APPENDIX M: BIRD AND BAT CONSERVATION STRATEGY

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Bird and Bat Conservation Strategy
Horse Heaven Wind Farm
Benton County, Washington

Horse Heaven Wind Farm, LLC

5775 Flatiron Parkway, Suite 120
Boulder, Colorado 80301

December 2020

Public Draft - For Distribution

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ABBREVIATIONS AND ACRONYMS

ac	acre
agl	above ground level
APLIC	Avian Power Line Interaction Committee
AWWI	American Wind and Wildlife Institute
BBCS	Bird and Bat Conservation Strategy
BCR 9	USFWS Bird Conservation Region 9, Great Basin
BGEPA	Bald and Golden Eagle Protection Act
CFR	Code of Federal Regulations
ECPG	USFWS *Eagle Conservation Plan Guidance*
ESA	Endangered Species Act
ETP	Eagle Take Permit
Final Rule	USFWS 2016 Eagle Permit Final Rule
Four Mile	Four Mile Wind Project
ft	foot
ha	hectare
HHE	Horse Heaven East
HHW	Horse Heaven West
HHWF	Horse Heaven Wind Farm, LLC
kHz	kilohertz

km	kilometer
LCBAS	Lower Columbia Basin Audubon Society
m	meter
MBTA	Migratory Bird Treaty Act
met	meteorological
mi	mile
min	minute
MW	megawatt
Nine Canyon	Nine Canyon Wind Project
O&M	Operations and maintenance
PCFM	post-construction fatality monitoring
Project	Horse Heaven Wind Farm
PV	photovoltaic
RSH	rotor-swept height
Scout	Scout Clean Energy, LLC
SWPPP	Storm Water Pollution Prevention Plan
TAC	Technical Advisory Committee
Turbine	Wind Turbine
US	United States
USC	United States Code
USDOI	United States Department of Interior
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WEG	USFWS *Land-Based Wind Energy Guidelines*
WEST	Western EcoSystems Technology, Inc.
WIRHS	Wildlife Incident Reporting and Handling System

Unit Conversions

Imperial	**Metric**
1 foot	0.3048 meter
3.28 feet	1 meter
1 mile	1.61 kilometer
0.621 mile	1 kilometer
1 acre	0.40 hectare
2.47 acre	1 hectare
Common Conversions	
Imperial	**Metric**
0.5 miles	800 meters
328 feet	100 meters
0.5 miles	0.8 kilometers
10 miles	16.1 kilometers

1.0 INTRODUCTION

1.1 Background and Purpose

Although wind and solar energy facilities utilize a renewable-energy resource, potential impacts to birds and bats can result from their construction and operation. Interactions with Turbines, solar arrays and the associated infrastructure such as energy transmission, distribution, and substations can result in fatalities or indirect effects including displacement of individuals or habitat loss (Marques et al. 2019, Kosciuch et al. 2020). To address these concerns, Scout Clean Energy, LLC (Scout) and its wholly owned subsidiary, Horse Heaven Wind Farm, LLC (HHWF), have developed this site-specific Bird and Bat Conservation Strategy (BBCS) for the Horse Heaven Wind Farm (Project), which will include up to 1,150 megawatts (MW) generated from a combination of Turbines and photovoltaic solar arrays.

This BBCS outlines various processes HHWF has employed and/or will employ to: 1) comply with all state and federal bird and bat conservation and protection laws and regulations applicable to the Project; 2) ensure that any effects to avian and bat resources are identified, quantified, and analyzed; and 3) avoid, minimize, or mitigate potential effects, consistent with the US Fish and Wildlife Service (USFWS) *Land-Based Wind Energy Guidelines* (WEG; USFWS 2012), the USFWS *Eagle Conservation Plan Guidance* (ECPG; USFWS 2013), and the Washington Department of Fish and Wildlife (WDFW) *Wind Power Guidelines* (WDFW 2009).

Federal laws and regulations protect the majority of birds found in and around the Project area, including the Migratory Bird Treaty Act of 1918 (MBTA), the Bald and Golden Eagle Protection Act of 1940 (BGEPA), and the federal Endangered Species Act of 1973 (ESA), as amended. The purpose of the BBCS is to meet the intent of these regulations and guidelines by reducing and managing the potential impacts to avian and bat species. This BBCS has been voluntarily prepared as a good faith effort by HHWF to proactively address potential impacts to birds and bats resulting from the construction and operation of the Project.

1.2 Objectives

HHWF has developed this BBCS to meet the following objectives:

1. Respond to the recommendations of the USFWS WEG for completion of a BBCS and a post-construction fatality monitoring protocol;
2. Document and describe the Project and the biological survey work conducted to date, and assess potential impacts to avian and bat resources posed by the Project. This objective includes providing a single point of reference for information related to avian and bat studies performed in relation to the Project;
3. Provide a plan that avoids or minimizes potential effects to avian and bat species resulting from the construction and operation of the Project, consistent with the WEG and ECPG;

4. Describe post-construction fatality monitoring efforts that will be implemented to identify impacts to birds and bats, as well as the methods for reporting the results of monitoring;
5. Outline the adaptive management framework that HHWF is committed to over the life of the Project and how HHWF plans to implement adaptive management during operation of the Project;
6. Provide an educational and practical point of reference for HHWF's employees and contractors to facilitate the application of measures to avoid and minimize potential negative effects to avian and bat species at the Project.

2.0 SITE AND PROJECT DESCRIPTION

Since 2017, the Project has expanded in size and scope primarily as a result of additional lease acquisitions of adjacent proposed wind energy projects (Figure 1), but also from the addition of new technologies with associated new leases. For the purposes of this BBCS, the Project is defined as two phases, Horse Heaven East (HHE; 18,089 ac) and Horse Heaven West (HHW; 54,338 ac), collectively referred to as the Project (Figure 1). HHE is composed of portions of what was referred to as the Four Mile Wind Project (Four Mile), whereas HHW is composed of portions previously referred to as the Horse Heaven Wind Project and Badger Canyon Wind Project (Badger Canyon).

The 72,427-ac Project area is located in Benton County, Washington, located within the Horse Heaven Hills which is an anticline ridge of the Yakima Folds within the larger Columbia Plateau Ecoregion (Clarke and Bryce 1997). Topography within the Project is composed primarily of rolling to incised hills with a broad northeast-facing rampart along the northern perimeter of the Project boundary. The highly-eroded drainages along the rampart create numerous canyons bisecting the Project (e.g., Badger Canyon, Coyote Canyon, Taylor Canyon) and expose basalt cliffs and ledges. On the southern side of the rampart, the landscape transitions to relatively rolling topography, with comparatively shallow, meandering canyons draining south into the Columbia River. The 63-wind turbine Nine Canyon Wind Project (Nine Canyon) is located directly north of the HHE portion of the Project (Figure 1).

Land cover within the Project area is a mosaic of dryland and irrigated croplands, shrub-steppe, eastside (interior) grasslands, and rural/urban development in mixed environs (Figure 2, Table 1). Cropland is the dominant land cover (74.4%), with eastside (interior) grasslands composing 11.8% of the surrounding area (Table 1). Lands enrolled in the Conservation Reserve Program (CRP) is a type of grassland composing 8.7%. Shrub-steppe (4.1%) is found in topographically steep areas where agriculture is not possible (Table 1). The remaining land cover is composed of a mix of development types and composes less than 1% of mapped land cover (Table 1, Figure 2; Tetra Tech 2020).

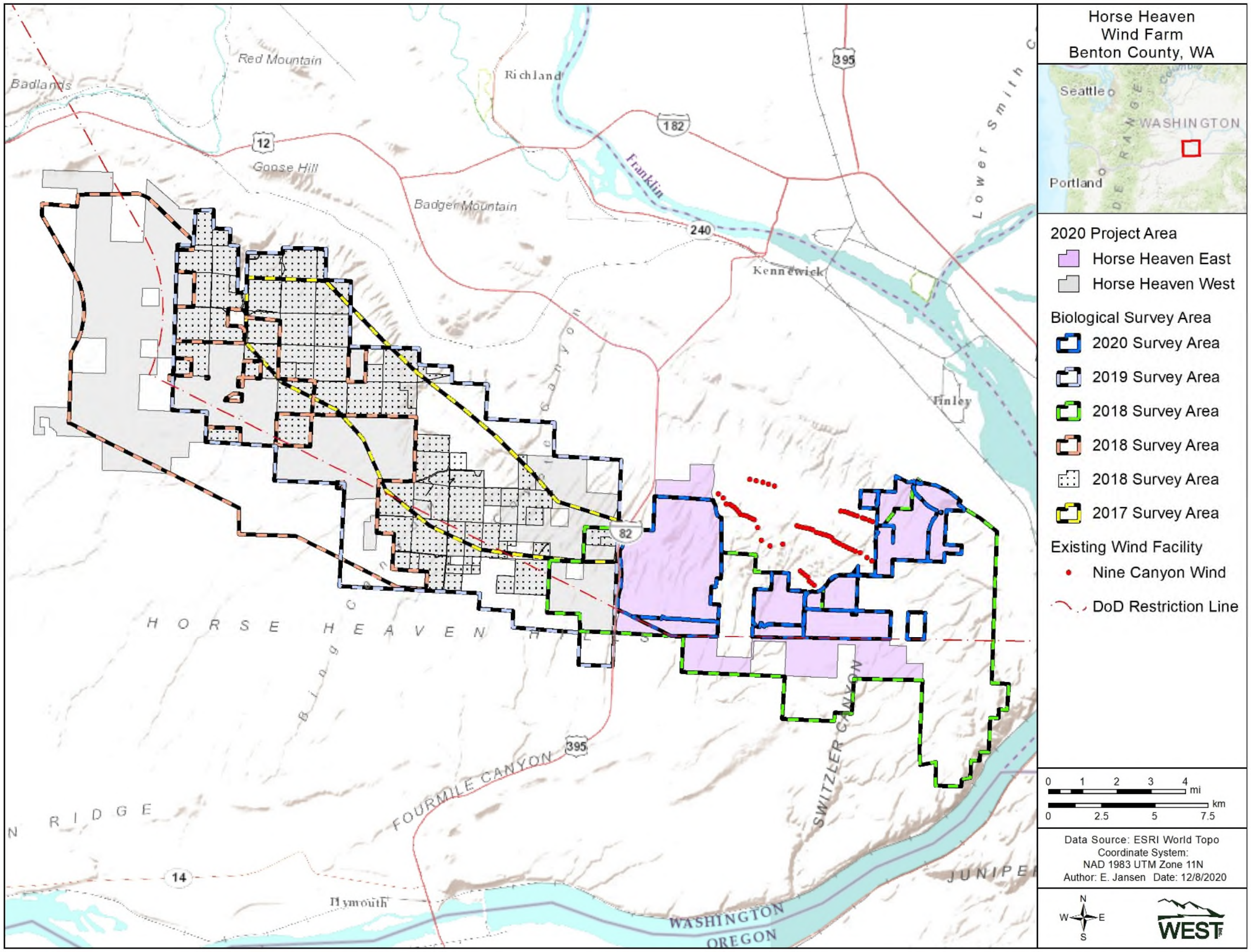

Figure 1. Overview of Survey Area development from 2017 – 2020 at the Horse Heaven Wind Farm, Benton County, Washington.

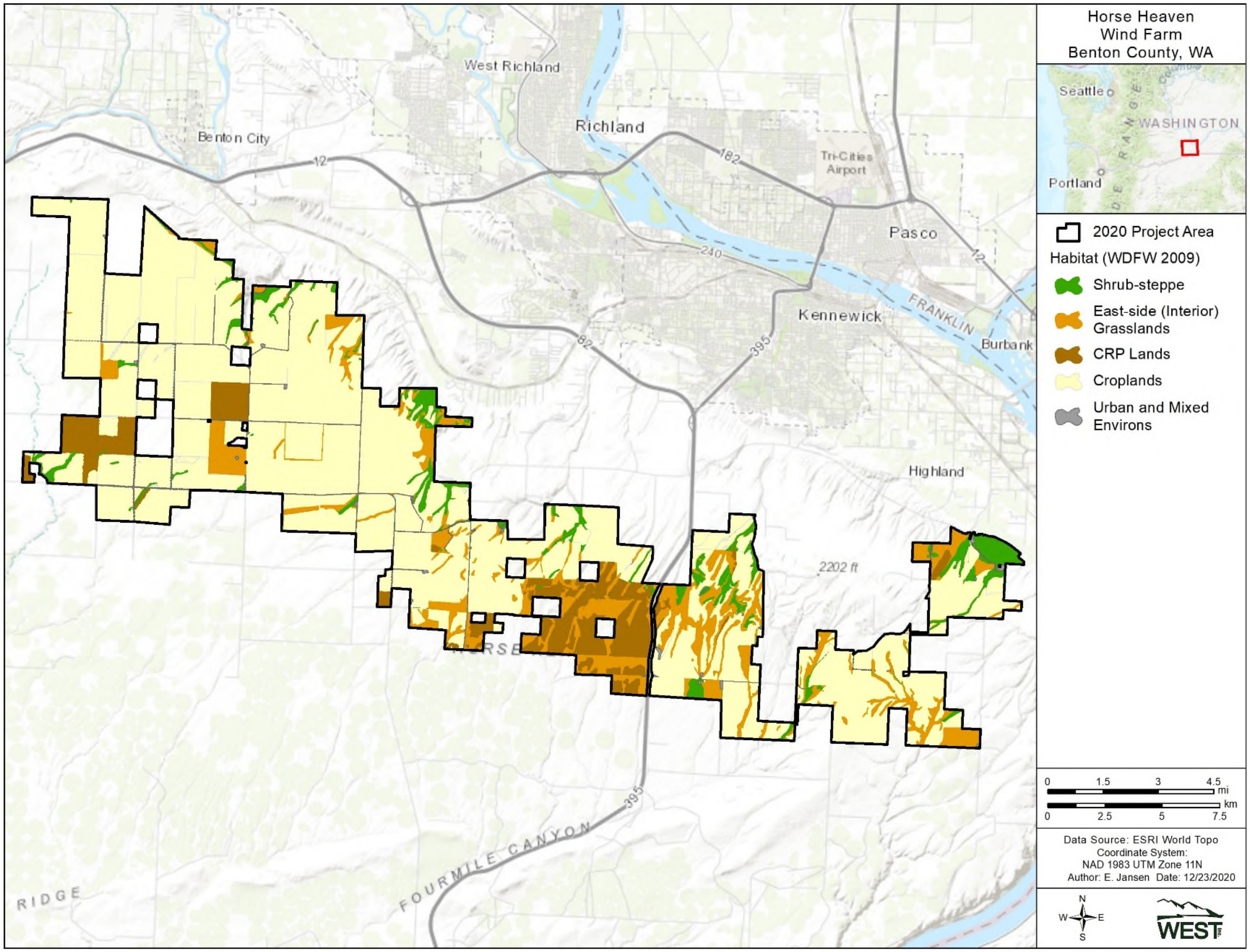

Figure 2. Land cover within and surrounding the Horse Heaven Wind Farm in Benton County, Washington (Tetra Tech 2020).

Table 1. Washington Department Fish and Wildlife (WDFW 2009) habitat types delineated within the Horse Heaven Wind Farm, Benton County, Washington.

WDFW Habitat Type[1]	Acres	Percent Composition
Croplands	53,886.1	74.4
Eastside (Interior) Grasslands	8,580.4	11.8
CRP Lands	6,305.8	8.7
Shrub-Steppe	3,003.2	4.1
Mixed Environs	652.3	<1.0
Total	**72,427.8**	**100.0**

[1] Habitat types include the following subtypes Eastside (Interior) Grasslands = unclassified grassland and non-native grassland; CRP lands = planted grassland and rabbitbrush shrubland; Shrub-steppe = sagebrush shrub-steppe, dwarf shrub-steppe, and unclassified shrubland. Types derived from Johnson and O'Neil (2001) and WDFW (2009) classifications as discussed in Tetra Tech (2020)

The Project Turbine layout for wind energy production includes up to 244 Turbines (Figure 3). To facilitate flexible turbine siting, the Horse Heaven is considering two general Turbine options comprised of four different Turbine technologies (Table 2). Generally, Option 1 is a shorter Turbine occupying a smaller air space, but would have more Turbines on the landscape compared to Option 2, which is a taller Turbine occupying a larger airspace, but because of its higher energy production capability would result in fewer Turbines (Table 2). Other Project infrastructure will include access roads, an underground collection system, a substation, operations and management (O&M) facility, and a transmission line. Temporary facilities during construction will include crane paths, laydown sites, and a concrete batch plant.

Table 2. Specifications of potential Turbine technologies considered at the Horse Heaven Wind Farm, Benton County, Washington.

Turbine Parameters	Turbine Layout: Option 1		Turbine Layout: Option 2	
	GE 2.82−MW	GE 3.03−MW	GE 5.5−MW	SG 6.0−MW
Tower Type	Tubular	Tubular	Tubular	Tubular Steel / Hybrid
Max. Number of Turbines considered	244	244	150	150
Turbine Rotor Diameter[1]	127 / 417	140 / 459	158 / 518	170 / 557
Turbine Hub Height (ground to nacelle)[1]	89 / 292	81 / 266	125 / 411	115 / 377
Max. Total Height (ground to blade tip)[1]	152 / 499	151 / 496	204 / 671	200 / 657

[1] meters / feet
Note: All values are approximate.

In addition to the energy production from Turbines, photovoltaic (PV) solar arrays and battery storage facilities are proposed to be co-located within the Project footprint to respond to seasonal energy demands and stabilize energy distribution during off-peak wind generation periods. The layout of the solar arrays will vary depending on the project size, technology, topography, and other constraints currently being analyzed. There will be up to three potential solar array sites, up to one on the east side of the Project Area and up to two on the west side. A determination of which project sites will be chosen has not yet been made. Therefore, due to the uncertainty in the exact location of the solar array and battery storage, the BBCS generalizes the construction and operational impacts from development. The solar array would be sited within an approximate 1,995 ac. footprint in the eastern array and two array options in the western part of the Project that total 2,641 ac. or 1,935 ac., respectively but the exact locations have not yet been finalized. The final solar array would be enclosed by a 6-foot (ft) tall security fence.

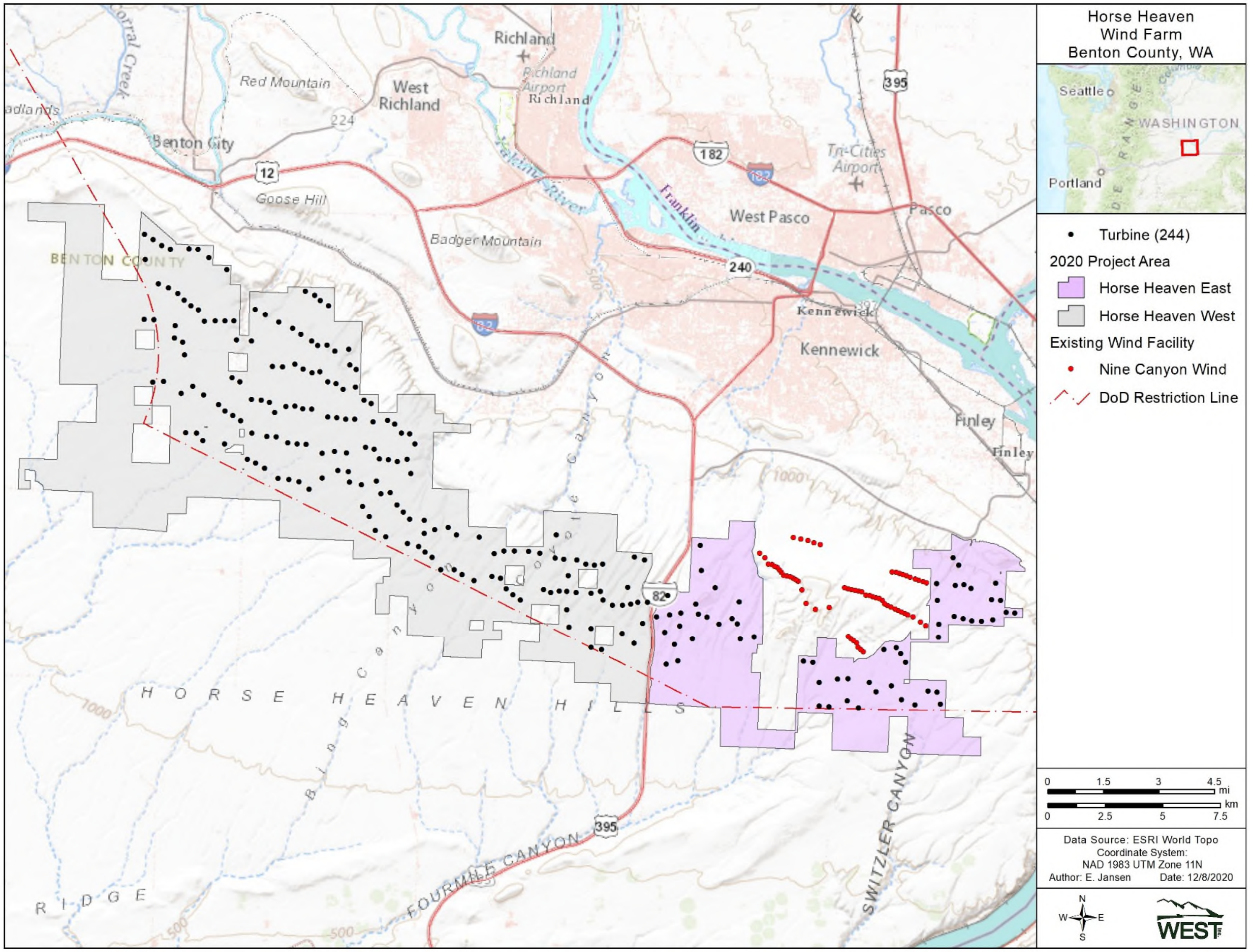

Figure 3. Proposed Turbine layout within the Horse Heaven Wind Farm in Benton County, Washington.

3.0 REGULATORY ENVIRONMENT

3.1 Federal Endangered Species Act

Species at risk of extinction, including many birds and bats, are protected under the federal ESA, as amended. The purpose of the ESA is to protect threatened and endangered species and to provide a means to conserve their habitats. Take under the ESA is defined as "…to harass, harm, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct" (16 United States Code [USC] 1532 [1973]) Harm is an act that injures or kills a wildlife species, including significant habitat modification or degradation; whereas harass is defined as an intentional or negligent act or omission which creates the likelihood of injury by annoying the animal to the extent it significantly disrupts normal behavior patterns such as breeding, feeding, or sheltering (50 Code of Federal Regulations [CFR] 17.3 [1975]. The ESA authorizes the USFWS to issue permits for "incidental take" of wildlife species, which is take resulting from an otherwise lawful activity.

3.2 Migratory Bird Treaty Act

The MBTA integrates and implements four international treaties that provide for the protection of migratory birds. The MBTA prohibits the "taking, killing, possession, transportation, import and export of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior" (16 USC 703 [1918]). The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." (50 CFR 10.12 [1973]). The USFWS maintains a list of all species protected by the MBTA at 50 CFR 10.13 (1973). This list includes over 1,000 species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines.

On August 8, 2020, the US District Court in the Southern District of New York vacated the US Department of the Interior (USDOI) Solicitor's Opinion (M-37050; USDOI 2017) which reverts the scope of the MBTA back to its 1973 intent where it is unlawful to take a migratory bird except as otherwise permitted by a lawful activity.

3.3 Bald and Golden Eagle Protection Act

The BGEPA, 16 USC 668-668d (1940), affords bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) additional legal protection. The BGEPA prohibits the "take, sale, purchase, barter, offer of sale, transport, export or import, at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof" (16 USC 668a [1940]). The BGEPA also defines take to include "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb," (16 USC 668c [1940]), and includes criminal and civil penalties for violating the statute (see 16 USC 668 [1940]). The USFWS further defined the term "disturb" as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior (72 Federal Register [FR] 31132 [2007]).

In September of 2009, the USFWS promulgated a final rule on two new permit regulations that specifically authorized under the BGEPA the non-purposeful (i.e., incidental) take of eagles and eagle nests in certain situations (see 50 CFR 22.26 [2009] and 22.27 [2009]). The permits authorized limited take of bald and golden eagles; authorizing individuals, companies, government agencies and other organizations to disturb or otherwise take eagles in the course of conducting lawful activities. To facilitate issuance of Eagle Take Permits (ETPs) for wind energy facilities, the USFWS clarified guidelines listed within the ECPG in the Final Rule (81 FR 91494 [2016]). If eagles are identified as a potential risk at a project site, developers are encouraged to follow the ECPG and standards described in the Final Rule. The ECPG describes specific actions recommended to achieve compliance with the regulatory requirements in the BGEPA for an ETP. The ECPG and Final Rule provide a national framework for assessing and mitigating risk specific to eagles through development of Eagle Conservation Plans and issuance of programmatic ETPs for eagles at wind energy facilities.

3.4 Washington State Species of Concern

The WDFW maintains a list of state endangered, threatened and sensitive species that are protected by law (Washington Administrative Code 232-12-014 [2015] and 232-12-011 [2015]). Permitting agencies (e.g., counties and local municipalities) often defer to WDFW guidance and consider these species' listings when granting wind energy permits.

4.0 AGENCY/ PUBLIC COORDINATION

The WEG strongly encourages wind energy developers to coordinate with agencies to obtain information on bird, bat or other wildlife issues within a project area and vicinity. In September 2017, concurrent with conducting the first year of baseline studies, HHWF met with biologists and energy project coordinators with the USFWS and WDFW to discuss the Project and upcoming survey protocols. HHWF incorporated recommendations to the avian use survey design that added greater survey coverage to caprock and canyon habitat.

In January 2020, after nearly three years of baseline environmental surveys in the Horse Heaven Hills, HHWF met with a similar group of staff from the USFWS and WDFW, and included regional staff from Lower Columbia Basin Audubon Society (LCBAS) to discuss survey results. During the meeting, minimization measures to reduce impacts to wildlife were discussed. HHWF presented Project updates to the LCBAS again in September 2020 as a way to engage the public and conservation stakeholders. HHWF intends to formally submit an application for Site Certification to the Washington Energy Facility Site Evaluation Council in January 2021.

5.0 AVIAN AND BAT RESOURCES: TIERS 1-3

The WEG outlines a tiered approach assessing the habitat suitability and risks to wildlife at a potential wind resource area. The "tiered" approach ensures that sufficient data are collected to enable project proponents to make informed decisions about continued development of a proposed project (USFWS 2012) while ensuring that HHWF is complying with its corporate environmental policy. At each tier, potential issues associated with the development or operations of the project are identified and questions are formulated to guide the decision process. This process starts at a relatively broad scale and provides more site-specific detail at each tier as more data are gathered and the potential for avian and bat issues are better understood.

A list of the biological studies conducted at the Project, including survey year, survey type, extent of the Project reflected within each report, and report citations, are summarized in Table 3.

Table 3. Summary of Wind Energy Guideline Tiers 1−3 desktop analyses and field studies conducted 2017 – 2020 at Horse Heaven Wind Farm, Benton County, Washington.

Year	Survey/Report	Extent	Reference
2017	Aerial raptor nest survey	*Horse Heaven West* 10-mi (eagle) and 2-mi (other raptor) buffers	Jansen 2017
2017 – 2018	Avian use survey, aerial raptor nest survey, and habitat mapping	*Horse Heaven West* 13 point count locations; 10-mi (eagle) and 2-mi (other raptor) buffers; habitat mapping and verification	Jansen and Brown 2018
2017 – 2018	Bat acoustic survey	*Horse Heaven West* 1 location at a met tower in the southeastern corner of the Project	Hays et al. 2019
2018	Site characterization study	*Horse Heaven West (i.e., Badger Canyon)* Desktop assessment and site visit	Chatfield and Thompson 2018a
2018	Habitat mapping	*Horse Heaven West (i.e., Badger Canyon)* Habitat mapping and verification	Chatfield and Brown 2018a
2018	Bat acoustic survey	*Horse Heaven West (i.e., Badger Canyon)* 1 location at a met tower in the central portion of the Survey Area	Hays et al. 2018a
2018	Site characterization study	*Horse Heaven East (i.e., Four Mile)* Desktop assessment and site visit	Chatfield and Thompson 2018b
2018	Habitat mapping	*Horse Heaven East (i.e., Four Mile)* Habitat mapping and verification	Chatfield and Brown 2018b
2018	Small mammal survey	*Horse Heaven East (i.e., Four Mile)* Townsend's ground squirrel survey	Chatfield and Brown 2018c
2018	Bat acoustic survey	*Horse Heaven East (i.e., Four Mile)* 2 locations in eastern portion of the Survey Area	Hays et al. 2018b
2018 – 2019	Avian use survey	*Horse Heaven West (i.e., Badger Canyon)* 28 point count locations	Chatfield et al. 2019a
2018 – 2019	Avian use survey	*Horse Heaven East (i.e., Four Mile)* 27 point count locations	Chatfield et al. 2019b
2018 – 2019	Avian use survey, aerial raptor nest survey	*Horse Heaven West* 13 point count locations; 10-mi (eagle) and 2-mi (other raptor) buffers	Jansen et al. 2019
2019	Aerial raptor nest survey	*Horse Heaven East* (i.e., *Four Mile*) 10-mi (eagle) and 2-mi (other raptor) buffers	Chatfield et al. 2019c

Table 3. Summary of Wind Energy Guideline Tiers 1−3 desktop analyses and field studies conducted 2017 – 2020 at Horse Heaven Wind Farm, Benton County, Washington.

Year	Survey/Report	Extent	Reference
2019	Aerial raptor nest survey	*Horse Heaven West (i.e., Badger Canyon)* 10-mi (eagle) and 2-mi (other raptor) buffers	Chatfield et al. 2019d
2019 – 2020	Avian use survey	*Horse Heaven East* 8 point count locations	Jansen 2020 (*in prep*)

Badger Canyon = Badger Canyon Wind Project, Four Mile = Four Mile Wind Project, met = meteorological, mi = mile, Project = Horse Heaven Wind Farm

All raptor nest surveys within the 2-mile survey buffer of the Survey Areas included raptors, vultures, owls, and corvids

5.1 Tiers 1 and 2 – Preliminary Site Evaluation and Characterization

As described in the WEG, Tier 1 and Tier 2 provide a framework for evaluating potential environmental resource issues that potentially need to be addressed before further actions can be taken relative to the development or operations of the Project. The objective of the Tier 1 study was to assist HHWF to further identifying a potential wind energy site. Tier 1 studies provided a preliminary desktop evaluation or screening of public data from federal, state, and tribal entities, and offered early guidance about the sensitivity of the site in regards to flora and fauna. The objective of Tier 2 studies was to determine potential effects of the proposed Project on any federal and state sensitive species. Tier 2 studies included a more substantive review of existing information, including publicly available data on land use/land cover, topography, wildlife, habitat, and sensitive plant distribution, a reconnaissance level site visit (to confirm presence of habitat types), and making first contact with agencies involved. Tiers 1 and 2 were evaluated in the site characterization studies (Chatfield and Thompson 2018a 2018b).

5.1.1 Potentially Occurring Sensitive Bird and Bat Species

Western EcoSystems Technology, Inc. (WEST) reviewed publicly available lists of federal and state-listed bird and bat species with the potential to occur in Benton County, Washington. Based on this assessment, bald eagle and golden eagle have potential to occur in the Project, as do three state-listed bird species and seven state candidate species for listing, including golden eagle (Table 4; Chatfield and Thompson 2018a, 2018b; WDFW 2020a).

Table 4. Federal and state-listed threatened, endangered, or candidate bird and bat species with the potential to occur at the Horse Heaven Wind Farm, Benton County, Washington

Common Name	Scientific Name	Status
American white pelican	*Pelecanus erythrorhynchos*	ST
bald eagle	*Haliaeetus leucocephalus*	BGEPA, PS
burrowing owl	*Athene cunicularia*	SC, PS
ferruginous hawk	*Buteo regalis*	ST, PS
golden eagle	*Aquila chrysaetos*	SC, BGEPA
loggerhead shrike	*Lanius ludovicianus*	SC
sagebrush sparrow	*Artemisiospiza nevadensis*	SC, PS
sage thrasher	*Oreoscoptes montanus*	SC
sandhill crane	*Antigone canadensis*	SE
Townsend's big-eared bat	*Coryhorhinus townsendii*	SC
Vaux's swift	*Chaetura vauxi*	SC

SE: state-listed endangered species, ST: state-listed threatened species, SC: state candidate species for listing, PS: state priority species (Washington Department of Fish and Wildlife 2020a); BGEPA: species protected under the Bald and Golden Eagle Protection Act (1940)

Source: Chatfield and Thompson 2018a, 2018b; WDFW 2020a

5.2 Tier 3 – Baseline Avian and Bat Field Studies

The baseline wildlife studies and their corresponding survey efforts were designed to meet the regulatory guidelines in all years (USFWS 2012, 2013, 2016; WDFW 2009). This BBCS discusses all baseline avian and bat studies completed over the four year pre-construction period that included the following: 1) avian use surveys, 2) aerial raptor nest surveys, and 3) bat acoustic surveys (Table 3).

5.2.1 Avian Use Survey Methods: 2017 − 2020

The general objective of the avian use surveys was to document temporal and spatial use in the Project in accordance with agency recommendations. Fixed-point avian use surveys were conducted from 2017 – 2020 for two discrete bird size classes, small-sized birds and large-sized birds, at each Survey Area. Survey Areas were defined as lease boundaries or general areas of interest that were provided by the developer for each survey year (Figure 1). Avian use surveys for the two size classes were conducted separately according to recommendations in the ECPG. Both survey types recorded similar types of data including species, distance from observer, flight heights and direction, and habitat types. When observed beyond the survey plot or incidental to protocol surveys (e.g., driving between point counts), bird species of management interest (species of concern[1]) were recorded on standardized datasheets. For years when the Turbine layout was preliminary, the number of survey points with an 800-m radius were selected to cover at least 30% of the area within a 1-km radius of turbines; for years when the Turbine layout was

[1] As defined here, "species of concern" includes any species which 1) is either a) listed as an endangered, threatened or candidate species under the Endangered Species Act, Bald and Golden Eagle Protection Act, or Washington State Environmental Protection Act; b) is designated by federal or state law, regulation, or other formal process for protection and/or management by the relevant agency or other authority; or c) has been shown to be significantly adversely affected by wind energy development, and 2) is determined to possibly be affected by the project (WDFW 2009, WAC 232-12-014 [2015], WDFW 2020a).

more developed, at least 30% of the total number of Turbines was surveyed within an 800-m survey radius, per ECPG and Final Rule standards.

For small bird use surveys, the objective was to collect data on species occurrence and the spatial and temporal patterns of avian use, with a particular focus on passerines and other non-raptors. All auditory and visual bird observations within a 100-m circular plot were recorded for a 10-minute (min) sample period. All points were surveyed once or twice per month, depending on the survey year. Data collection for small bird use surveys utilized commonly-used survey methods (Ralph et al. 1993).

For large bird use surveys, the objective was to collect data on species occurrence and the spatial and temporal patterns of avian use, with a particular focus on eagles, other raptors, and non-raptors, such as sandhill crane (*Antigone canadensis*) and American white pelicans (*Pelecanus erythrorhynchos*), with management concern. All auditory and visual bird observations within an 800-m circular plot were recorded for a 60-min sample period and large bird flight paths were recorded on topographic maps.

To be consistent with the ECPG and Final Rule, WEST recorded all eagle observations during large bird use surveys. The data recorded included the total number of minutes an eagle was observed within the 800-m survey plot and whether the bird was flying within 200-m above ground level (agl; eagle risk exposure) or perched. A minute was tallied at the top of the full minute and rounded to the nearest minute in situations of partial time. Observations of perched eagles and those outside of survey plots were not considered eagle risk exposure minutes; however, the perch locations and flight paths of all eagles were mapped to qualitatively assess areas of eagle use within the Project.

5.2.2 Avian Use Survey Analyses: 2017 − 2020

To calculate comprehensive metrics of bird abundance and flight behavior at the Project, data from all Survey Areas during all years were aggregated to calculate overall mean use estimates and exposure indices. Data were used from all survey points and seasons, which were standardized. Other metrics, such as species richness, frequency observed, percent of mean use, and other characteristics for each Survey Area are found in the original technical reports (Table 3).

For generating standardized fixed-point avian use estimates at the Project, small birds within a 100-m radius plot per 10-min survey and large birds within the 800-m radius plot per 60-min survey for all survey points were used in the analysis. The metric used to measure mean bird use was the number of observations per survey per plot. These standardized estimates of mean bird use were used to compare differences in relative abundance among bird types and species. Overall mean use was calculated by summing the total number of observations seen within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. Overall mean use was calculated as a weighted average of seasonal values by the number of days in each season.

The bird exposure index is used as a relative measure of species-specific risk of Turbine collision using flight height data collected during the pre-construction surveys. A relative index of bird exposure (*R*) was calculated for small- and large-sized bird species observed during avian use surveys using the following formula:

$$R = A \times P_f \times P_t$$

Where *A* equals the mean relative use for species *i* averaged across all surveys, P_f equals the proportion of all observations of species *i* where activity was recorded as flying (an index to the approximate percentage of time species *i* spends flying during the daylight period), and P_t equals the proportion of all initial flight height observations of species *i* within the likely rotor-swept height (RSH) for proposed Turbines at the Project. The minimum and maximum RSH for each Turbine type in Table 2 were rounded to the nearest five m increment to reflect the level of accuracy field data were recorded. The exposure index does not account for other possible collision risk factors, such as avoidance probabilities or inter/intra-specific behaviors. The flight height of first observation was used to minimize the unintentional bias associated with a change in bird behavior potentially caused by the presence of the observer.

5.2.2.1 Horse Heaven Wind Farm Results 2017 − 2020 – Overall Mean Use and Exposure

From 2017 − 2020, avian use surveys were conducted at 162 fixed-point locations (68 small bird and 94 large bird) for a total of 124 visits (i.e., survey rounds; Table 6). A total of 1191 hours of large bird use surveys were conducted (Figure 4). As the extent of the Project area was refined, the level of effort (i.e., months of survey) increased at points within the Project to comply with ECPG standards (Figure 4).

Overall mean use for small birds was composed primarily of use of horned lark (*Eremophila alpestris*; 5.3 observations/100-m plot/10-min survey), followed by western meadowlark (*Sturnella neglecta*; 0.28 observations/100-m plot/10-min survey; Appendix A). Horned lark had the highest exposure index relative to all other small bird species and in general; a higher percent of observations of this species were flying within the RSH for shorter Turbines with a lower tip height (i.e., General Electric [GE] 3.03 MW-Turbines at 10 to 155 m agl).

Overall mean use for large birds was composed primarily of use by snow goose (*Anser caerulescens*; 12.96 observations/800-m plot/ 60-min survey), followed by Canada goose (*Branta canadensis*; 1.87 observations/800-m plot/ 60-min survey). Snow goose had the highest exposure index relative to all other large bird species, and a higher percent of observations were flying within the RSH for taller Turbines with a larger rotor diameter (i.e., Siemens Gamesa 6.0-MW Turbines at 30 to 200 m agl). In general, exposure indices for raptors were higher for shorter Turbines with a maximum RSH of 155 m agl compared to taller Turbines with a maximum RSH of approximately 200 m agl. Conversely, exposure indices were higher for waterfowl when taller Turbines were analyzed (Appendix B).

5.2.2.2 Horse Heaven West Avian Use Results 2017 − 2019

Avian use surveys were conducted continuously in four different Survey Areas west of Highway 395 from August 2017 – June 2019 (Figure 1). Survey Areas were referred what was then called Badger Canyon (one year of surveys) and Horse Heaven (two years of surveys). The following summary statistics aggregates data from all three years of surveys. Site-specific details on mean use and collision risk and other indices are presented in Chatfield et al. (2019a), Jansen and Brown (2018), and Jansen et al. (2019). In total, 100 point counts were surveyed one or two times each month during all seasons for a total of 88 survey rounds.

A total of 4,438 small bird observations were recorded during 649 surveys, and consisted of 23 unique species were identified (Table 6). The most small bird observations were of horned lark (approximately 87% of small bird observations) and mean use was highest in winter. The second most abundant observations of small birds were attributed to western meadowlark with 131 observations (3%). All other small bird observations accounted for approximately 3% or less of all small bird observations. Although the highest mean use of small birds occurred during winter, relatively low species diversity and a comparatively low number of groups recorded indicates larger bird flocks during this time of year. Small birds had the highest mean use on the western side of HHW (Chatfield et al. 2018a, Jansen and Brown 2018, Jansen et al. 2019).

A total of 9,329 large bird observations were recorded during 827 surveys, and 32 unique species were identified (Table 6). The most large bird observations were of sandhill crane (approximately 28% of large bird observations) and mean use by this species was highest in fall. In all years, groups of sandhill cranes were observed flying above the RSH (more than 150 m agl) the majority of the time (more than 90%). Canada goose, snow goose, common raven (*Corvus corax*), and rock pigeon (*Columba livia*) composed 51% of all other large bird observations and observations of these species were most abundant in fall. Thirteen unique diurnal raptor species were observed; northern harrier (*Circus hudsonius*) was the most frequently observed raptor species, and most observations were recorded during fall; the majority of observations flying below RSH (less than 25 m agl). Overall large bird mean use was greatly influenced by waterfowl and waterbirds and use was highest at points on the western side of HHW (Chatfield et al. 2018a, Jansen and Brown 2018, Jansen et al. 2019).

A total of six golden eagle observations were recorded for a total of 43 exposure risk minutes. All but one of the golden eagle observations occurred during fall; one observation occurred during spring. The majority of exposure risk minutes was composed of one juvenile golden eagle circling the observer for 30 minutes. No obvious spatial pattern of golden eagle use was evident. A total of six bald eagle observations were recorded for a total of 13 exposure risk minutes. All but one of the bald eagle observations occurred during winter and spring; one observation occurred during fall. There was a spatial grouping of bald eagle observations in the center of HHW, along Bing Canyon and Coyote Canyon.

Eleven sensitive species, as classified by the USFWS or WDFW, were observed during standardized point counts or incidentally (Table 5). These bird species of concern and the associated risk for these species from Project operation are discussed further in Section 6.2.

Table 5. Species of concern observed during avian point count surveys or incidentally from 2017 – 2019 at Horse Heaven West[a], Benton County, Washington.

Species	Scientific Name	Status[b]	Surveys		Incidental		Total	
			grps	obs	grps	obs	grps	obs
American white pelican	*Pelecanus erythrorhynchos*	ST	8	79	0	0	8	79
bald eagle	*Haliaeetus leucocephalus*	BGEPA	6	6	1	1	7	7
ferruginous hawk	*Buteo regalis*	ST	4	4	0	0	4	4
golden eagle	*Aquila chrysaetos*	BGEPA, SC	6	6	1	1	7	7
great blue heron	*Ardea herodias*	SP	1	1	0	0	1	1
ring-necked pheasant	*Phasianus colchicus*	SP	8	8	0	0	8	8
sagebrush sparrow	*Arremisiospiza nevadensis*	SC	1	1	0	0	1	1
sandhill crane	*Antigone canadensis*	SE	24	2,667	20	3,307	44	5,974
loggerhead shrike	*Lanius ludovicianus*	SC	0	0	1	1	1	1
prairie falcon	*Falco mexicanus*	SP	3	3	1	1	4	4
tundra swan	*Cygnus columbianus*	SP	1	35	0	0	1	35

[a] Includes fixed-point avian use surveys conducted at Horse Heaven Wind Project from 2017 – 2018 (Jansen and Brown 2018), Horse Heaven Wind Project from 2018 – 2019 (Jansen et al. 2019), and Badger Canyon Wind Project from 2018 – 2019 (Chatfield et al. 2019a).

[b] BGEPA = Bald and Golden Eagle Protection Act (1940); SE = state-endangered species, ST = state-threatened species, SC = state candidate species, SP = state priority species. State species status from Washington Department of Fish and Wildlife (2008, 2020b).

grps = # of groups, obs= # of observations.

5.2.2.3 Horse Heaven East Avian Use Results 2018 – 2020

Avian use surveys were conducted during two discrete survey periods, from June 2018 – May 2019, and again from October 2019 – September 2020, in two different Survey Areas east of Highway 395. (Figure 1). Survey Areas were referred what was then called Four Mile (one year of surveys) and Horse Heaven East (one year of surveys). The following summary statistics aggregates data from two years of surveys. Site-specific details on mean use and collision risk and other indices are presented in Chatfield et al. (2019b), and Jansen (2020 [*in prep*]). In total, 64 point counts were surveyed one or two times each month during all seasons for a total of 36 survey rounds.

A total of 1,632 small bird observations were recorded during 309 surveys, and 20 unique species were identified (Table 6). The most abundant small bird observations were of horned lark (67% of small bird observations) and mean use of this species was highest during fall. Observations of three species, western meadowlark, European starling (*Sturnus vulgaris)*, and bank swallow (*Riparia riparia*), composed an additional 18% of small bird observations while each remaining species accounted for 3% or less of the total number of observations. No obvious spatial patterns of use were evident.

A total of 20,614 large bird observations were recorded during 405 surveys, and 28 unique species were identified (Table 6). The most abundant large bird was snow goose (76% of large bird observations), of which 66% of snow goose observations were recorded during winter. Three species, Canada goose, common raven, and American white pelican, composed an additional 17% of large bird observations while each remaining species accounted for 2% or less of the total number of large bird observations. Thirteen unique species of raptor were observed; northern harrier was the most frequently observed raptor species, over half (51%) of which were during the fall, and the majority observations flying below the RSH (less than 25 m agl). Waterfowl and waterbird observations were the most abundant among large bird types also had a relatively high proportion of groups flying within the RSH (25−150 m agl). Overall large bird mean use was greatly influenced by waterfowl and waterbirds and was highest at points on the eastern side of HHE, closer to the Columbia River, which are outside the current Project Area (Chatfield et al. 2019b, Jansen 2020 [*in prep*]).

One golden eagle observation was recorded during the fall for a total of 15 exposure risk minutes. The observation occurred on the last point count of the last survey for the year and consisted of one adult golden eagle circling the observer for 26 minutes, of which 15 minutes were within the 800-m survey plot and flying below 200 m agl. A total of 10 bald eagle observations were recorded for a total of 18 exposure risk minutes. Of the 10 bald eagle observations, one bald eagle was observed flying slightly beyond the 800-m survey plot. All bald eagle observations occurred during winter and spring; however, no obvious spatial pattern of bald eagle use was evident.

Table 6. Summary of fixed-point avian use surveys conducted from 2017 – 2020 at the Horse Heaven Wind Farm by Project phase, Benton County, Washington.

Project Phase	Horse Heaven West[a]	Horse Heaven East[b]
Survey Period	**August 2017 − May 2019**	**June 2018 − September 2020**
Small Bird Surveys (10-min fixed point, 100-m survey plot)		
Total # Point Counts	41	27
Total # Survey Rounds	37	12
Total # Surveys	649	309
Total # Observations	4,438	1,632
Total # Groups	1,469	561
# Unique Species[c]	23	20
Abundant Species	horned lark composed 87% of all small birds	horned lark composed 69% of all small birds
Sensitive Species (# obs.)[d]	sagebrush sparrow (1), sage thrasher (1), loggerhead shrike (1)	loggerhead shrike (1), sage thrasher (3)
Large Bird Surveys (60-min fixed point, 800-m survey plot)		
Total # Point Counts	59	35
Total # Survey Rounds	51	24
Total # Surveys	827	405
Total # Observations	9,329	20,614
Total # Groups	2,250	1,392
# Unique Species[c]	32	28
Abundant Species	sandhill crane, Canada goose, snow goose, and common raven composed 69% of all large birds	snow goose and Canada goose composed 83% of all large birds
Sensitive Species (# obs.)[d]	sandhill crane (5,944 observations), American white pelican (79), tundra swan (35), prairie falcon (4), ferruginous hawk (4)	American white pelican (847), sandhill crane (578), prairie falcon (19)
# GOEA[e] Obs. / Exposure Min.	6 / 43	1 / 15
# BAEA[e] Obs. / Exposure Min.	6 / 13	9 / 18

[a] Horse Heaven West = Horse Heaven Wind Project from 2017 – 2018 (Jansen and Brown 2018), Horse Heaven Wind Project from 2018 – 2019 (Jansen et al. 2019), and Badger Canyon Wind Project from 2018 – 2019 (Chatfield et al. 2019a)

[b] Horse Heaven East = Four Mile Wind Project (Chatfield et al. 2019b), and Horse Heaven East (Jansen 2020 [*in prep*]).

[c] Excludes unidentified species (e.g., unidentified passerine, unidentified swallow)

[d] Includes observations recorded during standardized point count surveys and incidentally. Eagle species are excluded from the list but were observed during surveys.

[e] Eagle Obs. = Total number of separate eagle observations. Exposure min. = Exposure Risk Minute: total number of minutes the eagle was observed flying below 200-meters (m) above ground level and within the 800-m radius of surveyor.

BAEA = bald eagle, GOEA = golden eagle, m = meter, min = minute, obs = observation

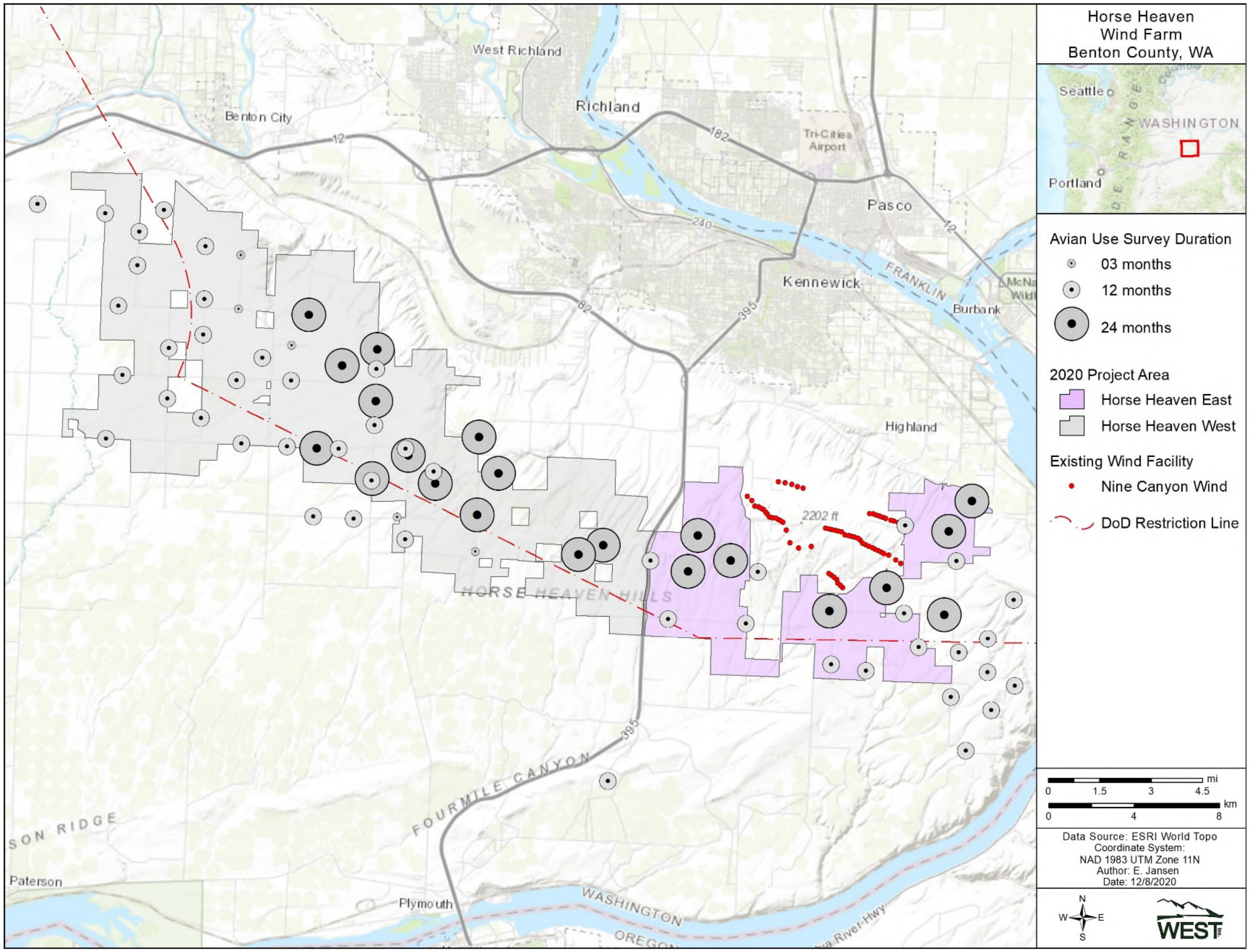

Figure 4. Fixed-point avian use points and survey duration from 2017 – 2020 at the Horse Heaven Wind Farm, Benton County, Washington.

Eight sensitive species, as classified by the USFWS or WDFW, were observed during standardized point counts or incidentally (Table 7). These bird species of concern and the associated risk for these species from Project operation are discussed further in Section 6.2.

Table 7. Species of concern observed during avian point count surveys or incidentally, from 2018 – 2020 at Horse Heaven East[a], Benton County, Washington.

Species	Scientific Name	Status[b]	Surveys		Incidental		Total	
			grps	obs	grps	obs	grps	obs
American white pelican	*Pelecanus erythrorhynchos*	ST	76	847	0	0	76	847
bald eagle	*Haliaeetus leucocephalus*	BGEPA	10*	10	0	0	10	10
golden eagle	*Aquila chrysaetos*	BGEPA	1	1	0	0	1	1
loggerhead shrike	*Lanius ludovicianus*	SC	0	0	1	1	1	1
prairie falcon	*Falco mexicanus*	SP	19	19	0	0	19	19
ring-necked pheasant	*Phasianus colchicus*	SP	2	2	0	0	2	2
sandhill crane	*Antigone canadensis*	SE	3	383	3	155	6	538
sage thrasher	*Oreoscoptes montanus*	SC	2	2	1	1	3	3

[a] Includes surveys conducted at Four Mile Wind Project from 2018 – 2019 (Chatfield et al. 2019) and Horse Heaven East from 2019 – 2020 (Jansen 2020 [*in prep*]).

[b] BGEPA = Bald and Golden Eagle Protection Act (1940); SE = state-endangered species; ST = state-threatened species; SC = state candidate species; SP = state priority species. State species status from Washington Department of Fish and Wildlife (2008, 2020b).

grps = # of groups, obs = # of observations.

* Includes an observation of one eagle beyond the 800-meter radius survey buffer.

5.2.3 Aerial Raptor Nest Survey Methods: 2017 − 2018

The objective of the raptor nest surveys was to document the location, territory occupancy, and nesting status of raptors within and surrounding the Project Area. Aerial raptor nest surveys were completed in spring of 2017 through 2019 within 10 mi of the Survey Areas identified in Figure 1 (Jansen 2017; Jansen and Brown 2018; Chatfield 2019c, 2019d; Jansen et al. 2019). During each survey, nests of all raptor species[2] were documented within two mi of the Survey Area, whereas only nests constructed by golden eagles or bald eagles were documented within 10 mi of the Survey Area. Each survey year, two rounds of double-observer (i.e., a primary and secondary observer) aerial nest surveys were conducted at least 30 days apart in a Robinson R-44 Raven II helicopter with bubble windows providing excellent visibility (Pagel et al. 2010, USFWS 2013). The first survey was conducted during a time period overlapping the primary early nesting period of eagles in the Pacific Northwest, when breeding pairs are exhibiting courtship, nest-building, and/or egg-laying and incubation behaviors (Isaacs 2018). A second survey was conducted when eagles are actively engaged in mid- to late breeding season reproductive activities (e.g., incubating, brooding, feeding nestlings), and when eagles engaged in ongoing nesting activities would be reliably on or around nests (Watson 2010, Isaacs 2018). Once a nest was identified, each proceeding year rechecked the nest if the nest was located within the respective survey buffer.

WEST categorized basic nesting territories and nest status using definitions originally proposed by Postupalsky (1974) and largely followed currently (USFWS 2013). Nests were classified as

[2] Includes owls, turkey vultures (*Cathartes aura*) and corvids

occupied if any of the following were observed at the nest structure: 1) an adult in an incubating position; 2) eggs; 3) nestlings or fledglings; 4) presence of an adult (sometimes sub-adults); 5) a newly constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed earlier in the breeding season; or 6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings and/or molted feathers on its rim or underneath. Occupied nests were further classified as active if an egg(s) or young were observed. Nests were classified as inactive if no eggs or young were present. Nests not meeting the above criteria for "Occupied" during at least two consecutive surveys were classified as "Unoccupied."

5.2.3.1 Non-Eagle Raptor Nest Results

Between 20 and 44 stick nests were documented within two mi of the Project Area during the 2017 – 2019 aerial surveys (Table 8). Although the number of nests located within the two mi Study Area of the Project increased from 2017 to 2019, nest density decreased because the Survey Area was over four times as large in 2019 due to expansion of the Project. During each survey year, nests of *Buteo* species composed the majority (64% to 73%) of all occupied nests (Table 8). Signs of active nesting were observed in all but two of the 30 occupied nests within two mi of the Project Area. Of the 44 nests documented in 2019, eleven (25%) were located within the 2020 Project Area and included five Swainson's hawk (*Buteo swainsoni*) nests, three common raven nests, one great horned owl (*Bubo virginianus*) nest, one ferruginous hawk (*Buteo regalis*) nest, and one unoccupied nest (Figure 5). Raptor nest substrates within the 2020 Project Area are limited to isolated trees or tree patches, often associated with [redacted]. Nests along cliffs and large rock outcrops, relatively common nest substrates for ferruginous hawks, [redacted] of the Project Area were inactive during all survey years. One ferruginous hawk was observed nesting in the same [redacted] during 2018 and 2019, at the [redacted] of the Project approximately [redacted] of the nearest proposed Turbine (Figure 5).

Table 8. Raptor nest results within a 2-mile buffer of the proposed Horse Heaven Wind Farm, Benton County, Washington. Aerial surveys were conducted March 31 and May 10, 2017; March 5 and May 10, 2018; and March 5 and May 16, 2019.

	2017		2018		2019	
Nesting Species	**# Nests**	**Nest Density (#/mi²)[a]**	**# Nests**	**Nest Density (#/mi²)[a]**	**# Nests**	**Nest Density (#/mi²)[a]**
common raven	1	0.013	1	0.007	5	0.015
ferruginous hawk	2	0.027	1	0.007	1	0.003
great horned owl	2	0.027	2	0.013	3	0.009
red-tailed hawk	4	0.054	8	0.052	14	0.043
Swainson's hawk	1	0.013	6	0.039	7	0.021
Unidentified[b]	10	0.134	14	0.092	14	0.043
Total	20	0.268	32	0.210	44	0.134

[a] Nest Density = # Nests within a 2-mile (mi) buffer of the Survey Area / (Survey Area + 2-mi buffer of the Survey Area). Survey Area: 2017 = 74.66 square mi (mi^2); 2018 = 152.60 mi^2 ; 2019 = 328.80 mi^2

[b] Unidentified stick nests were documented as unoccupied and inactive during surveys

[REDACTED DUE TO SENSITIVE INFORMATION]

Figure 5. Non-eagle raptor nests documented within the 2019 Survey Area of the Horse Heaven Wind Farm, Benton County, Washington.

5.2.3.2 Bald Eagle Nests

During aerial surveys conducted during 2017 − 2019, six bald eagle territories, comprising seven nests, were documented within 10 mi of the 2020 Project Area (Table 9, Figure 6), with no nests documented within the 2020 Project Area. Five of the six territories were beyond the ten mi survey radius during 2017 – 2018 and were not surveyed (Table 9). The Peavine Island Territory had two large stick nests at the southern end of the island. During 2019, all but one of the six territories (Yakima River Mouth Territory) were active during at least one of the survey rounds. Each of the five active nests had eggs or young approximately two to four weeks old observed during the second survey round. The distance of bald eagle nests to the nearest proposed Turbine ranged from 3.7 to 10.7 mi (average = 7.7 mi, standard deviation = 2.4 mi). No golden eagle nests were observed during any survey years.

Table 9. Bald eagle nest status and productivity within a 10-mile buffer of the Horse Heaven Wind Farm, Benton County, Washington.

Territory Name[a]	Nest Status	Nest Productivity	Distance to Turbine (mi)[b]
Prosser	2017 - Not in Survey Area 2018 - Not in Survey Area 2019 - Occupied/Active	2019 - two-three young, ~4 weeks old	10.7
Yakima River Mouth	2017 - Occupied/Active 2018 - Occupied/Active 2019 - Occupied/Inactive	2017 - one young, ~3 weeks old 2018 - two young, ~3 weeks old 2019 - adult flushed from nest	8.1
Port of Pasco	2017 - Not in Survey Area 2018 - Not in Survey Area 2019 - Occupied/Active	2019 - two young, ~3-4 weeks old	6.5
Peavine Island	2017 - Not in Survey Area 2018 - Not in Survey Area 2019 - Occupied/Active	2019 - two young, ~3 weeks old	3.7
McNary NWR	2017 - Not in Survey Area 2018 - Not in Survey Area 2019 - Occupied/Active	2019 - two young, ~3 weeks old	7.8
Sand Station	2017 - Not in Survey Area 2018 - Not in Survey Area 2019 - Occupied/Active	2019 - two eggs	9.2

[a] Territory names established by Western EcoSystems Technology, Inc. (Jansen 2017, Jansen and Brown 2018, Jansen et al. 2019, Chatfield et al. 2019c, 2019d)

[b] Distance to nearest proposed turbine

mi = mile, NWR = National Wildlife Refuge

[REDACTED DUE TO SENSITIVE INFORMATION]

Figure 6. Bald eagle nests documented during aerial surveys conducted from 2017 – 2019 within 10 miles of the Horse Heaven Wind Farm, Benton County, Washington.

5.2.4 Bat Acoustic Survey Methods: 2017−2018

The objective of bat surveys was to estimate levels of bat activity within the Project Area during the period of known activity for migratory and resident bats in eastern Washington. Bat acoustic surveys were conducted at four sites across the Project from May through October in 2017 and 2018 (Hays et al. 2018b, 2019). Anabat SD2 ultrasonic bat detectors (Titley Scientific, Columbia, Missouri) were deployed in 2017 and 2018 at HHW (Horse Heaven Wind Project), and in 2018, Song Meter 3 detectors (Wildlife Acoustics, Maynard, Massachusetts) at HHE (Four Mile) and HHW (Badger Canyon Wind Project). All detectors were outfitted with microphones, one at each detector; one microphone was deployed near the ground, at approximately 1.5 m agl, while the other microphone was raised on a meteorological (met) tower to approximately 45 m agl. The ground microphone was considered a ground sampling station, while the raised microphone was considered a raised sampling station; a total of nine sampling stations were utilized during the study (Table 10, Figure 7).

Table 10. Summary of bat acoustic study from monitoring conducted during 2017 and 2018 at the Horse Heaven Farm, Benton County, Washington.

Survey Year / Type	Horse Heaven West 2017[a]	Horse Heaven West 2018 [a]	Horse Heaven West 2018[b]	Horse Heaven East 2018[c]
Survey Dates	August 19 – October 30	May 14 – October 29	May 11 – October 29	May 11 – October 29
Technology	Anabat SD2	Anabat SD2	Song Meter 3	Song Meter 3
# Stations	1	1	1	2
# Detectors	1 (ground only)	2	2	4
Detector Nights	72	303	344	670
Total Bat Passes	24	82	384	734
# High Freq. (# Low Freq.)	2 (22)	1 (81)	24 (360)	55 (679)
Avg. Bat Passes / Detector Night[d]	0.33 ± 0.08	0.27 ± 0.05	1.12 ± 0.13	1.09 ± 0.11

[a] Horse Heaven Wind Project

[b] Badger Canyon Wind Project

[c] Four Mile Wind Project

[d] ± the standard deviation

Sources: Hays et al 2018a, 2018b, 2019

Ave. = average, Freq. = frequency

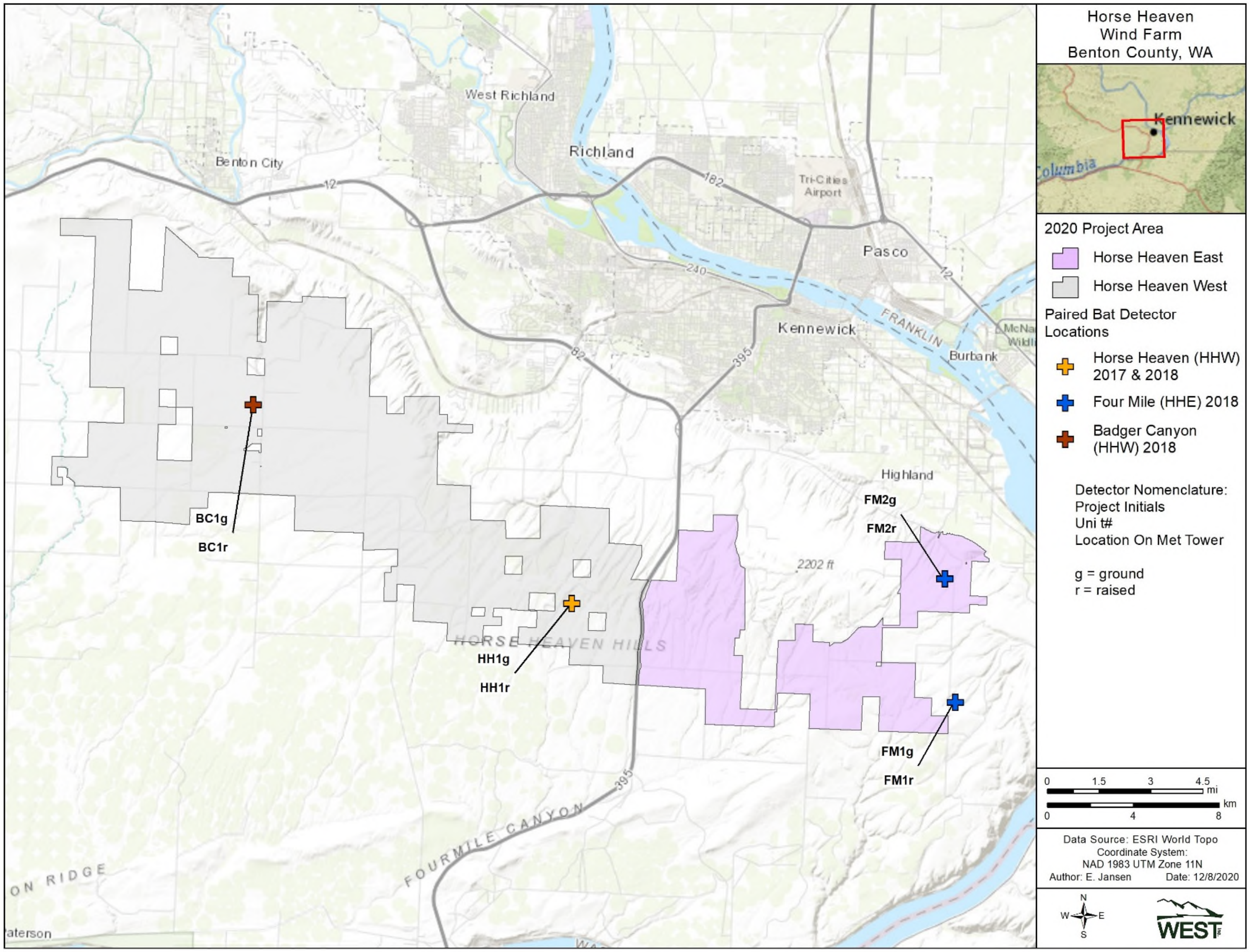

Figure 7. Bat detector locations during acoustic monitoring surveys conducted May – October 2017 and 2018 at the Horse Heaven Wind Farm, Benton County, Washington.

5.2.4.1 Bat Acoustic Survey Results

Bat calls were detected at all nine sites, and bats were detected at both high frequencies (more than 30 kilohertz [kHz]) and low frequencies (less than 30 kHz). Bat activity at the ground detector stations was generally higher than at the raised detector stations throughout the study periods. Eight species of bat were documented at the Project, with low-frequency species detected more often than high-frequency species (Tables 10 and 11). Townsend's big-eared bat was not confirmed during the study periods, and no federal or state-listed bat species were detected. The period of peak bat activity documented at the Project occurred during September at all stations.

Table 11. Number of detector-nights and percent of call identified to species present by study phase conducted in 2017 and 2018 at the Horse Heaven Wind Farm, Benton County, Washington

Common Name *Scientific Name*	**Horse Heaven West (2017 & 2018)**[a]	**Horse Heaven West (2018)**[a, b]	**Horse Heaven East (2018)**[a, c]
High-Frequency (> 30 kHz)			
California bat *Myotis californicus*	0 (0%)	0 (0%)	1 (<1%)
canyon bat *Parastrellus hesperus*	3 (<1%)	9 (3%)	11 (2%)
little brown bat *Myotis lucifugus*	0 (0%)	2 (1%)	8 (1%)
long-legged bat *Myotis volans*	0 (0%)	0 (0%)	2 (<1%)
western long-eared bat *Myotis evotis*	0 (0%)	0 (0%)	1 (<1%)
Low-Frequency (< 30 kHz)			
big brown bat *Eptesicus fuscus*	8 (2%)	19 (6%)	31 (5%)
hoary bat *Lasiurus cinereus*	13 (3%)	47 (14%)	91 (14%)
silver-haired bat *Lasionycteris noctivagans*	55 (15%)	81 (24%)	169 (25%)
Total Number of Detector Nights	**375**	**344**	**670**

[a] Number of nights a call identified to species was present (percent of nights species detected, rounded)

[b] Badger Canyon Wind Project (Hays et al. 2018a)
[c] Four Mile Wind Project (Hays et al. 2018b)

kHz = kilohertz

6.0 ASSESSMENT OF RISKS TO BIRDS AND BATS

Impacts to wildlife from the construction and operation of the Project can be direct or indirect and can occur at different temporal scales (e.g., during and after construction and operation) and spatial scales (e.g., within or outside the Projects). To provide context to the characteristics of the bird and bat community at the Project, species richness and composition of publicly available data of fatalities at existing wind facilities were evaluated at various spatial scales ranging from broad geographic areas to project-specific data (Appendix C), including:

- USFWS Pacific Region (Idaho, Oregon, and Washington; USFWS 2020a)
- USFWS Bird Conservation Region 9, Great Basin (BCR 9 USFWS 2008)
- Columbia Plateau Ecoregion (Level III; USEPA 2016, 2017)
- State of Washington (US Census Bureau 2018)
- Benton County, Washington (WEST 2019, eBird 2020)
- Existing wind energy facilities (WEST 2019)

Direct impacts include wildlife fatalities resulting from interactions with facility development or infrastructure. Some potential direct impacts from wind energy development include:

- Collisions with Turbines, buildings, vehicles, and equipment
- Avian power line interactions
- Habitat loss, fragmentation, and/or alteration during construction and operation

Indirect impacts are unintended, can potentially produce unforeseen consequences to wildlife, and are difficult to predict, especially at locations or regions where indirect impacts have not been studied. Displacement is the main potential indirect impact from wind energy development. In this document, direct and indirect impacts will focus on what is most likely to occur at the Project, particularly collisions with Turbines, avian power line interactions, and displacement.

To provide an assessment of risk to birds and bats at the Project, data from WEG-based Tier 3 avian and bat studies, publicly available information on post-construction mortality monitoring from other wind energy projects, and relevant literature were used to provide an assessment of risk to birds and bats at the Project.

6.1 Birds

During fixed-point avian use studies for all Study Areas during 2017 – 2020, 66 unique species of birds were documented. Of the 66 unique species observed at the Project, 37 were large birds and the remaining 29 species were small birds. This is approximately 22% of the 304 avian species reported in Benton County (eBird 2020). Observations of species during these studies compose approximately 13% of the 542 avian species occurring in the BCR 9 (eBird 2020) and approximately 13% of the 518 species recorded in Washington, not including extirpated species (Washington Ornithological Society 2019). Overall, the Project appears to contain a low number of avian species relative to these broader landscape scales and the species observed are generally typical of those commonly found throughout arid shrub-steppe, agriculture, and grassland habitats of the Columbia Plateau physiographic region.

6.1.1 Direct Impacts

6.1.1.1 Collisions

All Birds

WEST compiled publicly available data from 482 studies across 221 wind energy facilities in the US that reported 336 bird species as fatalities (WEST 2019). Of the studies between 2015 and 2018, fatality estimates at these facilities ranged from zero to nine birds/MW/year. The historic maximum was 12.1 birds/MW/year in California in 2014 (WEST 2019). The American Wind Wildlife Institute (AWWI) has also compiled publicly available data from 193 studies across 130 wind energy facilities in the US that reported 281 species of birds as fatalities during surveys and an additional 13 species as incidental observations (AWWI 2019). Of the studies between 2002 and 2017, fatality estimates at the facilities ranged from approximately zero to 12 birds/MW/year, with a median value of 1.8 birds/MW/year (AWWI 2019).

Among facilities in the USFWS Pacific Region fatality estimates ranged from less than 0.4 to 8.4 birds/MW/year (median of 2.4 birds/MW/year) based on the 22 wind facilities (30 technical reports; WEST 2019). Of the more than 500 avian species occurring in the Pacific Region 114 have been recorded as fatalities, with the more numerous fatalities from horned lark, gray partridge (*Perdix perdix*), golden-crowned kinglet (*Regulus satrapa*), ring-necked pheasant (*Phasianus colchcius*) and chukar (*Alectoris chukar*; WEST 2019). In Washington, of the 10 wind facilities with publicly available data, 107 unique bird species have been recorded during post-construction monitoring studies (WEST 2019), which is 62% more unique species found as fatalities compared to the total species observed at the Project. Overall bird fatality estimates at facilities in Washington were comparable to the Pacific Region, and ranged from 1.3 to 8.4 birds/MW/year (median of 2.6 birds/MW/year; WEST 2019).

Regional estimates of bird fatalities at larger geographic scales provide context of what can potentially be expected at the Project and are consistent with what has been observed at Nine Canyon, which is adjacent to the Project and the only other operational facility in Benton County. During one year of standardized post-construction monitoring surveys, conducted from 2002 − 2003, 14 unique species comprising 35 fatalities were recorded (Erickson et al. 2003a). Of the 35 fatalities, the top three bird fatalities were horned lark (47%), ring-necked pheasant (14%), and western meadowlark (6%) which is consistent with species found as fatalities at other facilities in the Pacific Region and Washington. The overall bird fatality estimate was 2.76 birds/MW/year (Erickson et al. 2003a), which is within the lower end of the range observed within the Pacific Region and Washington (WEST 2019). From 2005 − 2020, Nine Canyon has been reporting bird fatalities found during regular project O&M activities (Energy Northwest 2020). During this 16-year period, 14 unique species comprising 22 fatalities were reported. The most common species attributed to Turbine strikes included gray partridge, ring-necked pheasant, common raven, and red-tailed hawk (*Buteo jamaicensis*). Other bird fatalities included barn swallows (*Hirundo rustica*), chukar, and great horned owl, which were attributed to vehicle/window strikes, electrocution, or entrapment inside O&M buildings (Energy Northwest 2020). The range and species composition of bird fatalities anticipated at the Project is expected to be consistent with those found at multiple geographic scales, including with the adjacent operational facility, Nine Canyon. The various sources of bird mortality at Nine Canyon (e.g., turbine collisions, vehicle/window strikes) underscore the need for diverse avoidance and minimization measures, as discussed in Chapter 7.

In one of the most comprehensive contemporary analyses of impacts to birds from PV solar development, Kosciuch et al. (2020) reviewed bird species composition and fatality patterns at 10 PV solar facilities across a 13 site-year period in the Southwest US. Across all studies and years, ground-dwelling bird species (songbirds and pigeon/doves) composed the majority of the 86 identifiable species, totaling 669 fatalities. The highest concentration of fatalities were found during fall. The cause of mortality could not be determined for 61% of carcasses and over half (54%) were feather spots rather than carcasses or portions of carcasses, which introduced uncertainty in the fatality estimates. Water-obligate birds occurred during nine of the ten site-years in the Sonoran and Mojave Desert BCR 33. Of the 10 facilities with post-construction fatality data, one solar project in Nevada was located in BCR 9, which the same BCR as where the Project is located. Although only one year of post-construction monitoring was conducted in BCR 9, of the 12 fatalities recorded, 86% consisted of horned lark and western meadow lark, which reflects the patterns of species composition observed at the nine other sites. Fatalities of water-obligate birds were not observed at the one PV solar project in BCR 9, and the absence was attributed the project being located away from a relatively major concentrations of water-obligate birds, which were observed at other projects in closer proximity to the Salton Sea. However, the causal mechanisms of why water-obligate bird fatalities occur at solar facilities was not explicitly studied at any of the sites reviewed by Kosciuch et al. (2020), and remains an open topic of research. Although research on the direct impacts of PV solar facilities to birds in the Pacific Region and Washington are understudied, patterns observed at other solar facilities suggest: 1) the majority of fatalities will consist of the most abundant ground-dwelling birds, 2) will reflect a comparatively strong seasonal pattern, 3) will not consist of relatively large-scale fatality events of nocturnal migrants, and 4) the species identification and cause of mortality can be uncertain because the only evidence consists of feather spots. Based on these patterns, exposure to collision with Turbines increases during fall and winter for horned lark, western meadow lark, and mourning dove (*Zenaida macroura*), when these species are most abundant.

<u>*Diurnal Raptors*</u>

WEST compiled publicly available data from 482 studies across 221 wind energy facilities in the US reporting 336 bird species as fatalities (WEST 2019). Of the studies between 2011 and 2018, raptor fatality estimates at these facilities ranged from zero to 0.7 raptor/MW/year. The historic maximum was 0.7 raptors/MW/year in Puerto Rico in 2014 (WEST 2020). The AWWI has also compiled publicly available data from the US between 2002 and 2017, and raptor fatality estimates ranged from approximately zero to 1.0 bird/MW/year, with a median value of less than 0.01 bird/MW/year (AWWI 2019).

The Pacific Region of the US has diurnal raptor fatality estimates ranging from zero to 0.3 diurnal raptor/MW/year (median of 0.1 diurnal raptor/MW/year) based on the 30 facilities from this region (WEST 2019). The top five diurnal raptor fatalities were American kestrel (*Falco sparverius*), red-tailed hawk, Swainson's hawk, rough-legged hawk (*Buteo lagopus*), and golden eagle (WEST

2019). In Washington, of the 10 wind facilities with publicly available data, 19 unique raptor species (including owls and vultures) were recorded during post-construction monitoring studies; however, one species, barred owl (*Strix varia*) is unlikely to occur at the Project. Another owl species, burrowing owl (*Athene cunicularia*), has records of occurrence in WDFW Priority Habitats and Species databases (WDFW 2020b), but was not observed during avian point count surveys 2017−2020. Overall raptor fatality estimates at facilities in Washington were identical to the Pacific Region. Of the 144 raptor fatalities documented at 10 facilities in Washington, species composition of the top five raptor species are similar to the Pacific Region and include red-tailed hawk (33%), American kestrel (31%), short-eared owl (*Asio flammeus*; 6%), great horned owl (5%), and rough-legged hawk (3%; WEST 2019). This species composition is consistent with what was observed at Nine Canyon, where a fatality of an American kestrel and a short-eared owl were recorded during standardized post-construction monitoring surveys (Erickson et al. 2003a), and a great horned owl and three red-tailed hawks were reported during 16 years of O&M monitoring (Energy Northwest 2020).

Raptor nest density is one factor that can influence the probability of collision risk (Watson et al. 2014). Within the Columbia Plateau Ecoregion, Kolar (2013) observed a density-dependent relationship between red-tailed hawk and Swainson's hawk nest density with Turbine collisions. The complex interaction between other factors, such as raptor species characteristics, physical site attributes and wind facility specifications, also affect collision risk (Marques et al. 2014). Although nest density is likely not the only predictor of collision risk, the increase in flight activity of adults and fledglings around nests presents a clear risk to individuals when nests are in relatively close proximity to Turbines (Kolar and Bechard 2016, Bose et al. 2020). Raptor nest density at the Project is relatively low when compared with previous raptor nest studies at wind facilities in the Columbia Plateau Ecoregion (Table 12). Although direct comparisons between studies with such a relatively long temporal separation and general lack of project-specific fatality data reduces the inference that can be made about collision risk, raptor nest density at the Project appears low compared to other facilities in the Columbia Plateau Ecoregion.

These summaries of raptor species composition and fatalities that occurred in Washington and at Nine Canyon provide insight into species potentially expected as fatalities the Project. The range of raptor fatalities observed in Washington and species composition observed during pre-construction surveys indicate raptor fatality rates and species composition are within the range of what can potentially be expected at the Project.

Table 12. Estimated raptor nest densities at other regional proposed and existing wind projects located in comparable Columbia Plateau Ecoregion environments. The Horse Heaven Wind Farm (Project) nest density is the 2019 survey results within two miles of the 2020 Project Area (see Figure 5). (Table adapted from Northwest Wildlife Consultants [NWC] and Alaska Biological Research 2009.)

	Raptor Nest Density (# nests/mi^2), rounded								
	Sum	Buteos				Eagle	Falcon	Owl	Accip.
Project[a]	**Density**	**SWHA**	**RTHA**	**FEHA**	**UNBU**	**GOEA**	**PRFA**	**GHOW**	**SSHA**
Rattlesnake Road, OR	0.45	0.19	0.13	0.05	0.00	0.00	0.08	0.00	0.00
Hopkins Ridge, WA	0.42	0.01	0.27	0.01	0.05	0.00	0.00	0.08	0.00
Leaning Juniper I and II, OR	0.41	0.18	0.16	0.03	0.00	0.00	0.02	0.02	0.00
Goodnoe Hills/Imrie, WA (1 mile radius search area)	0.37	0.05	0.27	0.00	0.00	0.00	0.00	0.05	0.00
Columbia Hills, WA	0.30	0.04	0.18	0.00	0.00	0.02	0.02	0.02	0.02
Golden Hills, OR	0.25	0.04	0.16	0.00	0.00	0.00	0.00	0.05	0.00
Klondike I and II, OR (5-mile radius search area)	0.23	0.07	0.11	0.00	0.00	0.01	0.00	0.04	0.00
Juniper Canyon, WA	0.21	0.06	0.05	0.03	0.02	0.03	0.01	0.01	0.00
Stateline OR/WA	0.21	0.03	0.08	0.03	0.00	0.00	0.00	0.07	0.00
Klondike III, OR	0.20	0.04	0.11	0.00	0.01	0.00	0.00	0.03	0.00
Wild Horse, WA	0.16	0.00	0.12	0.00	0.00	0.00	0.02	0.02	0.00
Windy Flats, WA	0.15	0.00	0.13	0.00	0.00	0.00	0.00	0.02	0.00
Horse Heaven, WA 2019	**0.13**	**0.02**	**0.04**	**0.00**	**0.06**	**0.00**	**0.00**	**0.01**	**0.00**
Big Horn, WA	0.11	0.00	0.06	0.00	0.00	0.00	0.01	0.04	0.00
Zintel Canyon, WA	0.08	0.04	0.02	0.02	0.00	0.00	0.00	0.00	0.00
Nine Canyon, WA	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average Density	**0.23**	**0.05**	**0.12**	**0.01**	**0.01**	**0.00**	**0.01**	**0.03**	**0.00**

[a] References for projects: Rattlesnake Road (Kronner et al. 2007); Hopkins Ridge (Young et al. 2003); Leaning Juniper I and II (Kronner et al. 2005); Goodnoe Hills/Imrie (Northwest Wind Partners 2009); Juniper Canyon (NWC 2008); Columbia Hills (Erickson et al. 2002a); Golden Hills (Jeffrey et al. 2008); Stateline (Erickson et al. 2002a, 2004; NWC and Western EcoSystems Technology, Inc. 2001); Klondike I and II (Johnson et al. 2002), Klondike III (Mabee et al. 2005), Wild Horse (Erickson et al. 2003b), Windy Flats (Energy and Environment, Inc. 2007); Big Horn (Johnson and Erickson 2004); Nine Canyon and Zintel Canyon (Erickson et al. 2001, 2002a, 2002b).

SWHA = Swainson's hawk, RTHA = red-tailed hawk, FEHA = ferruginous hawk, UNBU = unknown species of the genus *Buteo,* GOEA = golden eagle, PRFA = prairie falcon, GHOW = great horned owl, SSHA = sharp-shinned hawk (Note: excludes common raven). Accip. = Accipiter

mi^2 = square mile

Passerines

The majority of avian fatalities at wind energy projects in North America are passerines (e.g., songbirds), which accounted for approximately 62.5% of the fatalities in 116 studies (Erickson et al. 2014). In WEST's analysis of 121 technical reports at 84 wind facilities in the US, the small bird fatality rate ranged from zero to 8.6 birds/MW/year (median of 1.9 birds/MW/year; WEST 2019). Passerine fatalities within the Pacific Region and Washington were within the range of other US regions (Table 13). Passerine fatalities at Nine Canyon (28 fatalities), composed mostly of horned larks (17 fatalities) was slightly above the median fatality rate in Washington at 2.5 birds/MW/year.

Table 13. Passerine fatality estimates (birds per megawatt [MW] per year) at wind facilities at various geographic scales (Western EcoSystems Technology, Inc. 2019).

Region	# Wind Projects	# Studies	Range (birds/MW/year)	Median Rate (birds/MW/year)
United States	84	121	0−8.6	1.9
Pacific	19	26	0.2−7.6	2.1
Washington	9	12	1.1−7.6	2.1

At all geographic scales analyzed, horned lark composed nearly half (48−49%) of all passerine fatalities in the Pacific Region, Columbia Plateau Ecoregion, Washington, and Nine Canyon (Erickson et al. 2003a, Johnson and Erickson 2011, WEST 2019). As discussed in Section 5.2, horned lark was most abundant passerine observed during all surveys and seasons, particularly winter. It is anticipated that horned lark will reflect the patterns observed at other facilities within Washington, and be the predominant passerine fatality at the Project. Other passerine species commonly observed at facilities in the Columbia Plateau Ecoregion include resident species, such as western meadowlark, European starling[3], and dark-eyed junco (*Junco hyemalis*), or migrants including golden-crowned kinglets (Johnson and Erickson 2011).

6.1.1.2 Avian Power Line Interactions

Potential impacts to birds from power line operation include electrocution and collision, and depend on voltage, configurations, and location relative to area habitats and bird presence/use. For this Project, collection lines will be buried where feasible to minimize electrocution and collision risk, although collection lines may be constructed overhead in select locations to span intermittent streams if applicable based on the final design.

The potential risk of bird electrocution and collision with the overhead transmission lines would be based on a number of site-specific factors. These factors would include line design, line orientation and placement, at-risk bird species present, topography, habitats, weather and seasonality, bird morphology, flight characteristics, land uses, and human influences (Avian Power Line Interaction Committee [APLIC] 2012). Development of the transmission routes and designs of the electrical transmission/distribution systems for the wind and solar phases of the Project are still pending; however, HHWF intends to implement the applicable engineering

[3] Introduced, non-native species

designs and technical specifications of the suggested guidelines (APLIC 2012) to avoid and minimize potential impacts to birds.

6.1.2 Indirect Impacts

Construction of the Project will result in habitat impacts potentially leading to indirect impacts of displacement of local avian species. Displacement effects are one type of indirect impacts to birds caused by the avoidance of Turbines at wind facilities. Displacement effects are defined as "the displacement of birds from areas within and surrounding wind farms due to visual intrusion and disturbance that can amount effectively to habitat loss" (Drewitt and Langston 2006). Displacement can occur during both the construction and operation of wind projects, and can be caused by the presence of the Turbines and/or because of vehicle/vessel and personnel movements.

The scale and degree of displacement effects varies according to site- and species-specific factors. The scale of disturbance caused by wind projects varies greatly and is likely to depend on multiple factors, including seasonal and daily patterns of use by birds, location to important habitats, availability of alternative habitats, and turbine and wind project specifications (Drewitt and Langston 2006, Lange et al. 2018). Similarly, the degree of the behavioral responses will vary among species and individuals, and can potentially depend on factors, such as life cycle stage (e.g., wintering, molting, breeding), flock size, and degree of habituation.

AWWI (2017) concluded that indirect impacts on birds from operating Turbines due to displacement include some species showing consistent decreases in abundance, while other species showed no effect. Research has indicated that indirect impacts from displacement of grassland birds by Turbines vary across years, species, sites, and distance from Turbines (Leddy et al. 1999, Johnson et al. 2000, Erickson et al. 2004, Young et al. 2006, Shaffer and Johnson 2009, Hale et al. 2014, Hale 2016, Johnson 2016, Shaffer and Buhl 2016).

For example, studies in the Great Plains on the effects of wind energy development on grassland breeding birds found immediate displacement effects (first year) for three species, attraction for two species, and no effect on four species (Shaffer and Buhl 2016). Over time, however, delayed effects (two to five years post-construction) were observed for seven species that showed some displacement up to 300 m from Turbines, whereas no effects were observed for two species (killdeer [*Charadrius vociferus*], vesper sparrow [*Pooecetes gramineus*]; Shaffer and Buhl 2016). Of the seven grassland-breeding birds showing displacement in the Shaffer and Buhl (2016) study, only western meadowlark was recorded at the project. Displacement effects for grassland breeding birds at the Project remain difficult to quantify because of the general lack of direct research on this issue in the Pacific Region.

Raptors nesting closer to Turbines have the potential to be impacted by disturbance due to construction or operation of the facility. Birds displaced from wind energy facilities could potentially move to lower quality habitat with fewer disturbances, with an overall effect of reducing breeding success (Marques et al. 2020). Stewart et al. (2007) provided a meta-analysis showing declines of raptor abundance near Turbines and displacement can persist over many years post-construction for some species (Hunt et al. 1995, Marques et al. 2020). However, the effects of displacement can be species-specific and diminish over time as resident birds become habituated to disturbances (Dohm et al. 2019). The degree of the effects of raptor displacement from the wind energy development remains variable and likely due to local conditions, such as existing raptor densities, species-specific behavior, and level of existing disturbances, among other factors (Watson et al. 2018). Because raptors nest in proximity to proposed Turbines or other infrastructure, some displacement of raptors or functional loss of foraging habitat is anticipated from Project operation. However, raptor nest densities were lower within the Project boundary compared to the surrounding area during three years of pre-construction surveys (Section 5.2.2), which suggests the presence of less suitable nest substrate than the surrounding area and potentially less displacement relative to nest activity in the surrounding landscape.

6.2 Bird Species of Management Interest

Twelve species of concern were documented during avian point counts or incidentally (e.g., driving between points) within the Survey Areas during 2017 − 2020. In addition to the regulatory listing status described for each species, all species are covered by the MBTA. All species except the loggerhead shrike (*Lanius ludovicianus*) were observed during point count surveys. Of the 22 studies available in Washington, six species have been recorded as fatalities at wind facilities and include bald eagle, ferruginous hawk, golden eagle, great blue heron (*Ardea herodias*), prairie falcon (*Falco mexicanus*), and ring-necked pheasant. At the adjacent Nine Canyon, a great blue heron and several ring-necked pheasant fatalities were documented since the start of project operations in 2002. This section provides a brief species account, describes the patterns of occurrence and behavior observed during pre-construction surveys, and summary of fatalities at different spatial scales. In the absence of post-construction data regarding impacts from solar energy development to these species of management concern, and to avoid speculating on causal mechanisms that influence impacts, species are discussed in the context of the wind energy component of the Project.

6.2.1 Sandhill Crane

The sandhill crane is listed as a state endangered species (WDFW 2020a). Populations of greater (*Antigone canadensis tabida*) and lesser (*A. c. canadensis*) sandhill crane that overwinter in the California Central Valley fly through the Project Area during spring and fall on the way to breeding areas in British Columbia and Alaska. In Washington, sandhill cranes are known to breed only in Yakima and Klickitat counties, east of the Project. Croplands and grasslands interspersed with wetlands provides stopover and staging areas in eastern Washington. Populations of both subspecies have increased within the last 10 years (Stinson 2017).

Sandhill crane observations totaling 3,050 cranes in 27 groups were recorded during point count surveys conducted during 2017 − 2020. The average flight height when first observed was approximately 253 m agl (range of 45–500 m agl). Of the 26 groups with flight height data, eight groups (31%) were observed flying within the RSH (25−150 m agl) at any point during the observation. This represents approximately 14% of the total number of observations recorded during surveys. No sandhill cranes were observed on the ground, either foraging or loafing. The majority of groups occurred during fall (19 groups), and which typically flew higher (average of

289 m agl) than groups recorded during spring (seven groups, average of 156 m agl). Although croplands are the primary land cover type in the Project Area, characteristic stopover habitat (croplands interspersed with wetlands) are mostly absent from the Project Area, which reduces the likelihood that sandhill cranes will land in the Project, thus reducing their exposure to collisions with turbines. Occurrence of sandhill cranes within or flying over the Project Area are migratory individuals, likely crossing over the Horse Heaven Hills to preferred staging areas north of the Tri-cities areas and near Othello, Washington (Stinson 2017, ebird 2020).

Sandhill cranes do not appear to be particularly susceptible to collision with Turbines. The three fatalities documented in the US were one individual at an older-generation facility at Altamont Pass in California (Smallwood and Karas 2009), and two fatalities in west Texas (Gerber et al. 2014, Navarrete and Griffis-Kyle 2014). Studies at wind facilities in other parts of the US have shown that sandhill cranes are likely to avoid Turbines despite relatively high numbers of sandhill cranes observed within and surrounding the wind facilities (Nagy et al. 2012, Pearse et al. 2016, Derby et al. 2018). No sandhill crane fatalities have been documented at the adjacent Nine Canyon since operations began in 2002.

Because the absence of suitable stopover habitat within the Project Area, flight behavior at heights typically above the RSH, the lack of fatalities at Nine Canyon, and the available data regarding this species' avoidance of Turbines, impacts to sandhill crane resulting from Project operation are anticipated to be relatively low.

6.2.2 American White Pelican

The American white pelican is listed as a state threatened species (WDFW 2020a). The species is considered a breeding resident and has one of the largest breeding colonies in the US located on Badger Island, four mi east of the Project on the Columbia River (Stinson 2016). The population on Badger Island has increased approximately 86% since 2009, to 3,267 total individuals. Breeding colonies are exclusively located on islands and the birds forage for salmonids and other bait fish. Populations have increased steadily since the mid-1990's (Stinson 2016).

American white pelican observation totaling 877 birds in 76 groups were recorded during point count surveys conducted from 2017 − 2020. The average flight height when first observed was approximately 130 m agl (range of 10−400 m agl). Of the 76 groups with flight height data, 61 groups (80%) were observed flying within the RSH (25−150 m agl) at any point during the observation. This represents approximately 83% of the total number of observations recorded during surveys. The majority of observations (82%) and groups (82%) occurred during summer at an average flight height within the RSH (Table 14). Of the 76 groups, all but four groups (94%) were recorded at point counts located in the eastern half of the 2018 − 2019 Four Mile Survey Area, which has been removed from the current Project Area.

Table 14. American white pelican flight heights recorded point counts conducted from 2017 − 2020 at the Horse Heaven Wind Farm, Benton County, Washington.

Season	# Obs	# Grps	Min. Flight Height (m)[a]	Max. Flight Height (m)[a]	Ave. Flight Height (m)[a]	Standard Deviation (m)
Fall	111	3	140	400	250	136
Spring	52	11	60	325	209	79
Summer	724	62	10	325	111	56
Total (Average)	887	76	(70)	(350)	(190)	(90)

[a] flight height when first observed
grps= groups, m = meters, max = maximum, min = minimum, obs = observations

No American white pelican foraging or breeding habitat is located within the Project Area, which reduces the likelihood that American white pelicans will land in the Project, thus reducing their exposure to collisions with Turbines. However, because of the relatively large resident population within four mi of the Project, individuals can occur within the Project during all seasons except possibly in winter. American white pelicans can potentially migrate over the Horse Heaven Hills or occur in the Project when traversing between foraging areas along the Columbia River. The relatively high abundance of American white pelicans observed in closer proximity to the Columbia River suggests the far eastern corner of the Four Mile Survey Area serves as a flyway, or short cut between foraging areas along the Columbia River and the breeding colony on Badger Island. The exclusion of this area from the current Project Area design reduces the collision exposure of American white pelicans with Turbines at the Project.

Although there is no suitable foraging and breeding habitat within the Project Area, areas of high American white pelican use have been excluded from the Project, and no fatalities have been documented at the adjacent Nine Canyon (Erickson et al. 2003a, Energy Northwest 2020), occasional use of the Project Area by American white pelicans can continue. Spatial and temporal patterns suggest exposure of collision with Turbines would be relatively higher at Turbines constructed in the far eastern half of the Project and exposure would increase during the summer months.

6.2.3 Golden Eagle

The golden eagle is protected by the BGEPA and is considered a state candidate for listing as well (WDFW 2008, WDFW 2020a). The Washington populations contains both breeding resident and migratory individuals (Watson and Whalen 2004). Open, arid plateaus deeply incised by canyons and shrub-steppe and grassland habitat characterize golden eagle habitat. Nests are most often located on prominent, steep cliffs; jackrabbits (*Lepus* spp.), yellow-bellied marmot (*Marmota flaviventris*), rock pigeon, and small mammals are preferred prey items (Watson and Whalen 2004). In 2014, the population in BCR 9 composed approximately 41% (*n* = 6,596 eagles) of individuals in the Pacific Flyway (USFWS 2016b). Population trend estimates of golden eagles in Washington have been stable to slightly declining based on breeding bird survey route data from 1993 − 2019 (Pardieck et al. 2020).

Seven golden eagle observations in seven groups were recorded during point count surveys conducted during 2017 – 2020. Four observations of adults and three observations of juveniles were recorded with five of the observations in fall (72%), and the remainder in spring. Golden eagles were not observed in the Survey Area during summer or winter. Excluding one observation of a juvenile perched in a field, the average flight height when first observed for the remaining six observations was approximately 88 m agl (range of 50−250 m agl). Once the perched individual took flight, all seven of the eagle observations were recorded flying within the RSH at any time during the observation for a total of 58 exposure risk minutes. Two observations (one adult and one juvenile) composed 45 minutes (approximately 78%) of the total 58 risk exposure minutes. Eagles were entering and leaving the survey plot and circling above the observer. The disproportionally high number of minutes attributed to a relatively few observations may mischaracterize the actual exposure risk of collisions with Turbines at the Project.

Although suitable golden eagle nest habitat is located along large cliffs adjacent to the Columbia River, four to six mi southeast of the Project, no golden eagle nests were observed within 10 mi of the Project during the 2018 – 2019 aerial surveys that surveyed the cliff areas. Using a 9-year study of 17 golden eagles within the Columbia Plateau, Watson et al. (2014) cautioned wind development within eight mi of an active golden eagle nest. However, the USFWS currently recommends golden eagle surveys within two mi of a Project footprint based on their analysis of the home range of 101 breeding golden eagle (USFWS 2020b).

Of the 10 golden eagle fatalities reported in the Pacific Region, two were reported in Washington. Because of the sensitive nature of any eagle fatality, golden eagle fatalities are likely underrepresented in publicly available literature and databases (e.g., Pagel et al. 2013 and WEST 2019). No golden eagle fatalities have been reported at Nine Canyon since the beginning of operations in 2003 (Energy Northwest 2020). However, because of relatively consistent use of the Project Area during migration that was documented over several years, golden eagles will likely continue to occur within the Project Area during Project operation and there will be continued exposure and some associated collision risk. Impacts to golden eagles can be better quantified through the additional modeling and cumulative impacts assessment, which is outside the purpose of this BBCS. Avoidance and minimization measures that reduce the likelihood of impacts to golden eagles are discussed in Chapter 7.

6.2.4 Bald Eagle

The bald eagle is protected by the BGEPA. The species is considered a year-round resident in the region of the Project. The open waters of the Columbia and Yakima rivers that remain ice free year-round and are lined with large deciduous trees provide foraging and nesting habitat. The population has shown a 28% annual increase since 2005, with new territories being established annually (Kalasz and Buchanan 2016). In 2005, Stinson et al. (2007) estimated territory density exceeded carrying capacity by over 100 active territories. Population growth indicates that new territories are likely being occupied by previously non-breeding adults (Stinson et. al. 2007).

Ten bald eagle observations in 10 groups were recorded during point count surveys conducted during 2017 – 2020. Juveniles and one sub-adult composed 80% of the observations, with six of the observations recorded in winter, three in spring, and one in fall. Bald eagles were not observed in the Survey Area during summer. No winter eagle roosts were observed in the Project Area.

The average flight height when first observed for all observations was approximately 75 m agl (range of 5−150 m agl). All 10 of the observations were recorded flying within RSH at any time during the observation, for a total of 31 exposure risk minutes. The number of observations were divided equally between HHE and HHW. Although no eagle nests were located within the Project Area, six occupied territories comprising seven nests were located along the Yakima and Columbia Rivers in 2019; the nearest nest was approximately 2.8 mi from the Project Area.

The Project Area lacks aquatic foraging habitat and trees suitable for eagle nesting. The absence of bald eagle observations in the Project Area during summer can reflect the tendency for adults to have smaller home ranges and higher site fidelity as a function of eagle nest-tending behaviors (Stalmaster 1987). As a result, exposure appears proportionately lower during the summer nesting period compared to other periods of the year when eagles can potentially migrate through the Project Area or fly inland for winter-killed prey. In winter, fish can become unavailable due to ice or dropping to lower water depths out of a bald eagle's reach, which can pressure bald eagles to utilize other prey items (Watson et al. 1991).

Because of the sensitive nature of any eagle fatality, the single bald eagle fatality documented in the Pacific Region at a Washington wind facility (per Pagel et al. 2013 and WEST 2019) likely underrepresents the number of actual fatalities. No bald eagle fatalities have been reported at Nine Canyon since the beginning of operations in 2003 (Energy Northwest 2020). Bald eagles will likely continue to occur within the Project Area during Project operation and there will be continued exposure to collision risk. However, based on the relatively low number of documented fatalities in Washington, increasing populations on a national, regional and state scales (Kalasz and Buchanan 2016) impacts to bald eagle are anticipated to be relatively low. Potential direct and indirect impacts to bald eagles would be reduced through implementation of conservation measures (see Chapter 7).

6.2.5 Ferruginous Hawk

The ferruginous hawk is listed as a state threatened species (WDFW 2020a). The species occurs in Washington only during the summer nesting period, followed by dispersal east to the Rocky Mountains to exploit ground squirrels, follow by migration to central California where the hawks spend the winter (Watson et al. 2018). Population trend estimates in Washington have been steadily declining based on breeding bird survey route data from 1993 − 2019 (Pardieck et al. 2020).

Four ferruginous hawk observations in four groups were recorded during point count surveys conducted from 2017 – 2020. The average flight height when first observed was approximately 48 m agl (range of 5−120 m agl). Of the four observations, three were during spring, one during fall, and all were within the HHW Survey Area during 2018. Observations occurred at three point counts nearest to an active nest that was located approximately two mi away. Observations of ferruginous hawks at exclusively at point counts nearest to an active nest suggests increased use is associated with territory occupancy. Although the majority of historic ferruginous hawk nests in the Survey Area were located on [redacted] 13 [redacted] of the Project Area, all nests available for breeding birds but inactive during the three years of aerial surveys. The active nest was located relatively 13 [redacted]. A 2010 survey of 192 ferruginous hawk territories in Washington resulted in the lowest number of occupied territories (19%) over a 14-year period, which indicates a persistent population decline in Washington (WDFW 2013). Predation at ground nests from predators such as such coyotes (*Canis latrans*), which were observed during surveys can contribute to reduced nest occupancy, and compound with other factors, such as habitat loss and associated prey abundance (Richardson 1996).

Of the five ferruginous hawk fatalities recorded in the Pacific Region, four have been documented at three different wind facilities in Washington. Exposure to Turbine collision risk present primarily during the breeding season and migration, when the species occurs in the region. Use of the Project Area by ferruginous hawk will likely continue following construction. Exposure to Turbine collision risk likely increases at Turbines in proximity to occupied territories, particularly if the nest is active during the nesting period (Kolar 2013). Due to past nesting activity in the Horse Heaven Hills and the overall relatively low territory occupancy in the region, impacts to ferruginous hawk can result in abandonment of the nest territories located closer to Project facilities, particularly because of the tendency of the species to avoid human development and activity (Richardson 1996). Project operations can further reduce territory occupancy and nest success of ferruginous hawk within the Horse Heaven Hills. To avoid and minimize potential impacts to ferruginous hawk, HHWF will implement spatial and seasonal restrictions on ground disturbing activities, per WDFW recommendations (Chapter 7).

6.2.6 Sagebrush Sparrow and Sage Thrasher

The sagebrush sparrow (*Artemisiospiza nevadensis*) and sage thrasher (*Oreoscoptes montanus*) are both considered state candidates for listing in Washington (WDFW 2008). Both species are sagebrush obligates that rely on relatively large patches of intact sagebrush for breeding, but can also occur in smaller fragments of sagebrush among agricultural fields (Buseck et al. 2004, Holmes and Johnson 2005). Population trend estimates in Washington have been relatively stable to slightly increasing for both species based on breeding bird survey route data from 1993 − 2019 (Pardieck et al. 2020).

One sagebrush sparrow, observed in spring, and three sage thrasher observations (one incidentally in spring and two in fall) were observed perched and flying low (less than six m agl) between bushes and fences within a grassland. Of the two sagebrush sparrows and one sage thrasher fatalities recorded at wind facilities in the Pacific Region, one of each species has occurred in Washington. Considering the timing of these observations and lack of large patches of sagebrush habitat within the Project, the observations were likely of individuals migrating through the Project and not a breeding resident.

Based on the presence of the two species and relatively small patches of suitable nesting and foraging habitat within the Project Area, the species are likely to occur during Project operations. Due to the high fragmentation of sagebrush patches throughout the majority of the Project, individuals are more likely migrating through the Project than breeding; thus, displacement of breeding individuals will be lower at the Project compared to other areas of higher-quality shrub-steppe. Based on the relatively low number of reported fatalities at facilities in Washington and larger spatial scales, the number of fatalities is anticipated to be comparatively low.

6.2.7 Prairie Falcon

The prairie falcon is considered a state priority species (WDFW 2008). The species is considered a year-round resident, with the largest wintering populations located in the Columbia Basin, which includes Benton County (Hays and Dobler 2004). The broad basalt rock cliff faces that line the Columbia River provide nesting habitat, while upland grassland and cropland fields offer foraging habitat. The composition of prey items reflects prey abundance; horned larks have been documented as a particularly important prey species within winter wheat (*Triticum aestivum*) crop habitat (Snow 1974, Beauvais and Enderson 1992), which is dominant crop type in the Project Area. Population trend estimates for prairie falcon in Washington have been steadily increasing based on breeding bird survey route data from 1993 – 2019 (Pardieck et al. 2020).

Thirty observations of prairie falcon in 30 groups were recorded during point count surveys conducted from 2017−2020. The average flight height when first observed was approximately 30 m agl (range of 2−85 m agl). Prairie falcons were observed during all seasons, the majority (73%) of which were during fall and spring, combined. Of the 26 observations with flight height data, 18 groups (69%) were flying within the RSH at any time during the observation. Of the 30 observations, 19 groups (63%) were either perched or actively hunting. Observations occurred evenly among cropland and grassland habitat types.

Of the three prairie falcon fatalities reported in the Pacific Region, two were from Washington (WEST 2019). Use of the Project by prairie falcons during Project operation will likely continue. Exposure to Turbine collision may increase during fall and winter when individuals occur more often within the Project Area. Use of the Project Area during spring and summer was relatively lower, which reduces the likelihood of collision and resulting potential nest failure during the breeding season. Despite suitable foraging habitat and use within the Project area, impacts to prairie falcons are anticipated to be low because of the relatively low number of fatalities reported at wind facilities in the region.

6.2.8 Loggerhead Shrike

The loggerhead shrike is considered a state candidate for listing (WDFW 2008). The species is considered a permanent breeding resident, with a relatively small migratory population (Vander Haegen 2004). Loggerhead shrikes in eastern Washington use lowland communities of shrub-steppe and grassland for foraging, and prefer trees and shrubs with dense foliage for nesting. Breeding populations in eastern Washington are discontinuous with distribution of other populations in the US (Dechant et al. 1998). Annual population estimates of loggerhead shrikes in Washington appear to fluctuate widely; however, trend estimates indicate a slightly declining population based on breeding bird survey route data from 1993 − 2019 (Pardieck et al. 2020).

One loggerhead shrike was observed incidentally to point count surveys in HHE during summer. The maximum flight height of the individual was three m agl. Based on the timing of the observation, the individual could have been nesting in the area. Nesting habitat in the Project

Area includes isolated hedgerows, plantings around abandoned homesteads, and isolated patches of sagebrush (*Artemisia* spp.).

One fatality of a similar species, the northern shrike (*Lanius borealis*), has been reported in the Pacific Region at a wind facility in Washington (WEST 2019). Loggerhead shrikes are expected to occur within the Project Area during operation; however, based on the relatively low number of observations during the survey period, the likelihood of collision appears low.

6.2.9 Tundra Swan

The tundra swan (*Cygnus columbianus*) is considered a state priority species (WDFW 2008). The species migrates through eastern Washington to wintering ground in California and Nevada, and returns to travel back to nesting grounds in the Arctic tundra (Limpert et al. 2020). A relatively small number of tundra swans may overwinter in eastern Washington. Mid-winter surveys conducted between 1949 − 2015 of this species in the Pacific Flyway show a steadily increasing population index (Pacific Flyway Council 2017). Western populations are managed to maintain a robust population to provide recreational hunting opportunities along the Pacific Flyway.

One group of 35 individual tunda swans were observed flying north during March at a flight height of 15 m agl (range of 5–30 m agl). Individuals were observed taking off from an agricultural field. Waterfowl, including tundra swans, can forage on the waste grain in wheat fields following harvest.

No tundra swan fatalities have been reported at wind facilities in Pacific Region and waterfowl as a type appear relatively less susceptible to Turbine collisions. Of the 1,351 fatalities comprising122 species reported at wind facilities in Washington, six Canada geese (less than 1%) were reported from the waterfowl type. Despite use by relatively large groups of waterfowl in the region, particularly during migration, waterfowl fatalities do not appear to increase with higher use. Croplands in the Project Area provide foraging habitat for waterfowl, for tundra swans and landing in fields may increase exposure to collisions with Turbines; however, the absence of wetlands and other waters in the Project Area, and the general lack of documented fatalities within the areas of the Pacific Region and State with comparatively robust waterfowl populations suggests impacts to tundra swan will be low.

6.2.10 Great Blue Heron

The great blue heron is considered a state priority species (WDFW 2008). The species is considered a permanent breeding resident and nests in large conspicuous rookeries along large streams and rivers, particularly along the Yakima River and Columbia River (Azarrad 2012, WDFW 2020b). Low levels of human disturbance at rookeries can potentially cause nest failure and abandonment, which has resulted in extra management concern. Population trend estimates for great blue heron in Washington have been relatively stable based on breeding bird survey route data from 1993 − 2019 (Pardieck et al. 2020).

One great blue heron was observed flying approximately 50–70 m agl in winter over a grassland. Of the four fatalities reported in the Pacific Region, three fatalities were found at wind facilities in

Washington, of which one fatality was discovered at Nine Canyon during standardized post-construction monitoring surveys in 2003 (Erickson et al. 2003, WEST 2019). The fatality at Nine Canyon was found in February, which is consistent with the season the species was observed during point count surveys. During the non-breeding season (fall and winter), adult and juvenile herons often prey on small mammals in fallow, freshly plowed, or mowed fields and in grasslands (Azarrad 2012). Individuals in nest rookeries along the rivers surrounding the Project may move inland to forage in the upland grassland and grain fields in the Project during fall and winter.

Based on the presence of the species, suitable foraging habitat within the Project Area, and documented fatalities at an adjacent wind facility, impacts to individual great blue herons from Project operation can potentially occur. Based on fatalities at facilities in the Pacific Region, the number of fatalities is anticipated to be comparatively low.

6.2.11 Ring-Necked Pheasant

The ring-necked pheasant is considered a state priority species and Benton County is within a primary pheasant management zone (WDFW 2008). Native to Asia, the species is a resident, non-native species and a recreationally important upland game bird. Because of the species' popularity for hunting, and the importance of associated revenue, habitat restoration programs have focused on improving ring-necked pheasant habitat (Ware and Tirhi 2004). Since 2006, populations have undergone a steady decline because of advances in farming technology/practices and loss of habitat (WDFW 2017).

Ten observations of ring-necked pheasant in 10 groups were recorded during point count surveys conducted from 2017 − 2020. No ring-necked pheasant were observed flying and 60% of the observations were of auditory calls. Habitat where the birds were observed was split evenly between cropland and grasslands. The seasons when the birds were observed were split roughly evenly between spring (60%) and summer (40%). Of the 10 groups recorded, seven were in HHW and three were in HHE.

Ring-necked pheasant are the seventh most common fatality reported at wind facilities in Washington (WEST 2019). Forty-six fatalities have been reported at seven wind facilities in Washington, which represents approximately 52% of the ring-necked pheasant fatalities in the Pacific Region (WEST 2019). Although a relatively common fatality at wind facilities, the cause of mortality has not always been clearly associated with Turbine operation. Of the 36 bird fatalities recorded during standardized post-construction monitoring surveys at Nine Canyon, five (14%) were ring-necked pheasants (Erickson et al. 2003). All fatalities consisted of feather spots, which indicates carcasses were scavenged prior to discovery by surveyors, and two of the five fatalities were at roost spots, which suggests predation could have been the cause of mortality (Erickson et al. 2003). Subsequent to the study by Erickson et al. (2003), one additional pheasant fatality was recorded in 2010 during operational monitoring at Nine Canyon (Energy Northwest 2020). The whole carcass was discovered at the base of the Turbine tower, presumably after hitting the tower.

Based on the presence of the species, suitable habitat within the Project Area, and documented fatalities at an adjacent wind facility, impacts to individuals from Project operation are likely to occur. Fatalities of upland game birds have been recorded through the US and Europe, and because upland game bird species rarely fly within the RSH, fatalities are most often attributable to collisions with towers, vehicles, or non-project related sources such as predation (WEST 2019, Choi et al. 2020). Other impacts include habitat removal or modification from Project construction. The various sources of mortality for game bird species underscores the diverse minimization measures the Project has implemented to minimize impacts to game birds (Chapter 7).

6.3 Bats

Eight species of bats were recorded within the Project (Hays et al. 2018a, 2018b, 2019) out of the 15 species that occur in Washington (Hays and Wiles 2013). The majority of bat passes recorded in the Project were produced by three low-frequency bat species: silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), and big brown bat (*Eptesicus fuscus*). For both study years combined, calls by silver-haired bat and hoary bat were documented on 22% and 11% of detector-nights, respectively. No federally or state-listed bat species were detected during the studies Impacts to bats from the construction and operation of the Project could include both direct and indirect impacts.

Direct impacts to bats as a result of collisions with operational Turbine blades is the main source of mortality at wind projects (Grodsky et al. 2011, Rollins et al. 2012), but the underlying reasons for why bats fly near Turbines are still largely unknown (Hein and Schirmacher 2016).

6.3.1 Direct Impacts

Collision fatalities at wind energy facilities are considered by many to be one of the greatest threats to bat populations in North America (O'Shea et al. 2016). The primary cause of bat fatalities at wind facilities are collisions with moving Turbine blades (Grodsky et al. 2011, Rollins et al. 2012) and 24 of 47 bat species in the continental US and Canada have been found as fatalities at wind energy facilities (Arnett and Baerwald 2013, AWWI 2018b). It is unknown why bats regularly fly in close proximity to operating Turbines (Cryan and Barclay 2009, Hein and Schirmacher 2016), although many of the hypotheses consider that at least some bat species can be attracted to Turbines (Cryan 2008, Barclay et al. 2017).

As of 2016, PCFM studies at wind energy facilities show that: migratory tree-roosting bat species (e.g., eastern red bat [*Lasiurus borealis*], hoary bat, and silver-haired bat) compose approximately 72% of reported bat fatalities; the majority of fatalities occur during the fall migration season (August and September); and most fatalities occur on nights with relatively low wind speeds (e.g., less than 6.0 m/second; AWWI 2018a, 2018b). According to the AWWI (2018b), eight bat species composed over 95% of the bat fatalities in the US between 2006 − 2016[4]. WEST has compiled

[4] AWWI (2018) reported 12,661 total bat fatalities, including included hoary bat (31.85%), eastern red bat (24.03%), silver-haired bat (16.14%), Mexican free-tailed bat (*Tadarida brasiliensis* 9.98%), little brown bat (*Myotis lucifugus;* 5.11%), big brown bat (5.02%), tri-colored bat (*Perimyotis subflavus*; 1.71%), and evening bat (*Nycticeius humeralis*; 1.67%; AWWI 2018b).

publicly available data from 64 studies across 52 wind energy facilities in Washington reporting five species of bats as fatalities (WEST 2019). Two species of migratory tree bats detected at the Project composed the majority of the 639 bat turbine fatalities reported in Washington: hoary bat (52%) and silver-haired bat (44%; WEST 2019). Although tree roosting migratory bat species compose the majority of bat fatalities at wind projects in US, each species detected during acoustic monitoring surveys at the Project (*see* Table 11) has been documented at a wind facility in the US. The disproportionate effect on a small number of bat species suggests impacts to bats at the Project will be species-specific and consistent with the species composition of fatalities found at wind facilities in the region.

The AWWI (2018b) has compiled publicly available data from wind energy facilities in the US, and the median adjusted fatality estimate was 2.6 bats/MW/year (range of less than one to 50 bats/MW/year; AWWI 2018b). In Washington, fatality estimates from 13 facilities had a median adjusted fatality rate of 1.4 bats/MW/year (range of 0.4−2.5 bat/MW/year; WEST 2019). The bat fatality rate of 2.47 bat/MW/year at Nine Canyon approximated the national median estimate, and consisted entirely of hoary bats and silver-haired bats during the spring and fall (Erickson et al. 2003a, WEST 2019).

Because of the differences in the technology involved, bat fatalities at PV solar facilities are uncommon compared to concentrating solar thermal plants which generate energy by concentrating solar power (CSP) to drive conventional steam turbines (Kosciuch et al. 2020). PV solar does not include the air-cooled condenser systems that are installed at CSP facilities where bats fatalities occur. Thus, direct impacts to bats are not anticipated from the development of the PV solar project.

These summaries of the species composition of bat fatalities that occur in the US and Washington provide insight into species that can be expected as fatalities at wind facilities in this region. The range and timing of bat fatalities observed in Washington can be expected to encompass the impacts anticipated at the Project, although there is uncertainty in this prediction because the comparatively wide regional differences in habitat among wind projects in Washington and the limited duration and extent of PCFM at Nine Canyon. For example, bias trials to account for observer detection bias and carcass persistence were not conducted for bats at Nine Canyon (Erickson et al. 2003a).

It is anticipated that direct impacts to bats will be consistent with the species composition and timing observed at other facilities in US and Washington. It is likely that bat mortality at the Project, would: a) within the range of other facilities in Washington; b) consist primarily of migratory, tree-roosting species (e.g., silver-haired bat, hoary bat); and c) occur mainly in the fall. PCFM will be conducted at the Project using contemporary survey protocols and statistical methods to determine the level of impact to bats from Project operations (see Chapters 7 and 8).

6.3.2 Indirect Impacts

Understanding how wind energy development could affect bats through indirect effects, such as disturbance or displacement, is relatively limited by the lack of knowledge on this topic (Kunz et al. 2007). Any bats roosting in the Project can be temporarily disturbed by human activities, although because of the absence of large forested areas, rock outcrops and cliffs providing roost habitat, it is not anticipated that operation of the Project would permanently disturb or displace roosting bats.

Habitat disturbance and modification from the construction of the wind and solar facilities would eliminate or degrade bat foraging habitat. The effect on bat foraging habitat from construction of the solar Project is likely greater than the wind Project because of the total area involved; however, the impacts to foraging habitat on a landscape scale would likely have relatively low impacts on local or migratory populations because of the availability of bat foraging habitat throughout the Horse Heaven Hills.

6.4 Habitat Loss or Alteration

Construction of the Project will result in temporary and permanent impacts to bird nesting habitat and foraging habitat by the removal or disturbance of vegetation and further fragmentation of the landscape. Priority Habitats, as defined by WDFW (2009), which include shrub-steppe and eastside (interior) grasslands, are located within the Project and can potentially be impacted. However, preliminary Project designs and layout have been developed in manner that avoids impacts to these habitat types and prioritizes development in previously disturbed areas and croplands which have less relative value to wildlife species. Removal of patches of trees suitable for bat roosting or maternity colonies in not anticipated. Restoration and mitigation of impacts to Priority Habitats and bird species will be consistent with the conservation measures discussed in Chapter 7 and by the WDFW (2009).

The total area and intensity of habitat disturbance and modification are different between wind energy development and solar energy development. Habitat disturbance associated with construction of the wind facility is anticipated to be relatively low compared to the development of the solar energy facility where nearly all habitat within the security fence surrounding the solar arrays will be disturbed to accommodate project infrastructure. Avoidance and minimization measures for each type of development have been integrated into Chapter 7 and will follow best management practices (BMPs) to the extent practicable (The Nature Conservancy 2019).

7.0 AVOIDANCE AND MINIMIZATION MEASURES

Information gathered during Tier 1, Tier 2, and Tier 3 studies will be used during the Project design and Turbine and infrastructure siting process to reduce potential impacts to birds and bats and the species' habitats. As part of the Energy Facility Site Evaluation Council process for approval of the Site Certificate, the Project will implement the applicable BMPs and mitigation measures specified Final Order. HHWF is committed to avoiding and/or minimizing impacts to wildlife through Project design, construction, and operation by implementing the following avoidance and minimization measures.

7.1 Preconstruction Site Selection and Project Design

7.1.1 Turbine Siting

- Federally listed avian or bat species are unlikely to occur within the Project, nor does the Project contain USFWS-designated critical habitat for these species.
- The Project is sited outside of areas designated for environmental resource conservation, such as Areas of Critical Environmental Concern, Important Bird Areas, National Wildlife Refuges, Wilderness Areas, important migratory pathways or stopover sites, or other specially designated areas.
- All wetlands, conservation easements, protected lands, and USFWS –designated critical habitat will be avoided.
- Turbines and associated facilities for the Project will be sited with consideration for the topographic and environmental characteristics of the site, efficiency of selected Turbine models, and minimal impacts to area residents.

7.1.2 Turbine Design

- Several alternative Turbine locations were developed to provide an opportunity to avoid or minimize potential impacts to natural resources and to work around potential issues that can potentially arise during development of the Projects.
- To the extent commercially reasonable, HHWF will maximize power generation per Turbine to reduce the number of Turbines needed to achieve maximum energy production.

7.1.3 Lighting

- Unnecessary lighting will be turned off at night to limit attraction of migratory birds. Lighting guidelines, where applicable, from the WEG will be followed. This includes using lights with timed shutoff, downward-directed lighting to minimize horizontal or skyward illumination, and avoidance of steady-burning, high-intensity lights. All internal Turbine nacelle and tower lighting will be extinguished when unoccupied by maintenance staff.
- The Turbines and met towers will be lit in accordance with the Federal Aviation Administration (FAA) requirements (FAA 2020).

7.1.4 Collector and Transmission Lines

- The up to 19 mi transmission line will be located in areas where HHWF has site control, and to the extent possible, in areas where previous disturbance has occurred, thereby minimizing impacts to habitat and associated wildlife.
- Where applicable, the Project's aboveground power lines and collection systems shall be designed and constructed to minimize avian electrocution, referencing guidelines outlined in APLIC standards (APLIC 2006, 2012). Overhead lines may be constructed in select locations to span intermittent streams, if applicable based on the final Project design.

- The underground communication cables and power collection system will be buried along the access roads in trenches extending from each of the Turbines to the Project's substation where practicable; lines will be buried along both private and public rights-of-way.

7.2 Construction

Construction of the Project is expected to begin in fourth quarter of 2021 and occur over a period of approximately 12 months (excluding times when the weather prevents construction activities). The following BMPs will be incorporated into the design and construction of the Project's facilities, as relevant and applicable:

7.2.1 Compliance and Reporting

- HHWF will comply with all applicable federal, state, and local environmental laws, orders, and regulations.
- Prior to construction, all supervisory construction personnel will be instructed on the BBCS and wildlife resource protection measures, including: 1) applicable federal and state laws (e.g., those that prohibit animal collection or removal); and 2) the importance of these resources and the purpose and necessity of protecting the resources, and ensuring this information is disseminated to applicable contractor personnel, including the correct reporting procedures.
- Construction personnel will be trained in the following areas when appropriate: awareness of sensitive bird species, potential bird nesting areas, potential bat roosting/breeding habitat, and general wildlife issues.
- Personnel will be instructed to use the HHWF incidental reporting process to document bird or bat casualties during construction at the Project.

7.2.2 Roads

- Traffic will be restricted to roads associated with the Project; use of unimproved roads will be minimized to the extent possible. Following Project construction, temporary access roads made for component delivery and not needed for site operations will be restored to native vegetation.
- Speed limits will be set to ensure safe and efficient traffic flow; signs will be placed along roads, as necessary, to identify speed limits, travel restrictions, and other standard traffic control information.

7.2.3 Stormwater and Erosion

- A Storm Water Pollution Prevention Plan (SWPPP) will be prepared and implemented, as required by the USEPA and the Washington Department of Ecology; the SWPPP will include standard sediment control devices (e.g., silt fences, straw bales, netting, soil stabilizers, check dams) to minimize soil erosion during and after construction.

- Storm water management practices will be implemented to minimize open water resources that can attract birds and bats.
- HHWF will be implemented for revegetation, soil stabilization, and erosion reduction measures to ensure temporary use areas are restored when no longer needed.

7.2.4 Wildlife and Vegetation

- The existing road network will be used to reduce the need for road construction, as well as minimizing disturbance to Priority shrub-steppe habitat as defined by WDFW 2009. HHWF will avoid siting Project components in wetlands and waterbodies.
- Per WDFW recommendations, wind turbine buffer zones will be established around known raptor nests (0.25-mi buffers) if site evaluations show that proposed construction activities would pose a risk of nest abandonment or failure to avian species of concern.
- To the extent commercially reasonable, un-guyed met towers will be used for permanent wind monitoring to minimize collision risk to birds and bats.
- During construction, existing trees, vegetation, water resources, and wildlife habitat will be protected and preserved to the extent practical.
- Noxious weed control measures will be implemented as specified by county, state, and federal requirements.
- All herbicide and pesticide mixing and applications will be conducted in accordance with all federal, state, and local laws and regulations and the specific product's label; herbicides and pesticides will only be directly applied to localized spots and will not be applied by broadcasting techniques.
- Gravel will be placed at least five ft around each Turbine foundation to discourage small mammals and reptiles from burrowing under or near Turbine bases.
- All trash will be covered in containers and work sites will be cleared regularly of any garbage and debris related to food.
- Pets will not be allowed in the Project Area.
- To the extent feasible, the area required for Project construction and operation will be minimized. HHWF will develop a restoration plan for restoring all areas of temporary disturbance to previous conditions, including the use of native species when seeding or planting during restoration. The restoration plan will ensure:
    - All areas disturbed temporarily by Project construction will be restored, including temporary disturbance areas around structure construction sites, laydown/ staging areas, and temporary access roads;
    - Topsoil salvage will be included in all grading activities;
    - Conduct habitat restoration activities in accordance with obligations in the wind leases.

7.3 Operations and Maintenance

The following BMPs will be implemented during the O&M phase of the Project, as relevant and applicable:

7.3.1 Operational Procedures

- Two years of standardized PCFM will be conducted to assess impacts of Turbine operation on birds and bats.
- All carrion (with the exception of birds and bats) discovered on site during regular maintenance activities will be removed and disposed of in an appropriate manner to avoid attracting eagles and other raptors; birds and bats discovered on site will be addressed in conformance with the Project's incidental reporting process and the PCFM protocols.
- Appropriate storm water management practices that do not create attractions for birds and bats will be implemented.
- Fire hazards from vehicles and human activities will be reduced (e.g., use of spark arrestors on power equipment, avoiding driving vehicles off roads, allowing smoking in designated areas only).
- Vehicle speeds will be limited to 25 mi per hour to avoid wildlife collisions.
- Noxious weed control measures will be implemented, as specified by county, state, and federal requirements.
- Other than maintenance vehicles, which will park at the entrance of Turbines for maintenance purposes, parts and equipment which can be used as cover for prey will not be stored at the base of Turbines while a Turbine is operational.

7.3.2 Training

- All of HHWF's employees and contractors working on site will receive worker awareness training for identifying and responding to encounters with sensitive biological resources, including avian and bat species. The training:
  - Will be conducted by HHWF or HHWF's designee.
  - Will instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons.
  - Will include instruction on identification and protection of plant and wildlife species and significant natural plant community habitats, the issue of microtrash and its effects, fire protection measures, and measures to minimize the spread of weeds during operation, as well as hazardous material spill and containment measures.
  - Will include a flyer in the O&M building and/or construction trailer(s) detailing information on potential state and federal special-status animal and plant species that could be discovered on the Project site.

- o Will include a Wildlife Incident Reporting and Handling System (WIRHS) that describing the steps O&M staff will take if a wildlife fatality is encountered.
- o Will include an overview of the distribution, general behavior, and ecology of golden and bald eagles. Employees will be informed that they are not authorized to approach, handle, or otherwise move any eagles that could be potentially be during construction or operation, whether alive, injured, or deceased. In the event of an eagle fatality, a structured reporting system will be followed to notify the HHWF Project managers and follow the appropriate notification protocols to report the fatality to the USFWS within 24 hours of positive identification of the fatality as an eagle.

8.0 POST-CONSTRUCTION MONITORING: TIER 4

8.1 Tier 4a – Avian and Bat Fatality Monitoring

PCFM is a critical component of this BBCS. The primary objective of fatality monitoring is to estimate avian and bat mortality at the Project and to determine whether the estimated fatality rate is lower, similar to, or higher than the average fatality rates observed at other regional projects. To structure the scope and scale of the PCFM program, WDFW (2009) recommends a Technical Advisory Committee (TAC) is formed. The role of the TAC is to review results of PCFM data and make suggestions to the project owner and permitting authority regarding the need to adjust mitigation and monitoring requirements based on results of monitoring data and relevant data. Potential members include stakeholders from environmental groups, wind project owners and/or developers of the Project, landowners, and county representatives, tribes, and state and federal resource agencies (WDFW 2009).

8.1.1 Baseline PCFM

Baseline PCFM consists of relatively short-term intensive surveys involving standardized carcass searches, bias trials for searcher efficiency, and carcass removal trials conducted by trained biologists. Baseline PCFM will be conducted during the first two years of commercial operations of the Project, pending TAC input. The PCFM study design will be consistent with the recommendations for operations monitoring included in the WEG and provided by the TAC. Additionally, the scope and duration of the PCFM study will be developed to be consistent with, and within the range of, monitoring programs that have been conducted at other wind projects in the Pacific Northwest.

8.1.1.1 <u>Monitoring Activities</u>

Baseline PCFM will be conducted during all seasons for the first two years of commercial operations of the Project. Baseline avian and bat PCFM will consist of the following components:

1) Standardized carcass searches of selected turbines in a plot centered on the Turbine;
2) Searcher efficiency trials to estimate the percentage of carcasses found by searchers;

3) Carcass persistence trials to estimate the length of time that a carcass remains in the field for possible detection; and
4) Data analysis and calculation of fatality rates.

8.1.1.2 Reporting

Annual reports will be completed following each year of PCFM and submitted to the TAC within three months of completion of the surveys. The report will discuss the results of PCFM surveys, as well as the results of searcher efficiency and carcass removal trials. Fatality rates will be estimated following the most recent and acceptable statistical methods.

8.1.2 Long-Term Monitoring

O&M staff will be specifically trained to monitor for dead or injured golden eagles, bald eagles, and other sensitive wildlife species during work activities. A WIRHS will be developed to facilitate operations personnel in the collection, reporting, and tracking of bird and bat mortality and injury information in a standardized format. Information reported within the WIRHS will be consistent with standards supporting a scientific collection permit from the WDFW. WEST will tailor existing Scout reporting procedures to be Project-specific and will include the development of training materials, and reporting protocols and documents that can be used by Project staff.

A data sheet that describes how Project personnel can recognize an injured or dead eagle or sensitive species will be posted in the O&M buildings. The data sheet will include instructions and the procedures that personnel shall take in the event an injured or dead golden eagle, bald eagle, or other protected species is discovered onsite, including whom to notify and what actions shall be taken. Any incident involving a state- or federally listed threatened or endangered species or a golden or bald eagle will be reported to the USFWS and the WDFW within 24 hours of identification.

9.0 ADAPTIVE MANAGEMENT

Within the WEG, the USFWS defines adaptive management as “an iterative decision process that promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Comprehensively applying the tiered approach embodies the adaptive management process” (USFWS 2012). The WEG further note that adaptive management at most wind facilities is unlikely to be needed if the facilities are sited in accordance with the tiered approach. Nevertheless, HHWF recognizes the value of applying this approach to its Project activities that include some uncertainty. As such, HHWF will incorporate an adaptive approach for the conservation of wildlife potentially impacted by the Project in coordination with the TAC prior to Project operation.

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Appendix A. Mean exposure indices calculated for small birds observed during fixed point count surveys conducted from 2017 – 2020 at the Horse Heaven Wind Farm, Benton County, Washington. Table sorted by exposure index for the GE 3.03-megawatt Turbine.

			GE 3.03 MW (10 - 155 m RSH)		GE 2.82 MW (25 - 155 m RSH)		GE 5.5 MW (45 - 205 m RSH)		SG 6.0 MW (30 - 200 m RSH)	
Common Name[a]	**Overall Mean Use**	**% Flying**	**% Flying within RSH**	**Exp. Index**	**% Flying within RSH**	**Exp. Index**	**% Flying within RSH**	**Exp. Index**	**% Flying within RSH**	**Exp. Index**
horned lark	5.30	69.0	34.9	1.275	8.5	0.312	0	0	5.1	0.187
unidentified small bird	0.15	96.1	95.9	0.140	21.6	0.032	21.6	0.032	21.6	0.032
bank swallow	0.14	100	50.0	0.072	0	0	0	0	0	0
white-crowned sparrow	0.14	70.0	62.5	0.063	0	0	0	0	0	0
European starling	0.10	69.6	81.9	0.059	79.8	0.057	2.1	0.002	78.7	0.057
barn swallow	0.09	100	41.4	0.039	10.3	0.010	0	0	10.3	0.010
Brewer's blackbird	0.03	100	50.0	0.014	0	0	0	0	0	0
western meadowlark	0.28	31.8	11.7	0.011	0	0	0	0	0	0
western kingbird	0.03	31.3	80.0	0.008	20.0	0.002	0	0	20.0	0.002
unidentified swallow	0.02	100	28.6	0.007	0	0	0	0	0	0
savannah sparrow	0.06	76.9	12.0	0.006	0	0	0	0	0	0
cliff swallow	0.04	100	10.0	0.004	0	0	0	0	0	0
American goldfinch	0.02	14.9	71.4	0.002	71.4	0.002	0	0	0	0
red-winged blackbird	<0.01	100	100	0.002	66.7	0.001	0	0	66.7	0.001
American pipet	<0.01	50.0	50.0	0.001	50.0	0.001	0	0	0	0
vesper sparrow	<0.01	85.7	16.7	0.001	16.7	0.001	0	0	0	0
American robin	<0.01	100	0	0	0	0	0	0	0	0
chipping sparrow	<0.01	50.0	0	0	0	0	0	0	0	0
golden-crowned sparrow	<0.01	100	0	0	0	0	0	0	0	0
grasshopper sparrow	0.02	16.7	0	0	0	0	0	0	0	0
house finch	0.01	100	0	0	0	0	0	0	0	0
lark sparrow	0.01	50.0	0	0	0	0	0	0	0	0
northern flicker	0.01	25.0	0	0	0	0	0	0	0	0
Say's phoebe	<0.01	100	0	0	0	0	0	0	0	0
song sparrow	0.01	100	0	0	0	0	0	0	0	0
unidentified passerine	<0.01	100	0	0	0	0	0	0	0	0
unidentified sparrow	<0.01	50.0	0	0	0	0	0	0	0	0

[a] Bewick's wren, dark-eyed junco, hermit thrush, house sparrow, sage sparrow, sage thrasher, spotted towhee did not have flight heights

Exp. = Exposure, GE = General Electric, m = meters, MW = megawatt, RSH = rotor-swept height

Appendix B. Mean exposure indices calculated for large birds observed during fixed point count surveys conducted from 2017 − 2020 at the Horse Heaven Wind Farm, Benton County, Washington. Table sorted by exposure index for the GE 3.03-megawatt Turbine.

			GE 3.03-MW (10 − 155 m RSH)		GE 2.82 MW (25 − 155 m RSH)		GE 5.5-MW (45 − 205 m RSH)		SG 6.0-MW (30 − 200 m RSH)	
Common Name[a]	Overall Mean Use	% Flying	% Flying within RSH	Exp. Index	% Flying within RSH	Exp. Index	% Flying within RSH	Exp. Index	% Flying within RSH	Exp. Index
snow goose	12.96	98.0	76.3	9.681	75.5	9.579	81.7	10.372	98.3	12.479
Canada goose	1.87	78.5	85.6	1.254	85.3	1.250	94.9	1.390	97.5	1.428
common raven	1.54	93.8	82.2	1.190	53.2	0.770	25.1	0.363	47.2	0.684
rock pigeon	1.01	80.2	78.2	0.634	47.8	0.388	8.8	0.071	37.5	0.304
American white pelican	0.35	100	81.9	0.290	81.5	0.289	85.6	0.303	85.6	0.303
red-tailed hawk	0.32	78.7	91.7	0.228	75.7	0.188	60.3	0.150	72.6	0.181
rough-legged hawk	0.26	88.7	93.8	0.213	75.9	0.172	49.5	0.112	71.0	0.161
California gull	0.23	100	91.1	0.206	70.2	0.159	28.6	0.065	78.0	0.176
Swainson's hawk	0.24	83.4	97.2	0.190	83.7	0.164	62.6	0.123	79.3	0.155
northern harrier	0.56	98.4	24.7	0.136	10.6	0.058	5.9	0.032	8.9	0.049
unidentified gull	0.09	100	97.1	0.090	94.2	0.087	89.4	0.082	93.3	0.086
American kestrel	0.18	52.6	72.6	0.070	22.1	0.021	4.4	0.004	15.0	0.014
sandhill crane	1.60	98.4	2.6	0.042	2.6	0.042	21.1	0.332	21.1	0.332
unidentified goose	0.04	100	100	0.037	100	0.037	100	0.037	100	0.037
unidentified raptor	0.02	100	90.9	0.015	54.5	0.009	36.4	0.006	63.6	0.011
unidentified *buteo*	0.03	75.0	70.0	0.013	70.0	0.013	63.3	0.012	73.3	0.014
bald eagle	0.02	100	73.3	0.011	60.0	0.009	80.0	0.012	80.0	0.012
greater white-fronted goose	0.01	100	100	0.011	100	0.011	57.1	0.006	100	0.011
tundra swan	0.01	100	100	0.011	0.0	0	0	0	0	0
prairie falcon	0.02	57.6	89.5	0.010	63.2	0.007	26.3	0.003	52.6	0.006
turkey vulture	0.01	100	100	0.008	100	0.008	100	0.008	100	0.008
golden eagle	0.01	85.7	100	0.007	100	0.007	83.3	0.006	100	0.007
Cooper's hawk	0.01	100	66.7	0.007	66.7	0.007	33.3	0.003	66.7	0.007
killdeer	0.01	96.0	83.3	0.007	16.7	0.001	0	0	0	0
ring-billed gull	0.02	100	30.8	0.005	30.8	0.005	3.8	0.001	28.8	0.005
mourning dove	0.01	65.4	52.9	0.005	0	0	0	0	0	0
sharp-shinned hawk	0.01	100	71.4	0.004	42.9	0.002	28.6	0.002	42.9	0.002
black-billed magpie	0.02	93.3	21.4	0.004	10.7	0.002	0	0	10.7	0.002
ferruginous hawk	0.01	100	75.0	0.004	50.0	0.003	50.0	0.003	50.0	0.003
long-billed curlew	0.01	60.0	100	0.003	16.7	0.001	0	0	16.7	0.001
unidentified accipiter	<0.01	100	75.0	0.003	75.0	0.003	75.0	0.003	100	0.003

Appendix B. Mean exposure indices calculated for large birds observed during fixed point count surveys conducted from 2017 − 2020 at the Horse Heaven Wind Farm, Benton County, Washington. Table sorted by exposure index for the GE 3.03-megawatt Turbine.

			GE 3.03-MW (10 − 155 m RSH)		GE 2.82 MW (25 − 155 m RSH)		GE 5.5-MW (45 − 205 m RSH)		SG 6.0-MW (30 − 200 m RSH)	
Common Name[a]	Overall Mean Use	% Flying	% Flying within RSH	Exp. Index	% Flying within RSH	Exp. Index	% Flying within RSH	Exp. Index	% Flying within RSH	Exp. Index
osprey	<0.01	100	100	0.002	100	0.002	100	0.002	100	0.002
unidentified falcon	0.01	70.0	42.9	0.002	28.6	0.001	14.3	0.001	14.3	0.001
great blue heron	<0.01	100	100	<0.001	100	<0.001	100	<0.001	100	<0.001
American crow	<0.01	100	0	0	0	0	0	0	0	0
California quail	0.01	13.3	0	0	0	0	0	0	0	0
gray partridge	0.01	11.1	0	0	0	0	0	0	0	0
merlin	<0.01	100	0	0	0	0	0	0	0	0
short-eared owl	<0.01	66.7	0	0	0	0	0	0	0	0

[a] great horned owl and ring-necked pheasant did not have flight heights

Exp. = Exposure, GE = General Electric, m = meters, MW = megawatt, RSH = rotor-swept height, SG = Siemens Gamesa

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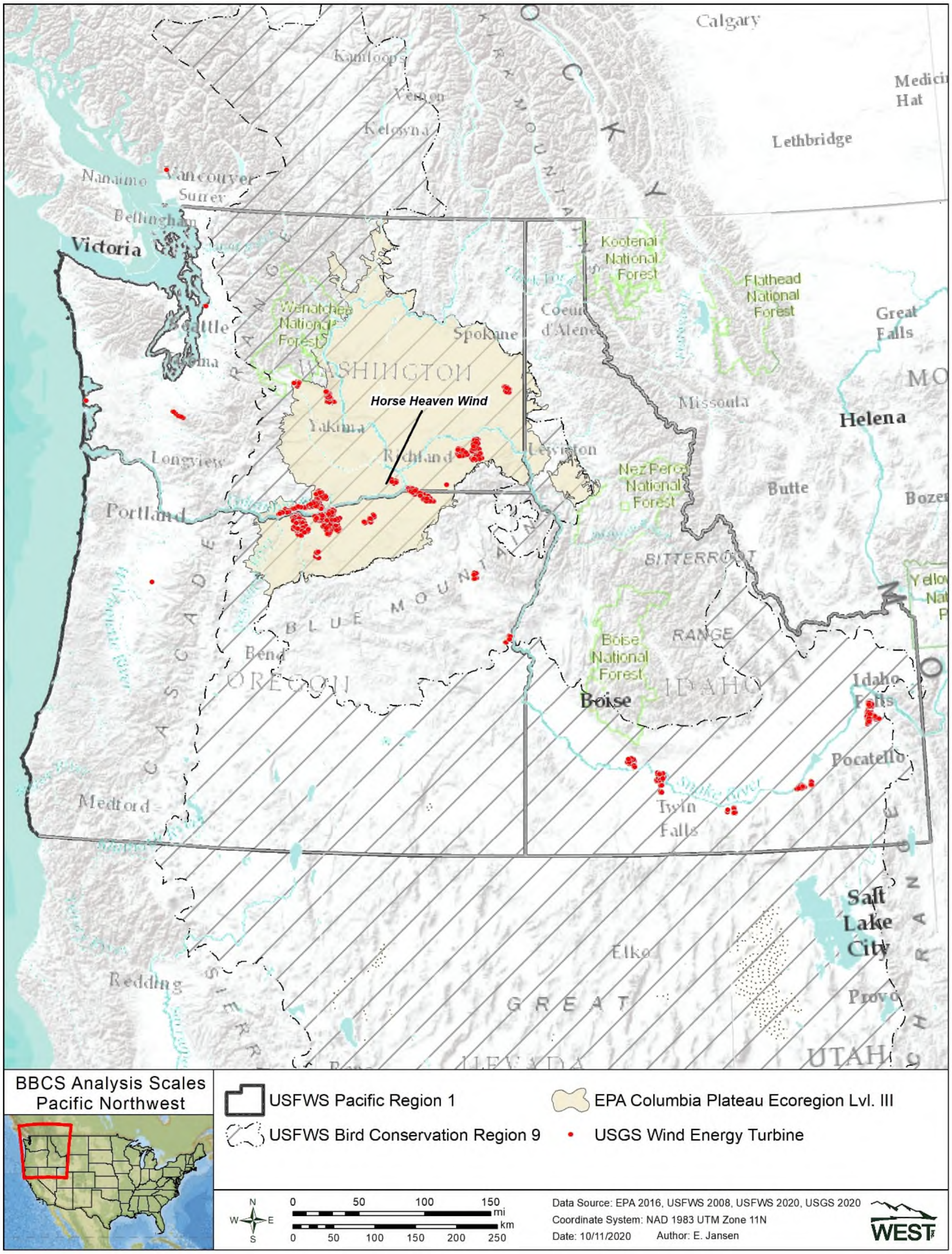

Appendix C. Various geographic scales used in the assessment of species diversity and species risk at the Horse Heaven Wind Farm, Benton County, Washington.