United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
Central Washington Field Office
215 Melody Lane, Suite 103
Wenatchee, Washington 98801

FEB 12 2018

In Reply Refer To:
01EWFW00-2018-F-0297

Jeffery Frey
Assistant Manager, Mission Support
Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

Dear Mr. Frey:

This letter transmits the U. S. Fish and Wildlife Service's Biological Opinion on the proposed Avista Utilities Benton-Othello 115-KV Transmission Line Rebuild on the Hanford Site, located in Franklin County, and its effects on White Bluffs bladderpod (*Physaria douglasii*, subsp. *tuplashensis*), and its designated critical habitat. Formal consultation on the proposed action was conducted in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Your September 14, 2017, request for formal consultation was received on September 22, 2017.

The enclosed Biological Opinion is based on information provided in the September 14, 2017, Biological Evaluation (BE), telephone conversations, field investigations, and other sources of information cited in the Biological Opinion. A complete record of this consultation is on file at the Central Washington Field Office in Wenatchee, Washington.

If you have any questions regarding the enclosed Biological Opinion, our response to your concurrence request(s), or our shared responsibilities under the Act, please contact Stephen Lewis at 509-665-3508.

Sincerely,

for

Eric V. Rickerson, State Supervisor
Washington Fish and Wildlife Office

Enclosure

RECEIVED
FEB 15 2018
DOE-RLCC

(This page intentionally left blank)

Endangered Species Act - Section 7 Consultation

BIOLOGICAL OPINION

U.S. Fish and Wildlife Service Reference:
01EWFW00-2018-F-0297

Avista Utilities Benton-Othello 115-KV Transmission Line Rebuild on the Hanford Site Project

Franklin County, Washington

Federal Action Agency:

US Department of Energy

Consultation Conducted By:

U.S. Fish and Wildlife Service
Washington Fish and Wildlife Office
Wenatchee, Washington

Jeffrey M Lutyka FOR

Eric V. Rickerson, State Supervisor
Washington Fish and Wildlife Office

12 Feb 2018

Date

TABLE OF CONTENTS

FIGURES

INTRODUCTION

This document represents the U. S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) based on our review of the proposed Avista Corporation's (Avista) Benton-Othello 115-KV Transmission Line Rebuild on the Hanford Site located in Franklin County, and its effects on the listed plant White Bluffs bladderpod (*Physaria douglasii*, subsp. *tuplashensis*)(bladderpod), and its designated critical habitat, in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA). Your September 14, 2017, request for formal consultation was received on September 22, 2017.

This Opinion is based on information provided in the September 14, 2017, Biological Assessment (Avista 2017), telephone conversations, field investigations, and other sources of information as detailed below. A complete record of this consultation is on file at the Central Washington Field Office in Wenatchee, Washington.

CONSULTATION HISTORY

The following is a summary of the important events associated with this consultation:

- Site visit with the Service was conducted on March 17, 2015.
- The Biological Assessment was received on September 22, 2017.
- Formal consultation was initiated on September 22, 2017.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

A federal action means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas (50 CFR 402.02).

The US Department of Energy (DOE) is the land owner for the entire Hanford Site; however, the management responsibility for the Hanford Reach National Monument (Monument) belongs to Service. The federal nexus is the required issuance of a land use agreement between Avista and the DOE to use lands outside their current right-of way agreement with the Service on the Monument. The purpose and need of the Project is to rebuild approximately 12.6 miles (20.3 km) of the existing Benton-Othello 115 kV electric transmission line by replacing outdated and deteriorating power poles and lines that no longer meet national safety codes and energy conveyance requirements. For a detailed description of the purpose and need for the Project, see the Project Description section in the BA.

The existing portion of the transmission line commences approximately 0.5 miles (0.8 km) south of State Route 24 and extends through the Monument portion of the Hanford Site managed by the Service for approximately 9.7 miles (15.6 km). It then crosses the Columbia River, and runs through a quarter mile (0.4 km) wide section of the Monument managed by DOE along the river.

The remaining segment of the line passes across the main portion of the Hanford Site managed by the DOE for approximately 2.1 miles (3.4 km) to the point where the ownership of the electrical transmission line changes from Avista to the Bonneville Power Administration (see Figure 1). The Project is located in Section 6, Township 14N, Range 28E to Section 27, Township 24N, Range 27E. It is anticipated that the project will be constructed beginning in the fall or winter season of 2018 and will be completed the following spring of 2019.

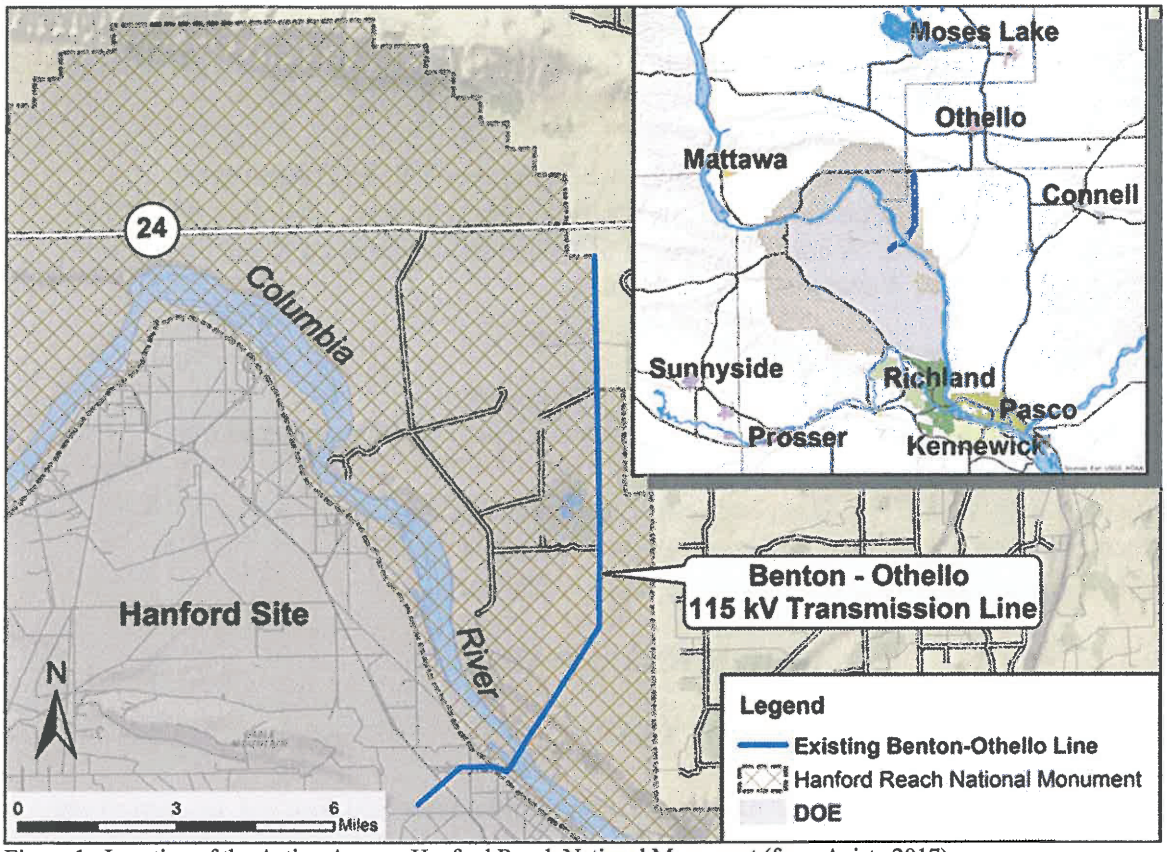

Figure 1: Location of the Action Area on Hanford Reach National Monument (from Avista 2017).

Avista proposes to replace the 128 existing wood and steel structures with approximately 95 new self-weathering steel structures including insulators, anchors, guy wires, etc. within the existing transmission line alignment for the entire length of the 12.6 mile (20.3 km) transmission line. The existing copper wire on the line will also be replaced with new, larger aluminum wire. The new structures will be similarly framed (H-frame) and no more than 10 feet (3.0 m) taller than the structures that are being replaced with two exceptions: 1) several structures near the wetlands in Section 31 (T14N R28E) will be up to 30 feet (9.1 m) taller, and 2) at the Columbia River crossing two taller structures will replace the existing structures that currently carry the line over the river. The Environmental Assessment (EA) for the proposed project entails measures designed to minimize the impacts to migratory birds in areas where taller structures would be located near these wetlands. These measures would include the installation of avian guards on new structures and avoiding construction time periods when nesting migratory birds are prevalent in the action area. The EA also includes the development of a nest site protection plan that addresses construction-related impacts on Swainson's and red-tailed hawks, burrowing owl,

long-billed curlew, and other migratory bird species in the action area. The Project will involve the following construction activities in the action area:

Road Work - Avista will access the transmission line right-of-way from the west using existing roads that are used and maintained by the Monument. Approximately 4630 feet (1410 meters) of this existing road lies within the designated critical habitat for bladderpod and will be widened to approximately 10 feet (3 meters) which is approximately 1.06 acres. Avista will also construct a new 10 feet (3.0 meters) by 133 feet (40.5 meters) spur road between the existing access road and an individual pole structure. This will be approximately 0.03 acres. The spur road is only required during the Project activities, and is not needed for subsequent line operation and maintenance. Avista will trim shrubs and other vegetation then lightly blade the surface to construct the spur road.

Transmission Line Replacement - The Project will replace 128 existing wood and steel transmission structures with 95 new steel structures. The transmission line and poles will be replaced within the existing Avista 200-foot right-of-way and in the same alignment, however, some poles will be moved to avoid resources, including wetlands, bladderpod plants, and cultural resource sites. This work will involve transporting the new poles, cross arms, braces, anchors, glass insulators, guy wires, and other associated material to the construction site using flatbed trucks, cranes, or forklifts then off-loading them onto the ground until assembly. Vehicles used in the action area include and estimated three pickup trucks, one Lo-Drill/Digger Derrick, one crane, one backhoe, two flatbed trucks with trailers, two line trucks, and two bucket trucks throughout the replacement process. After the new wire is strung, the existing pole structures will be disassembled. The entire pole structures will be removed, and the removed poles will then be cut above the preservative treatment line, and the butts, which may still retain some of the preservative, will be shipped to an approved landfill for proper disposal.

Other Ground Disturbance - The individual replacement poles will be assembled and installed using line trucks, bucket trucks, and/or a crane. Pole holes will be excavated using a digger derrick or Lo-Drill equipped with a full-flight auger or core barrel, or backhoe. The pole holes will be backfilled with crushed rock or concrete then the soil will be tamped around each hole. Workers will dig around the old anchors then cut them off below the ground. New helix anchors will be installed where possible, by screwing the anchors into the ground, having a smaller impact area compared to traditional plate anchors.

Conservation Measures

The following conservation measures will be used to minimize impacts to the bladderpod or its designated critical habitat:

- Avista or Rare Plant Care and Conservation Program (Rare Care) will flag and record the locations of bladderpod plants during the flowering period prior to mobilization. Avista or Rare Care will delineate the work areas before mobilization and avoid the plants where practicable.

- Where the road is sufficiently level, Avista will mow the vegetation, rather than blade it,

to allow heavy equipment and vehicles access. Mowing may lessen impacts by allowing for the regrowth of at least some of the existing vegetation in the impact area.

- Avista will prepare a Stormwater Pollution Prevention Plan and Spill Plan to help avoid, minimize and mitigate potential construction impacts and effects to the bladderpod from soil disturbance, construction waste and potentially hazardous materials. Depending on conditions, silt fencing, fiber wattles, and/or concrete washouts may be used.

- To prevent the spread of weeds, Avista will establish truck-washing stations outside of the action area to minimize or eliminate berms during road grading, and chemically or manually kill weeds during and at the conclusion of construction.

- To limit impact to plants, plywood or other suitable barriers will be used near the excavated holes to store the spoils that will be used as backfill.

- Extra spoils that normally would have been spread around the new poles will instead be hauled off site to avoid burying existing plants or inhibiting future seed germination and reestablishment.

- The project will occur between fall and early spring when fire potential is low and when plants are dormant.

- A helicopter will be used to replace the poles below the bluff so that new roads will not have to be constructed to access the two poles.

- All fueling areas, helicopter landing pads and laydown areas will be located outside of the designated critical habitat.

- Only the existing access roads and one new spur road will be used. No vehicles will be permitted off established roads.

- Where soil conditions are suitable, Avista will use helix anchors instead of plate anchors to minimize disturbance. Excavation and large installation equipment are not needed for this type of anchor.

- Avista will keep disturbance areas around each pole structure as small as possible, reducing from the more typical 100-foot radius to between a 25-foot and 65-foot radius depending on the need for guy wires. After construction, workers will recontour disturbed areas to preconstruction conditions.

- All vehicles will carry fire extinguishers, a shovel, and other fire control equipment to minimize habitat loss in the unlikely case of fire during construction and maintenance activities. Vehicle idling will be minimized to reduce risk of fire due to engine temperatures.

Revegetation of Disturbed Areas - Avista will replant all areas disturbed by the rebuild of the

Benton-Othello transmission line that are not needed to be maintained for the future operation and maintenance of the line. This revegetation will follow the guidelines and practices specified in the Hanford Site Revegetation Manual (DOE 2013) and will not be limited to the bladderpod. In addition, plans for any revegetation efforts that are done within the Service-managed portion of the Monument will be reviewed by Service personnel.

Avista will attempt to restore the shrub-steppe habitat by replacing the impacted plants on disturbed sites and reestablishing the pre-existing plant community. It will select source-identified native plant seeds collected from the Hanford Site and nearby locations, planting and seeding methods, and timing. Both pollinator-friendly species and culturally-important species will be included in the plant mix. Planting will occur within the period from mid-November to early February. Monitoring will meet the requirements of the *Hanford Site Revegetation Manual* (DOE 2013). The restoration area will occur annually over a five-year period. Monitoring will consider native plant cover, plant survival and growth, plant diversity, and weed cover. Areas will be replanted if necessary to meet success criteria and will be monitored for an additional 5-year period.

Research and Restoration - Avista, with assistance from Rare Care, will conduct a study that will provide additional information on the re-establishment of the bladderpod. Prior to construction, Rare Care will locate and mark bladderpod plants in the action area, collect seeds and bank seeds and develop an out-planting plan. Approximately 6,000 seeds will be collected and at least 10 percent of those will be stored in the Miller Seed Vault. The first spring after the project is constructed, Rare Care will propagate seeds and out-plant in an area less than 1/10 acre in a site determined suitable to Service and DOE and appropriate for the study as per the Reintroduction Plan. Avista will monitor the plants for three years, commencing with the first year of out-plantings.

Because little is known about the successful reestablishment of bladderpod plants, this study will add to the available information about the subspecies. However, given the experimental nature of reintroducing bladderpod plants, the final effects determination was made in the BA without consideration of this voluntary conservation commitment.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment. The action area for this proposed federal action includes all areas where any direct or indirect effects to bladderpod or its designated critical habitat may occur. The subspecies is a rare endemic plant located only in a single location, as depicted in Figure 2.

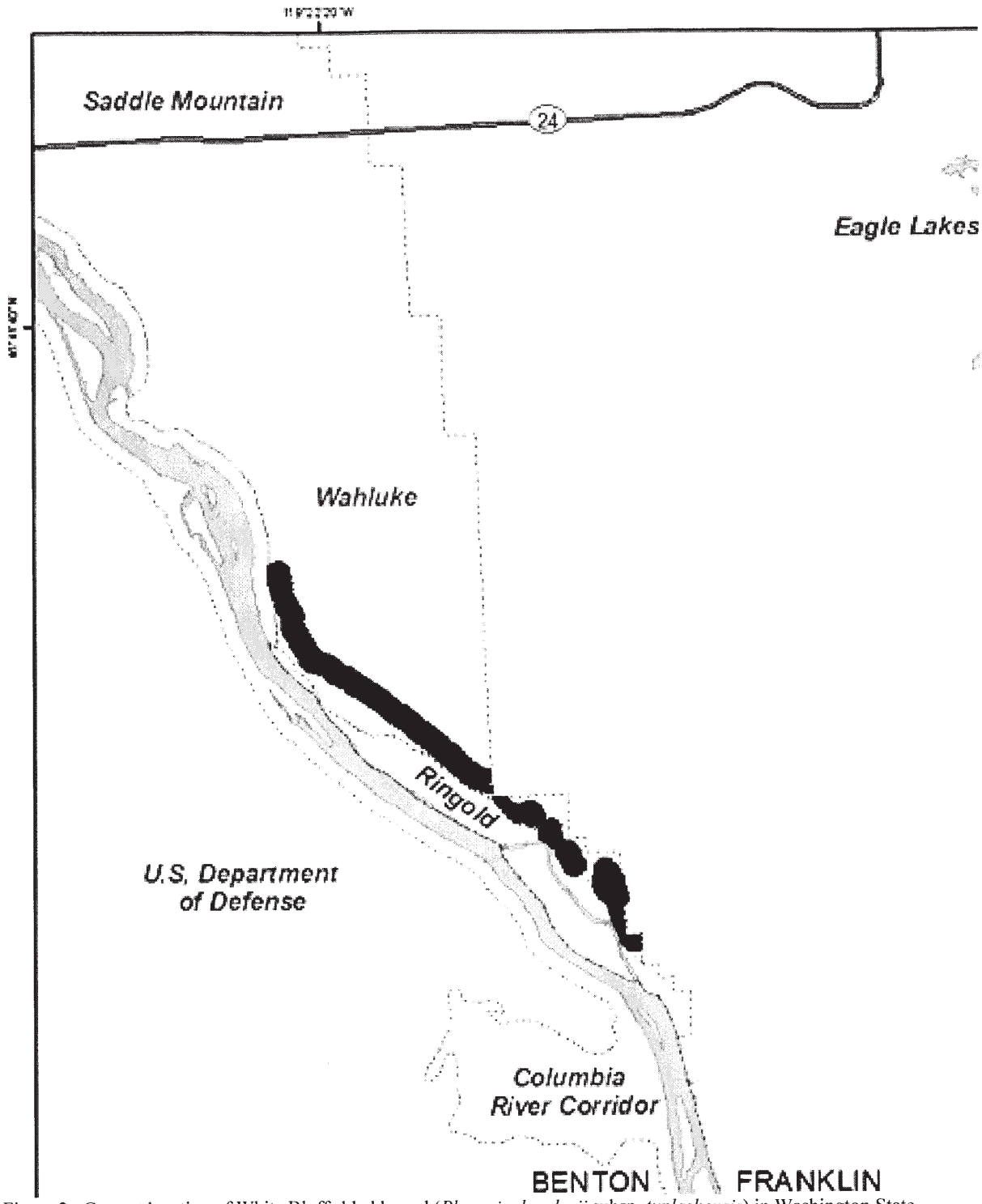

Figure 2: Current location of White Bluffs bladderpod (*Physaria douglasii* subsp. *tuplashensis*) in Washington State.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

The following analysis relies on the following four components: (1) the *Status of the Species*, which evaluates the rangewide condition of the listed species addressed, the factors responsible for that condition, and the species' survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) *Cumulative Effects*, which evaluates the effects of future, non-federal activities in the action area on the species.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed federal action in the context of the species' current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of listed species in the wild.

The jeopardy analysis in this Opinion emphasizes the rangewide survival and recovery needs of the listed species and the role of the action area in providing for those needs. It is within this context that we evaluate the significance of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Adverse Modification Determination

Section 7(a)(2) of the Act or ESA requires that Federal agencies insure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification of critical habitat" was published on February 11, 2016 (USFWS and NMFS 2016). The final rule became effective on March 14, 2016. The revised definition states: "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

Past designations of critical habitat have used the terms "primary constituent elements" (PCEs), "physical or biological features" (PBFs) or "essential features" to characterize the key components of critical habitat that provide for the conservation of the listed species. The new critical habitat regulations (81 FR 7414) discontinue use of the terms "PCEs" or "essential features," and rely exclusively on use of the term "PBFs" for that purpose because that term is contained in the statute. However, the shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs or essential features. For those reasons,

in this biological opinion, references to PCEs or essential features should be viewed as synonymous with PBFs. All of these terms characterize the key components of critical habitat that provide for the conservation of the listed species.

Our analysis of effects to critical habitat relies on the following four components: (1) the *Status of Critical Habitat*, which evaluates the range-wide condition of designated critical habitat for the bladderpod in terms of primary constituent elements (PCEs), the factors responsible for that condition, and the intended recovery function of the critical habitat overall; (2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units; and (4) *Cumulative Effects*, which evaluates the effects of future, non-federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units.

For purposes of making the destruction or adverse modification finding, the effects of the proposed Federal action, together with any cumulative effects, are evaluated to determine if the critical habitat rangewide would remain functional (or retain the current ability for the PBFs to be functionally re-established in areas of currently unsuitable but capable habitat) to serve its intended conservation/recovery role for the bladderpod.

STATUS OF THE SPECIES: White Bluffs Bladderpod

For a detailed account of bladderpod's biology, life history, threats, demography, and conservation needs, refer to the Federal Register (USFWS 2013a and USFWS 2013b).

Bladderpod is a low-growing, herbaceous, perennial plant with a sturdy tap root and a dense rosette of broad gray-green pubescent leaves (WDNR 2010). The subspecies produces showy yellow flowers on relatively short stems in May, June, and July. The subspecies inhabits dry, steep upper zone and top exposures of the White Bluffs area of the Hanford Reach at the lower edge of the Wahluke Slope. Along these bluffs, a layer of highly alkaline, fossilized cemented calcium carbonate (caliche) soil has been exposed (Rollins *et al.* 1996, pp. 203–205). A detailed description of the identifying physical characteristics of bladderpod is found in Rollins *et al.* (1996, pp. 203–205) and Al-Shehbaz and O'Kane (2002, pp. 319–320). Bladderpod is Washington State-listed as Threatened, with a global ranking of G2 (i.e., imperiled world-wide, vulnerable to extinction) and a state ranking of S2 (i.e., vulnerable to extirpation) (WDNR 2010).

Because of its recent discovery and limited range, little is known of the subspecies' life-history requirements. In a presentation of preliminary life history studies, Dunwiddie *et al.* (2001, p. 7) reported that most individuals reach reproductive condition in their first or second year, most adult plants flower every year, and the lifespan of this short-lived subspecies is probably 4 to 5 years. The population size appears to vary from year to year, and the survival of seedlings and adults appears to be highly variable (Dunwiddie *et al.* 2001, p. 8); however, more monitoring is needed to determine the magnitude and frequency of high and low-number years, as well as to obtain an understanding of the causes of these annual fluctuations (Evans *et al.* 2003, p. 64).

Monitoring by Monument staff (Newsome 2017, p. C-4) suggests that the annual population fluctuations appear to be tied to environmental conditions, such as seasonal precipitation and temperature.

In 1996, bladderpod was only known from a single population that occurred along the upper edge of the White Bluffs of the Columbia River in Franklin County, Washington (Figure 2). The population was described to occur intermittently in a narrow band (usually less than 10 m (33 ft.) wide) along an approximately 17-km (10.6-mi) stretch of the river bluffs (Rollins *et al.* 1996, p. 205). Most of the subspecies distribution (>85 percent) is within lands owned by the DOE and once managed by the Washington Department of Fish and Wildlife as the Wahluke Wildlife Area (USFWS 2008, p. 1–3). This land remains under DOE ownership, and is managed by the Monument. The remainder of the subspecies' distribution is thought to be on private land (Newsome 2011, pers. comm.) and Washington Department of Natural Resources (WDNR) land (Arnett 2012, pers. comm.).

Twenty permanent transects have been monitored between 1998 and 2017 in order to provide estimates of population size and detect trends in the overall population. Population monitoring of flowering plants was initiated originally by The Nature Conservancy of Washington (TNC) and subsequently continued by the WDNR Natural Heritage Program (WNHP) and the Service. Following the monitoring period in 2007, a large wildfire burned through the northern portion of the population within the monitoring transects. Annual monitoring was conducted through 2011 to attempt to determine the effects of fire on bladderpod. The monitoring results indicated that when burned and unburned transects were compared, plants in burned transects appear to have rebounded to some extent (Newsome 2017, p. C-3), although the data have too much variability to discern that difference. However, the burned transects appeared to have a mean of 24 percent fewer plants than in the unburned transects. The high variability in estimated population numbers was confirmed by the 2011 data, which documented the highest population estimate since monitoring began in 1997, even though it immediately followed the year representing the lowest estimate (2010). May 2011 was identified by the Hanford Meteorological Station (*http://www.hanford.gov/page.cfm/HMS*) as the fifth coolest and seventh wettest month on recorded at the installation since its establishment in 1944 (Newsome 2017, p. C-4). This environment likely provided ideal conditions for germination, growth, and flowering for that year's population following a rather moist fall and mild winter season (Autumn 2010 precipitation was 4.6 cm ((21.8 inches) above average); winter 2011 precipitation was 0.6 cm ((0.24 inches) below average.) (*http://ww.hanford.gov/page.cfm/hms/products/seaprcp*).

The population has ranged from an estimated low of 2,529 plants (2015) to a high of 58,887 plants (2011). The population estimate for 2017, is well above the 10,500 population proposed in Caplow (2003) as the threshold for management action, and is the second highest population recorded within the monitoring time frame. The population had been decreasing since 2011, however the data from the 2017 season shows a large rebound of the population, suggesting the declining trend suspected in the listing is no longer supported in the data (Newsome 2017, p. C–5).

The only known population of bladderpod is found primarily on near-vertical exposures of weathered, cemented, alkaline, calcium carbonate paleosol caps (ancient, buried soil whose composition may reflect a climate significantly different from the climate now prevalent in the area) (*http://www.alcwin.org/Dictionary_Of_Geology_Description-84–P.htm*). The hardened carbonate paleosol caps contain several hundred feet of alkaline, easily eroded, lacustrine sediments of the Ringold Formation, a sedimentary formation made up of soft Pleistocene deposits of clay, gravel, sand, and silt (Newcomb 1958, p. 328). The uppermost part of the Ringold Formation is a heavily calcified and silicified cap layer to a depth of at least 4.6 m (15 ft.). This layer is commonly called ''caliche'' although in this case, it lacks the nitrate constituents found in true caliche. The ''caliche'' layer is a resistant caprock underlying the approximately 274–304 m (900–1,000 ft.) elevation (above sea level) plateau extending north and east from the White Bluffs (Newcomb 1958, p. 330). The bladderpod may be an obligate calciphile, as are many of the endemic *Lesquerella* (now *Physaria*)(Caplow *et al.* 2005, pp. 2–12).

The habitat of bladderpod is arid, and vegetative cover is sparse (Rollins *et al.*1996, p. 206). Common associated plant species include: *Artemisia tridentata* (big sagebrush), *Poa secunda* (Sandberg's bluegrass), *Bromus tectorum* (cheatgrass), *Astragalus caricinus* (buckwheat milk-vetch), *Eriogonum microthecum* (slender buckwheat), *Achnatherum hymenoides* (Indian ricegrass), and *Cryptantha spiculifera* (Snake River cryptantha). Occasionally, White Bluffs bladderpod is numerous enough at some locations to be subdominant.

Groundwater movement from adjacent, up-slope agricultural activities has caused mass-failure landslides in portions of the White Bluffs. As a result, the habitat in approximately 6.0 km (3.7 mi), or about 35 percent of the known range of bladderpod has been moderately to severely altered (Cannon *et al.* 2005, p. 4.25; Caplow et al. 2005, pp. 48, 96; Lindsey 1997, pp. 4, 10–12,14). Bladderpod is also threatened by injury or mortality from recreational activities and off-road vehicle use, nonnative plants, small population size, and limited geographic range. Fire is also considered to be a threat to bladderpod, although the decline in population numbers after the 2007 fire indicated the population estimate was still within the known range of variability. The establishment and growth of non-native plant competition and fuels, specifically highly flammable cheatgrass, increases the likelihood of fire as well as its intensity, potentially elevating the risk of impacting the bladderpod population in the future. Fire suppression activities, which often damage or remove native plants from the habitat and disturb soils, could potentially be as damaging as the wildfire itself, and are therefore, considered a threat. However, no negative impacts from fire suppression activities were reported from the 2007 wildfire. Aerial drops of water or fire retardant have not occurred directly on the species to date.

STATUS OF CRITICAL HABITAT: White Bluffs Bladderpod

For a detailed account of the status of the designated critical habitat for bladderpod, refer to the Designation of Critical Habitat in the Federal Register (2013b,c).

Bladderpod was listed as threatened, with critical habitat designated, on April 23, 2013, (USFWS 2013a,b)(50 CFR 23984, 24008), under the Endangered Species Act of 1973, as amended (16 U.S. C. 1531 *et seq.*). Based on public comments and new survey information, the Service

reassessed all of the sites that were determined to be occupied in 1997 and determined that some of these sites on Federal land, and all of the sites on State and private lands, were likely no longer occupied at the time of listing. A revised critical habitat designation, following a new public comment period was published December 20, 2013, (USFWS 2013c) (50 CFR 76995). This revision removed private lands from critical habitat, but did not alter the threatened status for bladderpod from the final listing determination. Recovery planning documents have not been completed for this subspecies.

Based on our current knowledge of the physical or biological features and the habitat characteristics required to sustain the subspecies' life-history process, it was determined that the primary constituent elements specific to bladderpod are:

1. Weathered alkaline paleosols and mixed soils overlying the Ringold Formation. These soils occur within and around the exposed caliche-like cap deposits associated with the White Bluffs of the Ringold Formation, which contain a high percentage of calcium carbonate. These features occur between 210–275 m (700–900 ft.) in elevation.
2. Sparsely vegetated habitat (less than 10– 15 percent total cover), containing low amounts of nonnative or invasive plant species (less than 1 percent cover).
3. The presence of insect pollinator species.
4. The presence of native shrub steppe habitat within the effective pollinator distance (300 m (approximately 980 ft.).
5. The presence of stable bluff formations with minimal landslide occurrence.

Threats to the designated critical habitat for bladderpod are considered the same as those to the plants themselves, as they are bound to the landscape and are exposed to the same stressors. Therefore, the threats to critical habitat a11re landslides and slumps, wildfire and fire suppression, recreational activities and off-road vehicle use, nonnative plants, small population size, and limited geographic range.

Because bladderpod occurs only in a single, and rather small population and the critical habitat is primarily connected, the appropriate scale for the jeopardy/adverse modification analysis for this project is at the rangewide scale.

ENVIRONMENTAL BASELINE: White Bluffs Bladderpod and its designated Critical Habitat

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed federal projects in the action area that have undergone section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

Current Condition of the Species and Critical Habitat in the Action Area

Factors Responsible for the Condition of the Species

Groundwater movement from adjacent, up-slope agricultural activities has caused mass-failure landslides in portions of the White Bluffs. As a result, the habitat in approximately 6.0 km (3.7 mi), or about 35 percent of the known range of bladderpod has been moderately to severely altered (Cannon *et al.* 2005, p. 4.25; Caplow *et al.* 1996, p. 65; Drost *et al.* 1997, pp. 48, 96; Lindsey 1997, pp. 4, 10, 11, 12, 14). Bladderpod plants have not been observed in areas that have undergone recent landslides, regardless of whether the landslide disturbance is moderate or severe. They have not been observed to survive small slumping events, possibly because the mixed soils downslope post-event no longer have the soil horizon that bladderpod plants seem to require. All mass-failures occurring along the White Bluffs, with one historical exception, are found in association with water seepage (Bjornstad and Fecht 2002, p. 16). Since the Pleistocene Epoch, landsliding on the southern bluffs where bladderpod is found was dormant until the 1970s, when increased infiltration of moisture from agricultural activities caused a resurgence of slumping (Bjornstad and Peterson 2009; Cannon *et al.* 2005, p. 4.25; Bjornstad and Fecht 2002, p. 17; Drost *et al.* 1997, p. 76; Brown 1990, pp. 4, 38, 39).

Although wildfire is considered to be a threat to bladderpod, it is probably not the most significant. The 2008–2011 monitoring results demonstrated the negative impacts of the fire to be less than expected, as approximately 76 percent of the population remained viable the following year (Newsome and Goldie, 2008). Notwithstanding the subspecies' apparent ability to recover somewhat from the 2007 wildfire event, we believe that wildfire continues to be a threat to the existing population. This is because fire events tend to be large and unpredictable in the Hanford Reach and can potentially affect large numbers of plants and significant areas of pollinator habitat. In addition, wildfire also impacts pollinator communities by directly causing mortality, altering habitat, and reducing native plant species diversity. Since an increase in cheatgrass was observed within the bladderpod population and the surrounding areas affected by the 2007 fire, we presume a larger scale fire event would have similar results.

Factors Responsible for the Condition of Critical Habitat

As stated above regarding the threats to designated critical habitat for bladderpod; those factors responsible for the condition of critical habitat are considered to be the same as the factors affecting the condition of the plants themselves.

Conservation Role of the Action Area

The action area is located within the only known population of bladderpod, located in a linear fashion along the cliff tops of the White Bluffs portion of the Hanford Reach of the Columbia River. The action area represents a subset of the total area occupied by the subspecies and its surrounding designated critical habitat. Notable differences in conservation roles have not been observed between the action area and other locations along the White Bluffs where bladderpod is found. Similarly, the conservation roles of critical habitat were not described as being different in other portions of the subspecies' range. It is estimated that about one percent of the 2017 estimate of the total population will be affected by Project Activities within the action area.

Climate Change

Global climate change has the potential to affect the baseline condition of bladderpod habitat within the action area. Available evidence also indicates climate change effects are reasonably certain to continue into the foreseeable future. Consequently, climate change could be addressed under multiple headings in this Opinion (e.g., rangewide status of the species, environmental baseline, and cumulative effects). Rather than scatter our discussion of this important topic throughout the Opinion, we consolidate in this section our consideration of how climate change may alter baseline conditions in the Action Area.

Climate change is one of the most significant ongoing effects to baseline conditions for bull trout and their associated aquatic habitat throughout the state of Washington. Climate change, and the related warming of global climate, has been well-documented in the scientific literature (Bates et al. 2008; ISAB 2007). Evidence includes increases in average air and ocean temperatures, widespread melting of snow and glaciers, and rising sea level. Given the increasing certainty that climate change is occurring and is accelerating (Bates et al. 2008; Battin et al. 2007), we can no longer assume that climate conditions in the future will resemble those in the past.

At a regional scale, two different temperature prediction models are presented in Stockle *et al.* (2009, p. 199), yet show similar results. Outputs from both models predict increases in mean annual temperature for eastern Washington State. Specifically, the Community Climate System General Circulation Model projects temperature increase as 1.4, 2.3 and 3.2 °C (2.5, 4.1, and 5.8 °F) at Lind, Washington, which is 64 km (40 mi) northeast of the bladderpod population; approximately 1.7, 2.7, and 3.5 °C (3.1, 4.9, and 6.3 °F) at both Pullman, Washington, which is 169 km (105 mi) east of the population, as well as Sunnyside, Washington, which is 50 km (31 mi) southwest of the population, for the 2020, 2040, and 2080 modeling scenarios, respectively.

The projected warming trend will increase the length of the frost-free period throughout the State, increasing the available growing season for plants, which will continue to be limited in eastern Washington by water availability, and likely by extreme heat events in some instances. This will continue the trend observed from 1948 to 2002, during which the frost-free period has lengthened by 29 days in the Columbia Valley (Jones, 2005 *in* Stockle *et al.* 2009, p. 199). Weeds and insects will adapt to the longer season with more favorable conditions (Stockle *et al.* 2009, p. 200).

We do not know what the future holds with regard to climate change; however, bladderpod have a limited distribution and relatively small population size. Despite the lack of site specific data, increased average temperatures and reduced seasonal rainfall may cause a decline of these species and result in a loss of individuals and habitat. Hotter and drier summer conditions may also increase the frequency and intensity of fires in the area, as cheatgrass and other plants would become better competitors for resources than bladderpod. Alternatively, warmer and wetter winter conditions could potentially benefit the species by extending the growing season and providing additional moisture to soils in the spring. It is clear more thorough investigations are needed to better understand the potential impacts of climate change to this subspecies.

EFFECTS OF THE ACTION: White Bluffs Bladderpod and its designated Critical Habitat

Bladderpod

The effects of the action refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

Except for a small portion of the disturbance area needed to replace a single pole structure and along a small, 1710-foot (521-m) segment of the access road, the majority of the line rebuild construction would occur outside of the recognized bladderpod population boundary, in "unoccupied" habitat. A 2017 survey of bladderpod plants within or immediately adjacent to the transmission line right-of-way and along access roads identified a total of 448 plants that could be directly impacted by the Project if the project proceeds in the fall, winter, and spring of 2018-19, as planned. This number of plants represents approximately 0.8 percent of the total 2017 estimated population size at 58,472 individuals. If the project were delayed, the percentage of plants impacted would still be expected to be less than 1 percent of the total bladderpod population. Direct impacts to bladderpod are expected to be either from uprooting by heavy equipment digging or blading of the soil surface and below; or from crushing by tires and placement of supplies.

Indirect effects of the Project on the bladderpod population could result through actions that increase the likelihood of wildfire or increases in numbers and diversity of non-native plants. Invasive species have the potential to outcompete native species, including the bladderpod, and reduce population size over time.

The current transmission line includes a number of deteriorated wooden poles that carry a higher risk of outages and higher levels of maintenance. Implementation of the project is expected to decrease the risk of wildfire threats to the bladderpod population. The current pole structures will be replaced with presumably lower maintenance steel structures, and the existing copper wire on the line will be replaced with new, larger capacity aluminum wire. Construction activities including road grading, excavation for new transmission line poles, and removal of the existing poles have the potential to create exposed soil areas where weedy species can become established. In addition, vehicles and heavy machinery traveling to the construction site can serve as a vector to move weed seeds into the Project area.

Designated Critical Habitat

Portions of the access road and the transmission line right of way lie within designated critical habitat for bladderpod. The total length of the portion of the current access road to the transmission line that lies within the critical habitat is about 5,530 feet (1.524 m). Assuming a width of ten feet for this portion of the road, roughly 1.3 acres (0.53 ha) of road lies within the critical habitat. Approximately 1,970 feet (600 meters) of the transmission line that will be

rebuilt traverses the critical habitat. The line right-of-way, which extends 100 feet (30.5 meters) on either side of the line, a total of 9.1 acres (3.7 hectares) lies within critical habitat. Direct impacts expected within the critical habitat, will occur in a significantly smaller portion within this area. As presented below in Table 1, the Project would directly impact a total of approximately 2.3 acres (0.93 hectares) of the 2,033 acres (823 hectares) of the total designated critical habitat area for this subspecies (USFWS 2013c).

Table 1. Estimated Disturbance Areas within Critical Habitat.

Construction Activity in Action Area	Permanent Impact (acres)	Temporary Impact (acres)
Access Roads		
Improve existing roads used to access the transmission line right of way (10-feet wide by 4630-feet long)[1]	0	1.06
Improve existing access roads along transmission line (20-feet wide by 1910-feet long)[1]	0	0.87
Construct Spur Road (10-feet wide by 133-feet long)	0	0.03
Replacement of Transmission Line Pole Structures[2]		
Excavate holes, anchors, and install new pole structures: 22/10 (65-feet radius) and 22/8 (30 feet radius)[3]	0.02	0.21
Remove pole structure and anchors at 22/9 (20 feet radius)	0	0.06
String and tension new wires	0	0.14
Remove rollers	None	Use of access roads
Haul material off site as needed	None	Use of access roads
Subtotal Area of Disturbance	**0.02**	**2.37**
Total Impact within Critical Habitat	**2.33 acres**[3]	

[1] The areas calculated for access road improvement is a conservative estimate. Where practicable, vegetation may be mowed in lieu of bladed. Pull-off areas may be designated to minimize access road clearing.

[2] Note that the disturbance areas vary for the three poles within the critical habitat: a 30-foot (9.1-meter) radius is anticipated around pole 22/8; a 20-foot (6.1-meter) radius is expected at 22/9 because the pole is being removed and not replaced, and 65-foot (19.8-meter) radius is expected around pole 22/10 due to the guy wires and anchors required around this structure.

[3] Some construction activities would occur in overlapping areas; therefore, the sum of the construction area acreages exceeds the total disturbance area.

The majority of direct impacts, including construction of the new spur road to be used during construction, removing the existing pole structures, line tensioning and stringing activities, and material staging and other construction related activities, will likely be temporary in nature because impacted areas will be replanted with native vegetation as described above. As shown

above in Table 1, this area is expected to be contain nearly all of the 2.3 acres (0.93 hectare) impacted. A small area of the disturbance within the critical habitat will not be replanted and constitutes a permanent loss of habitat. This area consists of site where the new poles and associated hardware will be placed. As shown in Table 1, this area is expected to be less than a tenth of an acre. Approximately 2.33 acres in total of critical habitat (0.11 percent of the 2,033.4 total acres (822.9 ha) designated in 2013 will be impacted by Project activities.

Primary Constituent Elements

Soils - Weathered alkaline paleosols and mixed soils could be adversely impacted by the removal and/or replacement of the pole structures, including the backfill of holes. New pole holes would likely disturb the soil horizon and displace potential habitat. In addition, spoils have the potential to change soil composition or cover the suitable soil. Avista will minimize this potential by using geotextile fabric or other barriers for spoils, then hauling excess spoils and materials off-site.

Other soil disturbances due to staging or stockpiling may cause temporary disturbance, but would be unlikely to permanently affect the alkalinity of the soil or other important soil characteristics. These temporary effects would be minimized by restoring the spur road and reseeding the disturbed soils after construction.

Native Habitat - Trimming and clearing vegetation and blading to construct a spur road and improve existing access roads would impact the native habitat. In addition, other project activities that require heavy machinery may damage shrubs and/or crush local vegetation. Weeds could be introduced or spread through these access roads. Revegetation will be used to restore the native shrub-steppe vegetation following construction. Revegetation also serves to reduce areas of bare soils where weeds may become established. The spread of weeds will be minimized by using certified weed free materials during revegetation activities, installing truck-washing areas, and chemically or mechanically controlling weed populations in and near the action area during and following project construction. Overall, upgrading the aging transmission line is expected to reduce the need for line maintenance; less traffic through the critical habitat should result in fewer opportunities for the distribution of weed seeds from offsite locations. Perhaps the biggest threat to native plant communities in the in the action area and critical habitat is wildfire. Fire severity is expected to be reduced somewhat because the wood poles will be removed and fire risk will likely be reduced because aging electrical lines will be eliminated.

Pollinators - Pollinators and native shrub-steppe habitat (pollinator habitat) could be affected by digging, blading, trimming and clearing native vegetation in the action area to replace the pole structures and provide access. Plants that support pollinator species would be affected by removal of vegetation. Work areas will be delineated with construction fencing or signage prior to construction to limit disturbance to only the area needed for the activity. Revegetation of disturbed areas following construction will help to minimize impacts to this element.

Bluff Formations - The Project will cause soil disturbance and require the use of heavy machinery however, construction activities would not discharge large amounts of water or mechanical undermining that could cause mass slumping or otherwise cause slope instability. In

addition, the impacted area will be revegetated as soon as practical after disturbance, which will lessen the opportunity for runoff during storm events. The project is not expected to have a significant effect on this element.

Conclusion - Approximately 2.33 acres in total of critical habitat (0.11 percent) from the 2,033.4 acres (822.9 ha) designated in 2013 will be affected. Less than one percent of the total 2017 estimated 58,472 individual bladderpod plants will be impacted by the Project. Although they result in detrimental effects to bladderpod individuals and loss of critical habitat function, these effects are quite small in time and in space for a resilient subspecies spread over a17-km (10.6-mi) linear habitat.

CUMULATIVE EFFECTS: White Bluffs Bladderpod and its Designated Critical Habitat

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

While no other construction projects are currently scheduled to occur in proximity to the bladderpod and designated critical habitat, local private landowner activities, and recreational use could potentially result in a cumulative effect on the designated critical habitat for the bladderpod. Vegetation management activities will continue to occur in and around the Monument and on private farmland near or adjacent to the critical habitat. This may include controlled or prescribed burning, herbicide application, mechanical plant/weed removal, and other activities. Prescribed burning can increase the risk of damaging the bladderpod and pollinator habitat, which could adversely affect the bladderpod population. Herbicide applications from nearby farming could drift towards the bladderpod populations and adjacent habitat resulting in additional impacts to pollinators and plant species. Continued and potential increased use from improved access roads on the Monument for recreation could introduce weeds through human vectors and vehicles. Finally, recreational activities may result in crushing or uprooting of individual plants and loss or modification of suitable habitat as well as the introduction and spread new and or existing weeds. The effects described above are considered potential, and have not been documented in recent years; therefore may no longer be active or reasonably certain to occur.

INTEGRATION AND SYNTHESIS OF EFFECTS: White Bluffs Bladderpod and its Designated Critical Habitat

The Integration and Synthesis section is the final step in assessing the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we evaluate the effects of the action, the status of the species and critical habitat, the environmental baseline, and cumulative effects, to formulate our biological opinion as to whether the proposed action is likely to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated critical habitat for the conservation of the species. The significance of the effects depends in part on the resiliency of this population over the duration of this transmission line rebuild and its

long-term operation. The status and trend of White Bluffs bladderpod from this population suggests neither an increasing nor decreasing population, but rather stability at a low abundance. Project effects are likely to contribute to maintaining the population in a depressed condition, which may result in an increased risk of extirpation due to stochastic events.

Anticipated effects to critical habitat in this White Bluffs bladderpod population is the maintenance of a degraded condition, with the most severe effects expected to occur to the soils and native habitat PCEs and their relation to road work, transmission line replacement, and other ground disturbance activities specified in the proposed action. Fire severity and its implication on the native habitat PCE is expected to be reduced since wooden poles will be reduced and fire control measures have been developed as part of the proposed action. Decreases in population size or the creation of localized areas where the plants have been removed affect future population size by impacting the total genetic pool size or diversity, or by creating distance barriers to efficient pollination as explained in our effects analysis for the pollinators PCE.

After considering the status of the bladderpod and the current environmental baseline, the effects of the proposed action will injure or kill individual plants and may cause a small depression in the reproductive output for that individual plant. This effect will be small at the population level. The removal and reduction will also reduce bladderpod abundance for that year when the proposed action is implemented. Therefore, persistence at the population (and rangewide in this case) scale of bladderpod will be reduced at a detectible level, in numbers, reproduction, and distribution, but is expected to recover in the years following the completion of project activities.

CONCLUSION: White Bluffs Bladderpod and its Designated Critical Habitat

After reviewing the current status of White Bluffs bladderpod, the environmental baseline, the effects of the proposed action and the cumulative effects, it is the Service's Opinion that the action, as proposed, is not likely to jeopardize the continued existence of the White Bluffs bladderpod and will not destroy or adversely modify designated critical habitat. We reached this conclusion for the following reasons:

No Jeopardy

1. The effects of the action will result in the injury and death of White Bluffs bladderpod individuals in the population. The percentage of plants impacted by the action is expected to be less than one percent of the total bladderpod population.

2. Overall, the rebuild of the Benton-Othello transmission line rebuild project will not diminish the numbers, distribution, or reproduction of White Bluffs bladderpod to a degree that will depreciably reduce the likelihood of survival and recovery of bladderpod in the White Bluffs population.

No Destruction/Adverse Modification

1. The proposed Project is likely to affect the PCEs of designated critical habitat for the White Bluffs bladderpod in the short-term; however, upgrading the aging transmission

line is expected to reduce the need for line maintenance; less traffic through the critical habitat should result in fewer opportunities for the distribution of weed seeds from offsite locations. Perhaps the biggest threat to native plant communities in the in the action area and critical habitat is wildfire. Fire severity is expected to be reduced somewhat because the wood poles will be removed and fire risk will likely be reduced because aging electrical lines will be eliminated. Overall, the proposed action degrades the functional suitability of the PCEs, but not to the extent that we would expect a categorical relative to the baseline condition. Only a small fraction of the effects to the PCEs of designated critical habitat are permanent, and the critical habitat unit is expected to continue to function in the manner it was designed.

2. This aggregate effect is consistent with the conservation role of critical habitat range-wide to support viable populations. On that basis, implementation of the proposed Project is not likely to destroy or adversely modify White Bluffs bladderpod critical habitat at the range-wide scale.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. *Harm* is defined by the Service as an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). *Harass* is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of Federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.

Avista has committed to a number of conservation measures which should avoid or minimize the effects of the proposed action, consistent with Hanford Site direction and state law.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends that all conservation measures that Avista stated in the BA be implemented to the fullest during all Project activities.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or 3) a new species is listed or critical habitat designated that may be affected by the action.

LITERATURE CITED

Al-Shehbaz, I.A. and S.L. O'Kane. 2002. *Lesquerella* is united with Physaria. Novon 12: 319-329.

Avista Corporation. 2017. Biological Assessment for the Benton-Othello 115 kV Transmission Line Rebuild. Prepared by: Michelle Anderson. September 14, 2017. 35pp.

Bates, B.C., Z.W. Kundzewicz, S. Wu, and J.P. Palutikof, Eds., 2008: Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210 pp.

Battin, J., M.W. Wiley, M.H. Ruckelshaus, R.N. Palmer, E. Korb, K.K. Bartz, and H. Imaki. 2007. Projected impacts of climate change on salmon habitat restoration. Proceeding of the National Academy of Sciences of the United States of America. PNAS published online April 5, 2007. www.pnas.org.

Bjornstad, B., and K. Fecht. 2002. Ice-Age Floods Features in the Vicinity of the Pasco Basin and the Hanford Reach National Monument. Field Guide. Sponsored by: Ice-Age Floods Institute and Columbia River Exhibition of History, Science, and Technology. 23 pp.

Bjornstad, B.N. and R.E. Peterson. 2009. Presentation 4(a): Hydrogeologic controls and impacts of Quaternary landslides along the White Bluffs on the Columbia River, south-central Washington [abstract (b)]. PNNL-SA-63034. *In*: Washington Department of Ecology; U.S. Geological Survey, 7th Washington Hydrogeology Symposium Program. p. 36.

Brown, R. 1990. A Review of Water-Well Data from the Unconfined Aquifer in The Eastern and Southern Parts of the Pasco Basin. Report prepared for Rockwell Hanford Operations to U.S. Department of Energy, under contract number DE-AC06-77RL01030.

Cannon, S.D., S.P. Reidel, and A.C. Rohay. 2005. Chapter 4: Geology. *In*: Hanford Site. National Environmental Policy Act (NEPA) Characterization. PNNL-6415. Rev. 17. D.A. Neitzel, Editor.

Caplow, F.E., P. Dunwiddie, D. Reynolds, K. Beck, and T. Kaye. 1996. Evidence for the recognition of *Physaria tuplashensis* (Brassicaceae). Unpublished manuscript on file, U.S. Fish and Wildlife Service. 26 pp.

Caplow, F.E. 2003. Studies of Hanford Rare Plants 2002. Natural Heritage Report 2003-04. Washington Natural Heritage Program, Department of Natural Resources, Olympia, Washington.

Caplow, F.E. 2005. Demography of Eriogonum codium: Dynamics of the Seedling Life Stage. Washington Natural Heritage Program Report. Olympia, Washington. 10 pp. + Appendices.

DOE. U.S. Department of Energy. 2013. Hanford Site Revegetation Manual, DOE/RL-2011-116 Revision 1.

Drost, B.W., S.E. Cox, and K.M. Schurr. 1997. Changes in Ground-water Levels and Ground-water Budgets, From Predevelopment to 1986, in Parts of the Pasco Basin, Washington: U.S. Geological Survey Water-Resources Investigations Report 99-4086. 172 pp.

Dunwiddie, P.W., K. Beck, and F. Caplow. 2001. Demographic studies of *Eriogonum codium* Reveal, Caplow & Beck (Polygonaceae) in Washington. *In*: Conservation of Washington's Rare Plants and Ecosystems: Proceedings from a conference of the Rare Plan Care and Conservation Program of the University of Washington. Washington Native Plant Society. Seattle, Washington. pp. 59-68.

Evans et al., (eds). 2003. Biodiversity studies of the Hanford site, final report: 2002-2003. The Nature Conservancy, Seattle, Washington. 147 pp. + Appendices.

Independent Scientific Advisory Board (ISAB). 2007. Climate Change Impacts on the Columbia River Basin Fish and Wildlife. ISAB 2007-2. Portland, Oregon.

Lindsey, K.A. 1997. Aerial Photography Evaluation of Mass Movement Timing, Size, and Causes for Part of the White Bluffs of the Columbia River, South-Central Washington. Report for The Nature Conservancy. Daniel B. Stephens & Associates, Inc. 23 pp.

Newcomb, R.C. 1958. Ringold Formation of Pleistocene Age in Type Locality, the White Bluffs, Washington. American Journal of Science, Volume 256, pp. 328-340.

Newsome, H.P. 2017. Update of the current status of Physaria douglasii ssp. Tuplashensis on the Hanford Reach National Monument. Unpublished Report. Prepared June, 2017. 15 pp.

Newsome, H.P. and K. Goldie. 2008. Update of the current status of *Physaria* (*leqsquerella*) *tuplashensis* on the Hanford Site. Prepared August, 2008. 8 pp.

Rollins, R.C., K. Beck, and F. Caplow. 1996. An undescribed species of *Lesquerella* (Cruciferae) from the state of Washington. Rhodora. 97 (No. 891): 203-205.

Stockle, C.O., R.L. Nelson, S. Higgins, J. Brunner, G. Grove, R. Boydston, M. Whiting, C. Kruger. 2009. Assessment of Climate Change Impact on Eastern Washington Agriculture. *In*: The Washington Climate Change Impact

USFWS. U.S. Fish and Wildlife Service. 2008. Hanford Reach National Monument Comprehensive Conservation Plan. Mid-Columbia River NWRC. Burbank, Washington. 410 pp. + Appendices.

USFWS. U.S. Fish and Wildlife Service. 2013a. Department of the Interior. Endangered and Threatened Wildlife and Plants; Threatened Status for *Eriogonum codium* (Umtanum Desert Buckwheat) and Physaria douglasii subsp. Tuplashensis (White Bluffs Bladderpod); Final Rule. 50 CFR Part 17. Vol. 78. No. 78. April 23, 2013.

USFWS. U.S. Fish and Wildlife Service. 2013b. Department of the Interior. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for *Eriogonum codium* (Umtanum Desert Buckwheat) and Physaria douglasii subsp. Tuplashensis (White Bluffs Bladderpod); Final Rule. 50 CFR Part 17. Vol. 78. No. 78. April 23, 2013.

USFWS. U.S. Fish and Wildlife Service. 2013c. Department of the Interior. Endangered and Threatened Wildlife and Plants. Threatened Status for *Eriogonum codium* (Umtanum Desert Buckwheat) and *Physaria douglasii* subsp. *tuplashensis* (White Bluffs Bladderpod) and Designation of Critical Habitat; Revised Final Rule. 50 CFR Part 17. Vol. 78. No. 245. December 20, 2013.

WDNR 2010. Field Guide to the Rare Plants of Washington. P. Camp and J. Gamon, Eds. University of Washington Press. Seattle, Washington. 345 pp. + Appendices.

PERSONAL COMMUNICATIONS

Arnett, Joseph. 2012. Note to file: Telephone conversation with Tim McCracken, USFWS, Wenatchee, WA. February 9, 2012. Subject: Bladderpod locations in relations to slumps and areas of slides, response of plant to tillage.

Newsome, H. 2011. U.S. Fish and Wildlife Service. Hanford Reach N.M./Saddle Mountain National Wildlife Refuge, Richland, Washington. Telephone conversation with Tim McCracken, U.S. Fish and Wildlife Service, Wenatchee, Washington August 1, 2011. Subjects: Current and historical land ownership and land management in Hanford Reach, general fire planning and management documents, ERCO/PHDOTU vegetation distribution and mapping of locations of PHDOTU, and the Spotlight Species Action Plan for PHDOTU.