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April 14, 2016

Kimberly D. Bose, Secretary  
Federal Energy Regulatory Commission  
Mail Code: DHAC, PJ-12  
888 First Street, N.E.  
Washington, D.C. 20426

**RE: Priest Rapids Hydroelectric Project No. 2114-217  
License Compliance Filing – Article 411 Transmission Line Avian Collision Protection Plan  
2015 Annual Report**

Dear Secretary Bose,

Public Utility District No. 2 of Grant County, Washington (Grant PUD) respectfully submits to the Federal Energy Commission Regulatory Commission (FERC) its 2015 Transmission Line Avian Collision Protection Plan Annual Report.

On April 15, 2010, Grant PUD filed its Transmission Line Avian Collision Protection Plan (Plan) with FERC. On August 24, 2010, FERC issued an approving and modifying Order. Per the Plan, Grant PUD is required to install bird flight diverters (BFDs) upon ten transmission line spans from 2011 – 2015, conduct avian surveys from 2011 – 2016 and every fifteen years thereafter, and provide annual reports to the U.S. Fish and Wildlife Service (USFWS), Washington Department of Fish and Wildlife (WDFW) and FERC by April 17 of each reporting year.


The Plan identified ten transmission line spans located within five different transmission line corridors for avian interaction studies and line marking. In 2010, Grant PUD proposed to install BFDs all on these transmission line spans to be in accordance with the guidelines set forth in “Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006,” by the Edison Electric Institute and the Avian Power Line Interaction Committee (APLIC), or as such publication may be updated from time to time. In 2012, APLIC updated its suggested practices.

In review of the APLIC publication released in 2012 (APLIC 2012), Grant PUD determined that two of its three Midway transmission line spans were in accordance with the APLIC 2012 guidelines. The Midway transmission line spans are the interior spans of a five-span transmission line cluster thereby reducing avian collision potential due to the line configuration. As a result, Grant PUD proposed to its consulting parties – USFWS and WDFW – to not install BFDs on the two Midway transmission line spans. In addition, Grant PUD proposed to remove the overhead ground wires on one de-energized span, which will also reduce avian collision potential. Discussion of these proposals occurred over a number of occasions with the consulting parties; formal approval for these proposals were sought and received during

the consulting parties' review of the 2012 annual report in which the proposal was included. The USFWS and WDFW concurred with both of Grant PUD's proposals. On December 23, 2013, Grant PUD submitted an amendment request to FERC for License Article 411 be modified to reflect the agency-approved and APLIC-compliant avian collision minimization options for the four transmission line spans previously identified in the 2010 FERC Order. On May 6, 2014, FERC issued an order approving the Grant PUD's proposed modifications to not install BFDs on the two Midway transmission line spans.

FERC staff with any questions should contact Tom Dresser at 509-754-5088, ext. 2312 or by email at [tdresse@gcpud.org](mailto:tdresse@gcpud.org).

Respectfully,



Ross Hendrick  
License Compliance Manager

Enclosures: Final 2015 Transmission Line Avian Collision Protection Plan Report

Cc: Jessica Gonzales, USFWS  
Steve Lewis, USFWS  
Patrick Verhey, WDFW

**Priest Rapids Project – FERC No. 2114**

**Transmission Line Collision Protection Plan**

**2015 Annual Report**

**License Article 411**

Prepared by:



Environmental Assessment Services, LLC  
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For:

Grant County Public Utility District

**January 2016**

## Executive Summary

On August 24, 2010, the Federal Energy Regulatory Commission (FERC) issued the order modifying and approving the Transmission Line Avian Collision Protection Plan (Plan) pursuant to Article 411 of the license for the Priest Rapids Project No. 2114 (Project). Per FERC's approval of the Plan, Public Utility District No. 2 of Grant County, Washington (Grant PUD) is required to ensure that 10 of its transmission line spans are compliant with the guidelines set forth in "Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006" or an updated publication. In 2010, Grant PUD proposed to install bird flight diverters (BFDs) upon ten transmission line spans within five transmission line corridors from 2011–2015, conduct avian surveys from 2011–2016 and every 15 years thereafter, and provide annual reports to the U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, and FERC by April 17 of each report year.

Pursuant to the Plan, Grant PUD scheduled the installation of BFDs upon the overhead ground wires (OHGW) at the following corridors and years: 1) South Moran Slough (2011), 2) North Moran Slough (2012), 3) Wanapum Switchyard (2013), 4) Wanapum-Columbia/Moses Coulee (2014), and Midway/Columbia River (2015).

Avian surveys have been conducted seasonally each year at all five transmission line corridors to record avian interactions within 0.25 miles of each of the transmission lines. The Wanapum-Columbia/Moses Coulee transmission line corridor was generally characterized as a raptor location, having a high number (>10) of ledges and alcoves on the cliffs. The South Moran Slough, North Moran Slough, Wanapum Switchyard, and the Midway/Columbia River corridors were all generally characterized as waterfowl locations with open water, nesting habitat, and brood cover.

A total of 60 avian interaction surveys were conducted during 2015 and included a total of 8,077 bird observations. At least fifty-four different bird species were identified during 2015, including one species, American White Pelican (*Pelecanus erythrorhynchos*), is listed as endangered by the State of Washington.

Bird flight behaviors recorded at the South Moran Slough, North Moran Slough, Wanapum Switchyard, and Wanapum-Columbia corridors were examined for differences associated with BFD installations. At the South Moran Slough and Wanapum-Columbia corridors, the unaltered flight behavior of passerine species was significantly increased ( $\alpha = 0.05$ ) after BFDs were installed. No statistical differences were detected in the pre-BFD-installed and post-BFD-installed bird flight behavior data for birds of prey at all sites. A lack of flight behavior difference with birds of prey could reveal that these species already observed the OHGWs prior to BFD installation. Whereas for wading birds, such as herons, observations of unaltered flight behavior significantly decreased ( $\alpha = 0.05$ ). A decrease in the frequency of unaltered flights for wading birds suggests that the BFDs are increasing the visual profile of the static wires and as a result, the birds are altering their flight in order to avoid the lines.

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## **1.0 Introduction**

On August 24, 2010, the Federal Energy Regulatory Commission (FERC) issued the order modifying and approving the Transmission Line Avian Collision Protection Plan (Plan) pursuant to Article 411 of the license for the Priest Rapids Project No. 2114 (Project)<sup>1</sup>. FERC's approval of the Article 411 requires the Public Utility District No. 2 of Grant County, Washington (Grant PUD) to be required to insure that 10 of its transmission line spans are compliant with the guidelines set forth in "Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006" or an updated publication. In 2010, Grant PUD proposed to install bird flight diverters (BFDs) upon ten transmission line spans within five transmission line corridors from 2011–2015, conduct avian surveys from 2011–2016 and every 15 years thereafter, and provide annual reports to the U.S. Fish and Wildlife Service (USFWS), Washington Department of Fish and Wildlife (WDFW), and FERC by April 17 of each report year.

In 2001, Grant PUD assessed the potential for avian collisions with its transmission system. Avian surveys were conducted at a total of 28 transmission line corridors and included substations and switchyards (Framatome ANP 2003). In general, the primary source of birds collisions within the transmission system are birds colliding with the overhead ground wires (OHGW), and the installation of BFDs upon the OHGWs have reduced bird collisions in the range of 57-89% (Koops and De Jong 1982; Koops 1987).

Within the approved Plan, Grant PUD committed to mark five 230 kV transmission line corridors with BFDs and install BFDs upon OHGW and any guy wires associated with the ten transmission line spans within the five transmission line corridors. Grant PUD determined that it was not necessary to mark the transmission lines (T-lines); because, the 230 kV T-lines are thicker and have a line diameter equal to or greater than one inch in diameter (APLIC 1994, 2012). Additionally, most BFDs and devices cannot be installed on energized conductors with voltages over 230 kV (APLIC 1994).

## **2.0 Materials and Methods**

### **2.1 Bird Flight Diverter Installation**

Pursuant to the Plan, Grant PUD scheduled the BFD installation upon the OHGW at the following corridors and years: 1) South Moran Slough (2011), 2) North Moran Slough (2012), 3) Wanapum Switchyard (2013), 4) Wanapum-Columbia/Moses Coulee (2014), and Midway/Columbia River downriver from Priest Rapids Dam (2015). All outages were scheduled to occur during the months of September and October for the marking years.

### **2.2 Avian Surveys**

Pursuant to the approved Plan, avian surveys were conducted at the five corridors (South Moran Slough, North Moran Slough, Wanapum Switchyard, Wanapum-Columbia/Moses Coulee, and Midway/Columbia River downriver from Priest Rapids Dam). The transmission line corridor surveys recorded data in three categories: 1) Site Information, 2) Avian Location Type, and 3) Avian Interaction Survey to incorporate information within 0.25 miles of the transmission lines. See Appendix A for the datasheets used to record the data.

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<sup>1</sup> 132 FERC ¶ 62,127 (2010)

### **2.2.1 Site Information Data**

The Site Information included the following data:

- Date
- Surveyor
- Site Name
- Survey Period: Spring Migration (February–March); Nesting (April–May); Summer (July–August); Fall/Winter (Mid-September–November)
- Day Time Period: AM (survey started at civil twilight), Mid-Day, PM (survey concluded at civil twilight)
- Survey Start Time
- Survey End Time
- Bird Flight Diverter Status (Installed or Not Installed)
- Raptor Perches (Present/Absent)
- Large Migratory Flights (Present/Absent)
- Geographic Funnel (Present/Absent). River valleys and canyons are examples of geographic funnels.

### **2.2.2 Avian Location Types**

The Avian Location Types were classified at Raptor Locations or Waterfowl Locations. Raptor Locations noted the presence of ledges and alcoves on cliffs as not applicable (N/A), Low (0-5), Moderate (6-10), or High (>10). The presence or absence of updrafts and thermals were also recorded for Raptor Locations.

Waterfowl Locations Types recorded data on open water, nesting habitat, and brood cover. Open water data were recorded as present or absent. Nesting habitat data were recorded as present or absent during the nesting survey period only. Nesting habitat data were not applicable during the other survey periods. Brood cover data were recorded as present or absent during the Nesting and Summer Survey Periods. Brood cover data were not applicable during the other survey periods.

### **2.2.3 Avian Interaction Survey Data**

The avian interaction survey collected data within 0.25 miles of the transmission line spans. The avian interaction survey recorded data for observation time, bird category, number of birds, listing status, vertical plane interaction, weather, and behavior. The survey time lengths were two hours during the nesting, summer, and fall/winter survey periods and three hours for the spring migration survey period. Observation time was recorded as military time. Bird categories were recorded as the following: A) Birds of Prey, B) Waterfowl, C) Wading Birds (herons), D) Shorebirds (plovers, sandpipers), E) Aerialists (pelicans, gulls, terns), F) Fowl-Like Birds, G) Passerine (songbirds, etc.), H) Misc. Non-Passerine Birds (doves, swifts, hummingbirds, woodpeckers, kingfishers). Listing status included any state or federal listing status for the particular bird species. The vertical plane interaction data were recorded in the following four vertical zones: 1) N/A (Did Not Intersect T-Line), 2) below transmission lines, 3) between



transmission lines and OHGWs, and 4) above OHGWs. The vertical plane distance was recorded as the following: N/A (Did Not Intersect T-Line), 0–10 ft, 11–25 ft, 26–50 ft, 51–100 ft, and >101 ft. Weather data included notes relating to cloud cover, precipitation, wind speed. Behavior data were recorded as Unaltered Flight, Flight Among Wires, Altered Flight, Abrupt Altered Flight, Flushed, Perched on Tower, Perched on Wire, Perched on Other, On Water/Ground (Table 1; Framatome ANP 2003).

**Table 1 A description of the behavior data recorded during avian interaction surveys.**

|                       |   |
|-----------------------|---|
| Unaltered Flight      | Flight above or below (but not among) the transmission lines that includes no observable alterations in flight altitude, direction, speed or other flight characteristic that could be construed as a response to the transmission line structures, wires, or OHGW.   |
| Flight Among Lines    | Flight between transmission line wires, OHGW, or both that exhibited no observable alterations in flight altitude, direction, speed or other flight characteristic that could be construed as a response to the transmission line structures, wires, or OHGW.   |
| Altered Flight        | Any change in flight altitude, direction, speed, or other flight characteristic in apparent response to a transmission line structure, wire, or OHGW. The behavior occurs as the bird approaches the structure, wire or OHGW giving the individual the time necessary to make a relatively minor flight adjustment and avoid the structure. |
| Abrupt Altered Flight | Any change in flight altitude, direction, speed, or other flight characteristic in apparent response to a transmission line structure, wire, or OHGW occurring in very close proximity to a transmission line structure and involving a rapid and/or major flight adjustment to avoid the structure.  |
| Flushed               | Rapid take off from vegetative cover, water, or ground that was construed as being a direct result of disturbance (usually by the observer, but also including passing vehicles).   |
| Perched on Tower      | Perching on any transmission line tower, OHGW support, or structure that supports a wire, including those associated with a substation or switchyard.   |
| Perched on Wire       | Perching on any wire associated with the transmission line, substations, or switchyards, or adjacent distribution lines including OHGW or support (guy) wires.  |
| Perched on Other      | Perching on vegetation, fences or posts, autos and other machinery, cliffs, distribution poles, or any other man-made structures.   |
| On Water/Ground       | Stationary or moving on the ground, or on water (e.g., loafing, foraging on the surface, diving, or swimming).  |

## 2.2.4 Avian Interaction Statistical Analyses

Statistical comparisons [two-tailed Student's t-Test ( $\alpha \leq 0.05$ )] of altered and unaltered bird flight behavior were performed for pre-BFD and post-BFD treatment groups when conditions were the following:

- 1). at least three altered flight or unaltered flight observations per treatment group,
- 2). at least 20 total bird observations for a given bird category within both the pre-BFD and post-BFD treatment groups, and
- 3). at least three seasons of both pre-BFD and post-BFD treatment group surveys.

For treatment groups and bird categories that satisfied the above conditions, the number of birds that exhibited altered flight and unaltered flight were divided by the total numbers of birds observed for their respective bird category for each survey period and the aforementioned statistical comparisons were performed.

## 3.0 Results and Discussion

### 3.1 Bird Flight Diverter Installation

A complete list of BFD installation progress is presented in Table 2. BFDs installation upon the OHGW's at South Moran Slough was completed on October 10, 2011. The North Moran Slough was completed on November 9, 2012. The Wanapum Switchyard corridor BFD's were installed on September 30, 2013. The Wanapum-Columbia/Moses Coulee BFD's were installed on October 03, 2014.

**Table 2 The bird flight diverter installation completion dates for transmission line corridors.**

| Date of Completion | Span of BFD Installation  | Corridor                        |
|--------------------|---|---------------------------------|
| 8/30/2011          | Priest Rapids - Midway 230kV Line #3 between Structures #211 and #212 | South Moran Slough              |
| 9/12/2011          | Priest Rapids - Midway 230kV Line #1 between Structures #11 and #12   | South Moran Slough              |
| 10/10/2011         | Priest Rapids - Midway 230kV Line #2 between Structures #111 and #112 | South Moran Slough              |
| 11/9/2012          | Priest Rapids 230kV Line between Structures #76 and #77               | North Moran Slough              |
| 9/30/2013          | Wanapum-Priest Rapids 230kV Line, Structures #1 and #2                | Wanapum Switchyard              |
| 10/3/2014          | Wanapum-Columbia 230kV Line, Structures #132 and #133                 | Wanapum-Columbia / Moses Coulee |

## 3.2 Avian Surveys

### 3.2.1 Site Information Data & Avian Location Types

The five transmission line corridors were characterized by site information and avian location descriptions. The transmission line corridor site information data of avian location type, raptor perch presence/absence, geographic funnel presence/absence, and large migratory flight presence/absence were presented in Table 3. The Wanapum-Columbia/Moses Coulee transmission line corridor was the only raptor location, and the site was characterized as having a high number (>10) of ledges and alcoves on the cliffs with intermittent updrafts present on warm sunny days. The South Moran Slough, North Moran Slough, Wanapum Switchyard, and the Midway/Columbia River corridors were all characterized as waterfowl locations. The waterfowl site characterization data of open water, nesting habitat, and brood cover were presented in Table 4, Table 5, and Table 6, respectively. The surveys conducted during 2015 were presented for all five transmission line corridors survey sites with respect to the survey season and daytime period as shown in Table 7. During 2015, the spring migration surveys were performed March 11-29,

the nesting season surveys were conducted May 4-29, the summer season surveys were conducted between July 8 and August 26, and the fall/winter season surveys were conducted between September 23 and October 28 (Table 7).

**Table 3 Avian location type and site descriptive data of raptor perches, geographic funnel, and large migratory flights for the five transmission line corridors.**

| <b>Corridor</b>  | <b>Avian Location Type</b> | <b>Raptor Perches</b> | <b>Geographic Funnel</b> | <b>Large Migratory Flights</b> |
|--|----------------------------|-----------------------|--------------------------|--------------------------------|
| South Moran Slough                                     | Waterfowl                  | Present               | Absent                   | Absent                         |
| North Moran Slough                                     | Waterfowl                  | Present               | Absent                   | Absent                         |
| Wanapum Switchyard                                     | Waterfowl                  | Absent                | Absent                   | Absent                         |
| Wanapum-Columbia/Moses Coulee                          | Raptor                     | Present               | Present                  | Absent                         |
| Midway/Columbia River downriver from Priest Rapids Dam | Waterfowl                  | Absent                | Present                  | Absent                         |

**Table 4 Open water habitat waterfowl characterization data for the four waterfowl transmission line corridors.**

| <b>Corridor</b>                             | <b>Open Water</b>       |                |               |                    |
|---|-------------------------|----------------|---------------|--------------------|
|   | <b>Spring Migration</b> | <b>Nesting</b> | <b>Summer</b> | <b>Fall/Winter</b> |
| South Moran Slough                          | Present                 | Present        | Present       | Present            |
| North Moran Slough                          | Present                 | Present        | Present       | Present            |
| Wanapum Switchyard                          | Present                 | Present        | Absent        | Absent             |
| Midway/Columbia River downriver from Priest | Present                 | Present        | Present       | Present            |

**Table 5 Nesting habitat characterization data for the four waterfowl transmission line corridors.**

| <b>Corridor</b>                             | <b>Nesting Habitat</b>  |                |               |                    |
|---|-------------------------|----------------|---------------|--------------------|
|   | <b>Spring Migration</b> | <b>Nesting</b> | <b>Summer</b> | <b>Fall/Winter</b> |
| South Moran Slough                          | N/A                     | Present        | N/A           | N/A                |
| North Moran Slough                          | N/A                     | Present        | N/A           | N/A                |
| Wanapum Switchyard                          | N/A                     | Present        | N/A           | N/A                |
| Midway/Columbia River downriver from Priest | N/A                     | Present        | N/A           | N/A                |

**Table 6 Brood cover habitat characterization data for the four waterfowl transmission line corridors.**

| Corridor                                    | Brood Cover      |         |         |             |
|---|------------------|---------|---------|-------------|
|   | Spring Migration | Nesting | Summer  | Fall/Winter |
| South Moran Slough                          | N/A              | Present | Present | N/A         |
| North Moran Slough                          | N/A              | Present | Present | N/A         |
| Wanapum Switchyard                          | N/A              | Present | Present | N/A         |
| Midway/Columbia River downriver from Priest | N/A              | Present | Present | N/A         |

**Table 7 Avian survey dates conducted during 2015 at the five transmission line corridors with respect to survey period and daytime period.**

| Survey Period    | Corridor           | AM        | Mid-Day   | PM         |
|------------------|--------------------|-----------|-----------|------------|
| Spring Migration | South Moran Slough | 3/24/2015 | 3/23/2015 | 3/23/2015  |
|                  | North Moran Slough | 3/29/2015 | 3/24/2015 | 3/24/2015  |
|                  | Wanapum Switchyard | 3/26/2015 | 3/26/2015 | 3/29/2015  |
|                  | Wanapum-Columbia   | 3/12/2015 | 3/12/2015 | 3/11/2015  |
|                  | Midway             | 3/25/2015 | 3/25/2015 | 3/25/2015  |
| Nesting          | South Moran Slough | 5/6/2015  | 5/6/2015  | 5/28/2015  |
|                  | North Moran Slough | 5/8/2015  | 5/8/2015  | 5/27/2015  |
|                  | Wanapum Switchyard | 5/5/2015  | 5/4/2015  | 5/4/2015   |
|                  | Wanapum-Columbia   | 5/7/2015  | 5/7/2015  | 5/8/2015   |
|                  | Midway             | 5/19/2015 | 5/19/2015 | 5/29/2015  |
| Summer           | South Moran Slough | 7/9/2015  | 7/15/2015 | 8/26/2014  |
|                  | North Moran Slough | 7/16/2015 | 7/23/2015 | 8/12/2015  |
|                  | Wanapum Switchyard | 7/15/2015 | 7/8/2015  | 7/29/2015  |
|                  | Wanapum-Columbia   | 7/23/2015 | 7/16/2015 | 8/5/2015   |
|                  | Midway             | 7/8/2015  | 7/9/2015  | 7/28/2015  |
| Fall/Winter      | South Moran Slough | 9/24/2015 | 9/23/2015 | 10/8/2015  |
|                  | North Moran Slough | 9/30/2015 | 9/24/2015 | 10/14/2015 |
|                  | Wanapum Switchyard | 10/1/2015 | 10/7/2015 | 10/21/2015 |
|                  | Wanapum-Columbia   | 10/7/2015 | 10/1/2015 | 10/28/2015 |
|                  | Midway             | 9/23/2015 | 9/30/2015 | 10/15/2015 |

### 3.2.2 Avian Interaction Surveys

A total of 60 avian interaction surveys were conducted during 2015 at the five transmission line corridors. Fifty-four different bird species were identified during 2015, and their state and federal listing statuses is presented in Table 8. The American white pelican (*Pelecanus erythrorhynchos*) was the only species observed that currently has a state and/or federal Threatened or Endangered species listing status (Table 8). A total of 8,077 bird observations were recorded during the 2015 survey period. Bird observations were summarized by corridor (Table 9) and survey period (Table 10). Passerine species continue to be the most abundant birds for all sites. In 2015, the most abundant passerines were the European starling (*Sturnus vulgaris*; n = 2,284) and the red-winged blackbird (*Agelaius phoeniceus*; n = 1,107). The American Kestrel (*Falco sparverius*; n = 18) was the most abundant bird of prey species. Mallard ducks (*Anas platyrhynchos*; n = 379) were the most abundant waterfowl species. American white pelicans (n = 128) were the most abundant aerialists observed during 2015. Northern flickers (*Colaptes auratus*; n = 76) were the most common non-passerine bird species.

The bird interaction behavior data were presented in with respect to their flight across the transmission lines (i.e., above the OHGW, between OHGW and the T-Lines, or below T-Lines; Table 11). Of the 8,077 observations made during 2015, no bird collisions were documented; however, a number of altered flight patterns were documented (Table 12).

Table 13 illustrates the number of seasons currently available for comparing changes in bird responses (altered or unaltered flight patterns) that may be associated with installing BFDs on the transmission lines. Based on these minimum sample size criteria, statistical comparisons of the bird flight behavior data were available at South Moran Slough (Table 14), North Moran Slough (Table 15), Wanapum Switchyard (Table 16), and the Wanapum-Columbia (Table 17) sites. Table 14 and Table 17 documented similar significant ( $\alpha = 0.05$ ) bird behaviors for passerines species after BFDs were installed at the South Moran Slough and Wanapum-Columbia corridors. At both corridors, the unaltered flight behavior significantly increased for passerine species after BFDs were installed. No statistical differences were detected in the pre-BFD and post-BFD bird flight behavior data for birds of prey at all sites. A lack of flight behavior difference with birds of prey could reveal that these species already observed the OHGWs prior to BFD installation. Birds of prey (i.e., raptors) and passerine birds (i.e., songbirds) are reported to have the keenest sight of all birds, and they can resolve details at distances 2.5-3 times the distance that humans can (Gill 2007).

Whereas for wading birds, such as herons, observations of unaltered flight behavior significantly decreased ( $\alpha = 0.05$ ; Table 15). A decrease in the frequency of unaltered flights for wading birds suggests that the BFDs are increasing the visual profile of the static wires and as a result, the birds are altering their flight in order to avoid the lines.

In 2015, the numbers of observed birds increased in excess of 8,000 birds, which is similar to bird counts observed in 2011 (Table 18). Previously, a marked decline in the total number of bird observed was noted at all five sites from 2011-2014.

**Table 8 Bird species identified during the 2015 avian interaction surveys with their state and federal listing statuses.**

| <b>Bird Category</b>    | <b>Species</b>            | <b>State Listing</b> | <b>Federal Listing</b> |
|-------------------------|---------------------------|----------------------|------------------------|
| Birds of Prey           | American Kestrel          |                      |                        |
|                         | Bald Eagle                | Sensitive            | Species of Concern     |
|                         | Great Horned Owl          |                      |                        |
|                         | Northern Harrier          |                      |                        |
|                         | Osprey                    | Monitored            |                        |
|                         | Red-Tailed Hawk           |                      |                        |
|                         | Turkey Vulture            | Monitored            |                        |
| Waterfowl               | American Coot             |                      |                        |
|                         | Bufflehead                |                      |                        |
|                         | Canada Goose              |                      |                        |
|                         | Common Goldeneye          |                      |                        |
|                         | Common Merganser          |                      |                        |
|                         | Double-Crested Cormorant  |                      |                        |
|                         | Gadwall                   |                      |                        |
|                         | Green-Winged Teal         |                      |                        |
|                         | Mallard                   |                      |                        |
|                         | Northern Pintail          |                      |                        |
|                         | Pied-Billed Grebe         |                      |                        |
|                         | Wood Duck                 |                      |                        |
| Wading Bird             | Black-Crowned Night Heron | Monitored            |                        |
|                         | Great Blue Heron          | Monitored            |                        |
|                         | Great Egret               | Monitored            |                        |
| Aerialists              | American White Pelican    | Endangered           |                        |
|                         | California Gull           |                      |                        |
|                         | Ring-Billed Gull          |                      |                        |
| Fowl-Like Birds         | California Quail          |                      |                        |
| Passerines              | American Crow             |                      |                        |
|                         | American Goldfinch        |                      |                        |
|                         | American Magpie           |                      |                        |
|                         | American Robin            |                      |                        |
|                         | Bank Swallow              |                      |                        |
|                         | Barn Swallow              |                      |                        |
|                         | Black-Billed Magpie       |                      |                        |
|                         | Brewer's Blackbird        |                      |                        |
|                         | Brown-Headed Cowbird      |                      |                        |
|                         | Bullock's Oriole          |                      |                        |
|                         | Cedar Waxwing             |                      |                        |
|                         | Cliff Swallow             |                      |                        |
|                         | Common Raven              |                      |                        |
|                         | Eastern Kingbird          |                      |                        |
|                         | European Starling         |                      |                        |
|                         | Horned Lark               |                      |                        |
|                         | House Finch               |                      |                        |
|                         | Lark Sparrow              |                      |                        |
|                         | Lazuli Bunting            |                      |                        |
|                         | Red-Winged Blackbird      |                      |                        |
|                         | Tree Swallow              |                      |                        |
| Western Kingbird        |                           |                      |                        |
| Western Meadowlark      |                           |                      |                        |
| White-Crowned Sparrow   |                           |                      |                        |
| Non-Passerines<br>Misc. | Belted Kingfisher         |                      |                        |
|                         | Common Nighthawk          |                      |                        |
|                         | Mourning Dove             |                      |                        |
|                         | Northern Flicker          |                      |                        |

**Table 9 Summary of bird observations at each transmission line corridor during 2015.**

| Bird Category                | Species                   | Midway       | North Moran Slough | South Moran Slough | Wanapum Switchyard | Wanapum-Columbia | Grand Total  |
|------------------------------|---------------------------|--------------|--------------------|--------------------|--------------------|------------------|--------------|
| Birds of Prey                | American Kestrel          |              |                    |                    | 14                 | 4                | 18           |
|                              | Bald Eagle                | 1            |                    |                    |                    |                  | 1            |
|                              | Great Horned Owl          |              |                    |                    |                    | 2                | 2            |
|                              | Misc. Hawk                | 3            |                    |                    |                    | 2                | 5            |
|                              | Northern Harrier          |              | 8                  | 3                  | 1                  |                  | 12           |
|                              | Osprey                    | 5            | 1                  | 4                  |                    |                  | 10           |
|                              | Red-Tailed Hawk           | 1            |                    |                    | 2                  | 8                | 11           |
|                              | Turkey Vulture            |              |                    | 1                  |                    |                  | 1            |
| Unknown                      |                           |              |                    |                    | 2                  | 2                |              |
| <b>Birds of Prey Total</b>   |                           | <b>10</b>    | <b>9</b>           | <b>8</b>           | <b>17</b>          | <b>18</b>        | <b>62</b>    |
| Waterfowl                    | American Coot             |              | 13                 | 78                 |                    |                  | 91           |
|                              | Bufflehead                | 2            | 2                  |                    |                    |                  | 4            |
|                              | Canada Goose              | 160          | 27                 | 9                  |                    | 28               | 224          |
|                              | Common Goldeneye          |              | 1                  |                    |                    |                  | 1            |
|                              | Common Merganser          | 75           | 2                  | 11                 |                    |                  | 88           |
|                              | Double-Crested Cormorant  | 24           |                    |                    |                    |                  | 24           |
|                              | Gadwall                   |              | 4                  |                    |                    |                  | 4            |
|                              | Green-Winged Teal         |              | 10                 |                    |                    |                  | 10           |
|                              | Mallard                   | 130          | 192                | 48                 | 9                  |                  | 379          |
|                              | Misc. Duck                | 5            | 24                 | 125                |                    |                  | 154          |
|                              | Northern Pintail          |              | 2                  |                    |                    |                  | 2            |
|                              | Pied-Billed Grebe         |              | 9                  | 29                 |                    |                  | 38           |
|                              | Unknown                   | 11           |                    | 44                 |                    |                  | 55           |
| Wood Duck                    |                           | 4            | 5                  |                    |                    | 9                |              |
| <b>Waterfowl Total</b>       |                           | <b>407</b>   | <b>290</b>         | <b>349</b>         | <b>9</b>           | <b>28</b>        | <b>1,083</b> |
| Wading Birds                 | Black-Crowned Night Heron | 1            | 45                 |                    |                    |                  | 46           |
|                              | Great Blue Heron          | 20           | 18                 | 20                 |                    |                  | 58           |
|                              | Great Egret               |              | 1                  |                    |                    |                  | 1            |
|                              | Misc. Heron               |              |                    | 1                  |                    |                  | 1            |
| <b>Wading Birds Total</b>    |                           | <b>21</b>    | <b>64</b>          | <b>21</b>          |                    |                  | <b>106</b>   |
| <b>Shorebirds Total</b>      |                           | <b>0</b>     | <b>0</b>           | <b>0</b>           | <b>0</b>           | <b>0</b>         | <b>0</b>     |
| Aerialists                   | American White Pelican    | 116          | 12                 |                    |                    |                  | 128          |
|                              | California Gull           | 6            |                    | 1                  |                    |                  | 7            |
|                              | Misc. Gull                | 38           | 31                 | 8                  |                    |                  | 77           |
|                              | Ring-Billed Gull          | 7            |                    |                    |                    |                  | 7            |
| <b>Aerialists Total</b>      |                           | <b>167</b>   | <b>43</b>          | <b>9</b>           | <b>0</b>           | <b>0</b>         | <b>219</b>   |
| Fowl-Like Birds              | California Quail          | 2            | 7                  | 7                  | 2                  |                  | 18           |
| <b>Fowl-Like Birds Total</b> |                           | <b>2</b>     | <b>7</b>           | <b>7</b>           | <b>2</b>           | <b>0</b>         | <b>18</b>    |
| Passerines                   | American Crow             | 21           | 9                  | 5                  | 3                  | 7                | 45           |
|                              | American Goldfinch        | 4            |                    |                    |                    | 1                | 5            |
|                              | American Magpie           | 5            | 9                  | 2                  | 46                 |                  | 62           |
|                              | American Robin            | 25           | 19                 | 27                 | 27                 | 49               | 147          |
|                              | Bank Swallow              | 21           | 20                 | 341                |                    | 4                | 386          |
|                              | Barn Swallow              |              | 30                 | 6                  | 6                  |                  | 42           |
|                              | Black-Billed Magpie       | 10           | 48                 | 11                 | 100                |                  | 169          |
|                              | Brewer's Blackbird        |              |                    | 117                | 12                 |                  | 129          |
|                              | Brown-Headed Cowbird      | 49           |                    |                    | 15                 |                  | 64           |
|                              | Bullock's Oriole          | 23           |                    | 6                  | 1                  |                  | 30           |
|                              | Cedar Waxwing             | 20           |                    |                    |                    |                  | 20           |
|                              | Cliff Swallow             | 13           | 147                | 242                | 46                 | 65               | 513          |
|                              | Common Raven              | 9            |                    |                    | 1                  | 6                | 16           |
|                              | Eastern Kingbird          | 19           | 6                  | 23                 | 5                  |                  | 53           |
|                              | European Starling         |              | 13                 | 1,830              | 416                | 25               | 2,284        |
|                              | Horned Lark               | 12           | 1                  |                    |                    |                  | 13           |
|                              | House Finch               |              | 10                 | 1                  | 1                  | 505              | 517          |
|                              | Lark Sparrow              | 1            | 2                  |                    |                    | 3                | 6            |
|                              | Lazuli Bunting            | 1            |                    |                    |                    |                  | 1            |
|                              | Misc. Sparrow             | 2            | 6                  | 1                  |                    | 3                | 12           |
|                              | Misc. Swallow             |              | 72                 |                    |                    |                  | 72           |
| Red-Winged Blackbird         | 68                        | 548          | 445                | 43                 | 3                  | 1,107            |              |
| Tree Swallow                 |                           |              | 15                 |                    |                    | 15               |              |
| Unknown                      | 86                        | 90           | 76                 | 98                 | 241                | 591              |              |
| Western Kingbird             | 18                        |              | 16                 | 14                 | 23                 | 71               |              |
| Western Meadowlark           | 5                         |              | 17                 | 6                  |                    | 28               |              |
| White-Crowned Sparrow        |                           | 5            | 2                  |                    | 1                  | 8                |              |
| <b>Passerines Total</b>      |                           | <b>412</b>   | <b>1,035</b>       | <b>3,183</b>       | <b>840</b>         | <b>936</b>       | <b>6,406</b> |
| Non-Passerines Misc.         | Belted Kingfisher         |              | 2                  | 6                  |                    |                  | 8            |
|                              | Common Nighthawk          | 18           | 19                 | 4                  | 3                  |                  | 44           |
|                              | Misc. Woodpecker          |              |                    |                    | 1                  |                  | 1            |
|                              | Mourning Dove             | 4            | 18                 | 9                  | 4                  |                  | 35           |
|                              | Northern Flicker          | 8            | 13                 | 30                 | 20                 | 5                | 76           |
| <b>Non-Passerines Total</b>  |                           | <b>30</b>    | <b>52</b>          | <b>49</b>          | <b>28</b>          | <b>5</b>         | <b>164</b>   |
| Unknown                      |                           | 2            | 5                  | 2                  | 3                  | 7                | 19           |
| <b>Unknown Total</b>         |                           | <b>30</b>    | <b>52</b>          | <b>49</b>          | <b>28</b>          | <b>5</b>         | <b>164</b>   |
| <b>Grand Total</b>           |                           | <b>1,051</b> | <b>1,505</b>       | <b>3,628</b>       | <b>899</b>         | <b>994</b>       | <b>8,077</b> |

**Table 10 Summary of bird observations for each survey period during 2015.**

| Bird Category                | Species                   | Fall/Winter  | Nesting      | Spring Migration | Summer       | Grand Total  |
|------------------------------|---------------------------|--------------|--------------|------------------|--------------|--------------|
| Birds of Prey                | American Kestrel          | 7            |              | 2                | 9            | 18           |
|                              | Bald Eagle                |              |              | 1                |              | 1            |
|                              | Great Horned Owl          |              |              |                  | 2            | 2            |
|                              | Misc. Hawk                | 5            |              |                  |              | 5            |
|                              | Northern Harrier          | 5            | 5            | 1                | 1            | 12           |
|                              | Osprey                    | 2            | 4            |                  | 4            | 10           |
|                              | Red-Tailed Hawk           | 4            | 3            | 3                | 1            | 11           |
|                              | Turkey Vulture            | 1            |              |                  |              | 1            |
| Unknown                      |                           |              |              | 2                | 2            |              |
| <b>Birds of Prey Total</b>   |                           | <b>24</b>    | <b>12</b>    | <b>7</b>         | <b>19</b>    | <b>62</b>    |
| Waterfowl                    | American Coot             | 76           | 2            | 13               |              | 91           |
|                              | Bufflehead                |              | 2            | 2                |              | 4            |
|                              | Canada Goose              | 7            | 32           | 31               | 154          | 224          |
|                              | Common Goldeneye          |              |              | 1                |              | 1            |
|                              | Common Merganser          | 51           | 12           | 1                | 24           | 88           |
|                              | Double-Crested Cormorant  |              | 21           |                  | 3            | 24           |
|                              | Gadwall                   | 2            |              | 2                |              | 4            |
|                              | Green-Winged Teal         | 1            |              |                  | 9            | 10           |
|                              | Mallard                   | 94           | 114          | 59               | 112          | 379          |
|                              | Misc. Duck                | 153          |              |                  | 1            | 154          |
|                              | Northern Pintail          |              | 2            |                  |              | 2            |
|                              | Pied-Billed Grebe         | 27           |              | 2                | 9            | 38           |
|                              | Unknown                   |              |              |                  | 55           | 55           |
| Wood Duck                    | 9                         |              |              |                  | 9            |              |
| <b>Waterfowl Total</b>       |                           | <b>420</b>   | <b>185</b>   | <b>111</b>       | <b>367</b>   | <b>1,083</b> |
| Wading Birds                 | Black-Crowned Night Heron | 17           | 17           | 2                | 10           | 46           |
|                              | Great Blue Heron          | 6            | 18           | 6                | 28           | 58           |
|                              | Great Egret               | 1            |              |                  |              | 1            |
|                              | Misc. Heron               |              |              |                  | 1            | 1            |
| <b>Wading Birds Total</b>    |                           | <b>24</b>    | <b>35</b>    | <b>8</b>         | <b>39</b>    | <b>106</b>   |
| <b>Shorebirds Total</b>      |                           | <b>0</b>     | <b>0</b>     | <b>0</b>         | <b>0</b>     | <b>0</b>     |
| Aerialists                   | American White Pelican    | 4            | 54           |                  | 70           | 128          |
|                              | California Gull           |              |              |                  | 7            | 7            |
|                              | Misc. Gull                | 76           |              |                  | 1            | 77           |
|                              | Ring-Billed Gull          | 7            |              |                  |              | 7            |
| <b>Aerialists Total</b>      |                           | <b>87</b>    | <b>54</b>    |                  | <b>78</b>    | <b>219</b>   |
| Fowl-Like Birds              | California Quail          | 6            | 3            | 2                | 7            | 18           |
| <b>Fowl-Like Birds Total</b> |                           | <b>6</b>     | <b>3</b>     | <b>2</b>         | <b>7</b>     | <b>18</b>    |
| Passerines                   | American Crow             | 12           | 14           | 14               | 5            | 45           |
|                              | American Goldfinch        |              | 2            |                  | 3            | 5            |
|                              | American Magpie           | 62           |              |                  |              | 62           |
|                              | American Robin            | 77           | 25           | 22               | 23           | 147          |
|                              | Bank Swallow              |              | 376          | 10               |              | 386          |
|                              | Barn Swallow              |              |              |                  | 42           | 42           |
|                              | Black-Billed Magpie       |              | 24           | 85               | 60           | 169          |
|                              | Brewer's Blackbird        |              | 12           | 117              |              | 129          |
|                              | Brown-Headed Cowbird      | 15           | 6            |                  | 43           | 64           |
|                              | Bullock's Oriole          |              | 19           |                  | 11           | 30           |
|                              | Cedar Waxwing             |              |              |                  | 20           | 20           |
|                              | Cliff Swallow             |              | 212          | 168              | 133          | 513          |
|                              | Common Raven              | 7            | 6            | 1                | 2            | 16           |
|                              | Eastern Kingbird          |              | 10           |                  | 43           | 53           |
|                              | European Starling         | 1,479        | 1            | 22               | 782          | 2,284        |
|                              | Horned Lark               |              | 13           |                  |              | 13           |
|                              | House Finch               | 490          | 6            | 12               | 9            | 517          |
|                              | Lark Sparrow              |              |              | 2                | 4            | 6            |
|                              | Lazuli Bunting            |              | 1            |                  |              | 1            |
|                              | Misc. Sparrow             | 1            |              |                  | 11           | 12           |
|                              | Misc. Swallow             |              |              |                  | 72           | 72           |
| Red-Winged Blackbird         | 116                       | 260          | 323          | 408              | 1,107        |              |
| Tree Swallow                 |                           | 15           |              |                  | 15           |              |
| Unknown                      | 411                       |              |              | 180              | 591          |              |
| Western Kingbird             |                           | 9            |              | 62               | 71           |              |
| Western Meadowlark           |                           | 6            | 21           | 1                | 28           |              |
| White-Crowned Sparrow        | 8                         |              |              |                  | 8            |              |
| <b>Passerines Total</b>      |                           | <b>2,678</b> | <b>1,017</b> | <b>797</b>       | <b>1,914</b> | <b>6,406</b> |
| Non-Passerines Misc.         | Belted Kingfisher         | 7            |              | 1                |              | 8            |
|                              | Common Nighthawk          |              |              |                  | 44           | 44           |
|                              | Misc. Woodpecker          |              |              |                  | 1            | 1            |
|                              | Mourning Dove             | 1            | 5            |                  | 29           | 35           |
|                              | Northern Flicker          | 56           | 5            | 4                | 11           | 76           |
| <b>Non-Passerines Total</b>  |                           | <b>64</b>    | <b>10</b>    | <b>5</b>         | <b>85</b>    | <b>164</b>   |
| Unknown                      |                           | 12           |              |                  | 7            | 19           |
| <b>Unknown Total</b>         |                           | <b>12</b>    |              |                  | <b>7</b>     | <b>19</b>    |
| <b>Grand Total</b>           |                           | <b>3,315</b> | <b>1,316</b> | <b>930</b>       | <b>2,516</b> | <b>8,077</b> |



**Table 11 Flight distribution of birds intersecting the transmission line spans presented by bird category during 2015.**

| Type and Proximity of Transmission Line | Vertical Plane (ft) | Birds of Prey | Waterfowl    | Wading Birds | Shorebirds | Aerialists | Fowl-like Birds | Passerines   | Non-Passerine Misc. | Unknown   | Grand Total  |
|---|---------------------|---------------|--------------|--------------|------------|------------|-----------------|--------------|---------------------|-----------|--------------|
| Above OHGW                              | >101                | 1             | 1            |              |            | 13         |                 | 9            | 21                  |           | 45           |
|   | 0-10                | 7             | 47           | 4            |            | 12         |                 | 297          | 7                   |           | 374          |
|   | 11-25               | 6             | 99           | 8            |            | 24         |                 | 220          | 4                   | 1         | 362          |
|   | 26-50               | 5             | 87           | 1            |            | 14         |                 | 73           | 4                   | 3         | 187          |
|   | 51-100              | 2             | 43           | 8            |            | 24         |                 | 2            | 1                   | 1         | 81           |
| <b>Above OHGW Total</b>                 |                     | <b>21</b>     | <b>277</b>   | <b>21</b>    | <b>0</b>   | <b>87</b>  | <b>0</b>        | <b>601</b>   | <b>37</b>           | <b>5</b>  | <b>1,049</b> |
| Below T-Lines                           | >101                | 1             | 54           | 4            |            | 33         | 5               | 107          | 1                   |           | 205          |
|   | 0-10                |               | 5            | 7            |            |            |                 | 107          | 5                   |           | 124          |
|   | 11-25               | 1             | 23           | 4            |            | 2          |                 | 355          | 1                   |           | 386          |
|   | 26-50               | 4             | 22           | 6            |            | 3          |                 | 522          | 14                  | 2         | 573          |
|   | 51-100              | 8             | 167          | 20           |            | 17         |                 | 1,190        | 38                  | 5         | 1,445        |
| <b>Below T-Lines Total</b>              |                     | <b>14</b>     | <b>271</b>   | <b>41</b>    | <b>0</b>   | <b>55</b>  | <b>5</b>        | <b>2,281</b> | <b>59</b>           | <b>7</b>  | <b>2,733</b> |
| Between                                 | 0-10                | 5             | 14           | 4            |            | 14         |                 | 897          | 4                   |           | 938          |
|   | 11-25               | 1             | 7            |              |            |            |                 | 424          | 8                   | 3         | 443          |
| <b>Between Total</b>                    |                     | <b>6</b>      | <b>21</b>    | <b>4</b>     | <b>0</b>   | <b>14</b>  |                 | <b>1,321</b> | <b>12</b>           | <b>3</b>  | <b>1,381</b> |
| Did Not Intersect                       | N/A                 | 21            | 514          | 40           |            | 63         | 13              | 2,203        | 56                  | 4         | 2,914        |
| <b>Did Not Intersect Total</b>          |                     | <b>21</b>     | <b>514</b>   | <b>40</b>    | <b>0</b>   | <b>63</b>  | <b>13</b>       | <b>2,203</b> | <b>56</b>           | <b>4</b>  | <b>2,914</b> |
| <b>Grand Total</b>                      |                     | <b>62</b>     | <b>1,083</b> | <b>106</b>   | <b>0</b>   | <b>219</b> | <b>18</b>       | <b>6,406</b> | <b>164</b>          | <b>19</b> | <b>8,077</b> |

**Table 12 Bird flight behaviors observed during 2015.**

| Bird Category       | Abrupt Altered Flight | Altered Flight | Flight Among Wires | Flushed    | Perched on Other | Perched on Tower | Perched on Wire | Unaltered Flight | On Ground/Water | Grand Total  |
|---------------------|-----------------------|----------------|--------------------|------------|------------------|------------------|-----------------|------------------|-----------------|--------------|
| Birds of Prey       |                       |                | 2                  | 1          | 5                | 4                | 7               | 43               |                 | 62           |
| Waterfowl           | 7                     | 40             |                    | 33         | 7                |                  |                 | 582              | 414             | 1,083        |
| Wading Birds        |                       |                |                    | 6          | 11               |                  |                 | 82               | 7               | 106          |
| Shorebirds          |                       |                |                    |            |                  |                  |                 |                  |                 | 0            |
| Aerialists          | 2                     | 24             | 1                  | 13         |                  |                  |                 | 123              | 56              | 219          |
| Fowl-Like Birds     |                       |                |                    | 2          | 2                |                  |                 |                  | 14              | 18           |
| Passerines          | 29                    | 136            | 351                | 269        | 588              | 1,008            | 401             | 3,615            | 9               | 6,406        |
| Non-Passerine Misc. | 1                     | 4              | 2                  | 1          | 34               | 5                | 2               | 115              |                 | 164          |
| Unknown             | 3                     |                |                    |            |                  |                  |                 | 16               |                 | 19           |
| <b>Grand Total</b>  | <b>42</b>             | <b>204</b>     | <b>356</b>         | <b>325</b> | <b>647</b>       | <b>1,017</b>     | <b>410</b>      | <b>4,576</b>     | <b>500</b>      | <b>8,077</b> |

**Table 13 Seasons of available data for 2015 statistical comparison.**

| Corridor           | # Seasons of Pre-BFD data | # Seasons of Post-BFD data | Installation Year  | Statistical Comparison |
|--------------------|---------------------------|----------------------------|--------------------|------------------------|
| South Moran Slough | 3                         | 17                         | 2011               | 2012                   |
| North Moran Slough | 7                         | 13                         | 2012               | 2013                   |
| Wanapum Switchyard | 11                        | 9                          | 2013               | 2014                   |
| Wanapum-Columbia   | 15                        | 5                          | 2014               | 2015                   |
| Midway             | 20                        | 0                          | Scheduled for 2015 | Scheduled for 2016     |

**Table 14 Comparison of pre-BFD installation and post-BFD installation bird flight behavior data at South Moran Slough (2011 through 2015).**

| Bird Category                 | Pre-BFD Observation Summary |                  |                     |              | Post-BFD Observation Summary |                  |                     |              | Altered Behavior Statistics |    |             | Unaltered Behavior Statistics |    |             |
|-------------------------------|-----------------------------|------------------|---------------------|--------------|------------------------------|------------------|---------------------|--------------|-----------------------------|----|-------------|-------------------------------|----|-------------|
|                               | # Seasons                   | # alt<br>(0.96%) | # unalt<br>(17.87%) | Total Obs.   | # Seasons                    | # alt<br>(3.49%) | # unalt<br>(41.49%) | Total Obs.   | P(T<=t)                     | df | Significant | P(T<=t)                       | df | Significant |
| <b>A: Birds of Prey</b>       | 3                           | 2                | 8                   | 20           | 17                           | 7                | 26                  | 42           |                             |    |             | 0.13                          | 3  | no          |
| <b>B: Waterfowl</b>           | 3                           | 4                | 43                  | 110          | 17                           | 28               | 318                 | 964          | 0.606                       | 17 | no          | 0.65                          | 3  | no          |
| <b>C: Wading Birds</b>        | 3                           | 1                | 7                   | 8            | 17                           | 14               | 44                  | 75           |                             |    |             |                               |    |             |
| <b>D: Shorebirds</b>          | 3                           | 0                | 1                   | 3            | 17                           | 0                | 1                   | 1            |                             |    |             |                               |    |             |
| <b>E: Aerialists</b>          | 3                           | 0                | 2                   | 2            | 17                           | 1                | 31                  | 33           |                             |    |             |                               |    |             |
| <b>F: Fowl-Like Birds</b>     | 3                           | 0                | 0                   | 0            | 17                           | 0                | 0                   | 24           |                             |    |             |                               |    |             |
| <b>G: Passerine Birds</b>     | 3                           | 14               | 309                 | 2,004        | 17                           | 137              | 2,997               | 7,184        | 0.875                       | 4  | no          | <b>0.03</b>                   | 8  | yes         |
| <b>H: Non-Passerine Misc.</b> | 3                           | 0                | 19                  | 30           | 17                           | 3                | 85                  | 126          |                             |    |             | 0.88                          | 6  | no          |
| <b>Total</b>                  |                             | <b>21</b>        | <b>389</b>          | <b>2,177</b> |                              | <b>190</b>       | <b>3,502</b>        | <b>8,449</b> |                             |    |             |                               |    |             |

**Table 15 Comparison of pre-BFD installation and post-BFD installation bird flight behavior data at North Moran Slough (2011 through 2015).**

| Bird Category                 | Pre-BFD Observation Summary |                  |                     |              | Post-BFD Observation Summary |                  |                     |              | Altered Behavior Statistics |    |             | Unaltered Behavior Statistics |    |             |
|-------------------------------|-----------------------------|------------------|---------------------|--------------|------------------------------|------------------|---------------------|--------------|-----------------------------|----|-------------|-------------------------------|----|-------------|
|                               | # Seasons                   | # alt<br>(2.07%) | # unalt<br>(37.28%) | Total Obs.   | # Seasons                    | # alt<br>(4.35%) | # unalt<br>(62.96%) | Total Obs.   | P(T<=t)                     | df | Significant | P(T<=t)                       | df | Significant |
| <b>A: Birds of Prey</b>       | 7                           | 0                | 30                  | 43           | 13                           | 0                | 30                  | 42           |                             |    |             | 0.560                         | 13 | no          |
| <b>B: Waterfowl</b>           | 7                           | 40               | 468                 | 530          | 13                           | 92               | 867                 | 1,157        | 0.429                       | 8  | no          | 0.848                         | 9  | no          |
| <b>C: Wading Birds</b>        | 7                           | 7                | 44                  | 53           | 13                           | 9                | 59                  | 96           | 0.217                       | 14 | no          | <b>0.001</b>                  | 15 | yes         |
| <b>D: Shorebirds</b>          | 7                           | 0                | 7                   | 8            | 13                           | 0                | 1                   | 3            |                             |    |             |                               |    |             |
| <b>E: Aerialists</b>          | 7                           | 3                | 30                  | 38           | 13                           | 6                | 62                  | 68           | 0.346                       | 7  | no          | 0.562                         | 9  | no          |
| <b>F: Fowl-Like Birds</b>     | 7                           | 0                | 0                   | 0            | 13                           | 0                | 0                   | 9            |                             |    |             |                               |    |             |
| <b>G: Passerine Birds</b>     | 7                           | 21               | 676                 | 2,728        | 13                           | 59               | 1,376               | 2,435        | 0.204                       | 14 | no          | 0.818                         | 9  | no          |
| <b>H: Non-Passerine Misc.</b> | 7                           | 0                | 21                  | 23           | 13                           | 3                | 53                  | 78           |                             |    |             | 0.152                         | 9  | no          |
| <b>Total</b>                  |                             | <b>71</b>        | <b>1,276</b>        | <b>3,423</b> |                              | <b>169</b>       | <b>2,448</b>        | <b>3,888</b> |                             |    |             |                               |    |             |

**Table 16 Comparison of pre-BFD installation and post-BFD installation bird flight behavior data at the Wanapum Switchyard (2011 through 2015).**

| Bird Category                 | Pre-BFD Observation Summary |                  |                     |              | Post-BFD Observation Summary |                  |                     |              | Altered Behavior Statistics |    |             | Unaltered Behavior Statistics |    |             |
|-------------------------------|-----------------------------|------------------|---------------------|--------------|------------------------------|------------------|---------------------|--------------|-----------------------------|----|-------------|-------------------------------|----|-------------|
|                               | # Seasons                   | # alt<br>(3.86%) | # unalt<br>(51.96%) | Total Obs.   | # Seasons                    | # alt<br>(0.48%) | # unalt<br>(57.81%) | Total Obs.   | P(T<=t)                     | df | Significant | P(T<=t)                       | df | Significant |
| <b>A: Birds of Prey</b>       | 11                          | 2                | 53                  | 106          | 9                            | 0                | 11                  | 24           |                             |    |             | 0.737                         | 10 | no          |
| <b>B: Waterfowl</b>           | 11                          | 4                | 186                 | 193          | 9                            | 0                | 17                  | 17           |                             |    |             | 0.363                         | 5  | no          |
| <b>C: Wading Birds</b>        | 11                          | 0                | 0                   | 0            | 9                            | 0                | 0                   | 0            |                             |    |             |                               |    |             |
| <b>D: Shorebirds</b>          | 11                          | 0                | 0                   | 0            | 9                            | 0                | 0                   | 0            |                             |    |             |                               |    |             |
| <b>E: Aerialists</b>          | 11                          | 0                | 0                   | 0            | 9                            | 0                | 0                   | 0            |                             |    |             |                               |    |             |
| <b>F: Fowl-Like Birds</b>     | 11                          | 0                | 13                  | 19           | 9                            | 0                | 0                   | 2            |                             |    |             |                               |    |             |
| <b>G: Passerine Birds</b>     | 11                          | 73               | 764                 | 1,643        | 9                            | 5                | 900                 | 1,557        | 0.271                       | 10 | no          | 0.626                         | 17 | no          |
| <b>H: Non-Passerine Misc.</b> | 11                          | 1                | 60                  | 110          | 9                            | 3                | 34                  | 64           |                             |    |             | 0.438                         | 10 | no          |
| <b>Total</b>                  |                             | <b>80</b>        | <b>1,076</b>        | <b>2,071</b> |                              | <b>8</b>         | <b>962</b>          | <b>1,664</b> |                             |    |             |                               |    |             |

**Table 17 Comparison of pre-BFD installation and post-BFD installation bird flight behavior data at Wanapum-Columbia (2011 through 2015).**

| Bird Category                 | Pre-BFD Observation Summary |                  |                     |              | Post-BFD Observation Summary |                  |                     |              | Altered Behavior Statistics |    |             | Unaltered Behavior Statistics |    |             |
|-------------------------------|-----------------------------|------------------|---------------------|--------------|------------------------------|------------------|---------------------|--------------|-----------------------------|----|-------------|-------------------------------|----|-------------|
|                               | # Seasons                   | # alt<br>(0.20%) | # unalt<br>(46.85%) | Total Obs.   | # Seasons                    | # alt<br>(5.48%) | # unalt<br>(69.37%) | Total Obs.   | P(T<=t)                     | df | Significant | P(T<=t)                       | df | Significant |
| <b>A: Birds of Prey</b>       | 15                          | 0                | 42                  | 64           | 5                            | 0                | 14                  | 20           |                             |    |             | 0.357                         | 10 | no          |
| <b>B: Waterfowl</b>           | 15                          | 0                | 0                   | 0            | 5                            | 0                | 28                  | 28           |                             |    |             |                               |    |             |
| <b>C: Wading Birds</b>        | 15                          | 0                | 0                   | 0            | 5                            | 0                | 0                   | 0            |                             |    |             |                               |    |             |
| <b>D: Shorebirds</b>          | 15                          | 0                | 0                   | 0            | 5                            | 0                | 0                   | 0            |                             |    |             |                               |    |             |
| <b>E: Aerialists</b>          | 15                          | 0                | 0                   | 0            | 5                            | 0                | 0                   | 0            |                             |    |             |                               |    |             |
| <b>F: Fowl-Like Birds</b>     | 15                          | 0                | 0                   | 30           | 5                            | 0                | 0                   | 1            |                             |    |             |                               |    |             |
| <b>G: Passerine Birds</b>     | 15                          | 3                | 606                 | 1,304        | 5                            | 56               | 666                 | 967          | 0.619                       | 6  | no          | <b>0.009</b>                  | 13 | <b>yes</b>  |
| <b>H: Non-Passerine Misc.</b> | 15                          | 0                | 52                  | 96           | 5                            | 0                | 1                   | 6            |                             |    |             |                               |    |             |
| <b>Total</b>                  |                             | <b>3</b>         | <b>700</b>          | <b>1,494</b> |                              | <b>56</b>        | <b>709</b>          | <b>1,022</b> |                             |    |             |                               |    |             |

**Table 18 Trends in Total Number of Bird Observations (2011 through 2015).**

| <b>Corridor</b>    | <b>2011</b>  | <b>2012</b>  | <b>2013</b>  | <b>2014</b>  | <b>2015</b>  | <b>Grand Total</b> |
|--------------------|--------------|--------------|--------------|--------------|--------------|--------------------|
| Midway             | 2,148        | 883          | 1,101        | 783          | 1,051        | 5,966              |
| North Moran Slough | 2,687        | 1,498        | 680          | 946          | 1,505        | 7,316              |
| South Moran Slough | 2,429        | 2,066        | 1,150        | 1,355        | 3,628        | 10,628             |
| Wanapum Switchyard | 834          | 1,015        | 459          | 531          | 899          | 3,738              |
| Wanapum-Columbia   | 669          | 390          | 267          | 203          | 994          | 2,523              |
| <b>Grand Total</b> | <b>8,767</b> | <b>5,852</b> | <b>3,657</b> | <b>3,818</b> | <b>8,077</b> | <b>30,171</b>      |

#### **4.0 Acknowledgements**

Grant PUD acknowledges Environmental Assessment Services, LLC assistance in conducting the avian surveys and quality assurance and quality control for the data collected during 2015, as well as annual report preparation pursuant to the Plan.

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**Appendix A**  
**Article 411 Survey Forms**

**Article 411 Transmission Line Collision Protection Plan Survey**  
**Site Description Survey Form**

**Date:** \_\_\_\_\_

**Surveyor:** \_\_\_\_\_

- Site:**  Wanapum – Columbia (Span 1)  
Type D1 Towers,  
3 T-Lines  
2 OHGW's
- North Moran Slough (Span 3)  
Type TR1 & Tangent A1 Towers,  
3 T-Lines  
2 OHGW's
- Priest – Midway (Span 5, 7, and 9)  
Type B2 Special Towers,  
3 T-Lines/Span  
2 OHGW's/Span

- Wanapum Switchyard (Span 2)  
Type A2 Tangent & DS Towers,  
3 T-Lines  
2 OHGW's
- South Moran Slough (Span 4, 6, and 8)  
Type A1 Tangent Towers,  
3 T-Lines/Span  
1 OHGW/Span
- Midway – Frenchman (Span 10)  
Type SC Special Towers,  
3 T-Lines  
2 OHGW's

**Survey Period**

- Spring Migration (Feb – Mar)       Nesting (April – May)  
 Summer (July – Aug)                       Fall/Winter (Mid-Sept – Nov)

**Day Time Period**

- AM     Mid-Day     PM

Start Time: \_\_\_\_\_ End Time: \_\_\_\_\_

**Bird Flight Diverters Installed?**

- Yes     No

**Miscellaneous Information (Presence/Absence)**

- Raptor Perches  
 Large Migratory Flights  
 Geographic Funnel (i.e., Canyons/Valleys)

**Avian Location Type:**

- Raptor Location Type
- Ledges & Alcoves on Cliffs  
 N/A  
 Low (0-5)  
 Moderate (6-10)  
 High (>10)
- Updrafts/Thermals  
 Present     Absent

- Waterfowl Location Type
- Open Water  
 Present     Absent
- Nesting Habitat (Nesting Survey Only)  
 Present     Absent     N/A
- Brood Cover (Nesting/Summer Survey)  
 Present     Absent     N/A

## Article 411 Transmission Line Collision Protection Plan Survey Avian Survey Form

| Time | Bird Category | Species | n | Listing Status | Vertical Plane | Below T-Lines, Between T-Lines & OHGW, Above OHGW | Weather | Behavior |
|------|---------------|---------|---|----------------|----------------|---|---------|----------|
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |
|      |               |         |   |                |                |   |         |          |

- Observation Range:** Within 0.25 Miles of Transmission Line
- Time:** (Military). Survey Each Site 2 Hours. In Spring, Survey 3+ Hours.
- Bird Category:** A) Birds of Prey, B) Waterfowl, C) Wading Birds (herons), D) Shorebirds (plovers, sandpipers), E) Aerialists (pelicans, gulls, terns), F) Fowl-Like Birds, G) Passerine (songbirds), H) Misc. Non-Passerine Birds (doves, swifts, hummingbirds, woodpeckers, nightjars, kingfishers)
- n:** Count of Birds
- Listing Status:** State Listed, Federally Listed, Both
- Vertical Plane:** N/A (Did Not Intersect T-Line), 0–10 ft, 11–25 ft, 26–50 ft, 51–100 ft, >101 ft.
- Weather:** Cloud Cover, Precipitation, Wind Speed & Direction
- Behavior:** Unaltered Flight, Flight Among Wires, Altered Flight, Abrupt Altered Flight, Flushed, Perched on Tower, Perched on Wire, Perched on Other, On Water/Ground