CFE
2023 Raptor Nest Surveys for the
Horse Heaven Clean Energy Center,
Benton County, Washington
Erik Jansen - Cross Examination
EXH-3019_X_REDACTED

Redacted
EFSEC redaction code 13:
Fish and wildlife:
Sensitive fish and wildlife
data. RCW 42.56.430

2023 Raptor Nest Surveys for the Horse Heaven Clean Energy Center, Benton County, Washington

Adult Red-tailed Hawk on Nest 07

Adult Bald Eagle on Nest 48 – Peavine Territory

Landscape Surrounding Swainson's Hawk Nest 28

Adult Common Raven on Historic Ferruginous Hawk Nest 10

Prepared for:

Horse Heaven Wind Farm, LLC

5775 Flatiron Parkway, Suite 120
Boulder, Colorado 80301

Prepared by:

Erik W. Jansen

Western EcoSystems Technology, Inc.
2725 Northwest Walnut Blvd.
Corvallis, Oregon 97330

August 3, 2023

EXECUTIVE SUMMARY

Horse Heaven Wind Farm, LLC, is proposing development of the Horse Heaven Clean Energy Center (Horse Heaven and/or Project) in Benton County, Washington. As part of Project development, Western EcoSystems Technology, Inc. (WEST) was contracted to conduct raptor nest surveys within 2.0 miles (mi; 3.2 kilometers [km]) of proposed wind turbine generators (WTG) and solar arrays (Survey Area) during the 2023 nesting period. Raptor nest surveys complied with guidelines described by the Washington Department of Fish and Wildlife (WDFW) and recommendations from the US Fish and Wildlife Service (USFWS). The principal objective of this survey focused on searching for new raptor nests, documenting the status and condition of all historical ferruginous hawk nests, and checking all raptor nests documented during surveys conducted 2017 – 2019 and in 2022. This report summarizes the nesting status and condition of all raptor nests within the Survey Area in 2023 and how the results compare to previous survey efforts conducted for the Project. Combining historical ferruginous hawk nest data with previous survey data from 2017 – 2019 and 2022, 103 historical and current nest locations were checked during the 2023 surveys. Primary conclusions from this assessment include:

- In 2023, 63 raptor and/or common raven nests were documented. Of these 63 nests, 55 nests were located within the Survey Area and eight (all bald eagle nests) were located outside the Survey Area.
- Of the 55 occupied nests located within the Survey Area, the majority contained common raven (40%) followed by red-tailed hawk (23%), Swainson's hawk (23%), and great horned owl (10%); 25 nests were unoccupied; and 40 nests previously documented in the Survey Area could not be located and were considered Gone. Seven of the 58 historical ferruginous hawk nests documented in 2023 were occupied by species other than ferruginous hawk; 18 historical ferruginous hawk nests were unoccupied and 32 nests were Gone; one historical nest was not surveyed due to safety.
- Eight occupied bald eagle nests with young were located along the Columbia River during 2023 surveys. All nests were outside the Survey Area but were checked to maintain a nesting record. The distance of bald eagle nests to the nearest proposed WTG ranged from 3.7 mi to 10.7 mi (6.0 km to 17.2 km; average = 6.8 mi ± 2.4 mi [10.9 km ± 3.9 km]). Bald eagle nests were located beyond the 2.0-mile Survey Area that USFWS uses to evaluate project impacts to nearby nesting eagles.
- Ferruginous hawk nesting was infrequently observed during 10 survey rounds conducted over five survey years. The overall 5-year average of nest and territory occupancy was 4.4% and 5.6%, respectively. Historical ferruginous hawk nests were more likely to be occupied by other raptor species.
- Over 50% of land cover within the 2.0-mi core range of historical ferruginous hawk nests was agriculture, exceeding the threshold where populations of ferruginous hawk consistently decline. Residential development near 28 nests (48%) are likely a contributing factor in the relatively low ferruginous hawk nest occupancy in the Horse Heaven Hills.

- As Richardson et al. (2004) discusses, although nests can be found in areas with 50% to 100% wheatland within 1.9 mi (3.0 km; Bechard et al. 1990), ferruginous hawk populations decline consistently once cultivated land exceeds 30% of the area (Schmutz 1987, 1989). Agriculture comprises over 50% of land cover within the core area of historical ferruginous hawk nests within 3.2 km (2.0 mi) of the proposed WTGs. Analyses of resource selection around occupied nests in eastern Washington resulted in similar landscape patterns. In an analysis of 194 occupied ferruginous hawk nests in eastern Washington, 2000–2020 (28% of the 677 nests in the PHS database), occupied nests were more likely to be located with less agriculture within 0.25 mi (0.40 km) and avoided human development within 1.0 mi (1.6 km; Jansen et al. 2022). Occupied nests were selected closer to publicly accessible roads which may be a function of convenience sampling along roads, or the perching and access to foraging habitat that has been documented in other studies (Migaj et al. 2011, Nordell et al. 2017, Watson 2020).
- Although land conversion to agriculture and levels of human disturbance from housing, transportation, and electrical networks have been a historical feature in the Horse Heaven Hills, residential development into the foothills has increased over the past two decades, and noticeably since aerial surveys began in 2017. Housing development into the foothills is expected to continue, with new and on-going residential development in close proximity to Badger Canyon, Clodfelter, Clodfelter West, and Sheep Canyon ferruginous hawk territories decreasing the likelihood these nesting territories will become re-occupied by ferruginous hawks.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

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
0.12 miles	200 meters
0.5 miles	0.8 kilometers
10 miles	16.1 kilometers

STUDY PARTICIPANTS

Erik Jansen	PM, Field, GIS, Reporting
Joel Thompson	Senior Reviewer
Stephen Crane	Field Biologist
Timothy Lawes	Field Biologist
Andrea Palochak	Technical Editor

Photo Credits: All Photos by E. W. Jansen, Benton County, Washington.

REPORT REFERENCE

Jansen, E. W. 2023. 2023 Raptor Nest Surveys for the Horse Heaven Clean Energy Center, Benton County, Washington. Prepared for Horse Heaven Wind Farm, LLC., Boulder, Colorado. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon. August 3, 2023. 26 pages + appendices.

INTRODUCTION

Horse Heaven Wind Farm, LLC (HHWF) is proposing development of the Horse Heaven Clean Energy Center (Horse Heaven and/or Project) in Benton County, Washington. Since 2017, HHWF has conducted raptor nest surveys to characterize the raptor nesting community at the Project. Raptor nest surveys complied with recommendations described by the Washington Department of Fish and Wildlife (WDFW) *Wind Power Guidelines* (WPG; WDFW 2009), and the US Fish and Wildlife Service's (USFWS) *Land-based Wind Energy Guidelines* (WEG; USFWS 2012), Appendix C(1)(a) of the *Eagle Conservation Plan Guidelines* (USFWS 2013), and the *Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests* (81 Federal Register 91494 [December 16, 2016]).

In 2020, USFWS regulations reduced the survey area for bald eagles (*Haliaeetus leucocephalus*) from 10.0 miles (mi; 16.1 kilometers [km]) to 2.0 mi (3.2 km) surrounding a wind facility, indicating that the 2.0-mi survey buffer will provide sufficient information to evaluate project impacts to nearby nesting eagles (USFWS 2020). The change in regulation reduced the survey area; however, the HHWF chose to continue surveying all eagle nests in the greater 10.0-mi radius of the Project for due diligence purposes and to maintain the nesting record.

The ferruginous hawk (*Buteo regalis*) was listed as a state threatened species in 1983 and uplisted to endangered in 2021. Hayes and Watson (2021) listed habitat loss, degradation, and fragmentation among factors affecting ferruginous hawk population viability in Washington. Aerial surveys conducted since 2017 in the Horse Heaven Hills have noted the vast agricultural landscape and fragmented habitat, and past and on-going residential development in proximity to historical nests. A desktop analysis of land cover and human disturbance around historical ferruginous hawk nests was conducted in this report to supplement survey data.

As part of Project development, Western EcoSystems Technology, Inc. (WEST), was contracted to conduct raptor nest surveys in 2023 surrounding proposed wind turbine generators (WTG) and solar energy arrays. The objectives of this study were to:

1) document the status of previously identified and new raptor nests within 2.0 mi of the Project,
2) summarize historical and current ferruginous hawk territory status, including land cover characteristics within 2.0-mi (3.2 km) radius core areas and 6.2-mi (10.0-km) home ranges, and human disturbance within 1.0 mi (1.6 km),
3) document previously identified and new bald eagle nests within 10.0 mi (16.1 km) of the Project, and
4) summarize raptor nest data collected during surveys conducted at the Project from 2017 − 2019 and 2022 – 2023.

SURVEY AREA

Raptor nest surveys occurred in the eastern portion of the Horse Heaven Hills, in southeastern Benton County, Washington. A 245.5 mi^2 (635.8 km^2) Survey Area was designated by creating a 2.0-mi buffer around proposed WTG and solar arrays, which is the distance recommended by the WDFW (2009) and equal to the radius of the ferruginous hawk core area calculated by Hayes and Watson (2021). The 10 mi eagle survey radius is not displayed on figures because the distance is no longer a federal recommendation but is being proactively monitored by HHWF to maintain data continuity, ensure due diligence, and provide data to the scientific community. The Survey Area was located adjacent to the Tri-cities urban areas of Kennewick, Richland, and Pasco, and included portions of exurban communities associated with Benton City and Highland.

A prominent topographic feature in the Survey Area was a broad, northeast-facing anticline ridge along the northern perimeter, consisting of numerous highly eroded drainages and cliff-lined canyons (Badger Canyon, Coyote Canyon, Nine Canyon, Webber Canyon; Figure 1). South of the ridge, toward the interior of the Survey Area, the landscape transitions to relatively rolling topography with shallow, meandering canyons that drain south into the Columbia River. Elevation within the Survey Area was lowest toward the Columbia River to the east (approximately 350 feet [ft]; 107 meters [m]), rising to above 2,000 ft (610 m) at prominent features, including Chandler Butte (2,046 ft; 624 m), Johnson Butte (2,043 ft; 623 m), and Jump Off Joe (2,200 ft; 671 m), which all have radio and telecommunication installations (Figure 1).

Land cover within the Survey Area is a mosaic of dryland and irrigated cropland, shrub-steppe grasslands, and rural/urban development (HHWF 2021). Cropland is the dominant land cover throughout the Project and surrounding area (more than 80%; HHWF 2020). Shrub-steppe is found in topographically steep areas and drainage bottoms where conversion to cropland was not possible. A portion of the lands near the Project are enrolled in the US Department of Agriculture's Conservation Reserve Program. Raptor nest habitat includes the talus slopes, rock outcrops, and cliffs along the major canyons and drainages, isolated trees scattered throughout the Survey Area along roads and drainage bottoms, electrical transmission towers, and outbuildings. Tree cover was very sparse in the Survey Area.

Land use in the Survey Area consists predominantly of actively managed dryland winter wheat (*Triticum aestivum*) and associated infrastructure including silos and warehouses. Historic land use is reflected in abandoned and working farmsteads scattered in low density throughout the landscape. New residential development encroaches into the foothills and on top of the Horse Heaven Hills ridge, indicative of a growing Tri-cities area population. Several rock quarries in the Survey Area are actively used for on-going road maintenance and other construction projects. Electrical systems include radio and telecommunication towers, several high-voltage (115–500-kilovolt [kV]) Bonneville Power Administration (BPA) transmission lines bisecting the Survey Area, and numerous low-voltage (12.5-kV) distribution lines servicing business and residential buildings. Portions of the 63-WTG Nine Canyon Wind Project were located within or adjacent to the Survey Area (Figure 1).

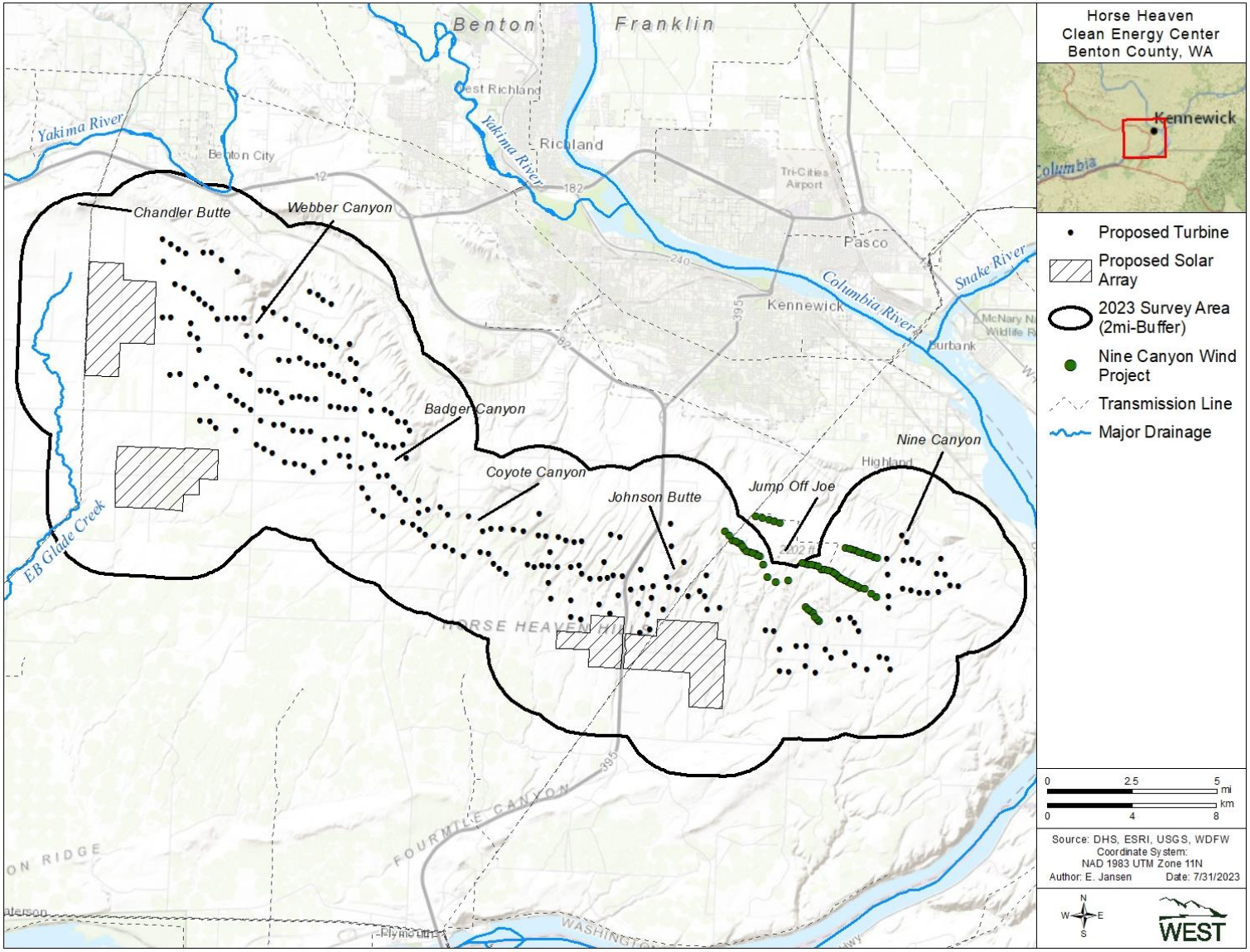


Figure 1. Landscape features within the 2023 raptor nest Survey Area for the Horse Heaven Clean Energy Center, Benton County, Washington.

METHODS

The 2017 study design and survey methods incorporated guidance described in the WDFW WPG and the WEG, with specific measures adapted for bald eagles and golden eagles (*Aquila chrysaetos*) as described by the USFWS (Pagel et al. 2010, USFWS 2013; 81 FR 91494 [December 16, 2016]). The same survey methods were used during previous raptor nest surveys conducted for the Project (Chatfield 2019a, 2019b; Jansen 2017, 2022a, 2022b; Jansen and Brown 2018; Jansen et al. 2019, Jansen 2022a, b).

Aerial Survey Preparation and Design

In fall 2022, WEST obtained records of all historical ferruginous hawk nests from the WDFW Priority Habitats and Species (PHS) database. Prior to aerial surveys in 2023, WEST integrated historical ferruginous hawk nest data with four years (2017 − 2019, 2022) of intensive WEST survey data to develop a comprehensive nest database. Proposed Project WTG and solar arrays, as presented in the updated Application for Site Certificate (HHWF 2021), were buffered by 2.0 mi in ArcMap (Esri, Redlands, California) to create the Survey Area. WEST developed a survey plan by plotting previously identified nests on maps and digital tablets (LG, Seoul, South Korea) with navigational software (Gaia GPS, Berkeley, California) that was used to guide aerial surveys.

Raptor nest surveys were conducted during two rounds of a double-observer (i.e., a primary and secondary observer) aerial survey. Survey rounds were conducted at least 30 days apart and performed using a Robinson R-44 Raven II helicopter with bubble windows that provided excellent visibility (Pagel et al. 2010, USFWS 2013). The first survey round was conducted early in the season prior to deciduous tree leaf out to ensure easier detection of nests. Conducting the survey early in the season also ensured the search effort coincided with the period when eagles were likely tending nests or incubating eggs and was based on chronology for nesting eagles in the region (Pagel et al. 2010, Isaacs and Anthony 2011, USFWS 2013, Isaacs 2021). The second survey round was conducted in May when eagles should have young in the nest and ferruginous hawks would be incubating or brooding young (Watson et al. 2018). Late-nesting species, including Swainson's hawk (*Buteo swainsoni*), should have also been occupying territories and initiating nesting by this time.

Aerial Survey Methods

Surveys rounds focused on checking the status of historical ferruginous hawk nests, checking previously identified bald eagle nests, checking previously identified raptor nests, and searching for new nests. Using the comprehensive ferruginous hawk nest database, 2023 surveys focused on visiting each historical nest location twice (March and May) to document known nests and search for possible new nests. Emphasis was placed on locating and documenting the status of historical nests by repeating standard survey protocols used during previous surveys that entailed a cautious approach, including circular or stationary hover and multiple sweeps, if needed, until sufficient confidence was established regarding nest status.

All stick nests that could be attributed to any raptor species or common ravens (*Corvus corax*) were documented within the Survey Area due to the potential for species to interchangeably use nests.

Surveys utilized an intuitive controlled survey method that focused on areas with the highest potential to support raptor nests, including rock outcrops and cliffs, basalt talus and scree slopes along incised drainages and canyons, transmission towers, distribution poles, windmills, and trees. Nests located during the first survey round were revisited during the second survey to further evaluate nesting status while also searching for new nests constructed after the first survey round was completed.

During aerial surveys, the helicopter was positioned to allow thorough visual inspection of all appropriate habitat features. In general, the helicopter maintained a distance of no closer than 66 ft (20 m) from cliff faces and nests. When a nest was located, the helicopter reduced speed and adjusted the flight track to allow for a clear view of the nest for documentation and photographing. The amount of time spent circling/searching a particular area or the distance to which a nest was approached was adjusted when birds were present on or near the nest to minimize survey-related disturbance (e.g., flushing). In the event of the presence of eggs/nestlings, deference was provided and nests located directly adjacent to the eggs/nestlings (e.g., within 656 ft [200 m]) were not surveyed.

For each nest or group of nests (e.g., nest site), Global Positioning System (GPS) coordinates were recorded, photographs were taken from a distance using a Nikon digital single lens reflex camera with 55−200-mm telephoto lens to reduce nest disturbance, and nest attribute data were collected. A nest site was defined as two or more nests that occurred on the same shelf, cliff face, or trees near one another. Data collected at each nest included the nesting species, status, and physical attributes that included condition, substrate, size, and signs of recent nest tending that included fresh sticks, greenery, or whitewash. The following definitions were used to characterize nests:

Nest Status

- Occupied Active = evidence of nest tending, with eggs/fragments, nestlings, and/or an adult in incubating/brooding position present at the time of the survey;
- Occupied Inactive = evidence of recent tending of the nest or presence of an adult, but no eggs, nestlings, or an adult in incubating/brooding position observed;
- Unoccupied = nest was classified as inactive for at least two consecutive survey rounds;
- Inactive = no evidence of nest tending and no eggs, nestlings, or adults present;
- Gone = previously documented nest determined to be completely missing or so degraded that only remnant material (scattered, loose sticks) were present, and that would need complete reconstruction in order to be used;
- Did Not Survey = Nest was outside the survey area for that particular survey year.
- Did Not Locate = Nest was not located during survey; typically historical nests in remnant condition;
- Unknown = nest likely present, but status cannot be determined. This scenario typically arises when cryptic nests were obscured by tree leaves, survey was aborted due to young on a neighboring nest, or disturbance issues related to horses or other human factors limited survey effort.

Nest Condition

Nest condition is a strong indicator of nest status; nests that are in better condition reflect the likelihood that the nest is currently in use or has recently been in use. However, longevity of the nest on the landscape is also affected by the stability of the nest construction, exposure of the nest to weather, wildfire, or human removal (WDFW 1996).

- Good = in excellent condition with very well-defined bowl, no sagging, may contain fresh material; possible to use immediately or currently in use;
- Fair = in generally good condition with fairly well-defined bowl, minor sagging of material but lacks substantive damage; may require some repair or addition to use immediately;
- Poor = material sloughing or sagging that would require reconstruction of the nest bowl in order to be used; most likely not being used during the current nesting season and possibly multiple nesting seasons, depending on nest exposure and other factors;
- Remnant = only loose or scattered material remains at the nest site, which would require complete reconstruction of the nest base, body, and bowl to be usable;
- Unknown = condition is unknown due nest not able to be located, typically due to leaf out or safety reasons.
- Gone = nest status unequivocally determined to be Gone, thus, condition is also Gone.

After each survey round, high-resolution aerial imagery, topographic maps, and flight tracks were used in ArcMap to georectify GPS coordinates recorded in the field to accurately correspond with the nest structure (tree, cliff face, rock outcrop, etc.) where the nest was observed. Nest photos were downloaded and labeled and a geodatabase was developed that tracked the status of each nest over the survey period.

Three types of metrics were used to compare the number of nests documented or occupied among survey years. Nest density by species was calculated as the number of nests documented during a survey year divided by the size of the Survey Area. Nests located beyond the 3.2 km Survey Area (i.e., bald eagle nests) and nests that were Gone, were excluded from the nest density calculation. Territory and nest occupancy was calculated for ferruginous hawk only and was calculated as the number of occupied territories or nests divided by the number of territories surveyed or the number of nests that were available for survey. The term territory was used for bald eagle and ferruginous hawk and was defined as a confined locality where nests are found, usually in successive years, and where no more than one pair is known to have bred at one time (Steenhof and Newton 2007). A territory can potentially consist of several alternate nests within a nesting territory that are not being used for laying eggs in a given year (Millsap et al. 2015). Metrics were calculated annually and over the 5-year survey period (2017–2019, 2022–2023).

Ferruginous Hawk Territory Characteristics

Total land cover by type within the 3.2 km radius core area and 10 km radius home range of historical and current ferruginous hawk nests were characterized using the National Land Cover Database (2019). The 3.2 km radius core area and 10 km radius home range were defined using distances described by Hayes and Watson (2021). Land cover composition between the core area and

home range was compared by subtracting the relative composition of land cover found in the home range from the core area.

The straight-lined distance of the edge of the nearest existing human disturbances within 1.6 km to each nest was measured using historical and current aerial photographs from 1986 to April 29, 2023 (Google Earth 2023). The distance of 1.6 km was used as the distance construction and other types of human disturbance WDFW recommends be avoided around a ferruginous hawk nest (Larsen et al. 2004). Human disturbance was defined as any ground disturbing activity, construction, or development that was not historically present on the landscape (e.g., county roads, agriculture fields, farmsteads). Publicly available real estate records and historical aerial imagery were used to determine the approximate year of the disturbance.

Database Management

Management of the raptor nest database was performed to remove non-ferruginous hawk nest sites retained in the database despite the total removal of the nesting substrate (e.g., tree or windmill) that resulted in no likelihood for nest rebuilding or site re-occupancy. Raptor nests colonized by black-billed magpies (*Pica hudsonia*) were retained due to the potential for raptor re-occupancy that has been documented in previous survey years. Fallen trees were retained due to the potential for raptor re-occupancy that has been documented in previous survey years. Similarly, sites of previously documented nests blown out of trees and no longer present were retained since re-occupancy of trees tends to be high due to the relative scarcity of trees on the landscape. Nest sites and the rational for database removal are reported in the results.

RESULTS

2023 Survey Results

Raptor nest surveys were conducted March 21, 22, and May 15, 2023, with a total of 103 historical and current nest surveyed (Table 1). Among the 103 locations, 63 nests were physically present during 2023 surveys, down 7.3% from 2022 surveys (68 nests), and 40 nests were Gone, up 8.1% from 2022 surveys (37 nests). The increase in the number of Gone nests resulted from nest disturbance (e.g., blown out of a tree or falling from a cliff, etc.) that eliminated sign of the nest on the nesting substrate. Of the 63 nests documented, 55 nests were located within the Survey Area and eight (all bald eagle nests) were located outside the Survey Area (Figures 2 and 3). Representative photographs of nests are found in Appendix C.

Table 1. Raptor nest status documented during 2023 raptor nest surveys for the Horse Heaven Clean Energy Center, Benton County, Washington.

	Nest Status				
Species or Status	**Occupied/Active**	**Occupied/Inactive**	**Unoccupied**	**Gone**	**Total**
bald eagle	8	–	–	1	9
common raven	12	–	1	–	13
great horned owl	3	–	–	–	3
red-tailed hawk	7	–	–	–	7
Swainson's hawk	7	–	–	–	7
unknown raptor	–	1	24	–	25
gone	–	–	–	39	39
Total	**37**	**1**	**25**	**40**	**103[a]**

[a.] Excludes one nest (ferruginous hawk historical Territory Sprit Lane Nest 87) that was not surveyed in 2023, and three other nests that were removed from the database.

Non-eagle Nests

Of the 30 occupied nests in the Survey Area, most contained common raven (40.0%), followed by red-tailed hawk (23.3%; *Buteo jamaicensis*), Swainson's hawk (23.3%), and great horned owl (10.0%; *Bubo virginianus*; Table 1). The higher number of common raven nests was a result of the increased nesting activity along a high-voltage transmission corridor in the western portion of the Survey Area. Nesting activity was low and delayed, with only eight non-eagle nests occupied during the first survey round, including four red-tailed hawk nests and four great horned owl nests. Nests occupied by common raven were not documented until the second survey round, which is uncharacteristic compared to previous survey years. The majority of unoccupied raptor nests (24 nests) were identified as historical ferruginous hawk nests in the WDFW PHS database. Ferruginous hawk is discussed in further detail below.

[REDACTED DUE TO SENSITIVE SPECIES INFORMATION]

Figure 2. Raptor nests (excluding eagle and ferruginous hawk nests) surveyed in 2023 for the Horse Heaven Clean Energy Center, Benton County, Washington.

[REDACTED DUE TO SENSITIVE SPECIES INFORMATION]

Figure 3. Nesting status of historical ferruginous hawk nests from the Washington Department of Fish and Wildlife Priority Habitat and Species database surveyed in 2023 for the Horse Heaven Clean Energy Center, Benton County, Washington.

Ferruginous Hawk

No ferruginous hawks were observed nesting within the Survey Area. One ferruginous hawk was observed circle soaring above Webber Canyon during the second survey round; however, additional focus on nests within the Webber Canyon area did not result in sign of nesting tending or maintenance. Over half of the 58 historical ferruginous hawk nests (32 nests; 55.2%) listed in the WDFW PHS database were classified as Gone, 18 nests (31.0%) were classified as unoccupied, and seven (12.1%) were classified as occupied by common raven (six nests) or great horned owl (one nest) and one nest was not surveyed (Figure 3; Appendix A). The 13 Lane historical ferruginous hawk nest (Nest 87) is in a horse pasture in the backyard of a residential area and was not surveyed due to the horses: 2022 surveys documented great horned owl occupancy. Future surveys may discontinue surveys at 13 Lane to avoid horse disturbance, which can be dangerous to people on the ground and livestock. The likelihood for a ferruginous hawk to occupy a nest deep in a residential area is considered low.

Four ferruginous hawk nests documented during 2022 surveys could not be relocated and were classified as Gone, including the tree nest in the 13 Territory that was occupied by Swainson's hawk in 2022, two ground nests in the Webber Canyon Territory that were in Remnant condition in 2022, and one cliff nest in Sheep Canyon that was in fair condition in 2022 (Jansen 2022a). The majority of unoccupied ferruginous hawk nests were in poor or remnant condition. Historical ferruginous hawk nests in good condition were occupied by another bird species. Discovered by WEST in 2017, the Coyote Canyon Territory (Nest 03) was occupied by ferruginous hawk in 2017 – 2019, by Swainson's hawk in 2022, and contained two great horned owl nestlings during the second survey round in 2023.

Aerial surveys conducted since 2017 have noted the construction of residential houses in proximity to historical ferruginous hawk nests. Human development and habitat conversion with the 3.2 km core area and 10 km home range surrounding a nest modifies foraging habitat, reduces nest site suitability, and has been identified as a conservation concern (Hayes and Watson 2021). Land cover was quantified within the 3.2 km radius core range and 10 km radius home range of historical nests, recognizing a circular radius around a nest likely does not represent the true distribution of an individual's movement (Isted et al. 2023). There is 11.0% more agriculture (i.e., cultivated crop) and 3.5% more grassland (e.g., grassland/herbaceous) within the core area than the home range (Table 2, Figure 4). There was an approximately equal percent composition of shrub-steppe (i.e., shrub/scrub) in the core area and home range. Developed land cover types, from open space to high intensity, comprised 6.7% (6,033.1 ac [2,441.5 ha]) of the core area and 13.1% (35,173.1 ac [14,234.0 ha]) of the home range, which overlaps the Tri-cities area.

Of the 58 historical ferruginous hawk nests, 28 nests (48.3%) in eight territories had residential development or other forms of human disturbance (e.g., water canal expansion) within 1.6 km of the nest. The average distance of development to a nest was 0.23 mi (0.37 km; median = 0.16 mi [0.25 km], range 0–0.96 mi [0–1.55 km]; Table 3). Historical nests near residential development tended to be Gone (64%) or in Poor or Remnant condition (25%) indicating no recent nest occupancy. If historical nests near residential development were occupied, the nesting species

was typically common raven, which tends to be more tolerant of human disturbance and is a competitor of ferruginous hawk (Coates et al. 2020, Hayes and Watson 2021).

Residential development in the Horse Heaven Hills is likely to continue. Publicly available real estate data indicates there are eight lots for sale totaling about 55 ac (22 ha) of shrub-steppe habitat in the Sheep Canyon Territory, two lots totaling 55.14 ac (22.31 ha) of shrub-steppe habitat in the Badger Canyon Territory, four lots totaling 22.24 ac (9.00 ha) of agriculture and shrub-steppe in the Clodfelter Territory, and an additional 19 lots totaling 156.14 ac (63.19 ha) of shrub-steppe, agriculture, and grasslands listed for residential development throughout the Horse Heaven Hills (Redfin 2023). The most frequently available lot size was 5 ac (2 ha), but the listings included several larger lots intended for subdivision.

Table 2. Land cover composition within the ferruginous hawk core area and home range of historical nests within 3.2 kilometers of the Horse Heaven Clean Energy Center, Benton County, Washington. Data sorted by % in Core Area.

	3.2 km Core Area		10 km Home Range		% in
Land Cover Type	**Acres**	**% Comp**	**Acres**	**% Comp**	**Core Area[1]**
Cultivated Crop	48,816.7	53.7	114,454.7	42.7	+11.0
Grassland/Herbaceous	14,590.4	16.0	33,632.7	12.5	+3.5
Deciduous Forest	2.2	<0.1	2.7	<0.1	<+0.1
Barren Land	3.6	<0.1	10.2	<0.1	<-0.1
Mixed Forest	–	–	4.0	<0.1	<-0.1
Evergreen Forest	1.6	<0.1	12.9	<0.1	<-0.1
Pasture/Hay	2,296.7	2.5	7,161.5	2.7	-0.1
Emergent Wetlands	44.0	<0.1	1,053.0	0.4	-0.3
Developed, High Intensity	67.6	0.1	1,191.4	0.4	-0.4
Woody Wetlands	13.8	<0.1	1,376.4	0.5	-0.5
Shrub/Scrub	18,827.5	20.7	56,923.0	21.2	-0.5
Developed, Open Space	2,556.0	2.8	9,911.0	3.7	-0.9
Developed, Low Intensity	2,449.9	2.7	13,843.2	5.2	-2.5
Developed, Medium Intensity	959.6	1.1	10,227.5	3.8	-2.8
Open Water	292.4	0.3	18,437.6	6.9	-6.6
Total[2]	**90,922.0**	**100**	**268,241.8**	**100**	

[1.] Percent difference in core area compared to the home range.

[2.] Values can differ from numbers shown due to rounding

Comp = composition

[REDACTED DUE TO SENSITIVE SPECIES INFORMATION]

Figure 4. Land cover types within the 3.2 km core area and 10 km home range surrounding historical ferruginous hawk nests from the Washington Department of Fish and Wildlife Priority Habitat and Species database within 3.2 km of the Horse Heaven Clean Energy Center, Benton County, Washington.

Table 3. Nearest disturbance distances within 1 mi (1.6 km) of historical ferruginous hawk nests located within 2 mi (3.2 km) of the Horse Heaven Clean Energy Center, Benton County, Washington.

Territory Name	Nest ID	2023 Condition	Distance (km)	Comment
Badger Canyon	97	gone	0.64	2023 - new road and residential construction; expanded construction plans
Badger Canyon	8	gone	0.68	2023 - new road and residential construction; expanded construction plans
Badger Canyon	96	gone	0.76	2023 - new road and residential construction; expanded construction plans
Badger Canyon NW	61	poor	0.77	2022 - 6.4 acres shrub-steppe cleared for new housing
Badger Canyon NW	85	poor	0.62	2022 - 6.4 acres shrub-steppe cleared for new housing
Badger Canyon NW	89	gone	0.24	2023 - new road to subdivision under construction
13 Road	64	gone	0.00	1992 - nest removed by residential development
13 Road	43	good	0.50	2023 - expanded equipment laydown; common raven occupied 2023
Clodfelter	22	remnant	0.23	2017 - residential development
Clodfelter	60	gone	0.28	2017 - residential development
Clodfelter	65	gone	0.25	2017 - residential development
Clodfelter	66	gone	0.09	2017 - residential development
Clodfelter	113	gone	0.25	2017 - residential development
Clodfelter	114	gone	0.04	2004 - 5-acre shrub-steppe cleared for housing
Clodfelter	81	gone	0.18	1992 - residential development
Clodfelter West	67	remnant	0.53	2020 - expanded residential development
Clodfelter West	4	poor	0.10	2018 - residential development
Clodfelter West	86	gone	0.09	2016 - residential development
13 Road	78	remnant	0.22	2021 - expanded canal construction
13 Road	12	good	0.42	2021 - expanded canal construction; common raven occupied 2023
Sheep Canyon	11	remnant	0.19	2023 - new residential construction along E Taggart Pr SE
Sheep Canyon	99	gone	0.15	2023 - new residential construction along E Taggart Pr SE
Sheep Canyon	100	gone	0.31	2023 - new residential construction along E Taggart Pr SE
Sheep Canyon	109	gone	0.60	2023 - new residential construction along E Taggart Pr SE
Sheep Canyon	116	gone	1.55	2023 - new residential construction along E Taggart Pr SE
13	102	gone	0.30	2015 - residential development
13	106	gone	0.23	2015 - residential development
13	101	good	0.09	2015 - residential development; common raven occupied 2023
		Mean	**0.37**	
		Median	**0.25**	

Bald Eagles

Eight occupied bald eagle territories were located along the Columbia River and its tributaries during 2023 surveys (Figure 5). Two of the bald eagle nests were newly documented on Foundation Island (Nest 129) and Peavine Island North (Nest 130), in addition to the six occupied bald eagle nests documented in 2022. Each of the occupied nests contained one to three young, approximately 4–6-weeks old, during the second survey round conducted on May 15. All eight territories were located along the major drainages of the Columbia River, Walla Walla River, and Yakima River. Bald eagle territories occurring from west to east in the Survey Area are discussed briefly below.

- *Prosser Territory* and has consistently produced two or three young since surveys began in 2019.
- *Yakima River Mouth* the nest has consistently produced one to three young each year and has longest survey history since surveys began in 2017.
- *Port of Pasco* the nest has consistently produced one or two young each year since surveys began in 2019.
- *Burbank –* surveys at the nest began in 2022 when the National Audubon Society notified the Project of the nest. The nest failed in 2022 based on the presence of an incubating adult during the first survey round and an absence of adults or of other sign on or near the nest bowl (e.g., eggshells, feathers, prey items) during the second survey round. Surveys in 2023 resulted in one young approximately 5–6-weeks old and two adults perched in the nest tree during the second survey round. As a practical and safety measure, WEST typically does not survey residential areas for eagle or other raptor nests.
- *Foundation Island* the nest was first documented in 2023 and contained one young appropriately 5–6-weeks old during the second survey round.

[REDACTED DUE TO SENSITIVE SPECIES INFORMATION]

Figure 5. Bald eagle nests surveyed in 2023 for the Horse Heaven Clean Energy Center, Benton County, Washington.

- *Peavine Island* [redacted] however, the alternate nest could not be located and was assumed to be Gone in 2022. A new occupied nest (Peavine Island North) located 0.7 mi (1.1 km) north of Peavine Island is the closest distance among occupied bald eagle nests in the Survey Area. Peavine Island has produced at least one or two young since surveys began in 2019; Peavine Island North had three young approximately 5–6-weeks old during the second survey round in 2023. Nests on Peavine Island are the nearest bald eagle nests to the proposed WTGs (3.7–3.9 mi [6.0–6.3 km] away).
- *McNary NWR* [redacted] the nest was first documented in 2019 and produced two young in 2023. Dense tree cover along the floodplain has resulted in difficult survey conditions during the second survey rounds, but nest occupancy or young have been observed during each of the three years surveyed.
- *Sand Station* [redacted] the nest contained two eggs during the second survey round in 2019, was unoccupied and in poor condition during 2022 surveys, and Gone in 2023. The nest was located along an exposed, windy stretch of the river and considered Gone after an intensive survey. Nest material was observed on the ground below the nest location.

Database Management

Three nests were removed from the database due to the removal of nesting substrate with no likelihood for nest re-occupancy (Table 4). After multiple years of surveys, the likelihood for nest building and re-occupancy at the location was determined as none.

Table 4. Historical raptor nests removed from the raptor nest database due to missing nesting substrate within 2.0 miles (3.2 kilometers) of the Horse Heaven Clean Energy Center, Benton County, Washington.

Nest ID	Nesting Species	Nest Status	Nest Substrate	Nest Condition	Comments
05	gone	gone	deciduous	gone	Nest located in uplands with no tree in area.
06	gone	gone	windmill	gone	Windmill removed.
14	gone	gone	deciduous	gone	Tree removed by canal construction.

2017 – 2019 and 2022 – 2023 Survey Comparison

The size of the Survey Area varied annually and ranged from 74−329 mi^2 (192–852 km^2), depending on the size of the Project Area under consideration (Table 5; Appendix B). A survey of suitable habitat within the Survey Area was typically accomplished within one-two days, depending on the size of the Survey Area. The following sections provide a summary comparison of raptor nests documented during surveys conducted from 2017 – 2019 and 2022 – 2023.

Table 5. Aerial raptor nest survey dates and area surveyed within the Horse Heaven Hills, 2017 – 2019 and 2022 – 2023.

Year	Survey Date[a] Round 1	Round 2	Survey Area (mi^2)[b]	Reference
2017	March 31	May 10	74.7	Jansen 2017
2018	March 5	May 10	152.6	Jansen and Brown 2018
2019	March 5, 7	May 16	328.8	Chatfield et al. 2019a, 2019b, Jansen et al. 2019
2022	March 23	May 5	245.5	Jansen 2022a, b
2023	March 21, 22	May 15	245.5	This Study

[a.] During 2017 – 2019, in addition to aerial surveys, ground-based surveys to document new nests and follow-up surveys were conducted for certain nests during year-round avian point count surveys

[b.] Survey Area 2017 = Generalized, conceptual area + 2.0-mile (mi) buffer

Survey Area 2018 – 2019 = Leased lands + 2.0-mi buffer

Survey Area 2022 – 2023 = Proposed turbines and solar arrays + 2.0-mi buffer

Non-eagle Nests

Between 20 and 61 stick nests were documented within the Survey Area during the 2017 – 2019 and 2022 – 2023 aerial surveys (Table 6). Although the number of nests located within the Survey Area increased annually from 2017 to 2022, nest density in 2022–2023 was lower than in 2017 because the Survey Area was approximately three to four times larger due to Project expansion. During 2017 – 2019 surveys, nests occupied by *Buteo* species (i.e., soaring hawks) composed the majority (70% to 83%) of all occupied nests; however, in 2022 and 2023, *Buteo* species composition decreased to 44% and 48%. In contrast, common raven occupancy increased significantly, from 10% in 2017 to 47% in 2022 and 41% in 2023 (Table 6). The increase in common raven nests in 2022 and 2023 was especially evident along the BPA transmission line on the western side of the Survey Area, where six to nine common raven nests (and one red-tailed hawk nest) were documented in 2022–2023 compared to one common raven nest in 2017 (Figure 2).

Table 6. Raptor nest survey results within a 2.0-mile Survey Area at the proposed Horse Heaven Clean Energy Center, Benton County, Washington.

	Survey Year									
	2017		2018		2019		2022		2023	
Species[a]	# Nests	Nest Density ($\#/mi^2$)[b]	# Nests	Nest Density ($\#/mi^2$)[b]	# Nests	Nest Density ($\#/mi^2$)[b]	# Nests	Nest Density ($\#/mi^2$)[b]	# Nests	Nest Density ($\#/mi^2$)[b]
common raven	1	0.013	1	0.007	5	0.015	16	0.065	12	0.049
ferruginous hawk	2	0.027	1	0.007	1	0.003	0	0.000	0	0.000
great horned owl	2	0.027	2	0.013	3	0.009	3	0.012	3	0.012
red-tailed hawk	4	0.054	8	0.052	14	0.043	11	0.045	8[c]	0.033
Swainson's hawk	1	0.013	6	0.039	7	0.021	4	0.016	7	0.029
unknown raptor[d]	10	0.134	14	0.092	14	0.043	27	0.110	25	0.102
Total	**20**	**0.268**	**32**	**0.210**	**44**	**0.134**	**61**	**0.248**	**55**	**0.224**

[a.] Data excludes nests determined as gone and bald eagle nests outside the Survey Area

[b.] Nest density = # nests documented / Survey Area. Sums/values can differ from what is shown due to rounding. Survey Area: 2017 = 74.66 square miles (mi^2); 2018 = 152.60 mi^2 ; 2019 = 328.80 mi^2, 2022-2023 = 245.51 mi^2

[c.] One occupied/inactive nest was attributed to red-tailed hawk, for simplicity

[d.] Unknown raptor stick nests were documented as unoccupied and inactive during surveys

The number of unoccupied nests in 2023 was comparable to the previous survey year. Unoccupied nests were often associated with old farmsteads or residential buildings, and on cliffs and large rock outcrops located along highly eroded drainages and cliff-lined canyons near the northern perimeter of the Survey Area. Nests located along the northern ridgeline were commonly associated with historical ferruginous hawk nests; however, no ferruginous hawks were observed nesting within the cliffs along the ridgeline since 2017. Many of the historical ferruginous hawk nests along the ridgeline were classified as Gone, Remnant, or Poor condition, which suggests that nests have not been maintained for a number of consecutive years (Jansen 2022a).

Ferruginous hawk nesting was infrequently observed during 10 survey rounds conducted over five survey years. During the five survey years, four nesting attempts were made at two nests located in the Coyote Canyon and Badger Canyon territories. Of 12 historical ferruginous hawk nests surveyed three or more years, two nests (Nest 03 in Coyote Canyon and Nest 08 in Badger Canyon) were occupied at least one year. Nest 03 was occupied active during three consecutive survey years (2017 − 2019). Nest 08 was occupied inactive in 2017 and remained in Good condition during the 2018 − 2019 surveys, but was Gone during 2022 and 2023 surveys, with sticks from the nest scattered throughout the area.

During the 5-year survey period, the number of occupied ferruginous hawk territories and nests declined, even as the number of surveyed territories and nests increased (Table 7). Annual territory and ferruginous hawk nest occupancy was highest in 2017 at approximately 20% and declined to no nest activity observed in 2022 or 2023. The overall 5-year average nest and territory occupancy was 4.4% and 5.6%, respectively. Historical nests were occupied by other raptor species and common raven more frequently than by a ferruginous hawk. Over five survey years, 11 historical ferruginous hawk nests were occupied 17 times by species other than a ferruginous hawk; the majority by common raven (11 occurrences), Swainson's hawk (three occurrences), great horned owl (two occurrences), or red-tailed hawk (one occurrence). Historical ferruginous hawk nests not occupied by ferruginous hawk had an overall occupancy rate of 19.5% ((17 nests occupied by other species ÷ (91 nest opportunities–4 nests occupied by ferruginous hawk)). Ferruginous hawk occupancy of nesting territories in the Horse Heaven Hills during the five years of surveys was 5.6%, which was much lower than the 14-year (1978 – 2016) statewide ferruginous hawk occupancy of nesting territories of 41.0% (Hayes and Watson 2021).

Table 7. Annual and overall ferruginous hawk territory and nest occupancy 2023 for the Horse Heaven Clean Energy Center, Benton County, Washington.

Survey Year	# Occupied	Territories		Nests		Comment[2]
		# Surveyed	% Occupied[1]	# Available	% Occupied[1]	
2017	2	9	22.2	10	20	Nest 08 = OI Nest 03 = OA
2018	1	10	10.0	12	8.3	Nest 03 = OA
2019	1	17	5.9	16	6.3	Nest 03 = OA
2022	0	18	0.0	28	0.0	Nest 03 = SWHA
2023	0	18	0.0	25	0.0	Nest 03 = GHOW
Total / Average	**4**	**72**	**5.6**	**91**	**4.4**	

[1] % occupied = # occupied divided by the # territories surveyed or the number of nests recorded in a survey year; all values rounded

[2.] OA = Occupied Active, OI = Occupied Inactive, SWHA = Swainson's hawk, GHOW = great horned owl

Raptor species observed during ground-based avian point count surveys conducted from 2017 − 2020 at the Project that were not observed nesting in 2023 included American kestrel (*Falco sparverius*), golden eagle, northern harrier (*Circus hudsonius*), osprey (*Pandion haliaetus*), peregrine falcon (*F. peregrinus*), short-eared owl (*Asio flammeus*), snowy owl (*Bubo scandiacus*), and turkey vulture (*Cathartes aura*). These species were likely not observed nesting due to a lack of suitable nesting habitat, cryptic nesting habitats not conducive to aerial survey methods, or the location of the Project outside the species' breeding range.

Bald Eagles

During aerial surveys conducted in 2017 – 2019 and 2022 – 2023, eight bald eagle territories were documented within approximately 10 mi of the Project (Table 8, Figure 5). The distance of bald eagle nests to the nearest proposed WTG ranged from 3.7 mi to 10.7 mi (average = 6.8 mi [10.9 km], standard deviation = 2.4 mi [3.9 km]). Overall nest occupancy was high (91%), with only one unoccupied nest (2022 Sand Station) and two Gone nests (2022 Peavine Island alternate, 2023 Sand Station) during the 5-year survey period. Two new bald eagle nests were documented in the 2023 breeding period, representing a substantial (33%) increase in the bald eagle nesting population compared to previous survey years. Each occupied nest contained at least one to three young between 4–6 weeks old. Historically, Peavine Island had an alternate and primary nest, with the alternate nest being missing in 2022. This is the first survey year two occupied nests were located so close to each other (0.69 mi [1.11 km]).

Table 8. Bald eagle nest status documented during surveys conducted 2017 – 2019 and 2022 – 2023 in the Study Areas surrounding the Horse Heaven Hill Clean Energy Center, Benton County, Washington.

Territory Name[1]	Nest Status	Nest Productivity	Distance to Turbine (mi)[2]
Prosser	2017 - not in survey area	2017 - No data	10.7
	2018 - not in survey area	2018 - No data	
	2019 - occupied/active	2019 - 2–3 young, ~4-weeks old	
	2022 - occupied/active	2022 - 2–3 young, ~4-weeks old	
	2023 - occupied / active	2023 - 2 young, ~5–6-weeks old	
Yakima River Mouth	2017 - occupied/active	2017 - 1 young, ~3-weeks old	8.1
	2018 - occupied/active	2018 - 2 young, ~3-weeks old	
	2019 - occupied/inactive	2019 - Adult flushed from nest	
	2022 - occupied/active	2022 - Adult on nest in brooding position and adult perched nearby	
	2023 - occupied / active	2023 - 3 young, ~5–6-weeks old	
Port of Pasco	2017 - not in survey area	2017 - No data	6.5
	2018 - not in survey area	2018 - No data	
	2019 - occupied/active	2019 - 2 young, ~3–4-weeks old	
	2022 - occupied/active	2022 - 1 young, ~3– 4-weeks old	
	2023 - occupied/active	2023 - Adult on nest in brooding position	
Burbank	2017 - not in survey area	2017 - No data	7.2
	2018 - not in survey area	2018 - No data	
	2019 - did not locate	2019 - No data	
	2022 - occupied/inactive	2022 - Adult on nest during first survey, no sign on nesting during second survey	
	2023 - occupied/active	2023 - 1 young, ~5–6-weeks old, adults perched in tree	
Foundation Island	2023 - occupied/active	2023 - 1 young ~5–6-weeks old, new nest	4.4
Peavine Island	2017 - not in survey area	2017 - No data	3.7
	2018 - not in survey area	2017 - No data	
	2019 - occupied/active	2019 - 2 young, ~3-weeks old	
	2022 - occupied/active	2022 - Adult on nest in brooding position, at least 1 young, ~3–4-weeks old; alternate nest gone.	
	2023 - occupied/active	2023 - 1 young, ~5–6 weeks old	
Peavine Island North	2023 - occupied/active	2023 - 3 young, ~5–6-weeks old; new nest	3.9
McNary National Wildlife Refuge	2017 - not in survey area	2017 - No data	7.8
	2018 - not in survey area	2018 - No data	
	2019 - occupied/active	2019 - 2 young, ~3-weeks old	
	2022 - occupied/active	2022 - Adult on nest, tree leafed out and obscuring nest contents	
	2023 - occupied/active	2023 - 2 young, ~5–6-weeks old	
Sand Station	2017 - not in survey area	2017 - No data	9.2
	2018 - not in survey area	2018 - No data	
	2019 - occupied/active	2019 - 2 eggs	
	2022 - unoccupied/inactive	2022 - Nest in poor condition	
	2023 - gone	2023 - No data	

[1.] Territory names established by Western EcoSystems Technology, Inc; [2.] Distance to nearest proposed turbine.

DISCUSSION

The raptor nesting community in 2023 was similar to previous years; however, nest occupancy was uncharacteristically low during the first survey round, suggesting a later raptor nest season that may be influenced by weather conditions, among other factors (Sarasola et al. 2018). Despite having a delayed start to the nesting season, the second survey round documented seven Swainson's hawk nests; Swainson's hawks typically nest later in the breeding season compared to red-tailed hawks and great horned owls. One ferruginous hawk, another later-nesting species, was observed flying above Webber Canyon; thus, surveys overlapped the period when territory occupancy and nest tending should have occurred. It is possible ferruginous hawk nest occupancy may have followed a delayed temporal pattern observed in other raptor species; however, the condition and status of historical ferruginous hawk nests was consistent with previous survey years and were primarily Gone or in Poor and Remnant condition. Consistent with previous years, historical ferruginous hawk nests were more likely to be occupied by another bird species. Six historical ferruginous hawk nests were occupied by common raven and the Coyote Canyon Territory was occupied by a great horned owl with two nestlings. Based on five years of raptor nest surveys at the Project, annual nest occupancy fluctuated slightly, and species occupancy turnover fluctuated slightly (e.g., different species occupying the same nest); however, nest locations were consistent due to the lack of suitable nesting substrates on the landscape. When not occupied by another raptor species, historical ferruginous hawk nests generally remained in a state of poor or degraded condition which indicated no recent nest tending or maintenance.

Bald eagle nest occupancy and productivity was high in 2023, consistent with previous survey years. One new bald eagle nest was documented on Foundation Island and a second occupied nest was documented on Peavine Island, only 1.2 km (0.69 mi) from the existing occupied nest in Peavine Island. In a study of bald eagle nests along the Lower Columbia River, Issacs and Anthony (2011) found density dependent factors likely began affecting nesting success when occupied bald eagle nests in adjacent breeding areas were less than< 3.2 km (2.0 mi) apart, and there was a strong negative influence at < 1.6 km (1.0 mi). The relatively close spacing of nests along this stretch of the Columbia River may reflect resource availability and an increasing bald eagle nesting population, which in Washington had increased 707% from 1981 – 2005 an increasing annual population trend of 9.4% (97.5% confidence interval: 6.5–12.5; Stinson et al. 2005, Ziolkowski et al. 2023). All nests are greater than 2.0 mi from proposed WTGs which the USFWS uses to evaluate project impacts to nearby nesting eagles (USFWS 2020).

WDFW management recommendations for ferruginous hawk encourage surrounding landowners to protect 50% or more of the shrub-steppe within a home range, avoid construction within 1.0 mi (1.6 km) of nests, and implement various spatial and temporal disturbance buffers around nests (Richardson et al. 2004; M. Ritter, WDFW Wind and Solar Lead, pers comm.; Appendix D). Based on land cover characteristics and human-caused disturbances, it appears residential development in the Horse Heaven Hills does not conform to WDFW management recommendations. As Richardson et al. (2004) discusses, although nests can be found in areas with 50% to 100% wheatland within 1.9 mi (3.0 km; Bechard et al. 1990), ferruginous hawk

populations decline consistently once cultivated land exceeds 30% of the area (Schmutz 1987, 1989). Agriculture comprises over 50% of land cover within the core area of historical ferruginous hawk nests within 3.2 km (2.0 mi) of the proposed WTGs. Analyses of resource selection around occupied nests in eastern Washington resulted in similar landscape patterns. In an analysis of 194 occupied ferruginous hawk nests in eastern Washington, 2000–2020 (28% of the 677 nests in the PHS database), occupied nests were more likely to be located with less agriculture within 0.25 mi (0.40 km) and avoided human development within 1.0 mi (1.6 km; Jansen et al. 2022). Occupied nests were selected closer to publicly accessible roads which may be a function of convenience sampling along roads, or the perching and access to foraging habitat documented in other studies (Migaj et al. 2011, Nordell et al. 2017, Watson 2020).

Although land conversion to agriculture and levels of human disturbance from housing, transportation, and electrical networks have been historical features in the Horse Heaven Hills, residential development into the foothills has increased over the past two decades, and noticeably since aerial surveys began in 2017. Housing development into the foothills is expected to continue, with new and on-going residential development in close proximity to Badger Canyon, Clodfelter, Clodfelter West, and Sheep Canyon ferruginous hawk territories decreasing the likelihood these nesting territories will become re-occupied by ferruginous hawks.

REFERENCES

Bechard, M. J., R. L. Knight, D. G. Smith, and R. E. Fitzner. 1990. Nest Sites and Habitats of Sympatric Hawks (*Buteo* spp.) in Washington. Journal of Field Ornithology 61: 159–170

Chatfield, A., T. Rintz, and E. Jansen. 2019a. Results of the 2019 Raptor Nest Survey for the Four Mile Wind Project, Benton County, Washington. Prepared for wpd Wind Projects Inc. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon. July 12, 2019

Chatfield, A., T. Rintz, and E. Jansen. 2019b. Results of the 2019 Raptor Nest Survey for the Badger Canyon Wind Project, Benton County, Washington. Prepared for wpd Wind Projects Inc. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon. July 12, 2019

Coates, P. S., S. T. O'Neil, B. E. Brussee, M. A. Ricca, P. J. Jackson, J. B. Dinkins, K. B. Howe, A. M. Moser, L. J. Foster, and D. J. Delehanty. 2020. Broad-Scale Impacts of an Invasive Native Predator on a Sensitive Native Prey Species within the Shifting Avian Community of the North American Great Basin. Biological Conservation 243: 108409. doi: 10.1016/j.biocon.2020.108409

Esri. 2023. World Imagery and Aerial Photos (World Topo). ArcGIS Resource Center. Environmental Systems Research Institute (Esri), producers of ArcGIS software, Redlands, California. Accessed July 2023. Available online: https://www.arcgis.com/home/webmap/viewer.html?useExisting=1&layers=10df2279f9684e4a9f6a7f08febac2a9

Google Earth. 2023. Google Earth Aerial Imagery. Version 7.3.6.9345. Google, Mountain View, California. Accessed July 2023. Available online: https://www.google.com/earth/

Hayes, G. E. and J. W. Watson. 2021. Periodic Status Review for the Ferruginous Hawk. Washington Department of Fish and Wildlife, Wildlife Program, Olympia, Washington. August 2021. 30 + iii pp. Available online: https://wdfw.wa.gov/sites/default/files/publications/02210/wdfw02210.pdf

Horse Heaven Wind Farm, LLC. 2020. Bird and Bat Conservation Strategy for the Horse Heaven Wind Farm, Benton County, Washington. Version 1.0. Scout Clean Energy, Boulder, Colorado. With Technical Assistance by Western Ecosystems Technology, Inc. (WEST), Corvallis, Oregon. December 28, 2020. 65 pages + appendices

Horse Heaven Wind Farm, LLC. 2021. Horse Heaven Wind Farm Washington Energy Facility Site Evaluation Coucil Application for Site Certification. EFSEC Docket Number EF-210011. Submitted to EFSEC, Olympia, Washington. Submitted by Horse Heaven Wind Farm, LLC, Boulder Colorado. February 2021. Available online: https://www.efsec.wa.gov/energy-facilities/horse-heaven-wind-project/horse-heaven-application

Isaacs, F. B. 2021. Golden eagles (*Aquila chrysaetos*) Nesting in Oregon, 2011–2020: Final Report, 20 December 2021 Draft. Oregon Eagle Foundation, Inc., Klamath Falls, Oregon.

Isaacs, F. B. and R. G. Anthony. 2011. Bald Eagles (*Haliaeetus leucocephalus*) Nesting in Oregon and Along the Lower Columbia River, 1978-2007. Final Report, 18 March 2011. Oregon Cooperative Fish and Wildlife Research Unit. Department of Fisheries and Wildlife, Oregon State University, Corvalis Oregon. USA

Isted, G. H., R. J. Thomas, K. S. Warner, M. J. Stuber, E. Ellsworth, T. E. Katzner. 2023. Ferruginous Hawk movements respond predictably to intra-annual variation but unexpectedly to anthropogenic habitats. Ibis. doi: 10.1111/ibi.13200

Jansen, E. 2017. 2017 Raptor Nest Survey Report for the Proposed Horse Heaven Wind Project, Benton County, Washington. Prepared for Horse Heaven Wind Farm, Boulder Colorado. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon

Jansen, E. W. 2022a. Patterns of Ferruginous Hawk Nesting in the Horse Heaven Hills, Benton County, Washington 2017-2019, 2022. Prepared for Horse Heaven Wind Farm, LLC., Boulder Colorado. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon. June 5, 2022. 17 pages + appendices

Jansen, E. W. 2022b. Raptor Nest Surveys for the Horse Heaven Clean Energy Center, Benton County, Washington, 2022. Prepared for Horse Heaven Wind Farm, LLC., Boulder Colorado. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon. July 11, 2022. 15 pages + appendices

Jansen, E. W., and S. R. Brown. 2018. Wildlife Survey Report for the Horse Heaven Wind Project, Benton County, Washington. Final Report: August 11, 2017 – July 16, 2018. Prepared for Horse Heaven Wind Farm, Boulder Colorado. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon

Jansen, E. W., S. R. Brown, and K. B. Hutchison. 2019. Avian Use Survey Report for the Horse Heaven Wind Energy Project, Benton County, Washington Draft Report. July 24, 2018 – June 22, 2019. Prepared for Horse Heaven Wind Farm, Boulder Colorado. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon. August 23, 2019

Jansen, E. W., K. T. Smith, and F. Kuzler. 2022. Multi-scale Resource Selection Nesting of Ferruginous Hawk (Buteo regalis) in Eastern Washington and at the Horse Heaven Clean Energy Center, Benton County, Washington. Prepared for Horse Heaven Wind Farm, LLC., Boulder, Colorado. Prepared by Western EcoSystems Technology, Inc. (WEST), Corvallis, Oregon. September 23, 2022. 29 pages + appendices.

Larsen, E., J. M. Azerrad, and N. Nordstrom. 2004. Management Recommendations for Washington's Priority Species, Volume IV: Birds. Washington Department of Fish and Wildlife, Olympia, Washington

Migaj. A., C. M. Kemper, B. L. Downey. 2011. Ferruginous hawk artificial nest poles: inventory and construction protocol. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 140, Edmonton, AB. 22 pp. Available online: https://open.alberta.ca/publications/9780778593669

Millsap, B. A., T. G. Grubb, R. K. Murphy, T. Swem, and J. W. Watson. 2015. Conservation Significance of Alternative Nests of Golden Eagles. Global Ecology and Conservation 3: 234–241

National Land Cover Database (NLCD). 2019. National Land Cover Database 2019 - Landcover & Imperviousness (NLCD2019). Available online: https://www.mrlc.gov/data. *As cited* includes:

Dewitz, J., and US Geological Survey (USGS). 2021. National Land Cover Database (NLCD) 2019 Products. Version 2.0. USGS data release. June 2021. doi: 10.5066/P9KZCM54

Homer, C., J. Dewitz, S. Jin, G. Xian, C. Costello, P. Danielson, L. Gass, M. Funk, J. Wickham, S. Stehman, R. Auch, and K. Riitters. 2020. Conterminous United States Land Cover Change Patterns 2001–2016 from the 2016 National Land Cover Database. ISPRS Journal of Photogrammetry and Remote Sensing 162(5): 184–199. doi: 10.1016/j.isprsjprs.2020.02.019

Jin, S., C. Homer, L. Yang, P. Danielson, J. Dewitz, C. Li, Z. Zhu, G. Xian, and D. Howard. 2019. Overall Methodology Design for the United States National Land Cover Database 2016 Products. Remote Sensing. 2971. doi: 10.3390/rs11242971

Wickham, J., S. V. Stehman, D. G. Sorenson, L. Gass, and J. A. Dewitz. 2021, Thematic Accuracy Assessment of the NLCD 2016 Land Cover for the Conterminous United States: Remote Sensing of Environment 257: 112357. doi: 10.1016/j.rse.2021.112357

and

Yang, L., S. Jin, P. Danielson, C. Homer, L. Gass, S. M. Bender, A. Case, C. Costello, J. Dewitz, J. Fry, M. Funk, B. Granneman, G. C. Liknes, M. Rigge, and G. Xian. 2018. A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies. ISPRS Journal of Photogrammetry and Remote Sensing 146: 108–123. doi: 10.1016/j.isprsjprs.2018.09.006

Pagel, J. E., D. M. Whittington, and G. T. Allen. 2010. Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance. US Fish and Wildlife Service (USFWS), Division of Migratory Bird Management. February 2010. Available online: https://tethys.pnnl.gov/sites/default/files/publications/Pagel-2010.pdf

Nordell C.J., T. I. Wellicome, E. M. Bayne. 2017. Flight initiation by Ferruginous Hawks depends on disturbance type, experience, and the anthropogenic landscape. PLoS ONE 12(5): e0177584. https://doi.org/10.1371/journal.pone.0177584

Redfin. 2023. Kennewick Homes for Sale. Accessed July 20, 2023. Available online: https://www.redfin.com/city/8974/WA/Kennewick

Richardson, S., M. Whalen, D. Demers, and R. Milner. 2004. Ferruginous Hawk. Pp. 7-1 - 7-6. *In:* E. Larsen, J. M. Azerrad, N. Nordstrom, eds. Management Recommendations for Washington's Priority Species. Volume IV: Birds. Washington Department of Fish and Wildlife, Olympia, Washington

Sarasola, J., J. Grande, J. Negro. 2018. Birds of Prey. Biology and Conservation in the XXI Century. Springer. doi: 10.1007/978-3-319-73745-4_3

Schmutz, J. K. 1987. The Effect of Agriculture on Ferruginous and Swainson's Hawks. Journal of Range Management 40:4 38–330

Schmutz, J. K. 1989. Hawk Occupancy of Disturbed Grasslands in Relation to Models of Habitat Selection. Condor 91: 362–371

Steenhof, K. and I. Newton. 2007. Assessing Nesting Success and Productivity. Pp. 181-191. *In*: D. M. Bird and K. Bildstein, eds. Raptor Research and Management Techniques. Hancock House, Blaine, Washington

Stinson, D. W., J. W. Watson, and K. R. McAllister. 2007. Washington State Status Report for the Bald Eagle. Washington Department of Fish and Wildlife, Olympia. 86 + viii pp

US Department of Homeland Security (DHS). 2023. Transmission Lines. Homeland Infrastructure Foundation-Level Data (HIFLD). Updated: December 11, 2022, Accessed July 27, 2023. Available online: https://hifld-geoplatform.opendata.arcgis.com/

US Fish and Wildlife Service (USFWS). 2012. Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online: https://www.fws.gov/sites/default/files/documents/WEG_final.pdf

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. US Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. Frontmatter + 103 pp. Available online: https://www.fws.gov/guidance/sites/ guidance/files/documents/eagleconservationplanguidance.pdf

US Fish and Wildlife Service (USFWS). 2020. Updated Eagle Nest Survey Protocol. USFWS, Washington, D.C. 4 pp. Available online: https://www.fws.gov/media/updated-eagle-nest-survey-protocol

US Geological Survey (USGS). 2023. The National Map. TNM Download V2.0. Topo Map data, 3DEP products, Lidar, IfSAR, NHD (Hydrography Dataset), NAIP Plus Imagery, National Structures Dataset. Accessed July 2023. Available online: https://apps.nationalmap.gov/downloader/#/

Washington Department of Fish and Wildlife (WDFW). 1996. Washington State Recovery Plan for the Ferruginous Hawk. WDFW, Olympia, Washington. 63 pp

Washington Department of Fish and Wildlife (WDFW). 2009. Wind Power Guidelines. WDFW, Olympia, Washington. April 2009. 30 pp. Available online: https://wdfw.wa.gov/publications/00294

Watson J. L. 2020. Ferruginous Hawk (Buteo regalis) Home Range and Resource Use on Northern Grasslands in Canada. A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Ecology, Department of Biological Sciences University of Alberta.

Watson, J. W., U. Banasch, T. Byer, D. N. Svingen, R. McCready, M. A. Cruz, D. Hanni, A. Lafon, and R. Gerhardt. 2018. Migration Patterns, Timing, and Seasonal Destinations of Adult Ferruginous Hawks (Buteo regalis). Journal of Raptor Research 52:267–281. doi: 10.3356/JRR-17-30.1

Ziolkowski, D.J., M. Lutmerding, W. B. English, V. I. Aponte, M-A. R. and Hudson. 2023. North American Breeding Bird Survey Dataset 1966 - 2022: U.S. Geological Survey data release. doi: 10.5066/P9GS9K64

Appendix A. Raptor Nests Documented During the 2023 Raptor Nest Survey at the Horse Heaven Clean Energy Center, Benton County, Washington

Appendix A. Raptor nests documented during the 2023 raptor nest survey at the Horse Heaven Clean Energy Center, Benton County, Washington.

Nest ID	Nesting Species	Nest Status	Nest Substrate	Nest Condition	Comments
01	great horned owl	occupied/active	deciduous	good	1 adult on nest
02	Swainson's hawk	occupied/active	deciduous	good	1 adult on nest
03	great horned owl	occupied/active	deciduous	good	Coyote Canyon Territory; ferruginous hawk nested in 2017–2019; 2 young and 1 adult on nest
04	unknown raptor	unoccupied/inactive	cliff	remnant	Clodfelter West Territory; historical ferruginous hawk nest; rocks in nest
07	red-tailed hawk	occupied/active	deciduous	good	2 young and 1 adult on rebuilt nest in northern tree
08	gone	gone	ground	gone	Badger Canyon Territory; historical ferruginous hawk nest; occupied inactive in 2017; scattered stick material
09	unknown raptor	occupied/inactive	deciduous	good	Fresh greenery, white wash and condition of recent maintenance.
10	unknown raptor	unoccupied/inactive	ground	poor	Sheep Canyon Territory; historical ferruginous hawk nest
11	unknown raptor	unoccupied/inactive	ground	remnant	Sheep Canyon Territory; historical ferruginous hawk nest, new residential construction within 0.19 km
12	common raven	occupied/active	cliff	good	[redacted] Road Territory; historical ferruginous hawk nest; 2 young
13	unknown raptor	unoccupied/inactive	ground	remnant	[redacted] Road Territory; historical ferruginous hawk nest
15	unknown raptor	unoccupied/inactive	ground	poor	Webber Canyon Territory; historical ferruginous hawk nest
16	unknown raptor	unoccupied/inactive	ground	poor	Webber Canyon Territory; historical ferruginous hawk nest
17	unknown raptor	unoccupied/inactive	rock outcrop	poor	Webber Canyon Territory; historical ferruginous hawk nest
18	bald eagle	occupied/active	deciduous	good	Yakima Mouth Territory; 3 young, ~5-weeks old
19	Swainson's hawk	occupied/active	deciduous	good	1 adult brooding; tree falling down
20	red-tailed hawk	occupied/active	deciduous	good	1 adult in brooding posture
22	unknown raptor	unoccupied/inactive	ground	remnant	Clodfelter Territory; historical ferruginous hawk nest
24	red-tailed hawk	occupied/active	deciduous	good	1 young with 1 adult tending nest, next to highway
25	gone	gone	deciduous	gone	Nest blown out of tree; next to highway
26	unknown raptor	unoccupied/inactive	platform	good	Nest platform along wind row that contains another stick nest - both inactive. Backyard next to highway.
27	unknown raptor	unoccupied/inactive	deciduous	poor	Ragged nest needing maintenance; poplar tree stand adjacent to residence.
28	Swainson's hawk	occupied/active	deciduous	good	1 adult on nest in east bush, 1 common raven on nest in west bush – 2 nests.
29	Swainson's hawk	occupied/active	deciduous	good	Head of Webber Canyon; 1 adult incubating position; former BBMA nest
30	unknown raptor	unoccupied/inactive	ground	poor	Webber Canyon Territory; historical ferruginous hawk nest
31	Swainson's hawk	occupied/active	deciduous	good	3 eggs; ragged tree stand; nest low; near old farmhouse
32	Swainson's hawk	occupied/active	conifer	good	1 adult incubating on nest next to commercial building
33	unknown raptor	unoccupied/inactive	cliff	fair	[redacted] Territory; historical ferruginous hawk nest; double side-by-side nest
34	unknown raptor	unoccupied/inactive	cliff	fair	Chandler Butte Territory; historical ferruginous hawk nest; substantial material sloughing off
35	common raven	occupied/active	building	good	Nest moved from pine tree next to house to opening at top of granary; conifer was the historical location
37	bald eagle	occupied/active	deciduous	good	Port of Pasco Territory; 2 young ~5-weeks old

Appendix A. Raptor nests documented during the 2023 raptor nest survey at the Horse Heaven Clean Energy Center, Benton County, Washington.

Nest ID	Nesting Species	Nest Status	Nest Substrate	Nest Condition	Comments
38	unknown raptor	unoccupied/inactive	tower	fair	On BPA tower; nest low, center of tower on horizontal truss
39	red-tailed hawk	occupied/active	deciduous	good	2 young and 1 adult in nest
40	red-tailed hawk	occupied/active	deciduous	good	3 young, 2 adults present
41	Swainson's hawk	occupied/active	deciduous	good	1 adult on nest in incubating position; tree slumped over
43	common raven	occupied/active	deciduous	good	[redacted] Road Territory; historical ferruginous hawk nest; 3 young; 3 nests in ragged tree patch
44	gone	gone	deciduous	gone	Nest gone; common raven in 2022
46	common raven	occupied/active	deciduous	good	[redacted] Road Territory; historical ferruginous hawk nest; 1 adult in nest, brooding
47	unknown raptor	unoccupied/inactive	deciduous	fair	Trending toward black-billed magpie nest, adjacent to agriculture
48	bald eagle	occupied/active	deciduous	good	Peavine Island Territory; 1 young ~5-6 weeks old
49	unknown raptor	unoccupied/inactive	deciduous	good	Large nest in windrow
50	red-tailed hawk	occupied/active	deciduous	good	3 young and 1 adult on nest
51	red-tailed hawk	occupied/active	deciduous	good	1 young and 1 adult on nest; 2 nests stacked on top of each other
52	great horned owl	occupied/active	deciduous	good	1 adult in nest with 2 owlets
53	gone	gone	deciduous	gone	Peavine Island Territory; 2019 alternate nest Gone
54	bald eagle	occupied/active	deciduous	good	McNary NWR Territory; 2 young ~5-weeks old
55	bald eagle	gone	deciduous	gone	Sand Station Territory; nest evidence gone
58	bald eagle	occupied/active	deciduous	good	Prosser Territory; 2 young and 1 adult on nest
59	gone	gone	gone	gone	Webber Canyon Territory; historical ferruginous hawk nest
60	gone	gone	rock outcrop	gone	Clodfelter Territory; historical ferruginous hawk nest; below residential subdivision
61	unknown raptor	unoccupied/inactive	ground	remnant	Badger Canyon NW Territory; historical ferruginous hawk nest; new residential construction within 0.77 km
63	gone	gone	deciduous	gone	West Fourmile Canyon Territory; historical ferruginous hawk nest
64	gone	gone	deciduous	gone	[redacted] Road Territory; historical ferruginous hawk nest; removed by residential development
65	gone	gone	rock outcrop	gone	Clodfelter Territory; historical ferruginous hawk nest; below residential subdivision
66	gone	gone	rock outcrop	gone	Clodfelter Territory; historical ferruginous hawk nest; below residential subdivision
67	unknown raptor	unoccupied/inactive	ground	remnant	Clodfelter West Territory; historical ferruginous hawk nest
68	common raven	occupied/active	deciduous	good	West Fourmile Canyon Territory; historical ferruginous hawk nest
69	gone	gone	gone	gone	Webber Canyon Territory; historical ferruginous hawk nest; no sign on barren landscape
70	gone	gone	gone	gone	Webber Canyon Territory; historical ferruginous hawk nest
71	gone	gone	ground	gone	Webber Canyon Territory; historical ferruginous hawk nest; Remnant 2022, currently Gone
72	gone	gone	ground	gone	Webber Canyon Territory; historical ferruginous hawk nest; 2022 = Remnant

Appendix A. Raptor nests documented during the 2023 raptor nest survey at the Horse Heaven Clean Energy Center, Benton County, Washington.

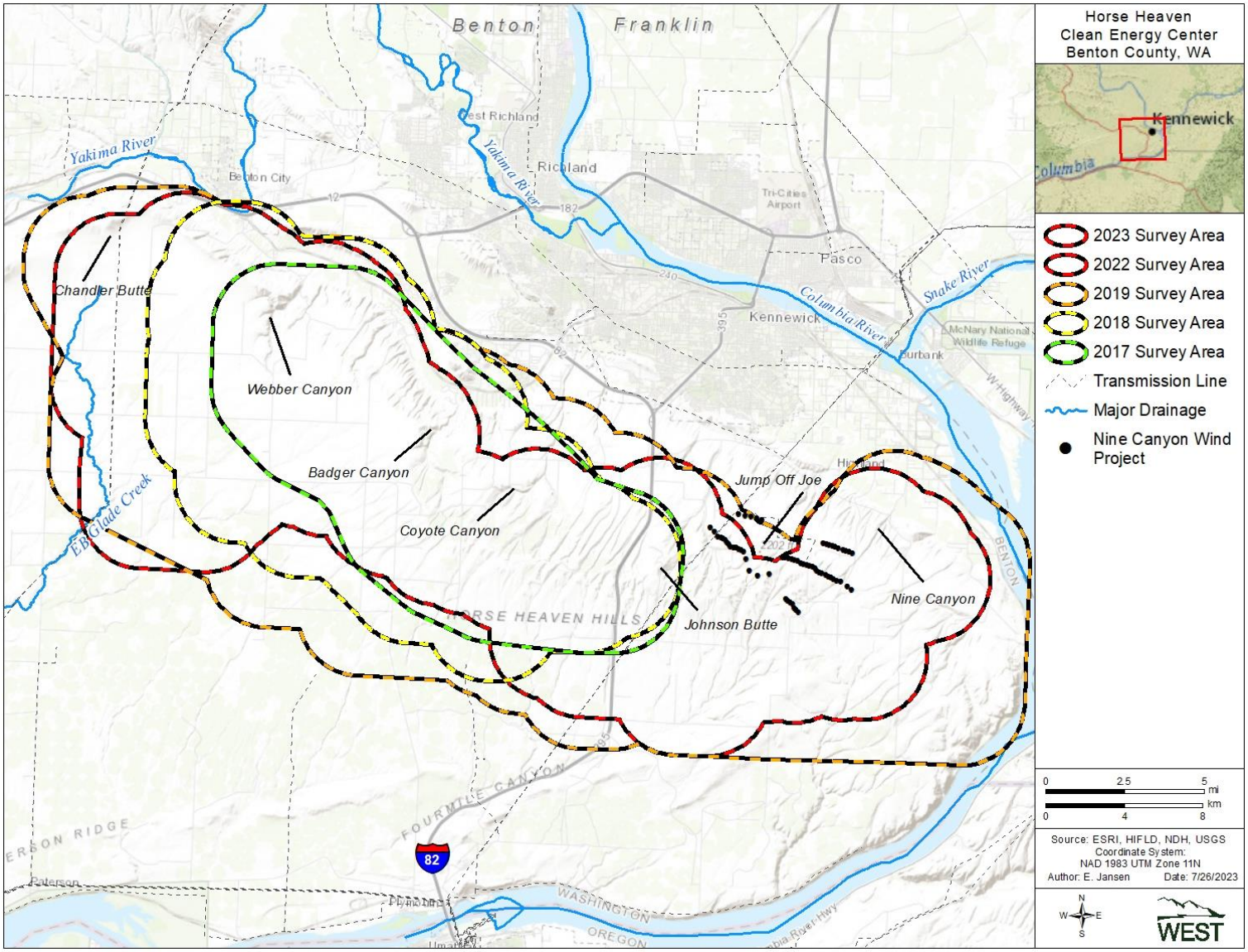
Nest ID	Nesting Species	Nest Status	Nest Substrate	Nest Condition	Comments
74	gone	gone	ground	gone	13 Road Territory; historical ferruginous hawk nest
75	gone	gone	ground	gone	13 Road Territory; historical ferruginous hawk nest
76	gone	gone	ground	gone	Webber Canyon Territory; historical ferruginous hawk nest
77	unknown raptor	unoccupied/inactive	cliff	remnant	13 Road Territory; historical ferruginous hawk nest; small nest
78	unknown raptor	unoccupied/inactive	ground	remnant	13 Road Territory; historical ferruginous hawk nest
80	gone	gone	gone	gone	Webber Canyon Territory; historical ferruginous hawk nest
81	gone	gone	rock outcrop	gone	Clodfelter Territory; historical ferruginous hawk nest; below residential subdivision
84	unknown raptor	unoccupied/inactive	ground	remnant	13 Road Territory; historical ferruginous hawk nest; rocks in nest
85	unknown raptor	unoccupied/inactive	ground	remnant	Badger Canyon NW Territory; historical ferruginous hawk nest; new residential construction 0.62 km
86	gone	gone	ground	gone	Clodfelter Territory; historical ferruginous hawk; below residential subdivision
87	did not survey	unknown	deciduous	unknown	13 Lane Territory; historical ferruginous hawk nest; horse pasture in middle of residential area; survey aborted
89	gone	gone	unknown	gone	Badger Canyon Territory; historical ferruginous hawk nest; no rock outcrop at coordinates; shrub-steppe
92	common raven	occupied/active	cliff	good	Chandler Butte Territory; historical ferruginous hawk nest; 2 young and 1 adult on nest
94	gone	gone	unknown	gone	Webber Canyon Territory; historical ferruginous hawk nest
95	gone	gone	ground	gone	Badger Canyon Territory; historical ferruginous hawk nest
96	gone	gone	ground	gone	Badger Canyon Territory; historical ferruginous hawk nest
97	gone	gone	ground	gone	Badger Canyon Territory; historical ferruginous hawk nest
99	gone	gone	ground	gone	Sheep Canyon Territory; historical ferruginous hawk nest; new residential construction 0.15 km away
100	gone	gone	ground	gone	Sheep Canyon Territory; historical ferruginous hawk; new residential construction 0.31 km away
101	common raven	occupied/active	cliff	good	13 Territory; historical ferruginous hawk nest; in quarry; 3 young
102	gone	gone	rock outcrop	gone	13 Territory; historical ferruginous hawk nest
106	gone	gone	rock outcrop	gone	13 Territory; historical ferruginous hawk nest
109	gone	gone	tree	gone	Sheep Canyon Territory; historical ferruginous hawk nest; tree removed by cropland
111	gone	gone	deciduous	gone	13 Territory; historical ferruginous hawk nest; Swainson's hawk 2022; broken branch and nest material on ground
112	gone	gone	ground	gone	Nine Canyon Territory; historical ferruginous hawk
113	gone	gone	rock outcrop	gone	Clodfelter Territory; historical ferruginous hawk; below residential subdivision
114	gone	gone	ground	gone	Clodfelter Territory; historical ferruginous hawk nest; 43 m from mansion
115	bald eagle	occupied/active	deciduous	good	Burbank Territory; 1 young ~5–6-weeks old

Appendix A. Raptor nests documented during the 2023 raptor nest survey at the Horse Heaven Clean Energy Center, Benton County, Washington.

Nest ID	Nesting Species	Nest Status	Nest Substrate	Nest Condition	Comments
116	gone	gone	ground	gone	Sheep Canyon Territory; historical ferruginous hawk nest; fair condition in 2022
117	gone	gone	tower	gone	Nest blown off tower, no sign
118	gone	gone	tower	gone	Nest blown off tower, no sign
119	common raven	occupied/active	tower	good	On BPA tower; adult incubating
120	common raven	occupied/active	tower	good	On BPA tower; adult incubating
121	common raven	occupied/active	tower	good	On BPA tower; adult incubating
122	common raven	occupied/active	tower	good	On BPA tower; adult standing on nest
123	gone	gone	tower	gone	Nest blown off tower, no sign
124	gone	gone	tower	gone	Nest blown off tower, no sign
125	unknown raptor	unoccupied/inactive	cliff	good	Nest in very low cliff adjacent to Webber Canyon Road; raven 2022
126	unknown raptor	unoccupied/inactive	tower	fair	On BPA tower
127	common raven	occupied/active	tower	good	On BPA tower; adult incubating
128	unknown raptor	Unoccupied/Inactive	platform	fair	New platform installed by Washington Department of Fish and Wildlife
129	bald eagle	occupied/active	tree	good	Fountain Island Territory; 1 young and adult on nest; ~5–6-weeks old
130	bald eagle	occupied/active	tree	good	Peavine Island Territory; 3 young and adult on nest; ~5–6-weeks old

BPA = Bonnevile Power Administration; km = kilometer; m = meter; mi = mile

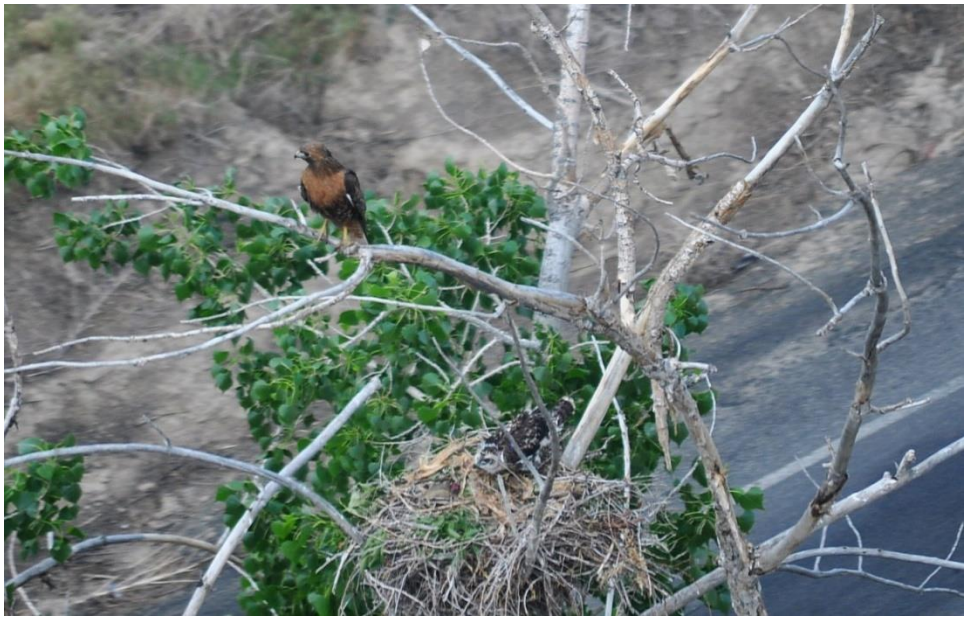
Appendix B. Survey Areas for Raptor Nest Surveys Conducted from 2017 – 2019 and 2022 – 2023 for the Horse Heaven Clean Energy Center, Benton County, Washington



Appendix B. Survey Areas for raptor nest surveys conducted from 2017 – 2019, 2022 – 2023 for the Horse Heaven Clean Energy Center, Benton County, Washington.

Appendix C. Representative Photographs of Raptor Nests and Surrounding Landscape Documented During Raptor Nest Surveys Conducted March 21, 22 and May 15, 2023 for the Horse Heaven Clean Energy Center, Benton County, Washington

Appendix C1. Operating Nine Canyon wind energy turbines and transmission infrastructure within the grasslands, cropland, and shrub-steppe landscape of the Survey Area; March 2022.



Appendix C2. Dark morph red-tailed hawk perched at Nest 24 with one young on the nest. Nest consistently occupied by ed-tailed hawk from 2018 – 2019, 2022–2023

Appendix C3. Adult bald eagle perched at Nest 48, with at least one 3–4-week-old young – Peavine Territory, May 2022. Occupied 2023.

Appendix C4. Adult bald eagle perched at Nest 58 with at least two approximately 4-week- old young − Prosser Territory, May 2023.

Appendix C5. Coyote Canyon historical ferruginous hawk Nest 03 during the second survey round in 2023 with a great horned owl adult and two young in the nest.

Appendix C6. Landscape of historical ferruginous hawk Nest 08 that was occupied/inactive in 2017 and located at the rock outcrop noted by the red arrow. Nest appeared in good condition in 2018 and 2019, and was gone in 2022 and 2023.

Appendix C7. Example of historical ferruginous hawk Nest 13 in remnant condition located in the [redacted] Road Territory, March 2022. Same condition in May 2023.

Appendix C8. Existing residential development along the ridgeline in proximity of the Clodfelter and Clodfelter West territories. The majority of the nests were Gone or in Remnant condition, May 2023.

Appendix D. Ferruginous Hawk Disturbance Recommendation for the Horse Heaven Clean Energy Center, Benton County, Washington, from Mike Ritter, Washington Department of Fish and Wildlife Statewide Technical Lead, Wind and Solar, January 28, 2020

WEST

Erik Jansen <ejansen@west-inc.com>

Ferr. Hawks

1 message

Ritter, Michael W (DFW) <Michael.Ritter@dfw.wa.gov> Tue, Jan 28, 2020 at 12:48 PM
To: Erik Jansen <ejansen@west-inc.com>, "Fossum, Linnea" <Linnea.Fossum@tetratech.com>, "pat@scoutcleanenergy.com" <pat@scoutcleanenergy.com>

Ferruginous hawk:

Taken from WDFW Priority Habitats and Species recommendations (2004)

Disturbance

Brief human access and intermittent ground-based activities should be avoided within a distance of 250 m (820 ft) of nests during the hawks' most sensitive period (1 March to 31 May) (White and Thurow 1985). Prolonged activities (0.5 hr to several days) should be avoided, and noisy, prolonged activities should not occur, within 1 km (0.6 mi) of nests during the breeding season (1 March to 15 August) (Suter and Joness 1981). Construction or other developments near occupied nests should be delayed until after the young have dispersed (Konrad and Gilmer 1986), which generally occurs about a month after fledging (Olendorff 1993; A. Jerman, unpubl. data).

Spatial and temporal buffers should be tailored to the individual hawks involved (Knight and Skagen 1988), based on factors such as line-of-sight distance between nest and disturbance, nest structure security, history of disturbance, observed responses, and nest elevation in relation to the disturbance.

Michael Ritter

Fish and Wildlife Area Habitat Biologist

Statewide Technical Lead: Wind and Solar

Washington Department of Fish and Wildlife

2620 N. Commercial Ave

Pasco, WA 99301

509-543-3319 (office)

509-380-3028 (cell)