordance with Permit Condition No. 45 of the Commission Order, Crowned Ridge Wind I will undertake two years of independently-conducted post-construction prairie grouse (greater prairie-chicken [*Tympanuchus cupido*]; GPCH) and sharp-tailed grouse [*Tympanuchus phasianellus*]; STGR) lek monitoring to evaluate the potential effect of CRI on the local prairie grouse population. In addition, Crowned Ridge Wind I is also required to develop a mitigation plan to address potential prairie grouse impacts from CRI. CR1 provides a unique opportunity to collect some pre-construction data as only 200 of the 300 permitted MW are being constructed in 2019. As a result, only two of the four leks in CR1 are within 2 kilometers of a turbine (Figure 1, leks 4 and 5) or in the area potentially affected by construction. Leks 3 and 6 are outside of the area potentially affected by construction in 2019 meaning there is an additional pre-construction data collection opportunity at these two leks with the phased construction.

Crowned Ridge Wind II, LLC (Crowned Ridge Wind II), an indirect wholly owned subsidiary of

NEER, is concurrently developing a second wind farm referred to as the Crowned Ridge II Wind Energy Facility (CRII) immediately to the south of the CRI project boundary (Figure 1). CRII submitted an application to the Commission on July 9, 2019 for an up to 300.6-megawatt wind energy facility to be located in Codington, Deuel, and Grant counties, South Dakota. The application is currently pending in front of the Commission as docket EL 19-027. Crowned Ridge Wind II has entered into a purchase and sale agreement under which it will permit and construct CRII, and, thereafter, transfer Crowned Ridge Wind II, along with its Facility Permits, to Northern States Power Company at the commercial operations date (COD). The COD for CRII is projected to be in or before the fourth quarter of 2020. The proposed development of CRII also provides a unique opportunity to implement a pre- and post-construction study to evaluate the potential effect of CRII on the local prairie grouse population, which is a study design component currently lacking from our understanding of wind energy impacts to prairie grouse populations.

Crowned Ridge worked with SDGFP to develop a prairie grouse lek monitoring Study Plan (Study Plan) as required by Permit Condition No. 45 (Crowned Ridge 2019). The Study Plan was approved on November 13, 2019 by the Commission and is hereby incorporated into the CRI WCS by reference. The other component of Permit Condition No. 45 is to develop a mitigation plan in the event results from the lek monitoring study indicate CRI has impacted prairie grouse leks. However, based on our current understanding of anthropogenic impacts to prairie grouse populations and through discussions with SDGFP, there is uncertainty in the adequacy of the lek monitoring study, as described in Permit Condition No. 45, to identify an impact and inform the level of mitigation necessary to offset a potential impact. There are two reasons for this uncertainty including 1) lack of long-term pre-construction lek monitoring data within CRI and in a control area and 2) a short study duration that will not capture time lags inherent in grouse populations. Implementing the lek monitoring study at CRI may satisfy Permit Condition No. 45, but it is not rigorous enough to inform the level of mitigation or add to our understanding of impacts of wind energy to prairie grouse populations thereby limiting Crowned Ridge Wind I's ability to develop an effective mitigation plan per Permit Condition No. 45. Instead, Crowned Ridge Wind I worked collaboratively with SDGFP to develop this In Lieu Mitigation Plan that incorporates the approved Study Plan and a robust telemetry study to better understand the effects of wind energy on prairie grouse populations with the overall goal of informing future siting and permitting decisions.

Uncertainty in prairie grouse responses to wind energy development exists because limited studies have been conducted to evaluate potential effects. Thus, wildlife managers lack the information needed to make science-based informed decisions regarding siting wind projects in prairie grouse habitats. Recognizing the intent of Permit Condition No. 45 is to collect the necessary information to help make future science-based decisions regarding wind energy development in prairie grouse habitat, Crowned Ridge worked with SDGFP to develop a more robust research study as an In Lieu Mitigation Plan as identified in Permit Condition No. 45. This study will be the first of its kind to evaluate effects of a wind energy facility on plains STGR population parameters and provide an experimental study design that will allow comparisons to similar studies on the closely related greater prairie-chicken. The study results and associated data will be invaluable to managers and developers in addressing uncertainty associated with siting facilities in prairie grouse habitat. This study provides an opportunity for multiple stakeholders to bring science-based solutions to wind energy siting concerns. Designing the study to be appropriate for publication in a peer-reviewed scientific journal and supporting the final submittal will also make the information more available and accessible than gray literature that may not be available to a wider audience.

SUMMARY OF EXISTING INFORMATION ON PRAIRIE GROUSE IMPACTS

Studies evaluating the effects of wind energy development on grouse populations have occurred in Idaho, Kansas, Nebraska, and Wyoming and the species included GRPC, Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*; CSTG), and greater sage-grouse (*Centrocercus urophasianus*; GRSG). The studies generally found that nest survival or nest site selection were not impacted by proximity to wind

turbines (McNew et al. 2014, LeBeau et al. 2017a, Harrison et al. 2017, Proett et al. 2019) and female survival was not negatively impacted by the presence of a facility (Winder et al. 2014a, Smith et al. 2017, and LeBeau et al. 2017a). Displacement effects outside of the nesting season were evaluated at two study sites and the researchers found the presence of wind turbines negatively affected space use or habitat selection during the general breeding periods (Winder et al. 2014b, LeBeau et al. 2017a). There is some evidence for greater lek abandonment of greater prairie-chicken leks in habitats close to wind turbines where the probability of lek persistence was approximately 0.5 for leks <1 km from a turbine and >0.95 for leks >6 km from a turbine (Winder et al. 2015). In addition, the rates or trends in the number of individuals attending leks between a control and treatment area did not change pre- to post-development (LeBeau et al. 2017b).

Although some information exists on the potential impacts of wind energy development to GRPC, GRSG, and CSTG, little information is known about the potential impacts to STGR populations. As a result, SDGFP, USFWS, and various other stakeholders recognize no studies exist that directly measure potential impacts to plains STGR from wind turbines. Because of this lack of information, managers are forced to make assumptions and interpret impacts to STGR and other prairie grouse from wind turbines to be similar to or greater than other forms of anthropogenic influences such as power lines and oil and gas development (e.g., Hagen et al. 2011). The presence of known leks within CRI and CRII (hereafter Projects) and the high probability of lek occurrence surrounding the Projects (Runia and Solem 2018), provide a unique opportunity to evaluate the potential effects of wind energy development on a STGR population (Figure 1).

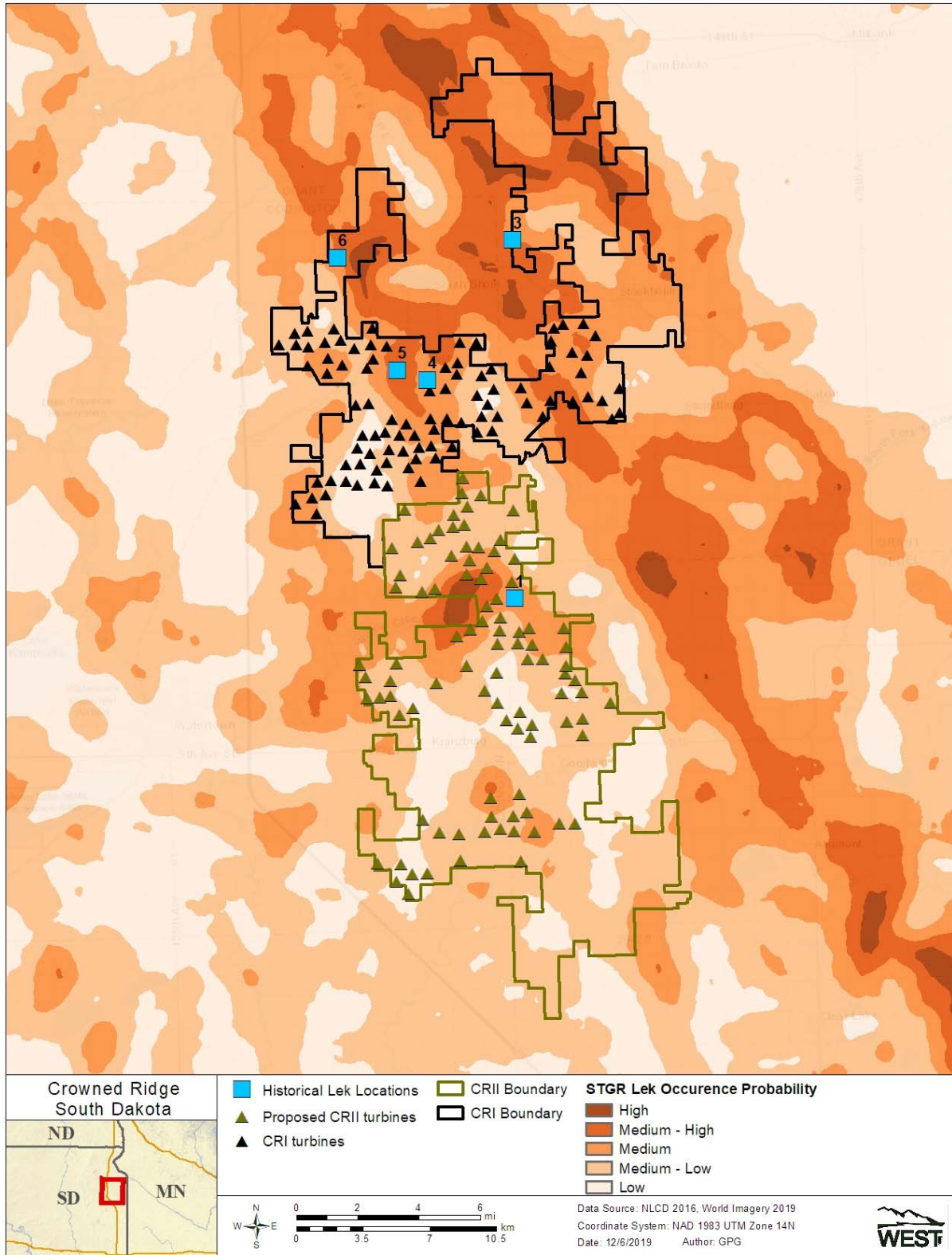


Figure 1. Known prairie grouse leks within Crowned Ridge I (CRI) and Crowned Ridge II (CRII) and sharp-tailed grouse (STGR) lek occurrence probability based on South Dakota Game, Fish, and Parks modeling data (Runia and Solem 2018).

IN LIEU MITIGATION STUDY PLAN

Objectives

The overall goal of this In Lieu Mitigation Plan is to quantify the effects of a wind energy development on prairie grouse seasonal habitat selection and demography through analysis of spatial and demographic data collected from marked individuals. Crowned Ridge Wind I designed the study to collect pre- and post-construction data along a gradient from wind turbines over a period that lapses multiple phases of project development and prairie grouse generations. There are several objectives associated with this research study to help inform management decisions relative to wind energy development.

- 1) Predict the relative probability of habitat selection to estimate potential displacement effects and impacts to habitat connectivity associated with the Projects' infrastructure using prairie grouse use and habitat data.
- 2) Predict nest, brood, and annual adult survival relative to the Projects' infrastructure.
- 3) Investigate the possibility of estimating population growth rate relative to Projects' infrastructure by incorporating the results from the displacement, survival, and lek trend analyses to provide an overall understanding of the effects on population viability.

More specifically, we propose to capture, mark, and monitor, through Global Positioning System (GPS) technology, female prairie grouse from known leks and off-site leks found during the study along a gradient of distances from wind turbines over the next three years. In addition, the Projects will monitor all known leks within the Project boundaries and new leks detected in these or off-site areas during the study to document peak lek attendance to be used in a population trend analysis as described in the Study Plan (Crowned Ridge 2019). Lek monitoring within CR1 will specifically include leks beyond the potential area of impact from construction in 2019, thereby presenting an additional pre-construction data gathering period due to the phasing of construction for CR1. The data collected will provide detailed information on lek trends, habitat selection, survival, and movements in and around the Projects and associated infrastructure, which can be used to inform management actions for future wind facilities.

In Lieu Mitigation Methods

The Projects propose to collect data over a three-year period that would include at least one year of pre-construction data at CR1 for the leks outside the area of potential impact (leks 3 and 6 from Figure 1 in 2020), and three years of post-construction monitoring at CR1 (2020 to 2022). Monitoring at CR2 will include one year of pre-construction monitoring (2020) and two years of post-construction monitoring (2021 to 2022). The field data collection methods will be consistent each year to facilitate annual summary reports and a cumulative report after the completion of three years of study. During each spring, all known leks within the Projects and any new leks found during the study along a gradient from wind turbines will be monitored following the methods outlined in the Study Plan (Crowned Ridge 2019). Active leks identified during the lek monitoring study (i.e., Study Plan) will be targeted for capturing and marking individual prairie grouse. In addition, because lek locations will be the primary sampling unit, an inventory of all leks that occur within six miles of the Projects is necessary to ensure a representative sample is captured. An aerial lek survey is necessary to survey and find leks in an area of that size in the short amount of time available during the lekking season (e.g., one month). This can be achieved by flying at high altitudes with infrared cameras or at lower altitudes with fixed-wing aircraft or helicopters (Coates et al. 2019). An aerial lek survey (helicopter or fixed-wing infrared) will occur between March 15 and April 15, 2020 within six miles of the Project's wind turbines in areas of higher relative probability of lek occurrence to find active prairie grouse leks (see Figure 1; Runia and Solem 2018). Active leks observed during the flight, any historically known leks, and any new leks within six miles will be targeted for capturing and will be monitored on the ground throughout the lekking period as outlined in the Study Plan (Crowned Ridge 2019).

Female prairie grouse will be captured on leks using walk-in drift traps and drop nets during the spring lekking period, March – mid May (Haukos et al. 1990). The Projects propose to maintain a sample size of 60 females with 30 captured in and around the Projects and 30 captured at two different control areas or leks located between three and six miles of the Projects. The Projects will supplement females with males in the event we are not able to capture enough females. We will estimate age for all captured prairie grouse (Copelin 1963) and fit birds with a solar-powered GPS telemetry unit with a modified rump-mounting harness that will last the life of the bird (Bedrosian and Craighead 2009). These units will be 18 grams in mass (less than 3% body weight) and will be programmed to collect locations every 30 minutes. We will coordinate with SDGFP on proposed capture and handling procedures and pursue any scientific collection permits required prior to beginning the study.

All marked individuals will be tracked regularly in the field and via real-time satellite communication. Once GPS fixes become localized during the nesting period (late March through early June) indicating a female is incubating on a nest, a WEST biologist will visit the potential nest location and flush the female in early incubation to determine clutch size and stage of incubation. No other disturbances from the researcher will occur during the incubation period. Once GPS locations indicate the female has departed the nest location, a WEST biologist will return to the nest site to determine nest success. WEST biologists will continue to monitor individuals throughout the brood rearing, summer, fall, and winter periods. In the event movements become localized for more than 24 hours, which likely indicate mortality, a WEST biologist will retrieve the GPS units.

The data collected will be used to evaluate displacement and connectivity, survival, and population growth rate. Determining the magnitude of displacement and impacts to connectivity between key habitats is important to evaluate population level effects and is necessary to inform siting of future facilities. Habitats selected for nesting, brooding, summering, and wintering will be identified as point locations following field procedures outlined above. Seasonal habitat use and connectivity will be modeled to investigate correlative associations with wind energy infrastructure and other landscape variables such as grass cover at multiple scales. Resource selection modeling will be used to estimate seasonal habitat use patterns (Manly et al. 2002) and will quantify differences in habitat selection by comparing used locations to available locations. The results can be used to predict changes in habitat selection relative to wind energy infrastructure.

Information on population fitness parameters (e.g., lek attendance and nest, brood, and female survival) is necessary to understand the effects of the Projects on population viability. We will relate wind energy infrastructure and habitat variables to these fitness parameters to determine if the presence of the wind energy facility is influencing vital population metrics. The habitat selection and connectivity information and data on population fitness parameters will be used to evaluate population growth rate if possible. The results of these analyses can be correlated to different facility characteristics (i.e., density of turbines or turbine configuration), which will in turn inform future siting considerations as it relates to wind turbine placement on the landscape.

SUMMARY OF IN LIEU MITIGATION BENEFITS

The uncertainty of the lek monitoring study (i.e., Study Plan) to estimate impacts and inform potential levels of mitigation required, created a unique collaboration opportunity between the Projects and SDFGP to develop this In Lieu Mitigation Plan. . The Projects and SDGFP agree the proposed In Lieu Mitigation Plan is an appropriate study design to address the potential questions the Commission intended when the permit was issued. This In Lieu Mitigation Plan will include the Study Plan previously approved by the Commission along with an additional telemetry component with a robust study design consistent with the intent of the Commission. The phased and overlapping construction schedule for both CRI and CRII provide a unique and valuable opportunity in the U.S. to immediately begin implementation of a scientifically robust design that addresses a gap in the scientific literature. In combination, the Projects believe that our voluntary efforts

to locate and monitor additional off-site leks that were not required by the permit and our up-front mitigation in the form of this In Lieu Mitigation Plan should satisfy the requirements of CRI Permit Condition No. 45.

IN LIEU MITIGATION STUDY PARTICIPANTS

The Projects recognize the importance of this In Lieu Mitigation Plan to help inform siting of future wind energy projects in prairie grouse habitats and have engaged in a collaborative process to design and develop this In Lieu Mitigation Plan to ensure success. The Projects intend to continue this collaborative approach through implementation to the extent SDGFP resources allow during capture efforts and lek detection and monitoring. The Projects have and will continue to seek and incorporate technical input from SDGFP during all phases of the Study Plan and In Lieu Mitigation Plan implementation, including the final outcome of submitting a manuscript to a peer-reviewed journal for publication. The Projects, WEST, and SDGFP have already established this working relationship by evaluating the most effective way to implement Permit Condition No. 45 and will continue to foster this collaborative approach. Specific steps to formalize the commitment to ongoing collaboration and communication are described further in the *Timeline* section below.

TIMELINE

As part of the study design and implementation, regularly scheduled phone calls will occur on a monthly basis with the study participants to ensure all parties are involved throughout the study. Along with monthly phone calls, periodic reports will be provided to study participants for review and comment. As part of the Permit Condition No. 45, the Projects are committed to funding three years of post-construction study at CRI, and one year of pre-construction plus two years of post-construction study at CRII. Below is the proposed timeline associated with the study and will generally follow similar milestones in each study year beginning in 2020. Dates below may fluctuate one or two weeks pending team schedules and other project-specific considerations.

Date	Description	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)
January 10	Annual study kick-off meeting by phone with study participants			
January 16	Purchase GPS backpacks from Ecotone			
March 1	GPS backpacks delivered to WEST	Pre and Post-construction CRI (1 year);	Post-construction CRI (2 years);	Post-construction CRI (3 years);
March 15	Capture procedures will commence at known leks identified in 2019 and new leks in 2020 – 2022	Pre-construction CRII (1 year)	Post-construction CRII (2 years)	Post-construction CRII (3 years)
May 15	Capture procedures complete and a summary report will be provided to study participants			
July 1	Nesting season complete			
August 31	Breeding season complete			

GPS = Global Positioning System; WEST = Western EcoSystems Technology, Inc.; CRI = Crowned Ridge I; CRII = Crowned Ridge II.

IN LIEU MITIGATION REPORTING DELIVERABLES

Below are deliverables associated with the study. Dates below may fluctuate pending team schedules and other project-specific considerations if mutually agreed by the Projects and SDGFP. As noted below, the cumulative report on all three years of data with statistical telemetry analysis will be provided to SDGFP and filed with the Commission.

Date	Description
Reporting	
July 15, 2020 – 2022	Annual report summarizing captures provided to SDGFP
January 31, 2021 – 2023	Annual report summarizing breeding metrics (lek attendance, nesting, brooding, and survival) and telemetry statistical analysis provided to SDGFP and Commission
June 1, 2023	Cumulative report on all three years of data with statistical telemetry analysis provided to SDGFP and filed with the Commission
August 1, 2023	Draft manuscript summarizing habitat selection, survival, and movement modeling for collaborator review provided to SDGFP

ADAPTIVE MANAGEMENT

The Projects and SDGFP have collaborated to develop this In Lieu Mitigation Plan using appropriately qualified technical experts drawing upon the best available science and expert opinion. As a result, the Projects have completed sufficient due diligence to conclude that this In Lieu Mitigation Plan represents a well-developed and carefully crafted plan with a reasonable certainty of success in achieving the minimum target sample size of birds to be captured for a robust telemetry study. In the unlikely event that field efforts in 2020 indicate the minimum sample size of birds to be captured is not feasible, the Projects will consult with SDGFP to investigate the feasibility of modifications or additional in lieu mitigation, if warranted. After consulting with SDGFP, the Projects will also coordinate with Commission Staff in a similar manner to the approach utilized to date in development of the Study Plan and this In Lieu Mitigation Plan.

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