Schultz-Hanford Area Transmission Line Project

Draft Environmental Impact Statement

Bonneville Power Administration
U.S. Department of Energy

Bureau of Land Management
Bureau of Reclamation
Fish and Wildlife Service
U.S. Department of Interior

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Summary

In this Summary:

- The Purposes and Need for Action
- Alternatives
- Affected Environment
- Impacts

This summary covers the major points of the Draft ***Environmental Impact Statement*** (***EIS***) prepared for the BPA Schultz-Hanford Transmission Project proposed by the Bonneville Power Administration (***BPA***). The project involves constructing a new 500-kilovolt (***kV***) line in central Washington, north of Hanford. The new line would connect to an existing line at the Schultz Substation near Ellensburg and to a new or existing substation in the Hanford area (see Map 2 in EIS). The project may also involve constructing a new substation to accommodate the new transmission line. As a federal agency, BPA is required by the National Environmental Policy Act (***NEPA***) to take into account potential environmental consequences of its proposal and take action to protect, restore, and enhance the environment during and after construction. Preparation of this EIS assists in meeting those requirements.

➡ For Your Information

Words and acronyms in bold and italics are defined in Chapter 9, Glossary and Acronyms. Some are also defined in sidebars.

S.1 Purposes and Need for Action

S.1.1 Need

BPA owns and operates a system of transmission lines that move electricity through central Washington. Since the mid-1990's, the transmission lines that move electricity in a north-to-south direction on the east side of the Cascades, north of the U.S. Department of Energy Hanford Reservation (Hanford Site), have grown increasingly constrained. During spring and early summer months, the amount of power that needs to move through this area exceeds the carrying capacity of the existing transmission lines. Not having enough ***transmission capacity*** can compromise safety and decrease transmission ***system reliability***.

***Transmission capacity** refers to the maximum load that a transmission line or network of transmission lines can carry.*

In the event of an ***outage***, additional power cannot be moved through the existing transmission system because the lines would overheat and sag below acceptable levels potentially causing fires and further equipment failure. This can lead to ***brownouts*** or, under certain conditions, a ***blackout***. Therefore, BPA needs to increase transmission capacity ***north of Hanford*** to move additional power through this area.

S.1.2 BPA's Purposes

Purposes are goals to be achieved while meeting the need for the project. They are used to evaluate project alternatives. BPA will use the following purposes to choose among the alternatives:

- Maintain transmission system reliability;
- Optimize transmission ***system usage***;
- Minimize environmental impacts;
- Minimize costs; and
- Meet ***energization date*** of late 2004.

For Your Information

*The **energization date** is when the project has been built and is operational.*

S.1.3 Background

BPA has limited transmission capacity north of Hanford because of two main reasons:

- Wholesale power deregulation; and
- Obligations to threatened and endangered species (fish).

Wholesale power deregulation started in 1992, causing BPA to cut costs in many ways in order to stay competitive in an open market. BPA had not built any major transmission lines since the mid-1980's, and this continued after deregulation. Investments in the transmission system (including maintenance) were small, inexpensive, and quickly energized compared to building expensive transmission lines. However, this allowed BPA to squeeze more performance out of the existing transmission system and continue to meet growing load. Over the past five years, there has been an increase in the usage of the transmission system due to an increase in regional power transfers. The increased transmission usage in the Northwest has outrun the capacity of the existing transmission system.

Since the early 1990's, several species of salmon have been listed as threatened or endangered under the Endangered Species Act (**ESA**). Federal agencies that operate the dams in the Northwest take specific actions to help salmon survive. During the ***spring run-off***, water in the Lower Snake and Columbia Rivers that had previously been used to generate electricity at dams (Lower Granite to Bonneville) is now used to help transport juvenile salmon down river to the ocean. ***Spilling*** water over these dams causes less water to go through the turbines which results in less power being generated. To make up for the loss of generation, dams along the mid- and upper-Columbia River in northern Washington (e.g., Grand Coulee and Chief Joe) need to generate additional power to meet market demands during the spring and summer months. This is in addition to power coming from Canada.

As electricity is generated at the mid- and upper-Columbia dams, it moves south through central Washington to load centers like Portland and Seattle, and to the ***Southern Intertie***. It also flows west over the Cascade Mountains and then south through the Seattle area. The transmission capacity across the north of Hanford area cannot accommodate the amount of electricity needing to flow through the area to the south.

For Your Information

*The **Southern Intertie** is a collective group of transmission lines that move power north and south between Oregon and California.*

S.2 Alternatives

After identifying existing and future electrical needs in the area, BPA began to develop alternatives to meet that need. BPA did long range (5- to 10-year) studies to determine what actions could meet the need, what each would cost, and how each could affect the transmission system. Several alternatives were identified. These alternatives – the Preferred Alternative (Alternative 2), and Alternatives 1, 3, and 1A – are discussed in this EIS, as well as the No Action Alternative.

S.2.1 Segments

Segments A through F make up the routes for the construction alternatives being considered. All segments are ***single-circuit*** lines unless otherwise specified.

*A **single-circuit** line has one electrical circuit per structure.*

Segment A, common to all alternatives, starts at the BPA Schultz Substation and goes southeast, following the existing Vantage – Schultz 500-kV transmission line. In order to make room for the new line and improve the configuration of the existing lines, BPA would relocate the first mile of the existing Sickler-Schultz 500-kV transmission line. Segment A is about 29.4 mi long and ends south of Interstate 90 (I-90).

Segment B starts where the new transmission line would cross to the south side of the existing Schultz-Vantage line south of I-90 and has two route options: B_{NORTH} and B_{SOUTH}.

B_{NORTH} runs to the east, parallel to and 1,200 feet south of the Schultz-Vantage line. This route option follows the existing line across the Columbia River and ends at the BPA Vantage Substation. B_{NORTH} is 9.5 miles long.

B_{SOUTH} initially runs farther to the south and then heads east immediately parallel to an existing 230-kV wood pole transmission line on the south side of the John Wayne Trail. Just before the

Columbia River, B_{SOUTH} angles slightly to the north towards the Schultz-Vantage line and crosses the Columbia River adjacent to the existing Schultz-Vantage line river crossing. B_{SOUTH} ends at the BPA Vantage Substation. B_{SOUTH} is 10.4 miles long.

Segment C starts in the same place as Segment B (where the new line would cross the existing Schultz-Vantage line). The segment would turn south, crossing the Yakima Training Center (YTC). This segment would not parallel an existing line. The segment would angle southeast, leave the YTC, cross Highway 24 and end where it intersects the existing Hanford-Ostrander and Hanford-John Day 500-kV transmission lines. This intersection of lines would be the site of a new substation, called Wautoma Substation. Segment C is 29.8 miles long.

Segment D starts in the area just south of Vantage Substation. It would head in a southeasterly direction, directly adjacent and parallel to the existing Midway-Vantage 230-kV line on the west side. The segment would cross Crab Creek and climb the Saddle Mountains.

For Your Information

Double-circuit *towers hold conductors for two transmission lines.*

Starting at about 9 mi south of the Vantage Substation, the Midway-Vantage line would be removed and ***double-circuit*** towers built in its place to carry both lines through the irrigated area (about 8 mi long). Beyond the irrigated areas, Segment D would again parallel the Midway-Vantage line on the west side and cross the Columbia River. Segment D would pass the BPA Midway Substation and continue south to the new substation site, while immediately paralleling the existing Midway-Big Eddy 230-kV line on the west side. Segment D is 27.3 miles long.

Segment E begins at Vantage Substation and heads south, paralleling the existing Vantage-Hanford 500-kV line 1,200 feet to the north. It would cross Crab Creek, climb the Saddle Mountains and head southeast, crossing the Saddle Mountain Unit of the Hanford Reach National Monument. After crossing the Columbia River, Segment E would end at the existing BPA Hanford Substation. Segment E is 23.2 miles long.

Segment F begins at Vantage Substation and heads east, then south crossing Crab Creek and climbing the Saddle Mountains. It would then follow the Vantage-Hanford line for a short length before turning due east. Segment F would traverse about 14 miles along the south slope of the Saddle Mountains, and then intersect the Grand Coulee-Hanford 500-kV transmission line. It would then turn south and parallel the existing Grand Coulee-Hanford line 1,200 feet to the east across the Wahluke Slope. After crossing the Columbia River, the segment ends at the Hanford Substation. Segment F is 32.1 miles long.

S.2.2 Preferred Alternative–Alternative 2

BPA is proposing to construct a new 500-kV transmission line between the Schultz Substation, almost nine miles north of Ellensburg, Washington, and a new substation (Wautoma Substation) in Benton County, two miles south of Hwy 24. The Preferred Alternative is Alternative 2 and is made up of Segments A, $B_{SOUTH,}$ and D.

The Preferred Alternative would cost approximately $76,500,000 (2001 dollars).

S.2.2.1. Structures

The Preferred Alternative would primarily use 500-kV, ***single-circuit*** steel lattice structures, also called towers, to support the transmission line conductors. On YTC land, flat configuration 500-kV single-circuit structures would be used. Outside of the YTC, delta configuration structures would be used for single-circuit structures. In one area of Segment D, 500-kV double-circuit lattice structures would be used to hold the new 500-kV and the existing 230-kV line. The height of each structure would vary by location and surrounding land forms. Single-circuit structures would average 135 feet high. The double-circuit structures would average 170 feet high.

S.2.2.2. Conductors and Insulators

The wires or lines that carry the electrical current in a transmission line are called conductors. ***Alternating current*** transmission lines, like the new line, require three sets of wires to make up a circuit. For a single-circuit 500-kV transmission line, there would be three sets of wires and for a double-circuit line (Segment D) there would be six sets of wires.

Conductors are not covered with insulating material, but rather use the air for insulation. Conductors are attached to the structure using porcelain or fiberglass insulators. Insulators prevent the electricity in the conductors from moving to other conductors, the structure, and the ground.

Two smaller wires, called overhead ground wires, are attached to the top of transmission structures. Overhead ground wires protect the transmission line from lightning damage. To disseminate the electrical power from lightning, the power is routed to the ground at each tower through wires called counterpoise.

S.2.2.3. Right-of-Way

New ROW would be needed for the new structures and line. The new ROW would be 150 feet wide. Where the new line would parallel an existing 500-kV line (Segment A) the new line would be up to 1,400 feet from the existing line. In Segment D where the existing line would be replaced with a double-circuit line, the existing ROW would be expanded 25 feet on the west side, to increase the ROW from the existing 100 feet to 125 feet. Where the new line is parallel to the 230-kV line in Segment D, the new 150 feet ROW would be directly adjacent to the existing ROW.

BPA would obtain easements from landowners for new ROW. Fee title to the land covered by the easement generally remains with the owner, and is subject to the provisions of the easement.

S.2.2.4. Clearing

Vegetation within the ROW is restricted by height. This is required for the safe and uninterrupted operation of the line. It is not anticipated that a large number of trees will need to be cleared for this project; however, because of safety considerations, there may be some trees at water crossings that would need to be cut.

At the structure sites, all trees and brush would be cut and removed within a quarter acre area, with root systems being removed from a 50-by-50-foot area for the tower footings. A portion of the site would be graded to provide a relatively level work surface for the erection crane. The Preferred Alternative would require an estimated 71 acres to be cleared for structure sites along the 67-mile route.

S.2.2.5. Road System

Access roads on and off the ROW would be used to construct and maintain a new line. Where the new line would be 1,200 feet to 1,400 feet from the existing line, a new road system would be built. Where the new line would be built directly adjacent to the existing line, existing access roads would be used, with ***spur roads*** constructed to the new structures.

New roads would be located within the ROW wherever possible. Where conditions require, such as at steep cliffs, roads would be constructed and used outside the ROW. BPA normally acquires easements for the right to develop and maintain permanent over-ground access for wheeled vehicle travel to each structure. No permanent access road construction would be allowed in cultivated or fallow fields unless previously agreed to by the landowner. After construction of the line is completed, BPA would allow any roads in cropland to be returned to crop production.

New access roads surfaces would be 16 feet wide, with additional road widths of up to 25 feet for curves. When needed, a 5-foot ditch would be added to one side of the road. Roads would be dirt, gravel,

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or rock. Approximately 64.7 mi of new roads and 74.6 mi of improved roads would be built.

Dips, culverts, and ***waterbars*** would be installed within the roadbed to provide drainage. Fences, gates, cattle guards, and additional rock would be added to access roads where necessary.

S.2.2.6. Pulling and Reeling Areas

Pulling and reeling areas would be needed for the installation of the conductor. Each pulling and reeling area would be one acre in size and located every 2.5 miles. The Preferred Alternative would require an estimated 28 acres to be cleared for the pulling and reeling areas along the route.

S.2.2.7. Staging Areas

During construction of the transmission line, areas would be needed off the main highways, near the ROW, where equipment such as steel, spools of conductor, and other construction materials would be stored until material is needed. Prior to construction these would be determined and agreements with landowners made.

S.2.2.8. Substation Facilities

For the Preferred Alternative, a new transmission line would begin at Schultz Substation and terminate at a new substation, called Wautoma Substation. Additions and modifications would occur at Schultz Substation. No work would be needed at the Vantage or Midway Substations.

Schultz Substation – A new bay would be constructed within the existing fenced yard of the substation. New equipment within the substation would include power circuit breakers, switches, **buswork**, **potential transformers (PT's)**, and substation dead-end towers.

Wautoma Substation – A new substation would be constructed in Benton County, two miles south of Hwy. 24 (T12N, R24E, sec 20). The new substation would be sited at the intersection of the new transmission line and the Hanford-Ostrander 500-kV and Hanford-John Day 500-kV transmission lines. These two lines would be tied into the new substation. A parcel of approximately 25 acres would be needed for the new substation. Land for the new substation would be acquired in fee and would remain in BPA and federal government ownership.

The footprint of the substation would be approximately 800 feet by 500 feet. This area would include the substation yard (equipment within the fence) and grading outside of the fence. The actual fenced area would be about 760 feet by 450 feet. Equipment such as breakers, buswork, switches, and PT's would be installed in the yard, and the control rack would be installed in the control house.

S.2.2.9. Communications Equipment

BPA substations are electronically connected to BPA's transmission system control centers. Microwave communication sites and fiber-optic communication lines connect BPA's high-voltage substations to system control centers located in Vancouver and Spokane, Washington.

As part of the Preferred Alternative, BPA would install fiber optic cable between Vantage Substation and the new Wautoma Substation (about 27.3 miles) and from Vantage Substation north to the BPA Columbia Substation (about 32 miles).

From Vantage to Columbia Substation, fiber would be strung on existing transmission line structures. From Vantage to the new Wautoma Substation, the fiber would either be strung on the new transmission line or existing lines, where available. Detailed design is still to be determined.

S.2.2.10. Maintenance

BPA would perform routine, periodic maintenance and emergency repairs on structures, substations, and accessory equipment. These activities typically include replacing insulators, inspections of structures, and vegetation control. Within the substations, BPA may need to periodically replace equipment.

Existing and new permanent access roads to structures would remain throughout the life of the line so that BPA can perform routine and emergency maintenance on the transmission line. Road maintenance could include grading and clearing, and repairing ditches and culverts.

A large part of maintenance activities is vegetation control. In Central Washington, this primarily focuses on the spread of noxious weeds. Tall growing vegetation would also need to be managed in and adjacent to the ROW, primarily where the line crosses water bodies. Vegetation maintenance activities would follow the guidelines set in the BPA Transmission System Vegetation Management Program EIS. When vegetation control is needed, a vegetation management checklist would be developed for the right-of-way. It would identify sensitive resources and the methods to be used to manage vegetation. Substations are periodically sprayed with herbicide to keep plants from growing and creating a safety hazard.

S.2.3 Alternative 1

Alternative 1 would start at the Schultz Substation and follow the Schultz-Vantage line along Segments A and B. It would then follow the existing Vantage-Hanford 500-kV line 1,200 feet to the north along Segment E. The new line would end at the existing Hanford Substation.

This alternative has an estimated cost of $88,000,000.

S.2.3.1. Structures

Alternative 1 would use 500-kV single-circuit steel lattice structures. The height of each structure would vary by location and surrounding land forms, with an average height of 135 feet.

S.2.3.2. Conductors and Insulators

The single-circuit transmission line would be made up of three sets of wires. The insulators and overhead ground wires would be the same as discussed earlier for the Preferred Alternative.

S.2.3.3. Right-of-Way

New ROW would be needed for the new structures and line. The new ROW would be 150 feet wide and offset from the existing 500-kV line up to 1,400 feet along Segment A, as described for the Preferred Alternative. Where the new ROW would parallel existing 500-kV lines along Segments B and E, the offset would be 1,200 feet.

Easement provisions would be the same as those discussed earlier for the Preferred Alternative.

S.2.3.4. Clearing

Clearing requirements would be the same as those discussed earlier for the Preferred Alternative. Alternative 1 would require an estimated 63 acres to be disturbed for structure sites along the 63-mile route.

S.2.3.5. Road System

A new access road system would be built for the majority of Alternative 1. Wherever possible, the access roads would be located on the ROW. BPA normally acquires easements for the right to develop and maintain permanent over-ground access for wheeled vehicle travel to each structure. No permanent access road construction would be allowed in cultivated or fallow fields. Any roads in cropland would be removed and the ground would be restored to the original contour when construction of the line is completed.

New access roads surfaces would be 16 feet wide, with additional road widths of up to 25 feet for curves. When needed, a 5-foot ditch would be added to one side of the road. Roads would be dirt, gravel, or rock. Approximately 94.9 mi of new roads and 85.5 mi of improved roads would be built.

Drainage, fences, and gates would be installed where needed as described earlier for the Preferred Alternative.

S.2.3.6. Pulling and Reeling Areas

Pulling and reeling area requirements would be the same as those discussed earlier for the Preferred Alternative. Alternative 1 would require an estimated 27 acres to be cleared for the pulling and reeling areas along the route.

S.2.3.7. Staging Areas

Staging areas would be located and used similar to those described earlier for the Preferred Alternative.

S.2.3.8. Substations

For Alternative 1, a new transmission line would begin at the Schultz Substation and end at Hanford Substation. The line would pass through the Vantage Substation, but no electrical equipment would be installed within the Substation as part of this project.

Schultz Substation – The new equipment installed at Schultz Substation would be the same as described earlier for the Preferred Alternative.

Hanford Substation – A new bay would be constructed within the existing fenced yard of the substation. Outside of the substation fence, one or two of the existing transmission line structures may need to be relocated in order to align with the readjusted substation equipment. The new equipment within the substation would include breakers, switches, buswork, and PT's.

Vantage Substation – The line would pass through the Vantage Substation in order to get from the west to east side of existing lines. A new bay and dead end would be constructed within the existing fenced yard of the substation. Some existing transmission line towers may need to be moved to make room for the new line.

S.2.3.9. Communications Equipment

As part of Alternative 1, BPA would install fiber optic cable between Vantage Substation and Midway Substation (about 19.3 miles) and from Vantage Substation north to the BPA Columbia Substation (about

32 miles). The new fiber would reinforce BPA's communication network and make the fiber optic system more reliable.

S.2.3.10. Maintenance

Maintenance activities would be similar to those described earlier for the Preferred Alternative.

S.2.4 Alternative 3

Alternative 3 would start at the Schultz Substation and follow Segment A. It would then turn south and follow segment C through the YTC. South of the YTC in Benton County, the line would terminate at the new Wautoma Substation as described earlier for the Preferred Alternative.

This alternative has an estimated cost of $67,000,000. No land costs were added to the estimate for the purchase of easements across the YTC. It is possible that in lieu of an easement payment, BPA would compensate the Army for the loss of the use of land used for maneuvers (i.e., purchasing adjoining land).

S.2.4.1. Transmission Line

Structures and conductor would be the same as described earlier for Alternative 1.

S.2.4.2. Right-of-Way

New ROW would be needed for the new structures and line. The new ROW would be 150 feet wide and offset from the existing 500-kV line up to 1,400 feet along Segment A. In Segment C, the transmission line would be in a new ROW and not parallel to any existing lines.

Easement provisions would be the same as those discussed earlier for the Preferred Alternative.

S.2.4.3. Clearing

Clearing requirements would be the same as those discussed earlier for the Preferred Alternative. Alternative 3 would require an estimated 62 acres to be disturbed for structure sites along the 59-mile route.

S.2.4.4. Access Roads

New access roads would be built for the majority of Alternative 3. Roads would be built as described earlier for Alternative 1. Approximately 130.4 mi of new roads and 98.0 mi of improved roads would be built.

S.2.4.5. Pulling and Reeling Areas

Pulling and reeling area requirements would be the same as those discussed earlier for the Preferred Alternative. Alternative would require an estimated 24 acres to be cleared for the pulling and reeling areas along the route.

S.2.4.6. Staging Areas

Staging areas would be located and used similar to those described earlier for the Preferred Alternative.

S.2.4.7. Substations

Schultz Substation – The new equipment installed at Schultz Substation would be the same as described earlier for the Preferred Alternative.

Wautoma Substation – The construction of the substation would be the same as described earlier for the Preferred Alternative.

S.2.4.8. Communication Equipment

As part of Alternative 3, BPA would install fiber optic cable between Vantage Substation and Midway Substation (about 19.3 miles) and from Vantage Substation north to the BPA Columbia Substation (about 32 miles). BPA would also install fiber from Midway Substation to the new Wautoma Substation using a combination of existing lines and the new transmission line.

S.2.4.9. Maintenance

Maintenance activities would be similar to those described earlier for the Preferred Alternative.

S.2.5 Alternative 1A

Alternative 1A would start at the Schultz Substation and follow Segments A and B. The new line would enter the Vantage Substation and cross to the east side of the existing transmission lines. The line would then follow Segment F into Hanford Substation. The outside limits of the Hanford Substation would not need to be expanded for this alternative.

This alternative has an estimated cost of $67,000,000.

S.2.5.1. Transmission Line

Structures and conductor would be the same as described earlier for Alternative 1.

S.2.5.2. Right-of-Way

New ROW would be needed for the new structures and line. The new ROW would be 150 feet wide and offset from the existing 500-kV line up to 1,400 feet along Segment A, as described in the Preferred Alternative. Where the new ROW would parallel existing 500-kV lines along Segments B and F, the offset would be 1,200 feet. A new 150 feet wide ROW would also be acquired in the areas of Segment F that are not parallel to an existing line.

Easement provisions would be the same as those discussed earlier for the Preferred Alternative.

S.2.5.3. Clearing

Clearing requirements would be the same as those discussed earlier for the Preferred Alternative. Alternative 1A would require an estimated 75 acres to be disturbed for structure sites along the 72-mile route.

S.2.5.4. Access Roads

New access roads would be built for the majority of Alternative 1A. Roads would be built as described earlier in Alternative 1. Approximately 112.9 mi of new roads and 71.2 mi of improved roads would be built.

S.2.5.5. Pulling and Reeling Areas

Pulling and reeling area requirements would be the same as those discussed earlier for the Preferred Alternative. Alternative 1A would require an estimated 30 acres to be cleared for the pulling and reeling areas along the route.

S.2.5.6. Substations

For Alternative 1A, a new transmission line would begin at the Schultz Substation and end at Hanford Substation. The line would pass through Vantage Substation.

Schultz Substation – The new equipment installed at Schultz Substation would be the same as described earlier for the Preferred Alternative.

Hanford Substation – The new equipment installed at the Hanford Substation would be the same as described earlier for Alternative 1.

Vantage Substation – The line would pass through the Vantage Substation in order to get from the west to east side of existing lines as described earlier for Alternative 1.

S.2.5.7. Communication Equipment

BPA would install fiber optic cable similar to what is described earlier for Alternative 1.

S.2.5.8. Maintenance

Maintenance activities would be similar to those described earlier for the Preferred Alternative.

S.2.6 No Action Alternative

The No Action Alternative is traditionally defined as the no build alternative. This alternative would mean that a new transmission line would not be built, and no other equipment would be added to the transmission system. None of BPA's purposes for this project would be met. Maintenance and operation of the existing transmission line and substations would continue unchanged.

S.2.7 Alternatives Considered by Eliminated from Detailed Study

BPA studied a variety of alternatives to meet the need for the project. After preliminary study, the following alternatives were eliminated from detailed consideration because they either could not meet the need for the project or they were considered unreasonable.

S.2.7.1. Alternative 4 Transmission Line

BPA studied the possibility of paralleling the existing Columbia-Ellensburg-Moxee-Midway 115-kV transmission line. The new line would begin at Schultz Substation and be routed through Ellensburg and Yakima, west of the Yakima Training Center and into a new substation. This was referred to as Alternative 4 during the scoping period. BPA received a large number of comments from the public in opposition to this alternative. The existing 115-kV line is adjacent to many homes. Early estimates showed that the cost to buy property and relocate residents would be over $60,000,000. This did not include new transmission equipment, substation equipment, or construction costs. This alternative was eliminated from further study due to cost.

S.2.7.2. Schultz-Ashe Transmission Line

During the scoping process, maps presented by BPA showed a possible route going through the Hanford Substation and on to the BPA Ashe Substation located on the Hanford Site. Transmission system studies showed that line termination at the Ashe Substation, rather than the Hanford Substation, did not improve reliability. Termination of the line at the Ashe Substation also did not improve transfer capability over the Hanford Substation or Wautoma

Substation alternatives. The 17 additional miles of transmission line needed for this alternative would increase the cost of construction by about $13,000,000.

This alternative was eliminated from further study because the system studies did not show an electrical benefit versus the added cost associated with the added miles of transmission line.

S.2.7.3. Undergrounding

During the scoping process, some people suggested burying the transmission line. Occasionally BPA has used underground transmission cables for new lines. Transmission line cables are highly complex in comparison to overhead transmission lines. For a 500-kV line, the underground cable could be 10 to 15 times the cost of an overhead design. Because of cost, BPA uses underground cable in limited situations, such as for long waterbody crossings or in urban areas.

Underground transmission cables used by BPA are short in comparison to typical overhead transmission lines and are used for lower voltage lines. BPA's longest underground transmission cable (at 115-kV) is 8 miles.

Cable remains a tool available for special situations, but because of its high cost it was eliminated from further consideration.

S.3 Affected Environment

S.3.1 Water Resources

S.3.1.1. Precipitation

Most of the study area is in the rain shadow of the Cascades, which results in a semiarid climate. Most precipitation in the study area falls as rain, with as little as 7 to 8 in of precipitation per year at lower elevations.

S.3.1.2. Watersheds

River basins crossed by the project are the Central Columbia and Yakima. Within these basins the streams crossed by the line segments fall into five watersheds: the Lower Yakima, Upper-Columbia-Priest Rapids, Lower Crab, Upper Yakima, and Upper Columbia-Entiat. Some of the ***perennial streams*** crossed include Lower Crab Creek, Naneum Creek, and Wilson Creek, in addition to the Columbia River. Due to low precipitation in the study area, streams are generally small and intermittent.

S.3.1.3. Water Quality

The Lower Yakima and Upper Columbia-Priest Rapids are identified as having serious water quality problems, such that aquatic conditions are well below state and tribal water quality goals (U.S. EPA 2000). The remaining three watersheds (Lower Crab, Upper Yakima, and Upper Columbia-Entiat) have less serious problems, although their aquatic conditions are also below state or tribal water quality goals (U.S. EPA 2000). Lower Crab Creek and the Columbia River are listed as ***water quality limited*** under Section 303(d) of the Federal Clean Water Act.

S.3.1.4. Shorelines

The Washington State Shoreline Management Act allows for cities or counties to guide the planning and management necessary to prevent the potential harmful effects of uncontrolled development along the shorelines of Washington State. The various line segments cross one river (Columbia), two creeks (Naneum and Lower Crab), and one lake (Nunnally) that have been designated as shorelines.

S.3.1.5. Aquifers

Aquifers between Miocene basaltic rocks are prominent in the Columbia Plateau basaltic aquifer system. Groundwater quality in the proposed study area is variable, depending on the layer of basalt from which the groundwater is taken. The Columbia Plateau basaltic aquifer system is a major source of water for municipal, agricultural, and domestic uses (USGS 1991).

S.3.2 Floodplains and Wetlands

S.3.2.1. Floodplains

Six floodplains associated with the following features would potentially be crossed within the study area: Wilson Spur/Naneum Creek crossings, Cooke Canyon Creek, Columbia River crossings, Lower Crab Creek, Nunnally Lake, and Dry Creek. The Columbia River 100-year floodplain is relatively narrow because dams in the study area regulate flows. It is very unlikely that large scale flooding would occur because of the construction of several flood control/water-storage dams upstream of the study area.

S.3.2.2. Wetlands

Many of the wetlands in the study area have been altered or disturbed by human activities, such as road crossings, agricultural uses and grazing. Once wetlands have been disturbed, they are susceptible to invasion by non-native species that out-competes native wetland species and reduces the habitat function. The study area for wetlands included a 500-foot corridor along all of the line segments. The presence of wetlands in the study area was initially investigated using National Wetlands Inventory (NWI) maps. Sixty wetlands were identified in the study area. Wetland vegetation classes included palustrine emergent, scrub-shrub, open water, and forested. All alternatives would cross some wetlands.

S.3.3 Soils and Geology

Diverse landforms and geologic features exist within the proposed study area, which is in the Columbia Plateau **physiographic** province. The landscape within the plateau consists mostly of large and small hills with flat tops, extensive plateaus, **incised** rivers, and **anticline** ridges. The **Miocene Columbia River Basalt Group** underlies the region and is interbedded by **Neogene** terrestrial sediments (DNR 1991).

Geologic hazards in the proposed study area include steep slopes and erosion. Soil blowing and water erosion are the most active erosion processes due to the area's high relief, steepness of slope, and restricted available water capacity for the production of **forage** (USDA 1984).

S.3.4 Vegetation

S.3.4.1. Cover Types

The vegetation type found in most of the study area is referred to as shrub–steppe, with some grasslands (Franklin, 1973**)**. With the exception of some riparian areas, few trees are able to survive in this arid landscape. The dominant woody vegetation on most upland sites consists of shrub species, predominantly sagebrush species. The understory of herbaceous plants in shrub-steppe was dominated by native perennial bunchgrasses prior to European settlement. Within the project area, native bunchgrass dominated communities are no longer common due to invasion by annual grasses and weedy species after various types of disturbance (Quigley, 1999).

Shrub-steppe vegetation in the study area is characterized as a potential big sagebrush/bluebunch wheatgrass zone (Daubenmire, 1970). This is the community that is expected to occur without disturbance, alteration of habitat, or invasion by non-native species.

The dominant shrubs currently existing in upland areas commonly include several species of sagebrush, including big sagebrush, threetip sagebrush, stiff sagebrush, low sagebrush, bitterbrush, and rabbitbrush. In most areas today, non-native species, including cheatgrass, are now dominant.

In the study area, very few riparian areas have a tree overstory, and shrub-lined riparian areas are more common. Drier riparian areas are typically vegetated with upland shrubs, including sagebrush. Russian olive (an invasive species) is the most common tree species in riparian areas and wet areas.

The agricultural lands in the valley are mainly in cropland with small adjacent areas that may have some remnants of native plant communities.

S.3.4.2. High Quality Plant Communities

The Washington Natural Heritage Program (WNHP) tracks the occurrence of "high quality plant communities" within "***high quality terrestrial ecosystems***" (WNHP Website). Two WNHP high quality plant communities occur along line segments: the Wyoming big sagebrush/bluebunch wheatgrass shrubland community and the bitterbrush/Indian ricegrass shrubland community.

S.3.4.3. Weeds

Some plant species are designated as weeds by federal or state law. Weed species reduce the native plant ***biodiversity*** of shrub-steppe communities. Washington State law designates some particularly troublesome weeds as "noxious weed" species. The list of noxious weed species is divided into three classes (A, B, and C) within each county, based on the state of invasion. Designated noxious weeds are present on all alternatives within the study area.

S.3.4.4. Rare Plants

The USFWS identified one federally listed threatened species and three federal candidate species with the potential to occur within the study area (USFWS, 2001). Ute ladies' tresses, listed as threatened, is not known to occur in the study area. Two of the candidate species, northern wormwood and basalt daisy, are not none to occur within 1 mile of the line segments. However, one population of a federal candidate species (Umtanum desert buckwheat) is known to occur near the Preferred Alternative. BLM sensitive species may occur on BLM-administered lands along Alternative 1A.

S.3.5 Wildlife

Approximately 150 wildlife species (birds, mammals, reptiles, and amphibians) are known to occupy shrub-steppe habitat, which represents the majority of available habitat within the study area. Of these species, approximately 50 are closely associated with shrub-steppe habitat, and the remaining species use shrub-steppe habitat occasionally or incidentally. These 150 species, however, do not represent the total number of species that may exist within the proposed study area. For example, a study of the Hanford Site documented 195 bird species in the general area where the project is proposed. Many of these species are associated with open water habitats along the Columbia River.

Analysis of wildlife focused on species that are: federally listed as threatened or endangered or candidate for listing; federal species of concern, and Washington state listed threatened, endangered, sensitive or monitor species.

S.3.5.1. Federally Listed or Candidate Species

The bald eagle, western sage grouse, Washington ground squirrel, and Mardon skipper butterfly were investigated for known occurrences in the study area. Core sage grouse habitat is located in the central Yakima Training Center along one segment, and the species is known to be occasionally present in the northern Yakima Training Center, which all alternatives cross. Wintering bald eagles are known to occur along the Columbia River, Wilson and Naneum Creeks, and streams within the YTC. Washington ground squirrels were historically present east of the Columbia River, but have no recent documented occurrences within the study area. Suitable habitat exists along all segments east of the Columbia River. The Mardon skipper butterfly is not present in the study area.

S.3.5.2. Federal Species of Concern

Approximately 20 federal species of concern are known to occur within the study area of the various alternatives.

S.3.5.3. Washington State Species

Approximately 50 wildlife species that are listed by Washington State as threatened, endangered, sensitive or monitor species are known to occur within the study area of the alternatives.

S.3.6 Fish Resources

The most significant fish resources found within the project area are endangered anadromous salmonids such as salmon and steelhead. These fish are born and rear in small streams, then migrate down the Columbia River to the ocean. After several years in the ocean, they migrate upstream back to their native streams to spawn. Resident salmonids such as bull trout and rainbow trout are also important resources, as are a number of other cold and warm water fish species.

S.3.6.1. Chinook Salmon

Upper Columbia spring-run Chinook would be encountered in the Columbia River, which juveniles and adults use as a migration corridor between the ocean and the headwater streams they spawn and rear in.

S.3.6.2. Steelhead Trout

The Upper Columbia River Steelhead would be encountered in the Columbia River and tributaries upstream of the Yakima River, which they would use for migrating, spawning and rearing purposes.

The Middle Columbia River Steelhead would be encountered in tributaries of the Yakima River, although these tributaries have blockages from dams and irrigation withdrawals that do not allow steelhead access to the area crossed by the project.

S.3.6.3. Bull Trout

The proposed study area is located within the Columbia River ***Distinct Population Segment*** (***DPS***) for bull trout. The only stream within the project area that has been documented as containing bull trout is Coleman Creek, but none have been observed since 1970.

S.3.7 Land Use

The project crosses through private lands and publicly administered lands in four Washington counties: Kittitas, Grant, Benton, and Yakima.

S.3.7.1. Kittitas County

Kittitas County lies within the upper Yakima River watershed and on the east side of the Cascade Mountains. Mountains and steep hills ring an extensive irrigated area known as the Kittitas Valley where most of the County's residents live. Major irrigation projects of the 1940's and 50's distributed water to the valley floor, turning arid lands into productive farmland.

S.3.7.2. Grant County

Grant County is bordered by the Columbia River to the west and southwest. The County is a state and national leader in the production of wheat, corn, hay, potatoes, and several tree fruits and is a major livestock production center. Agricultural areas are concentrated throughout the County and the location of agriculture has been strongly influenced by the construction of irrigation facilities.

S.3.7.3. Benton County

Benton County is located in the central part of the Columbia Basin. The principal land use is commercial dryland and irrigated agriculture with its related industries such as storage, shipping, processing, and sales of chemicals and equipment. Irrigated crop production and dryland agriculture is located throughout the agricultural lands designation. It is estimated that 17 percent of Benton County is irrigated land and 50 percent is range and dryland agriculture. Major crops in Benton County are wheat, corn, potatoes, apples, cherries, hops, mint, alfalfa hay, and wine grapes. Beef cattle are also raised in the County.

S.3.7.4. Yakima County

Yakima County has leading industries in agriculture and related sectors. The location of agriculture has been strongly influenced by the construction of irrigation facilities. Cultivated agriculture in Yakima County is heavily concentrated in and around the valley floors, while grazing lands and most orchards are located along many of the hillsides.

Roughly 35 percent of the study area is located on privately owned land, which is characterized by open rangeland, agricultural land, open space, some rural residential, and a limited amount of quarrying.

The remaining 65 percent of the land in the study area is administered by seven public agencies. The public land areas crossed are under the administration of two Washington State agencies, Department of Natural Resources (DNR) and Washington Department of Fish and Wildlife (WDFW), and five federal agencies: Bureau of Land Management (BLM), Department of Defense (DOD), Bureau of Reclamation (BOR), U.S. Fish and Wildlife Service (USFWS), and Department of Energy (DOE).

Public land uses in the study area are predominantly agriculture, rangeland, wildlife habitat, and recreation. The study area also includes crossing the BLM Saddle Mountains Management Area, the Saddle Mountains Unit of the Hanford Reach National Monument, Hanford Site, and Yakima Training Center.

S.3.8 Socioeconomics

Agriculture is an important industry sector that influences local economies as well as demographic composition. Correspondingly, the booms and busts of agricultural dependent industries are reflected in population and economic growth of the area. Other industries important to the area include service, retail trade, and manufacturing sectors. Kittitas, Grant, Yakima, and Benton counties, in general, are less racially diverse, have lower per capita and median household incomes, and have a lower percentage of income derived from work earnings than the state.

S.3.8.1. Population

The population within the study area is primarily located in sparsely populated rural areas. Public lands are predominantly uninhabited in the study area. Caucasians comprise approximately 95 percent of the total population in Benton, Grant, and Kittitas counties. In Yakima County, however, Native Americans form 7 percent and Caucasians form 88 percent of the population. Hispanic origin varies greatly across the area, ranging from 11 percent of Benton County, 27 percent of Grant County, 5 percent of Kittitas County, and 37 percent of Yakima County as compared to a statewide composition of 6 percent.

S.3.8.2. Economy

The service, retail trade, manufacturing, and agriculture sectors drive the central Washington economy in the private industry. Employment and income derived from government and government services also play a major role in the local economies. Kittitas County has the lowest median household income ($26,770) compared to $30,979 in Grant County, $31,522 in Yakima County, and $44,219 in Benton County. All study area counties are lower that the state median household income of $46,080.

S.3.8.3. Employment

Agriculture is an important sector for Grant and Yakima counties. Jobs in agriculture account for 16 percent of the wage earnings in Grant County and 13 percent of the wage earnings in Yakima County. Agriculture is less important in Benton County and Kittitas County (4 percent and 5 percent of the total earned wages, respectively).

S.3.9 Visual Resources

The study area's visual character and quality are primarily natural and rural, defined by rolling as well as steep and dramatic mountain ranges, consistent stretches of sagebrush and rabbitbrush, and agricultural uses including orchards, vineyards and ranches. Its visual character and quality are also defined by dispersed residential areas, existing transmission and generation facilities, the natural beauty of the Columbia River, and the way topography and vegetation relate to the sky and the changing patterns of light throughout the day and year. All of these factors contribute to the area's visual interest and perceived visual quality.

Locations that are visually sensitive have been identified due to their visual quality, uniqueness, cultural significance, or **viewer characteristics**. These areas include:

- **Viewpoint A**, the area near Colockum Pass, due to the number of residences with **foreground** views of the transmission line project;
- **Viewpoint B**, the north face of the Saddle Mountains near the Columbia River and Crab Creek, due to its unique and striking landform, relationship to adjacent water bodies and number of viewers on Route 243; and
- **Viewpoint C**, the Saddle Mountains Ridgeline, due to its striking landform, recreational value and potential impact from a ridgeline transmission line corridor placement.

S.3.10 Recreation Resources

Two resources have dedicated recreational activities. The John Wayne Pioneer Trail is an abandoned railroad line ROW that has been converted to a multi-use trail extending 110 mi from North Bend, Washington to the Columbia River. Also, the Wanapum Dam provides interpretive facilities as part of the Native American Heritage Center and the Dam Powerhouse.

Other recreational activities within the study area are dispersed and include bird watching, boating, environmental education, falconry, field dog training, fishing, hang gliding, hiking, horseback riding, hunting, mountain biking, off-road vehicle use, paragliding, photography, primitive camping, ***rock hounding***, sightseeing, snowmobiling, snowshoeing, water sports, and wildlife observation.

S.3.11 Cultural Resources

The Columbia, Kittitas, Wanapam, Wenatchee, and Yakama peoples lived in the vicinity of the study area at the time of the Lewis and Clark expedition of the Snake and Columbia rivers in 1805 en route to the Pacific (Ray 1936). Their life was focused on an annual round anchored by specific times for gathering, hunting, fishing, and trading, but also for religious activities, visiting, courting, storytelling, dancing, and other such activities.

A period of exploration and trapping followed, with early travelers such as Wilson P. Hunt of the Astor Company, David Thompson of the Northwest Company, Alexander Ross, Ross Cox, and many others arriving in this area between 1805 and 1815. Gold mining brought many Europeans, Euroamericans, and Chinese through the study area beginning around 1850, but it was ranching that kept them there. Transportation – particularly river crossings – provided the means for expansion and trading. Horse ranching and fruit farming increased in the latter half of the last century, but it was not until more efficient irrigation systems were organized about the turn of the century that fruit farming really became a major activity in this region.

For Your Information

Cultural resources *are those historic and archaeological properties, properties of traditional and cultural significance, sacred sites, Native American human remains and associated objects, and cultural landscapes which are entitled to special consideration under federal statute, regulations, and/or executive orders.*

A search of recorded sites was conducted in the study area. ***Cultural resources*** located in the proposed study area include prehistoric camps, **lithic** scatters, prehistoric stone tool quarries, historic homesteads, historic railroad sites, and traditional root-gathering areas. There are no sacred sites recorded at this time in the study area.

S.3.12 Public Health and Safety

S.3.12.1. Electric and Magnetic Fields

electric and magnetic fields *(EMF) are the two kinds of fields produced around the electric wire or conductor when an electric transmission line or any electric wiring is in operation.*

Transmission lines, like all electrical devices and equipment, produce ***electric and magnetic fields*** (EMF). The voltage, or force that drives the ***current***, is the source of the electric field. The current, or movement of electrons in a wire, produces the magnetic field. The strength of magnetic field depends on the current, design of the line, and the distance from the line. Field strength decreases rapidly with distance.

There are currently no national standards in the United States for electric and magnetic fields from transmission lines. The state of Washington does not have limits for either electric or magnetic fields from transmission lines. The BPA has maximum allowable electric fields of 9-kV/m on the ROW and 5-kV/m at the edge of the ROW.

S.3.12.2. Noise

Corona *is an electrical discharge, at the surface of a conductor. A technical definition is included in Chapter 9 (Glossary and Acronyms).*

Transmission line noise – Audible noise can be produced by transmission line ***corona***. Corona-generated audible noise can be characterized as a hissing, crackling sound that under certain conditions is accompanied by a 120-Hz hum. The conductors of high-voltage transmission lines are designed to be corona-free under ideal conditions. However, a protrusion on the conductor surface – particularly water droplets on or dripping off the conductors – cause electric fields near the conductor surface to exceed corona onset levels, and corona occurs. Therefore, audible noise from transmission lines is generally a foul-weather (wet-conductor) phenomenon. However, during fair weather, insects and dust on the conductors can also serve as sources of corona.

Substation noise – Sound varies at the substation sites, as a result of weather and other factors such as background noise and the kind of equipment operating, and could be higher or lower on any given day or at any given time at these substations.

S.3.12.3. Radio and TV Interference

Corona on transmission line conductors can generate electromagnetic noise in the frequency bands used for radio and television signals. In rare circumstances, corona-generated ***electromagnetic interference (EMI)*** can also affect communication systems and sensitive receivers. Corona-caused television interference occurs during foul weather and is generally of concern only for conventional receivers within about 600 feet of a line. Cable and satellite television receivers are not affected.

S.3.12.4. Toxic and Hazardous Materials

During construction, hazardous materials could be encountered anywhere along the proposed route and could include such things as illegally dumped waste, drug lab chemicals, spilled petroleum products, pesticides, and other wastes.

Minimal amounts of hazardous waste result from routine maintenance procedures performed on substation equipment and transmission lines. The type and volume of waste such as oily rags, minor leaks from vehicles, etc., depend on maintenance procedures.

S.3.12.5. Fire

Numerous wildfires have occurred on private and public land in and around the proposed routes over the past several years. They may have been caused by human actions such as vehicle ignitions from roads, unattended campfires, burning of adjacent agricultural lands and arson, or by natural causes such as lightning.

S.3.13 Air Quality

In the four counties where the study area is located, two local clean air authorities and two regional WDOE offices work together to control, monitor, and prevent air pollution:

- Benton Clean Air Authority: Benton County
- Yakima Regional Clean Air Authority: Yakima County
- USDOE Central Regional Office: Kittitas County
- USDOE Eastern Regional Office: Grant County

There are no nonattainment areas designated by the EPA or Class 1 areas designated by Section 160 of the Clean Air Act in the study area.

S.4 Impacts

To analyze potential impacts for construction, operation, and maintenance activities, resource specialists have analyzed actions using a scale with four impact levels: high, moderate, low, and no impact. Impact discussions include recommended ***mitigation*** that could reduce both the direct, indirect, and ***cumulative impacts*** of the proposed alternatives.

S.4.1 Water Resources & Soils and Geology

Common to all alternatives are the following impacts: sedimentation would be of short duration during construction with potential stream turbidity occurring in the short-term; no impacts to aquifers would result; and impacts to **303(d) streams** would not alter those parameters for which they are listed.

The **Preferred Alternative, Alternative 1 and Alternative 1A** would have **low to moderate** impacts that result from the abovementioned common impacts.

Alternative 3, in addition to the common impacts, would also have greater sedimentation and turbidity impacts. This is due to the larger quantity of new access roads that would be constructed. Overall impact to water resources and soils and geology: **moderate**.

For the **No Action Alternative, o**ngoing maintenance of existing lines would cause **no to low** impacts to water resources, soils and geology.

S.4.2 Floodplains and Wetlands

Floodplains within the study area may be directly impacted by the placement of structures in several locations. However, impacts would be avoided by placing structures in areas adjacent to floodplains.

Impacts to wetland areas generally impair or remove wetland functions, either temporarily or permanently. These impacts generally decrease a wetland's ability to provide food, water, or cover for wildlife. Building structures or roads near wetland areas could destabilize soils and slopes, and increase sedimentation in wetlands.

It is unlikely that any wetlands within the study area would be directly impacted by the placement of structures. Most of the wetlands within the study area are not extensive, and can be spanned by structures placed in upland areas adjacent to wetlands.

Some portions of wetland areas along creeks would need to be filled for road crossings. Roads and culvert crossings would be designed to minimize impacts to wetland areas.

The ongoing maintenance of transmission lines and access roads would impact wetlands in several ways. Some trees may need to be removed for safety reasons. Roads serve as a corridor for invasion by some weed species that tend to grow in wet areas.

The **Preferred Alternative** would potentially affect approximately 28 wetlands, locate one structure in the Columbia River floodplain, and involve constructing new access roads in the Caribou Creek floodplain. Overall impact to floodplains and wetlands: **moderate**.

Alternative 1 would affect approximately 32 wetlands, potentially locate one structure in the Columbia River floodplain, and involve constructing a new access road in the Caribou Creek floodplain. Overall impact to floodplains and wetlands: **moderate**.

Alternative 3 would affect approximately 28 wetlands and involve constructing new access roads in the Caribou Creek and Dry Creek floodplains. Overall impact to floodplains and wetlands: **moderate**.

Alternative 1A would affect approximately 31 wetlands, potentially locate one structure in the Columbia River floodplain, and involve constructing a new access road in the Caribou Creek floodplain. Overall impact to floodplains and wetlands: **moderate**.

No Action Alternative would cause **no** impacts on floodplains and wetlands.

S.4.3 Vegetation

In general, shrub-steppe plant communities are slow to recover from disturbance. Some construction-related impacts would be temporary. Although the aboveground portion of shrubs would be broken or crushed by heavy machinery maneuvers, the roots and soils would not be disturbed, and vegetation would eventually return to pre-disturbance conditions.

The construction or replacement of structures would require vegetation removal and would compact soils. Construction of structures on ridges can decrease slope stability, which can lead to degradation of plant communities on the slope and in the riparian area. Vegetation would also be impacted by the disturbance of biological crusts, which would decrease soil fertility and increases the likelihood that an area would be invaded by non-native species. The removal of vegetation along waterways causes an increase in water temperature, increases water velocity, and decreases wildlife habitat. Disturbance of soil in or near riparian areas may lead to erosion of stream banks, which increases the deposition of sediment into waterways.

The construction of access roads would involve clearing vegetation. Impacts in the area of the finished roadbed and shoulder would be permanent.

Rare plant species and associated habitat may be directly or indirectly impacted by construction activities. Specific rare plants that may be affected are described below for each alternative.

After disturbance, bare land would likely be invaded by non-native species. The introduction and spread of noxious weeds would impact native vegetation reestablishment after the construction disturbance. Mitigation would be employed to avoid or minimize impacts to these species. In addition, a Weed Management Plan would be developed to minimize the introduction and spread of noxious weeds.

The **Preferred Alternative** would potentially affect habitat for Umtanum wild buckwheat, Ute ladies' tresses, northern wormwood, basalt daisy, and several BLM sensitive species. Two high-quality plant communities designated by the WNHP would be impacted. Overall impact to vegetation: **moderate to high**.

Alternative 1 would potentially affect habitat for Ute ladies' tresses, northern wormwood, and several BLM sensitive species. Two high-quality plant communities designated by the WNHP would be impacted. Overall impact to vegetation: **moderate**.

Alternative 3 would potentially affect habitat for Ute ladies' tresses, basalt daisy, and several BLM sensitive species. One high-quality plant communities designated by the WNHP would be impacted. Overall impact to vegetation: **moderate**.

Alternative 1A would potentially affect habitat for Ute ladies' tresses, northern wormwood, and several BLM sensitive species. One high-quality plant communities designated by the WNHP would be impacted. Overall impact to vegetation: **moderate**.

No Action Alternative would cause **no** impact on vegetation and rare plants.

S.4.4 Wildlife

Clearing areas of native shrub-steppe vegetation can increase the risk of predation for shrub-steppe dependant small mammal, reptile and bird species. In areas of undisturbed, native shrub-steppe habitat, clearing would constitute a high impact, because high-value habitat for state or federally listed shrub-steppe-dependant species (e.g., sage sparrows, sage thrashers and loggerhead shrikes) would be reduced. In areas of degraded shrub-steppe vegetation (e.g., vegetation infested with weed species), clearing would constitute a moderate impact, since the habitat is already degraded. Clearing in areas previously cleared or severely disturbed (such as agricultural lands) would result in minimal impacts to wildlife species.

Since the proposed transmission line would either span riparian areas or would be located upslope of stream channels, little or no riparian vegetation would need to be removed for transmission line clearance and tower construction. However, since riparian areas are extremely important wildlife habitat, clearing riparian vegetation for ROW or access road construction would cause moderate to high impacts to wildlife species, by disrupting movement corridors, removing nesting or foraging habitat, and compacting stream banks.

Mitigation for disturbance such as construction timing restrictions, placing markers on transmission lines or ground wires to reduce avian collisions, minimizing areas of disturbance and appropriate revegetation of disturbed areas would reduce overall impacts to wildlife species.

The **Preferred Alternative** has moderately disturbed shrub-steppe habitat on Segments A and B. Segment D, however, is highly degraded in terms of wildlife habitat. Overall impacts to wildlife and habitat: **low to moderate**.

Alternative 1 has the same habitat areas on Segments A and B as the Preferred Alternative. Segment E is mostly disturbed agricultural area with low habitat value, except for the Hanford area, which is high quality, undisturbed shrub-steppe habitat. Overall impacts to wildlife and habitat: **moderate**.

Alternative 3 has the same habitat areas on Segment A as the Preferred Alternative. Existing habitat on Segment C is relative undisturbed and of high quality, especially on the YTC. Segment C has core sage grouse areas. Overall impacts to wildlife and habitat: **high**.

Alternative 1A has the same habitat areas on Segments A and B as the Preferred Alternative. Segment F along the Saddle Mountains is high elevation and has sensitive habitat this is relatively undisturbed. The Hanford area on Segment F is relatively undisturbed shrub-steppe habitat of high quality. Overall impacts to wildlife and habitat: **high**.

No Action Alternative would cause **no** impact on wildlife.

S.4.5 Fish Resources

Short-term construction disturbances, depending on the time of year and the location, could impact various fish species by causing sedimentation, habitat and/or individual fish disturbance, or the release of hazardous materials into a waterway. However, since most of the project construction will occur away from streams and include mitigation (such as construction timing restrictions and spill prevention and erosion measures), short-term construction-related disturbances should result in low or no impacts to all fish species.

Long-term impacts resulting from operation and maintenance would result mostly from habitat alteration due to clearing of riparian vegetation, changes in runoff and infiltration patterns (from upland vegetation clearing), sedimentation from cleared areas, and maintenance access across streams.

The **Preferred Alternative** would cross 10 fish bearing streams. Segment A would cross streams that are designated as critical habitat for Middle Columbia River steelhead trout and bull trout. Neither species are known to occur in the reaches of these streams where the project crosses although steelhead are present in the lowest reaches of some streams. Upper Columbia River steelhead trout are present in the lower reaches of two streams spanned by Segments B and D, but not where the project crosses them. Chinook salmon and Upper Columbia River steelhead trout are present in the Columbia River, and would thus be spanned by Segments B and D. Overall impact to fish resources: **none to low**.

Alternative 1 would cross 11 fish bearing streams. It shares the same impacts as the Preferred Alternative on Segments A and B. Segment E would also span the Columbia River where Chinook salmon and Upper Columbia River steelhead trout are present. Overall impact to fish resources: **none to low**.

Alternative 3 would cross 17 fish bearing streams. It shares the same impacts as the Preferred Alternative on Segment A. Upper Columbia River steelhead trout are present in the lower reaches of two streams spanned by Segment C. Overall impact to fish resources: **low to moderate**.

Alternative 1A would cross 11 fish bearing streams. It shares the same impacts as the Preferred Alternative on Segments A and B. Segment F would also span the Columbia River where Chinook salmon and Upper Columbia River steelhead trout are present. Overall impact to fish resources: **none to low**.

No Action Alternative would cause **no** impact on fish resources.

S.4.6 Land Use Impacts

Common to all the alternatives, the following activities and associated impacts would occur to existing land uses:

- Heavy machinery used for construction would temporarily damage crops, compact soils, and disrupt land use activities on approximately 0.3 acre around each structure.
- To construct and maintain the proposed transmission line, some existing access roads would need to be improved and new access roads would need to be constructed.
- The area that would become new ROW would have limitations on the types of crops that may be located under the transmission lines.
- Activities such as grazing and the movement of livestock would be able to continue around the towers, underneath the transmission lines, and over any necessary access roads.

Overhead transmission lines represent a hazard to low-flying aircraft such as those used in the military training exercises conducted at the Yakima Training Center. Overhead transmission towers and conductors would pose a hazard and affect the ability to operate the low flying aircraft. The towers and conductors would also affect the parachute drops used to bring in supplies during maneuvers. To reduce the profile of the proposed line where it crosses the YTC, the proposed towers and conductors in the YTC will be at a lower height above ground than elsewhere along the route. In the YTC standard airway marker balls would be installed on the overhead ground wires to enhance visibility of the conductors.

The **Preferred Alternative** would allow existing grazing uses to continue. On Segment A of this alternative, land use impacts to residential housing and quarry activities would be moderate to high. On Segment B as the line crosses the YTC, military maneuvers would continue under similar circumstances to the existing condition, a low to moderate impact. On Segment D, by using existing structures and double-circuiting where the line crosses irrigated farmlands, impacts to agricultural land use activities would be moderate. In areas designated for preservation and along the Columbia National Wildlife Refuge, impacts would be moderate due to the new line following an existing transmission line right-of-way. Overall land use impact: **moderate to high**.

Alternative 1 would have the same impacts as the Preferred Alternative on Segments A and B. On Segment E, however, impacts to agricultural activities and residential activities would be high. In addition, this alternative crosses the Columbia National Wildlife Refuge and an area designated as preservation land on the Hanford Reach National Monument. Impacts to preservation efforts would be high. BLM-administered lands crossed is primarily used for rangeland and wildlife habitat, associated land use impacts would be low. Overall land use impact: **high**.

Alternative 3 would have the same impacts as the Preferred Alternative along Segment A. Segment C is primarily located on the YTC and would not be adjacent to other transmission lines. A new line would eliminate the ability to perform military training, aviation, ground maneuvers that currently occur in this area, which would be a high impact. Impacts to agricultural lands crossed would be high; impacts to grazing activities would be low. Overall land use impact: **high**.

Alternative 1A would have the same impacts as the Preferred Alternative along Segments A and B. Approximately 40 percent of Segment F would be a new utility corridor on BLM-administered lands. Impacts to mineral resources, rangelands, recreation and wildlife habitat on these lands would be low. In addition, this alternative crosses an area designated as preservation land on the Hanford Reach National Monument. Impacts to preservation efforts would be high. Overall land use impact: **moderate to high**.

No Action Alternative would cause **no** impact on land use.

S.4.7 Socioeconomics

No impacts to local populations, including minority and low-income groups, are expected to occur. A small positive impact to local economies and sales tax revenues would result from construction-related jobs and expenditures. Decreases in property tax revenues would occur from the purchase of land by BPA to locate the new substation for the Preferred Alternative and Alternative 3. The new line is not expected to cause overall long-term adverse effects on property values.

All construction Alternatives would have **minimal** impacts, both positive and negative, on socioeconomics in the study area.

No Action Alternative may have negative impacts to the greater region, as a result of the lack of adequate transmission capacity to support expected growth in the Northwest.

S.4.8 Visual Resource Impacts

Transmission line facilities would be seen from a variety of potential viewpoints along all of the proposed routes, including private residences, highways, and recreation areas.

The **Preferred Alternative** would pass near residences on Segment A, but would not dominate the view. On Segment B_{SOUTH}, the line would be visible to users of the John Wayne Trail, however, other transmission lines are visible from the trail. On Segment D, the line would be clearly visible to residents, tourists, and recreationists in the Saddle Mountain area. Overall visual impact: **low to moderate**.

Alternative 1 would have the same impacts as the Preferred Alternative on Segments A and B. On Segment E, a new line in the Saddle Mountains would be slightly further away from most viewers. Overall visual impact: **low to moderate**.

Alternative 3 would have the same impacts along Segment A as in the Preferred Alternative. No visually sensitive areas were identified along Segment C. Overall visual impact: **low to moderate**.

Alternative 1A would have the same impacts along Segments A and B as in the Preferred Alternative. Segment F would cross the north face of the Saddle Mountains furthest from most viewers. Overall visual impact: **low to moderate**.

No Action Alternative would cause **no** impact on visual resources.

S.4.9 Recreation Resource Impacts

All the alternatives would have **low** impact on recreation in the area. There are no developed recreational sites in the study area that would be interfered with or limited by any of the transmission line routes. There could be low impacts to some recreation activities during construction. These activities are not limited to a specific area and could undergo a minor relocation without much interruption during the short duration of construction. On the YTC, the John Wayne Trail may be temporarily closed during construction.

No Action Alternative would cause **no** impact on recreation.

S.4.10 Cultural Resources

Any ground-disturbing activity within the boundaries of a significant cultural resource would be destructive, resulting in the permanent, irreversible, and irretrievable loss of scientific information and/or cultural value. Non-ground-disturbing activities, such as cutting vegetation and road easements, may or may not have negative impacts on cultural resources depending on the type of resource involved and the proximity of the activity to the resource.

Sensitive areas indicate the presence of potentially affected resources that should be avoided. When unavoidable, they should be mitigated. All cultural resource areas are important, thus no impact levels were assigned for the construction alternatives.

The **Preferred Alternative** would impact 36 sensitive areas totaling 7.2 mi^2.

Alternative 1 would impact 36 sensitive areas totaling 7.4 mi^2. The B_{SOUTH} option within this alternative would increase the number of sensitive areas by 2 and increase the total affected area by 0.3 mi^2.

Alternative 3 would impact 38 sensitive areas totaling 8.0 mi^2.

Alternative 1A would impact 38 sensitive areas totaling 7.8 mi^2. The B_{SOUTH} option within this alternative would increase the number of sensitive areas by 2 and increase the total affected area by 0.3 mi^2.

No Action Alternative would cause **no** impact on cultural resources.

S.4.11 Public Health and Safety

All alternatives would have similar impacts to public health and safety. The BPA designs and operates transmission lines in compliance with NESC standards in order to minimize the impacts of EMF and safety hazards. Mitigation will be employed during construction, operation and maintenance activities to minimize radio/TV interference, impacts due to toxic and hazardous materials, and fire danger. Noise related to construction will comply with audible noise regulations. Transmission line and substation noise may increase during foul weather, which is typically of short duration.

The **Preferred Alternative** would have low impacts on public health and safety on Segment B and moderate impacts on Segment D. Overall impacts to health and safety would be **low to moderate**. Impacts to noise would be **low**.

Alternative 1 would have low impacts on public health and safety on Segment B and moderate impacts on Segment D. Overall impacts to health and safety would be **low to moderate**. Impacts to noise would be **low**.

Alternative 3 and **Alternative 1A** would have **low** impacts on public health and safety. These alternatives would also have **low** impacts on noise.

No Action Alternative would cause **no** impact on public health and safety and **no** impact on noise.

S.4.12 Air Quality

On all of the proposed routes, construction vehicles and windblown dust from the construction sites would create short-term impacts. Emissions would be short-term and would have low or no impact on air quality. No long-term impacts would occur.

All Alternatives, including the No Action Alternative, would have **no** impact to air quality.

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Chapter 1 — Purpose and Need

In this Chapter:

- **Purpose and Need for Action**
- **Scoping and Major Issues**
- **Cooperating Agencies**
- **Decisions to be Made**

The ***Bonneville Power Administration (BPA)****, a federal agency, owns and operates over 15,000 circuit miles of transmission lines throughout the Northwest. BPA sells power to large direct service industries (***DSI***s) and to utilities that provide electricity for homes, businesses, and farms in the Pacific Northwest. BPA also uses the transmission system to provide power to regions outside of the Northwest, such as Canada and California.

This chapter explains a problem or need that exists in central Washington on BPA's ***transmission system***. It describes conditions that have come together to create this need, and identifies the agencies that are working together to find a solution.

1.1 Need For Action

BPA owns and operates a system of transmission lines that move electricity through central Washington. Since the mid-1990's, the transmission lines that move electricity in a north-to-south direction on the east side of the Cascades, north of the U.S. Department of Energy Hanford Reservation (Hanford Site), have grown increasingly constrained. During spring and early summer months, the amount of power that needs to move through this area exceeds the carrying capacity of the existing transmission lines. Not having enough ***transmission capacity*** can compromise safety and decrease transmission ***system reliability***.

In the event of an ***outage***, additional power cannot be moved through the existing transmission system because the lines would overheat and sag below acceptable levels potentially causing fires and further equipment failure. This can lead to ***brownouts*** or, under certain conditions, a ***blackout***. Therefore, BPA needs to increase transmission capacity ***north of Hanford*** to move additional power through this area.

For Your Information

Words and acronyms in bold are defined in Chapter 9, **Glossary and Acronyms. Some are also defined in sidebars.*

*The **transmission system** includes 115-, 230-, and 500-kilovolt transmission lines. A kilovolt is one thousand volts.*

For a general location of "north of Hanford," see Map 1, *BPA Transmission System.*

***Transmission capacity** refers to the maximum load that a transmission line or network of transmission lines can carry.*

***System reliability** is the ability of a power system to provide uninterrupted service.*

*A transmission line that is not in service, either planned or unplanned, is called an **outage**.*

*A **brownout** is a partial reduction of electrical voltages that causes lights to dim and motor-driven devices to lose efficiency.*

*A **blackout** is the disconnection of the source of electricity from all electrical loads in a certain geographical area.*

1.2 Purpose

Purposes are goals to be achieved while meeting the need for the project. They are used to evaluate project alternatives. BPA will use the following purposes to choose among the alternatives:

- Maintain transmission system reliability;
- Optimize transmission ***system usage***;
- Minimize environmental impacts;
- Minimize costs; and
- Meet ***energization date*** of late 2004.

For Your Information

*The **energization date** is when the project has been built and is operational.*

1.3 Background

BPA has limited transmission capacity north of Hanford because of two main reasons:

- Wholesale power deregulation; and
- Obligations to threatened and endangered species (fish).

Investments included cost-effective measures such as remedial action schemes; automatic measures like generation and/or load dropping that ensure acceptable transmission system performance.

Wholesale power deregulation started in 1992, causing BPA to cut costs in many ways in order to stay competitive in an open market. BPA had not built any major transmission lines since the mid-1980's, and this continued after deregulation. Investments in the transmission system (including maintenance) were small, inexpensive, and quickly energized compared to building expensive transmission lines. However, this allowed BPA to squeeze more performance out of the existing transmission system and continue to meet growing load. Over the past five years, there has been an increase in the usage of the transmission system due to an increase in regional power transfers. The increased transmission usage in the Northwest has outrun the capacity of the existing transmission system.

__Spring run-off__ refers to water from the snow melting in the spring that adds to the amount of water flowing in the Columbia River.

*In the process of **spilling** water, dam gates are opened and water flows out. The water does not go through the turbines, which could injure fish.*

Since the early 1990's, several species of salmon have been listed as threatened or endangered under the Endangered Species Act (**ESA**). Federal agencies that operate the dams in the Northwest take specific actions to help salmon survive. During the ***spring run-off***, water in the Lower Snake and Columbia Rivers that had previously been used to generate electricity at dams (Lower Granite to Bonneville – see Map 1, *General System*) is now used to help transport juvenile salmon down river to the ocean. ***Spilling*** water over these dams causes less water to go through the turbines which results in less power being generated. To make up for the loss of generation, dams along the mid- and upper-Columbia River in northern Washington (e.g., Grand Coulee and Chief Joe – see Map 1, *General System)*, need to generate additional power to meet market demands during the spring and summer months. This is in addition to power coming from Canada.

As electricity is generated at the mid- and upper-Columbia dams, it moves south through central Washington to load centers like Portland and Seattle, and to the ***Southern Intertie***. It also flows west over the Cascade Mountains and then south through the Seattle area. (See Map 1, *General System*). The transmission capacity across the north of Hanford area cannot accommodate the amount of electricity needing to flow through the area to the south.

For Your Information

*The **Southern Intertie** is a collective group of transmission lines that move power north and south between Oregon and California.*

1.4 Finding Solutions

After identifying existing and future electrical needs in the area, BPA began to develop transmission alternatives to meet the need. BPA did 6-year studies to determine what actions could meet the need, what each would cost, and how each could affect the transmission system.

The ***Environmental Impact Statement (EIS)*** will help refine these actions or alternatives based on comments from agencies and the public. It identifies the environmental resources that could be affected, and discloses the potential impacts to the resources associated with these alternatives. Chapter 2, *Alternatives*, describes the alternatives.

*An **EIS** is a document that discloses the environmental impacts of a proposed action and alternatives.*

1.5 Scoping and Major Issues

Scoping refers to a time early in a project when the public has an opportunity to express which issues and concerns should be considered in an EIS. On November 9, 2000, BPA published a ***Notice of Intent*** to prepare an EIS and conduct public scoping meetings for the proposed project. A letter was sent to the public on December 12, 2000, explaining the proposal, the environmental process, and how to participate. A comment sheet was included to enable individuals to mail comments back to BPA. An e-mail address was also given to enable people to comment by e-mail. Project scoping meetings were held in Desert Aire, Yakima, and Ellensburg, Washington. Written and verbal comments were collected during scoping.

*The **Notice of Intent** for this project was included in the Federal Register (65 FR 77352), which publishes regulations and legal notices issued by federal agencies.*

A second project mailing went to the public on March 26, 2001. This letter updated interested parties on the progress of the project and the information gathered during the scoping process. Many issues were raised during the scoping process, and most of the comments received focused on the following issues:

- Potential environmental impacts, including impacts to residential land and property values;
- The proposed alternatives and how the line would be designed;
- Agricultural land impacts; and
- The need for the project, and the agencies that BPA should coordinate with during the process.

Environmental specialists took the comments received during the scoping period into consideration, while developing the environmental impact analyses. Issues raised during scoping and additional concerns are addressed in Chapter 4, *Environmental Consequences*.

On June 6, 2001, a third letter was mailed to landowners along a new route located in the Saddle Mountain area east of Vantage. Members of the public who attended the scoping meetings proposed a route in this general area. BPA personnel took a closer look and developed a route, which is discussed in the next chapter.

A fourth letter was mailed on July 30, 2001. This letter identified BPA's Preferred Alternative and the reasoning behind the choice.

Copies of the public mailings are included in Appendix A, *Public Involvement*.

1.6 Cooperating Agencies

When a project could involve more than one federal agency, those agencies often work together during the planning and decision-making process. BPA is the lead federal agency on this project and supervises the preparation of the EIS. BPA has invited the following agencies to cooperate in the EIS process, because the proposed project potentially crosses land managed by these agencies:

U.S. Department of Defense
- Department of Army (USDOA)

U.S. Department of Interior
- Bureau of Land Management (BLM)
- Bureau of Reclamation (BOR)
- Fish and Wildlife Service (USFWS)

The project also potentially crosses the Hanford Site, which is managed by the U.S. Department of Energy (USDOE). Since BPA is also part of the USDOE, the Richland Operations Office has been asked to make joint decisions with BPA rather than being a cooperating agency.

1.7 Decisions to be Made

A project of this size involves different alternatives and options for decision-makers to consider. The following kinds of decisions must be made by the federal agencies involved:

- BPA must first choose an alternative. If the alternative is to build a new transmission line, BPA must decide which route, and which substation would be the end point. BPA must further define the location of the new right-of-way (ROW), where structures and access roads would be placed, and the types of structures to be used.
- The USDOA must decide if the project complies with the current management plan of the Yakima Training Center (YTC).
- The BLM must decide whether the project complies with their currently approved management plan; and whether a Right-of-Way Grant or easement would be needed for construction, operation, and maintenance of project facilities.
- The BOR must decide if the project meets the conditions of the longstanding Memorandum of Understanding with BPA to allow the crossing of BOR land and waterways.
- The USFWS must decide if the project complies with the current management objectives for the Columbia National Wildlife Refuge. The USFWS must also decide if the project complies with the management objectives of the Hanford Reach National Monument and the presidential proclamation establishing the National Monument.
- The USDOE has two decisions to make:
  - Whether the project complies with management plans for the Hanford Site.
  - Whether the project complies with the management objectives of the Hanford Reach National Monument, which includes the Saddle Mountains Unit. This decision must be made in conjunction with the USFWS.

More information about federal, state, and local consultations and permits for this project is included in Chapter 5, *Consultation, Permit, and Review Requirements*.

1.8 Other Projects in the Area

McNary-John Day Transmission Line Project – BPA is in the process of preparing an EIS for the construction, operation, and maintenance of a 75-mile, 500-kV transmission line between BPA's McNary Substation in Benton County, Washington, and the John Day Substation in Sherman County, Oregon.

For Your Information

*A **megawatt (MW)** is one million watts, or one thousand kilowatts.*

Starbuck Power Project – Starbuck Power Co, LLC, a division of PPL Global of Fairfax, Virginia, is proposing a 1,200-***megawatt (MW)*** natural gas combined-cycle combustion turbine in Columbia County, Washington, northwest of the town of Starbuck. The electricity produced by the facility would be delivered to the transmission system through one existing and one new BPA 500-kV transmission line.

Wallula Power Project – Newport Northwest, LLC is proposing to construct and operate a 1,300-MW natural gas combined-cycle combustion turbine at Wallula, Washington, in Walla Walla County. The facility would most likely connect to an existing BPA 500-kV transmission line, located approximately five miles east of the proposed facility. It will also require a new 30-mile 500-kV transmission line.

Stateline Wind Project – FPL Energy proposes to construct and operate a 250- to 300-MW wind generation facility, in southern Walla Walla County, Washington, and in Umatilla County, Oregon, along the Oregon-Washington border. A new substation and transmission line would be built to connect to the existing transmission system.

Maiden Wind Project – Washington Winds, Inc. is developing a wind farm in the Rattlesnake Hills area. It would produce a maximum of 494 MW of electricity. The project would connect to existing BPA transmission lines via a new substation.

Nine Canyon Wind Project – Energy Northwest is developing a wind farm south of Kennewick, Washington, to generate 25 to 50 MW. The project would connect to the local utilities' transmission system.

Horse Heaven Hills – Washington Winds, Inc. is proposing to construct and operate a 225-MW wind farm in Benton County, Washington. A new substation and transmission line would be built to connect to the existing transmission system.

1.9 Organization of the Draft EIS

This EIS includes information necessary for agency officials to make decisions based on the environmental consequences of proposed actions. Federal regulations specify the kinds of information decision-makers should have in order to make good decisions. This document follows those recommendations:

Chapter 1 states the purpose and need for the project. Alternatives are evaluated based on the purpose and need for the project.

Chapter 2 describes the agency Preferred Alternative and other alternatives, including taking no action, and summarizes the differences between the alternatives.

Chapter 3 describes the existing environment within the study area of the project. Resources described include both natural and human resources.

Chapter 4 analyzes the possible environmental consequences of the alternatives. Impact rankings range from no impact to high impact.

Chapter 5 lists the licenses, permits, and other approvals or conditions the alternatives must obtain or meet.

Chapter 6 includes a list of the individuals who helped prepare the EIS.

Chapter 7 lists the individuals, organizations, and agencies who will receive copies of the EIS.

Chapter 8 provides a list of the references used in preparing the EIS.

Chapter 9 includes a Glossary of Terms and List of Acronyms used in the EIS.

Chapter 10 is an Index.

Supporting technical information is provided in the Appendices.

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Chapter 2 — Alternatives

In this Chapter:

- **Segments**
- **Agency Preferred Alternative**
- **Other Construction Alternatives**
- **No Action Alternative**
- **Alternatives Eliminated from Consideration**
- **Comparison of Alternatives and Summary of Impacts**

BPA studied ways to relieve constraints on the transmission system in central Washington. Four construction alternatives were developed, all of which involve constructing a new transmission line. The alternatives are divided into segments for ease in analysis and are shown on Map 2, *Alternatives*. Segment A is common to all construction alternatives. Segment B has two route options (B_{NORTH} and B_{SOUTH}), which begin and end at the same points. The remaining segments are C, D, E, and F.

For Your Information

Construction Preferred Alternative and Alternatives 1, 3, and 1a are made up of Segments A through F.

This chapter describes the segments and alternatives, summarizes how environmental consequences would differ among them, and compares the alternatives against the purposes of the project. BPA has identified a preferred alternative that best meets the purpose and need for the project.

This chapter also describes other alternatives (e.g., burying transmission lines) that were briefly studied and eliminated from detailed consideration for technical or economic reasons.

2.1 Segments

The following is a description of Segments A through F. (See Map 2, *Alternatives*.)

2.1.1 Segment A

Common to all alternatives, Segment A starts at BPA's Schultz Substation and goes southeast, following the existing Vantage–Schultz 500-kV transmission line. Figure 2.1, *Schultz Substation Area Redesign,* shows the Schultz Substation area. BPA plans to redesign the existing lines that exit the Schultz Substation to the east, in order to make room for the new line and improve the configuration of the existing lines. BPA would relocate the first mile of the existing Sickler-

For Your Information

*A **bay** is an area set aside in a substation for special equipment.*

*To **reconductor** means to take the existing conductors off of the structures and replace them with new conductors.*

Schultz 500-kV transmission line. Instead of its current location, the Sickler-Schultz line would exit a new ***bay*** on the north side of the substation and head northeast for about a mile to intersect with the existing Rocky Reach–Maple Valley 345-kV line. It would then follow the Rocky Reach–Maple Valley line for about 1.5 miles. At this point, the relocated Sickler-Schultz line would reconnect with the existing Sickler-Schultz line and continue to the northeast.

The existing Schultz-Vantage 500-kV line from Schultz Substation to the Naneum Crossing would be ***reconductored*** or rebuilt. The line would then be connected with the new transmission line continuing to the southeast parallel to the existing Schultz-Vantage line. The existing Schultz-Vantage line would be connected to the vacated portion of the Sickler-Schultz line running into the Schultz Substation. The portion of the Sickler-Schultz line that runs due north from the Naneum crossing would be removed because it would no longer be needed. This combination of rerouting and reconnecting lines would eliminate 500-kV lines from crossing each other.

Southeast of Naneum crossing, the new transmission line would be constructed parallel and up to 1,400 feet to the north of the existing Schultz-Vantage line. Segment A is about 29.4 miles long and ends south of Interstate 90 (I-90).

There is a small potential reroute within Segment A, referred to on Map 2, *Alternatives,* and shown in detail on Map 3, *Reroute in Segment A*. The existing Schultz-Vantage line and the new transmission line would be rerouted to the south of the existing alignment. They would run parallel to each other at a separation of about 200 feet. A little over a mile in length, the reroute would start about a half-mile south of Coleman Road. The lines would be rerouted to the south and then the east, joining the existing alignment just west of Colockum Road.

2.1.2 Segment B

Segment B has two route options, B_{NORTH} and B_{SOUTH}.

Segment B begins where the new transmission line would cross to the south side of the existing Schultz-Vantage line; about 5.75 miles south of where the Schultz-Vantage transmission line crosses I-90. (See Map 2, *Alternatives*.)

B_{NORTH} runs to the east, parallel to and 1,200 feet south of the Schultz-Vantage line. This route option follows the existing line across the Columbia River and ends at the BPA Vantage Substation. B_{NORTH} is 9.5 miles long.

B_{SOUTH} initially runs farther to the south and then heads east immediately parallel to an existing 230-kV wood pole transmission line on the south side of the John Wayne Trail. Just before the Columbia River, B_{SOUTH} angles slightly to the north towards the Schultz-Vantage line and crosses the Columbia River adjacent to the existing Schultz-Vantage line river crossing. B_{SOUTH} ends at the BPA Vantage Substation. B_{SOUTH} is 10.4 miles long.

2.1.3 Segment C

Segment C starts in the same place as Segment B (where the new line would cross the existing Schultz-Vantage line). The segment would turn south, crossing the Yakima Training Center (YTC). This segment would not parallel an existing line. The segment would angle southeast, leave the YTC, cross Highway 24 and end where it intersects the existing Hanford-Ostrander and Hanford-John Day 500-kV transmission lines. This intersection of lines would be the site of a new substation, called Wautoma Substation. Segment C is 29.8 miles long.

2.1.4 Segment D

Segment D begins in the area just south of Vantage Substation (See Map 2, *Alternatives*). The new line would not enter the substation. Segment D would head in a southeasterly direction, directly adjacent and parallel to the existing Midway-Vantage 230-kV line on the west side. The segment would cross Crab Creek and climb the Saddle Mountains.

Starting at about nine miles south of the Vantage Substation, the Midway-Vantage line structures would be removed and replace with ***double-circuit*** structures. The structures would carry the existing and new lines through irrigated areas. This double-circuit section would be about eight miles long from existing structure 11/1 to 2/4. The conductors on the east side of the double-circuit structures would operate at 230-kV (existing Midway-Vantage line), and the west side would operate at 500-kV (new line). Beyond the irrigated areas, Segment D would again parallel the Midway-Vantage line on the west side and cross the Columbia River. Segment D would pass the BPA Midway Substation and continue south to the new substation site, while immediately paralleling the existing Midway-Big Eddy 230-kV line on the west side. Segment D is 27.3 miles long.

For Your Information

Double-circuit *structures hold conductors for two transmission lines.*

BPA structures are numbered. The first number is the transmission line mile, and the second number is the structure in that mile.

2.1.5 Segment E

Segment E begins at Vantage Substation and heads south, paralleling the existing Vantage-Hanford 500-kV line 1,200 feet to the north. It would cross Crab Creek, climb the Saddle Mountains and head

Map 2, Alternatives, shows all segments.

southeast, crossing the Saddle Mountain Unit of the Hanford Reach National Monument. After crossing the Columbia River, Segment E would end at the existing BPA Hanford Substation. Segment E is 23.2 miles long.

2.1.6 Segment F

Segment F begins at Vantage Substation and heads east, then south crossing Crab Creek and climbing the Saddle Mountains. It would then follow the Vantage-Hanford line for a short length before turning due east. Segment F would traverse about 14 miles along the south slope of the Saddle Mountains, and then intersect the Grand Coulee-Hanford 500-kV transmission line. It would then turn south and parallel the existing Grand Coulee-Hanford line 1,200 feet to the east across the Wahluke Slope. After crossing the Columbia River, the segment ends at the Hanford Substation. Segment F is 32.1 miles long.

2.2 Agency Preferred Alternative (Alternative 2)

For Your Information

These preliminary estimates were generated shortly after the scoping period.

BPA is proposing to construct a new 500-kV transmission line between the Schultz Substation, almost nine miles north of Ellensburg, Washington, and a new substation (Wautoma Substation) in Benton County, two miles south of Hwy 24 (T12N, R24E, Sec. 20). The Preferred Alternative is Alternative 2 and is made up of Segments A, B_{SOUTH}, and D (see Map 2, *Alternatives*). The Preferred Alternative would cost approximately $76,500,000 (2001 dollars).

2.2.1 Transmission Line

2.2.1.1 Structures

A transmission line designed to hold one electrical circuit is called ***single-circuit.***

The Preferred Alternative would primarily use 500-kV, ***single-circuit*** steel lattice structures, also called towers, to support the transmission line conductors (see Figure 2.2, *Proposed Structures*). On YTC land, flat configuration 500-kV single-circuit structures would be used. Outside of the YTC, delta configuration structures would be used for single-circuit structures. In one area of Segment D, 500-kV double-circuit lattice structures would be used to hold the new 500-kV and the existing 230-kV line. The height of each structure would vary by location and surrounding land forms. Single-circuit structures would average 135 feet high. The double-circuit structures would average 170 feet high. For a more thorough description of transmission construction, see Appendix B, *Construction and Maintenance Activities*.

2.2.1.2 Conductors

The wires or lines that carry the electrical current in a transmission line are called conductors. ***Alternating current*** transmission lines, like the new line, require three sets of wires to make up a circuit. For a single-circuit 500-kV transmission line, there would be three sets of wires and for a double-circuit line (Segment D) there would be six sets of wires.

Conductors are not covered with insulating material, but rather use the air for insulation. Conductors are attached to the structure using porcelain or fiberglass insulators. Insulators prevent the electricity in the conductors from moving to other conductors, the structure, and the ground.

Two smaller wires, called overhead ground wires, are attached to the top of transmission structures. Overhead ground wires protect the transmission line from lightning damage. To disseminate the electrical power from lightning, the power is routed to the ground at each tower through wires called counterpoise.

For Your Information

Alternating current *is an electric current that reverses directions at regular intervals.*

2.2.2 Right-of-Way

New ROW would be needed for the new structures and line. The new ROW would be 150 feet wide. Where the new line would parallel an existing 500-kV line (Segment A) the new line would be up to 1,400 feet from the existing line. See Appendix C, *Line Separation Issue Paper,* for an explanation of the separation distance. In Segment D where the existing line would be replaced with a double-circuit line, the existing ROW would be expanded 25 feet on the west side, to increase the ROW from the existing 100 feet to 125 feet. (See Figure 2.2, *Proposed Structures.)* Where the new line is parallel to the 230-kV line in Segment D, the new 150 feet ROW would be directly adjacent to the existing ROW.

BPA would obtain easements from landowners for new ROW. These easements give BPA the right to construct, operate, and maintain the line. Fee title to the land covered by the easement generally remains with the owner, and is subject to the provisions of the easement. For more information on easement acquisition, see Appendix D, *Property Impacts*.

The easement prohibits large structures, tall trees, storing flammable materials, and other activities that could be hazardous to people or endanger the transmission line. Activities that do not interfere with the transmission line or endanger people are usually not restricted.

2.2.3 Clearing

Vegetation within the ROW is restricted by height. This is required for the safe and uninterrupted operation of the line. It is not anticipated that a large number of trees will need to be cleared for this project; however, because of safety considerations, there may be some trees at water crossings that would need to be cut.

At the structure sites, all trees and brush would be cut and removed within a quarter acre area, with root systems being removed from a 50-by-50-foot area for the tower footings. A portion of the site would be graded to provide a relatively level work surface for the erection crane. The Preferred Alternative would require an estimated 71 acres to be cleared for structure sites along the 67-mile route.

Woody debris and other vegetation would either be left lopped and scattered, piled, or chipped, or would be taken off-site. Burning would not be used.

2.2.4 Access Roads

For Your Information

Spur roads *are short road segments branching off the trunk roads that go to each structure if the structure is not located on a trunk road.*

Access roads on and off the ROW would be used to construct and maintain a new line. Where the new line would be 1,200 feet to 1,400 feet from the existing line, a new road system would be built. Where the new line would be built directly adjacent to the existing line, existing access roads would be used, with ***spur roads*** constructed to the new structures.

New roads would be located within the ROW wherever possible. Where conditions require, such as at steep cliffs, roads would be constructed and used outside the ROW. BPA normally acquires easements for the right to develop and maintain permanent over-ground access for wheeled vehicle travel to each structure. No permanent access road construction would be allowed in cultivated or fallow fields unless previously agreed to by the landowner. After construction of the line is completed, BPA would allow any roads in cropland to be returned to crop production.

Where existing access roads would be used, BPA would improve them to a level that supports construction travel needs. This would be done by grading, improving drainage, and adding gravel to the road surface.

The following tables show the miles of estimated new access roads and existing roads that would need to be improved for each segment of the Preferred Alternative. Assumptions were made based on terrain and line location.

New access roads surfaces would be 16 feet wide, with additional road widths of up to 25 feet for curves. When needed, a 5-foot ditch would be added to one side of the road. Roads would be dirt, gravel, or rock.

Table 2.2-1
Preferred Alternative: Estimate of Access Road Development (Length)

Segment	Segment Length (mi)	New Construction (road mi/ segment mi)	Total New Construction (mi)	Improvement (road mi/ segment mi)	Total Improvement (mi)
A	29.4	1.6	47.0	0.8	23.5
BSOUTH	10.4	1.7	17.7	1.5	15.6
D	27.3	0	0	1.3	35.5
TOTAL	**67.1**		**64.7**		**74.6**

For Your Information

Waterbars *are smooth shallow ditches excavated at an angle across a road to decrease water velocity and divert the water off and away from the road surface.*

Dips, culverts, and ***waterbars*** would be installed within the roadbed to provide drainage. Temporary roads would be repaired and if the land use permits, the road would be reseeded with appropriate seed mixtures.

Fences, gates, cattle guards, and additional rock would be added to access roads where necessary.

Table 2.2-2
Preferred Alternative: Estimate of Access Road Disturbance (Area)

Segment	Existing Road Disturbance Width (ft)	New Road Disturbance Width (ft)	New Road (Ac)	Improved Roads (Ac)	Road Work (Ac)
A	16	25	142.4	45.6	188.0
BSOUTH	16	25	53.6	30.3	83.9
D	16	25	0	68.8	68.8
TOTAL			**196**	**144.7**	**340.7**

2.2.5 Pulling and Reeling Areas

Pulling and reeling areas would be needed for the installation of the conductor. Each pulling and reeling area would be one acre in size and located every 2.5 miles. The Preferred Alternative would require an estimated 28 acres to be cleared for the pulling and reeling areas along the route.

2.2.6 Staging Areas

During construction of the transmission line, areas would be needed off the main highways, near the ROW, where equipment such as steel, spools of conductor, and other construction materials would be stored until material is needed.

At this time, staging area locations are not known. Prior to construction these would be determined and agreements with landowners made.

2.2.7 Substations

For the Preferred Alternative, a new transmission line would begin at Schultz Substation and terminate at a new substation, called Wautoma Substation. Additions and modifications would occur at Schultz Substation. No work would be needed at the Vantage or Midway Substations.

Schultz Substation – A new bay would be constructed within the existing fenced yard of the substation. The following equipment would be installed in the Schultz Substation.

***Power circuit breakers* –** A breaker is a switching device that can automatically interrupt power flow on a transmission line at the time of a fault, such as a lightning strike. The breakers would be installed in the substations at either end of the line. The breakers would be gas breakers, which are insulated by special non-conducting gas (sulfur hexafluoride). The breakers would not contain oil, except for a small amount of hydraulic fluid used to open and close the electrical contacts.

***Switches* –** These devices are used to mechanically disconnect or isolate equipment. Switches are normally located on both sides of circuit breakers.

***Buswork* –** Power moves within the substation on rigid aluminum pipes called bus tubing. The tubing is supported and vertically elevated by pedestals called bus pedestals. Buswork is a generic term to describe all equipment associated with the bus tubing.

***Potential transformers (PTs)* –** A type of transformer that uses low-voltage to monitor the high-voltage system. The low-voltage output of this transformer is used for relaying and metering.

***Substation dead-end towers* –** Towers within the confine of the substation where incoming and outgoing transmission lines end. Dead-ends are typically the tallest structures in a substation.

Wautoma Substation – A new substation would be constructed in Benton County, two miles south of Hwy. 24 (T12N, R24E, Section 20). The new substation would be sited at the intersection of the new transmission line and the Hanford-Ostrander 500-kV and

Hanford-John Day 500-kV transmission lines. These two lines would be tied into the new substation. A parcel of approximately 25 acres would be needed for the new substation. Land for the new substation would be acquired in fee and would remain in BPA and federal government ownership.

The footprint of the substation would be approximately 800 feet by 500 feet. This area would include the substation yard (equipment within the fence) and grading outside of the fence. The actual fenced area would be about 760 feet by 450 feet. See Figure 2.3, *New Wautoma Substation Footprint*.

In order to build a new substation, construction crews would first clear and grade the substation site. Conduits, drainage pipes, and the grounding system would be trenched or dug into the ground. Footings for the equipment and foundation for the control house would be placed in appropriate positions. A chain link fence around the substation would be installed. About six inches of rock would be laid, which would extend outside of the fence. Equipment such as breakers, buswork, switches, and PT's would be installed in the yard, and the control rack would be installed in the control house.

2.2.8 Communication Equipment

BPA substations are electronically connected to BPA's transmission system control centers. Microwave communication sites and fiber-optic communication lines connect BPA's high-voltage substations to system control centers located in Vancouver and Spokane, Washington. Dispatchers within the control centers remotely monitor meters and gauges on electric power equipment within each substation and receive alarm signals when emergency conditions occur. Dispatchers have the ability to disconnect lines and electrical equipment when transmission failures occur.

As part of the Preferred Alternative, BPA would install fiber optic cable between Vantage Substation and the new Wautoma Substation (about 27.3 miles) and from Vantage Substation north to the BPA Columbia Substation (about 32 miles). The new fiber would reinforce BPA's communication network and make the fiber optic system more reliable.

From Vantage to Columbia Substation, fiber would be strung on existing transmission line structures. From Vantage to the new Wautoma Substation, the fiber would either be strung on the new transmission line or existing lines, where available. The fiber would be mounted under the conductors. The fiber cable would be less than an inch in diameter. Detailed design is still to be determined.

2.2.9 Maintenance

BPA would perform routine, periodic maintenance and emergency repairs on structures, substations, and accessory equipment. These activities typically include replacing insulators, inspections of structures, and vegetation control. Within the substations, BPA may need to periodically replace equipment.

Existing and new permanent access roads to structures would remain throughout the life of the line so that BPA can perform routine and emergency maintenance on the transmission line. Road maintenance could include grading and clearing, and repairing ditches and culverts.

A large part of maintenance activities is vegetation control. In Central Washington, this primarily focuses on the spread of noxious weeds. Tall growing vegetation would also need to be managed in and adjacent to the ROW, primarily where the line crosses water bodies. Vegetation maintenance activities would follow the guidelines set in the BPA Transmission System Vegetation Management Program EIS. When vegetation control is needed, a vegetation management checklist would be developed for the right-of-way. It would identify sensitive resources and the methods to be used to manage vegetation. Substations are periodically sprayed with herbicide to keep plants from growing and creating a safety hazard.

For Your Information

The BPA Transmission System Vegetation Management Program EIS was completed in August 2000, and describes the planning steps, agencies and landowners to be coordinated with, and the tools to be used to control vegetation along BPA facilities. This document is available for review on the Web at http://www.efw.bpa.gov/cgi-bin/PSA/NEPA/SUMMARIES/VegetationManagement_EIS0285.

2.3 Alternative 1

Alternative 1 would start at the Schultz Substation and follow the Schultz-Vantage line along Segments A and B. The line would enter the Vantage Substation in order to get to the east side of existing lines. It would then follow the existing Vantage-Hanford 500-kV line 1,200 feet to the north along Segment E. The new line would end at the existing Hanford Substation. The outside limits of the Hanford Substation would not need to be expanded for this alternative. This alternative has an estimated cost of $88,000,000.

2.3.1 Transmission Line

2.3.1.1 Structures

Alternative 1 would use 500-kV single-circuit steel lattice structures. See Figure 2.2, *Proposed Structures*. The height of each structure would vary by location and surrounding land forms, with an average height of 135 feet.

2.3.1.2 Conductors

The single-circuit transmission line would be made up of three sets of wires. The insulators and overhead ground wires would be the same as discussed earlier for the Preferred Alternative.

2.3.2 Right-of-Way

New ROW would be needed for the new structures and line. The new ROW would be 150 feet wide and offset from the existing 500-kV line up to 1,400 feet along Segment A, as described for the Preferred Alternative. Where the new ROW would parallel existing 500-kV lines along Segments B and E, the offset would be 1,200 feet. See Appendix C, *Line Separation Issue Paper,* for an explanation of the line separation.

Easement provisions would be the same as those discussed earlier for the Preferred Alternative.

2.3.3 Clearing

Clearing requirements would be the same as those discussed earlier for the Preferred Alternative. Alternative 1 would require an estimated 63 acres to be disturbed for structure sites along the 63-mile route.

2.3.4 Access Roads

A new access road system would be built for the majority of Alternative 1. Wherever possible, the access roads would be located on the ROW. BPA normally acquires easements for the right to develop and maintain permanent over-ground access for wheeled vehicle travel to each structure. No permanent access road construction would be allowed in cultivated or fallow fields. Any roads in cropland would be removed and the ground would be restored to the original contour when construction of the line is completed.

The following tables show the miles of estimated new access roads and existing roads that would need to be improved for each segment of Alternative 1. Assumptions were made based on terrain and line location.

New access roads surfaces would be 16 feet wide, with additional road widths of up to 25 feet for curves. When needed, a 5-foot ditch would be added to one side of the road. Roads would be dirt, gravel, or rock.

Drainage, fences, and gates would be installed where needed as described earlier for the Preferred Alternative.

Table 2.3-1
Alternative 1: Estimate of Access Road Development (Length)

Segment	Segment Length (mi)	New Construction (road mi/ segment mi)	Total New Construction (mi)	Improvement (road mi/ segment mi)	Total Improvement (mi)
A	29.4	1.6	47.0	0.8	23.5
BNORTH	9.5	1.7	16.2	1.5	14.3
BSOUTH	10.4	1.7	17.7	1.5	15.6
E	23.2	1.3	30.2	2	46.4
TOTAL BN	**62.1**		**93.4**		**84.2**
TOTAL BS	**63.0**		**94.9**		**85.5**

Table 2.3-2
Alternative 1: Estimate of Access Road Disturbance (Area)

Segment	Existing Road Disturbance Width (ft)	New Road Disturbance Width (ft)	New Road (Ac)	Improved Roads (Ac)	Road Work (Ac)
A	16	25	142.4	45.6	188.0
BNORTH	16	25	99.1	27.7	76.8
BSOUTH	16	25	53.6	30.3	83.9
E	16	25	91.5	90.0	181.5
TOTAL BN			**283**	**163.3**	**446.3**
TOTAL BS			**287.5**	**165.9**	**453.4**

2.3.5 Pulling and Reeling Areas

Pulling and reeling areas would be needed for the installation of the conductor. Each pulling and reeling area would be one acre in size and located every 2.5 miles. Alternative 1 would require an estimated 27 acres to be cleared for the pulling and reeling areas along the route.

2.3.6 Staging Areas

Staging areas would be located and used similar to those described earlier for the Preferred Alternative.

2.3.7 Substations

For Alternative 1, a new transmission line would begin at the Schultz Substation and end at Hanford Substation. The line would pass through the Vantage Substation, but no electrical equipment would be installed within the Substation as part of this project.

Schultz Substation – The new equipment installed at Schultz Substation would be the same as described earlier for the Preferred Alternative.

Hanford Substation – A new bay would be constructed within the existing fenced yard of the substation. Outside of the substation fence, one or two of the existing transmission line structures may need to be relocated in order to align with the readjusted substation equipment. The new equipment within the substation would include breakers, switches, buswork, and PT's.

Vantage Substation – The line would pass through the Vantage Substation in order to get from the west to east side of existing lines. A new bay and dead end would be constructed within the existing fenced yard of the substation. Some existing transmission line towers may need to be moved to make room for the new line.

2.3.8 Communication Equipment

As part of Alternative 1, BPA would install fiber optic cable between Vantage Substation and Midway Substation (about 19.3 miles) and from Vantage Substation north to the BPA Columbia Substation (about 32 miles). The new fiber would reinforce BPA's communication network and make the fiber optic system more reliable.

The fiber optic cable would be strung on existing transmission line structures. The fiber cable would be less than an inch in diameter. Detailed design is still to be determined.

2.3.9 Maintenance

Maintenance activities would be similar to those described earlier for the Preferred Alternative.

2.4 Alternative 3

Alternative 3 would start at the Schultz Substation and follow Segment A. It would then turn south and follow segment C through the YTC. South of the YTC in Benton County, the line would terminate at the new Wautoma Substation as described earlier for the Preferred Alternative. This alternative has an estimated cost of $67,000,000.

2.4.1 Transmission Line

Structures and conductor would be the same as described earlier for Alternative 1.

2.4.2 Right-of-Way

New ROW would be needed for the new structures and line. The new ROW would be 150 feet wide and offset from the existing 500-kV line up to 1,400 feet along Segment A. See Appendix C, *Line Separation Issue Paper,* for an explanation of the line separation. In Segment C, the transmission line would be in a new ROW and not parallel to any existing lines.

Easement provisions would be the same as those discussed earlier for the Preferred Alternative.

2.4.3 Clearing

Clearing requirements would be the same as those discussed earlier for the Preferred Alternative. Alternative 3 would require an estimated 62 acres to be disturbed for structure sites along the 59-mile route.

2.4.4 Access Roads

New access roads would be built for the majority of Alternative 3. Roads would be built as described earlier for Alternative 1.

The following tables show the miles of estimated new access roads and existing roads that would need to be improved for each segment of Alternative 3. Assumptions were made based on terrain and line location.

Table 2.4-1
Alternative 3: Estimate of Access Road Development (Length)

Segment	Segment Length (mi)	New Construction (road mi/ segment mi)	Total New Construction (mi)	Improvement (road mi/ segment mi)	Total Improvement (mi)
A	29.4	1.6	47.0	0.8	23.5
C	29.8	2.8	83.4	2.5	74.5
TOTAL	**59.2**		**130.4**		**98.0**

Table 2.4-2
Estimate of Access Road Disturbance (Area)

Segment	Existing Road Disturbance Width (ft)	New Road Disturbance Width (ft)	New Road (Ac)	Improved Roads (Ac)	Road Work (Ac)
A	16	25	142.4	45.6	188.0
C	16	25	252.7	144.5	397.2
TOTAL			**395.1**	**190.1**	**585.2**

2.4.5 Pulling and Reeling Areas

Pulling and reeling areas would be needed for the installation of the conductor. Each pulling and reeling area would be one acre in size and located every 2.5 miles. Alternative 3 would require an estimated 24 acres to be cleared for the pulling and reeling areas along the route.

2.4.6 Staging Areas

Staging areas would be located and used similar to those described earlier for the Preferred Alternative.

2.4.7 Substations

For Alternative 3, a new transmission line would begin at the Schultz Substation and end at the new Wautoma Substation.

Schultz Substation – The new equipment installed at Schultz Substation would be the same as described earlier for the Preferred Alternative.

Wautoma Substation – The construction of the substation would be the same as described earlier for the Preferred Alternative.

2.4.8 Communication Equipment

As part of Alternative 3, BPA would install fiber optic cable between Vantage Substation and Midway Substation (about 19.3 miles) and from Vantage Substation north to the BPA Columbia Substation (about 32 miles). BPA would also install fiber from Midway Substation to the new Wautoma Substation using a combination of existing lines and the new transmission line. The exact route has not been determined.

2.4.9 Maintenance

Maintenance activities would be similar to those described earlier for the Preferred Alternative.

2.5 Alternative 1A

Alternative 1A would start at the Schultz Substation and follow Segments A and B. The new line would enter the Vantage Substation and cross to the east side of the existing transmission lines. The line would then follow Segment F into Hanford Substation. The outside limits of the Hanford Substation would not need to be expanded for this alternative. This alternative has an estimated cost of $67,000,000.

2.5.1 Transmission Line

Structures and conductor would be the same as described earlier for Alternative 1.

2.5.2 Right-of-Way

New ROW would be needed for the new structures and line. The new ROW would be 150 feet wide and offset from the existing 500-kV line up to 1,400 feet along Segment A, as described in the Preferred Alternative. Where the new ROW would parallel existing 500-kV lines along Segments B and F, the offset would be 1,200 feet. See Appendix C, *Line Separation Issue Paper,* for an explanation of the line separation. A new 150 feet wide ROW would also be acquired in the areas of Segment F that are not parallel to an existing line.

Easement provisions would be the same as those discussed earlier for the Preferred Alternative.

2.5.3 Clearing

Clearing requirements would be the same as those discussed earlier for the Preferred Alternative. Alternative 1A would require an estimated 75 acres to be disturbed for structure sites along the 72-mile route.

2.5.4 Access Roads

New access roads would be built for the majority of Alternative 1A. Roads would be built as described earlier in Alternative 1.

The following tables show the miles of estimated new access roads and existing roads that would need to be improved for each segment of Alternative 1A. Assumptions were made based on terrain and line location.

Table 2.5-1
Alternative 1A: Estimate of Access Road Development (Length)

Segment	Segment Length (mi)	New Construction (road mi/ segment mi)	Total New Construction (mi)	Improvement (road mi/ segment mi)	Total Improvement (mi)
A	29.4	1.6	47.0	0.8	23.5
BNORTH	9.5	1.7	16.2	1.5	14.3
BSOUTH	10.4	1.7	17.7	1.5	15.6
F	32.1	1.5	48.2	1	32.1
TOTAL BN	**71.0**		**111.4**		**69.9**
TOTAL BS	**71.9**		**112.9**		**71.2**

Table 2.5-2
Alternative 1A: Estimate of Access Road Disturbance (Area)

Segment	Existing Road Disturbance Width (ft)	New Road Disturbance Width (ft)	New Road (Ac)	Improved Roads (Ac)	Road Work (Ac)
A	16	25	142.2	45.6	188.0
BNORTH	16	25	49.1	27.7	76.8
BSOUTH	16	25	53.6	30.3	83.9
F	16	25	146.1	62.3	208.4
TOTAL BN			**337.6**	**135.6**	**473.2**
TOTAL BS			**342.1**	**138.2**	**480.3**

2.5.5 Pulling and Reeling Areas

Pulling and reeling areas would be needed for the installation of the conductor. Each pulling and reeling area would be one acre in size and located every 2.5 miles. Alternative 1A would require an estimated 30 acres to be cleared for the pulling and reeling areas along the route.

2.5.6 Staging Areas

Staging areas would be located and used similar to those described earlier for the Preferred Alternative.

2.5.7 Substations

For Alternative 1A, a new transmission line would begin at the Schultz Substation and end at Hanford Substation. The line would pass through Vantage Substation.

Schultz Substation – The new equipment installed at Schultz Substation would be the same as described earlier for the Preferred Alternative.

Hanford Substation – The new equipment installed at the Hanford Substation would be the same as described earlier for Alternative 1.

Vantage Substation – The line would pass through the Vantage Substation in order to get from the west to east side of existing lines as described earlier for Alternative 1.

2.5.8 Communication Equipment

BPA would install fiber optic cable similar to what is described earlier for Alternative 1.

2.5.9 Maintenance

Maintenance activities would be similar to those described earlier for the Preferred Alternative.

2.6 No Action Alternative

The No Action Alternative is traditionally defined as the no build alternative. This alternative would mean that a new transmission line would not be built, and no other equipment would be added to the transmission system. Maintenance and operation of the existing transmission line and substations would continue unchanged.

2.7 Alternatives Eliminated from Detailed Consideration

BPA studied a variety of alternatives to meet the need for the project. After preliminary study, the following alternatives were eliminated from detailed consideration because they either could not meet the need for the project or they were considered unreasonable.

2.7.1 Alternative 4 Transmission Line

BPA studied the possibility of paralleling the existing Columbia-Ellensburg-Moxee-Midway 115-kV transmission line. The new line would begin at Schultz Substation and be routed through Ellensburg and Yakima, west of the Yakima Training Center and into a new substation. This was referred to as Alternative 4 during the scoping period. BPA received a large number of comments from the public in opposition to this alternative. The existing 115-kV line is adjacent to many homes. Early estimates showed that the cost to buy property and relocate residents would be over $60,000,000. This did not include new transmission equipment, substation equipment, or construction costs. This alternative was eliminated from further study due to cost.

2.7.2 Schultz-Ashe Transmission Line

During the scoping process, maps presented by BPA showed a possible route going through the Hanford Substation and on to the BPA Ashe Substation located on the Hanford Site. Transmission system studies showed that line termination at the Ashe Substation, rather than the Hanford Substation, did not improve reliability. Termination of the line at the Ashe Substation also did not improve transfer capability over the Hanford Substation or Wautoma Substation alternatives. The 17 additional miles of transmission line needed for this alternative would increase the cost of construction by about $13,000,000.

This alternative was eliminated from further study because the system studies did not show an electrical benefit versus the added cost associated with the added miles of transmission line.

2.7.3 Undergrounding

During the scoping process, some people suggested burying the transmission line. Occasionally BPA has used underground transmission cables for new lines. Transmission line cables are highly complex in comparison to overhead transmission lines. For a 500-kV line, the underground cable could be 10 to 15 times the cost of an overhead design.

Because of cost, BPA uses underground cable in limited situations. Underground cables are considered where an overhead route is not appropriate, such as water crossings, such as in the San Juans, or in urban areas.

Underground transmission cables used by BPA are short in comparison to typical overhead transmission lines. BPA's longest underground transmission cable (at 115-kV) is 8 miles. The Bureau of Reclamation operates two 500-kV underground cable circuits at Grand Coulee Dam. These circuits are about 6,000 feet long.

Cable technologies have not advanced as fast as the industry anticipated they would 10 years ago, nor have costs declined as expected. Underground cable remains a tool available for special situations, but because of its high cost it was eliminated from further consideration.

2.8 Comparison of Alternatives and Summary of Impacts

For Your Information

Impacts to resources along route options B_{NORTH} and B_{SOUTH} ranged from none to moderate. For all resources studied, there were no significant differences in impacts between B_{NORTH} and B_{SOUTH}.

Impacts to resources along the reroute in Segment A would be similar to those along Segment A.

A team of environmental specialists evaluated the impacts associated with each of the alternatives. Each resource specialist developed an impact assessment methodology that determined the level, magnitude, and significance of their impact findings, which are described in Chapter 4, *Environmental Consequences*. Table 2.8-1, *Summary of Impacts*, summarizes the environmental impacts for each alternative.

Chapter 1, *Purpose and Need*, identifies the purposes for this project. Purposes help decision-makers decide which alternative is the best solution to meet the need. Table 2.8-2, *Comparison of Alternatives to the Purposes*, describes how each alternative fulfills the purposes.

Table 2.8-1
Summary of Impacts

Resource	Existing Conditions	Preferred (2)	Alternative 1	Alternative 3	Alternative 1A	No Action
Water Resources (See Sections 3.1, *Water Resources*, and 4.1, *Water Resources, Soils, and Geology.*)	Watersheds within the project area are a part of the Yakima and Columbia River Basins. With the exception of the Columbia River, water is scarce. Streams are generally small and intermittent. Lower Crab Creek and the Columbia River are listed as water-quality limited under Section 303(d) of the Federal Clean Water Act, due to extensive habitat modification. In addition, the project area is within the Columbia Plateau basaltic aquifer system. Groundwater quality issues are mostly due to elevated concentrations of nutrients, trace organic compounds and nitrates.	Impacts would be low to moderate and short term. Sedimentation, increased runoff, and short-term turbidity would occur. It is not anticipated that impacts to streams listed as water-quality limited under Section 303(d) would alter the parameters for which they are listed. Impacts to aquifers are not anticipated.	Impacts would be low to moderate and short term. Similar to the Preferred Alternative.	Impacts would be moderate and short term. This alternative has the largest number of acres of new access roads. This would cause sedimentation, increased runoff, and short-term turbidity to water resources. No Section 303(d) stream would be crossed. Impacts to aquifers are not anticipated.	Impacts would be low to moderate and short term. Similar to the Preferred Alternative.	No new impacts are expected.
Floodplains (See Sections 3.2, *Floodplains and Wetlands,* and 4.2, *Floodplains and Wetlands.*)	All proposed alternatives would cross 100-year floodplain areas. The floodplain associated with the Columbia River is narrow, due to the regulation of flows by upstream dams. One floodplain is associated with Nunnally Lake, a narrow water body. The remainder of the floodplains in the project area are narrow and associated with creeks, including Wilson, Naneum, Caribou, Crab, and Dry Creeks. Impacts to floodplains could occur from the placement of structures. Because the placement of access roads in floodplains would not affect flood storage or the course of floodwaters, the impact would be low.	There would be no impacts to floodplains, except for a possible low impact if a structure is placed within the Columbia River floodplain at the southern crossing. The new substation would be located outside of the floodplain, some dirt access roads may be within it along Dry Creek, resulting in a low impact.	There would be no impacts to floodplains, except for a possible low impact if a structure is placed within the Columbia River floodplain at the southern crossing.	No impacts to floodplains would occur along the transmission line. The new substation would be located outside of the floodplain, some dirt access roads may be within it along Dry Creek, resulting in a low impact.	Impact would be the same as Alternative 1.	No new impacts are expected.

Resource	Existing Conditions	Preferred (2)	Alternative 1	Alternative 3	Alternative 1A	No Action
Wetlands (See Sections 3.2, *Floodplains and Wetlands,* and 4.2, *Floodplains and Wetlands.*)	Many of the wetlands identified in the study area are associated with streams. The few small isolated wetlands that occur in the study area would be avoided.	Impacts to wetlands would be moderate. The construction of fords and other water crossings for access roads could impact 16 wetlands associated with creeks. This represents a moderate impact. The implementation of erosion control measures could minimize impacts. Trees may be removed in four riparian areas. Maintenance activities such as improving access roads could impact wetlands.	Impacts to wetlands would be moderate, similar to the Preferred Alternative, with 17 creek crossings and possible removal of trees in four riparian areas.	Impacts to wetlands would be moderate, similar to the Preferred Alternative, with 22 creek crossings and possible removal of trees in three riparian areas.	Impacts to wetlands would be moderate, similar to the Preferred Alternative, with 15 creek crossings and possible removal of trees in five riparian areas.	No new impacts are expected.
Soils & Geology (See Sections 3.3, *Soils and Geology*, and 4.1, *Water Resources, Soils, and Geology.*)	There are diverse landforms and geologic features within the Columbia Plateau. The plateau's landscape consists mostly of large and small hills with flat tops, extensive plateaus, incised rivers, and anticline ridges. Geologic hazards include steep slopes and erosion. Blowing soil and water erosion are the most active erosion processes, due to the area's high relief, steepness of slope, and restricted available water.	Low to moderate impact is anticipated, caused by erosion, the loss of productive soils, and increased runoff.	Low to moderate impacts are anticipated similar to the Preferred Alternative.	Moderate impacts would occur caused by erosion, loss of productive soils, and increased runoff.	Low to moderate impacts are anticipated similar to the Preferred Alternative.	No new impacts are expected.

Resource	Existing Conditions	Preferred (2)	Alternative 1	Alternative 3	Alternative 1A	No Action
Vegetation (See Sections 3.4, *Vegetation*, and 4.3, *Vegetation*.)	The vegetation in most of the project area is shrub-steppe. With the exception of some riparian areas, few trees are found. Sagebrush species are the dominant woody vegetation. Two Washington Natural Heritage Program (WNHP) high-quality plant communities occur in the project area: the Wyoming big sagebrush/ bluebunch wheatgrass shrubland (Segment A), and the bitterbrush/ Indian ricegrass shrubland (Segments D, E, and F).	There are potential impacts to areas within 43.3 miles of shrubland and 11.9 miles of grasslands, ranging from low to moderate. In Segment A, there are potential impacts within 0.2 mile of a WNHP high-quality plant community. This represents a moderate to high impact. In Segment D, there is 0.8 mile of high quality plant community. Degradation would cause a moderate impact. The introduction or spread of weed species would be a low to moderate impact.	There are potential impacts to areas within 46.1 miles of shrubland and 8.5 miles of grasslands, ranging from low to moderate. There are potential impacts within WNHP high-quality plant communities, including 0.2 mile in Segment A and 2.8 miles in Segment E. This represents a moderate to high impact. The introduction or spread of weed species would be a low to moderate impact, depending on the quality of the plant communities affected.	There are potential impacts to areas within 48.3 miles of shrubland and 9.2 miles of grasslands, ranging from low to moderate depending on the types of impacts. In Segment A, there are potential impacts within 0.2 mile of a WNHP high-quality plant community. This represents a moderate to high impact. The construction of a new transmission line in an area currently without one is expected to degrade existing plant communities. This could result in a low to high impact, depending on the quality of the plant communities impacted. The introduction or spread of weed species would be a low to moderate impact, depending on the quality of the plant communities affected.	There are potential impacts to areas within 55.9 miles of shrubland and 12.4 miles of grasslands, ranging from low to moderate depending on the types of impacts. The construction of a new transmission line in an area currently without one is expected to degrade existing plant communities. This could result in a low to high impact, depending on the quality of the plant communities impacted. There are potential impacts within WNHP high-quality plant communities, including 0.2 mile in Segment A and 0.3 mile in Segment F. This represents a moderate to high impact. The introduction or spread of weed species would be a low to moderate impact depending on the quality of the plant communities affected.	No new impacts would occur.

Resource	Existing Conditions	Preferred (2)	Alternative 1	Alternative 3	Alternative 1A	No Action
Threatened & Endangered, and Sensitive Vegetation (See Sections 3.4, *Vegetation*, and 4.3, *Vegetation*.)	Potential habitat for rare and endangered plant species is scattered throughout the study area. A survey of the preferred alternative would locate any populations, and they would be avoided, if possible. BLM sensitive species may occur within BLM managed lands.	Impacts would be moderate to high if species are not avoided. Along Segment D, there is known and potential habitat for Umtanum wild buckwheat. Segments A and D have potential habitat for Ute ladies' tresses. The Columbia River crossings have potential northern wormwood habitat. Segment D has potential habitat for basalt daisy. BLM sensitive species may occur within the BLM managed lands in Segments A and D. Impacts would be moderate if BLM species are not avoided.	Segments A and E have potential habitat for Ute ladies' tresses and Segments B and E have potential habitat for northern wormwood at the Columbia River crossings. BLM sensitive species may occur within the BLM managed lands in Segments A and E. Impacts would be moderate if BLM species are not avoided.	Segment A has potential habitat for Ute ladies' tresses, and Segment C has potential habitat for basalt daisy. BLM sensitive species may occur within the BLM managed lands in Segment A. Impacts would be moderate if BLM species are not avoided.	Segments A and F have potential habitat for Ute ladies' tresses. Segments B and F have potential habitat for northern wormwood at the Columbia River crossing. BLM sensitive species may occur within the BLM managed lands in Segment A and along the Saddle Mountain area crossed by Segment F. Impacts would be moderate if BLM species are not avoided.	No new impacts would occur.
Wildlife (See Sections 3.5, *Wildlife*, and 4.4, *Wildlife*.)	The shrub-steppe habitat in the study area supports a variety of wildlife species including birds, mammals, reptiles, and amphibians. The study area is located within the Pacific Flyway. Crab Creek (Segments D, E, and F) is an important wildlife migratory corridor, and one of the most important flyways in Washington for migrating birds.	Impacts would be high to low. Parts of Segment A are relatively undisturbed shrub-steppe habitat. Existing habitat along Segment D is highly degraded.	Impacts would be high to moderate. Parts of Segment A are relatively undisturbed shrub-steppe habitat. Segment E is mostly disturbed agricultural area with low habitat value, except for the Hanford Site, which is high quality, important undisturbed shrub-steppe habitat.	Impacts would be high. Parts of Segment A are relatively undisturbed shrub-steppe habitat. Existing habitat in Segment C is relatively undisturbed, especially in the YTC.	Impacts would be high. Parts of Segment A are relatively undisturbed shrub-steppe habitat. Segment F along Saddle Mountains is high elevation, sensitive habitat that is relatively undisturbed. The Hanford Site is high quality, important undisturbed shrub-steppe habitat.	No new impacts would occur.

Resource	Existing Conditions	Preferred (2)	Alternative 1	Alternative 3	Alternative 1A	No Action
Threatened & Endangered Wildlife (See Sections 3.5, *Wildlife*, and 4.4, *Wildlife*.)	The south side of Umtanum Ridge (Segment C) is a core area for sage grouse. Wintering and breeding bald eagles occur in the project area.	With mitigation, impacts would be moderate. Bald eagles winter along Wilson and Naneum Creeks on Segment A. Segment D has few T&E species occurrences.	With mitigation, impacts would be moderate. Bald eagles winter along Wilson and Naneum Creeks on Segment A. Bald eagles are present in the Hanford Reach National Monument on Segment E.	With mitigation, impacts would be high. Bald eagles winter along Wilson and Naneum Creeks on Segment A. Segment C has core sage grouse areas.	With mitigation, impacts would be moderate. Bald eagles winter along Wilson and Naneum Creeks on Segment A. Bald eagles are present in the Hanford Reach National Monument on Segment F.	No new impacts would occur.
Fish Resources (See Sections 3.6, *Fish Resources*, and 4.5, *Fish Resources*.)	Several streams that the project would cross provide habitat for over 16 species of fish. In addition, the Columbia River hosts approximately 40 species of fish. Chinook salmon, sockeye salmon, steelhead, and Pacific lamprey use the Columbia River in the study area as a migration corridor. Fish commonly pursued for sport include whitefish, small-mouth bass, sturgeon, catfish, walleye, and perch. Rough fish such as squawfish, carp, suckers, and shiners are also present in large numbers.	Impacts would be low to none. Ten fish-bearing streams would be crossed.	Impacts would be low to none. Eleven fish-bearing streams would be crossed.	Impacts would be moderate to low. Seventeen fish-bearing streams would be crossed.	Impacts would be low to none. Eleven fish-bearing streams would be crossed.	No new impacts would occur.

Resource	Existing Conditions	Preferred (2)	Alternative 1	Alternative 3	Alternative 1A	No Action
Land Use (See Sections 3.7, *Land Use*, and 4.6, *Land Use*.)	The alternatives cross private and public land in four Washington counties. Land use varies by line segment, but mostly include rangelands and agricultural lands, some military lands and lands designated for preservation, and limited residential lands.	The overall land use impact would be moderate to high. There would be a moderate to high impact on residential and quarry land uses, which are localized. The impact to the YTC would be moderate/ low. Impacts to other public lands would be low. Agricultural impacts would be moderate along Segment D, because about 8 miles would be double-circuited.	Overall impact to land use would be high. Impacts to the YTC and quarry land use are similar to the Preferred Alternative. About 6.4 miles of agricultural lands on both public and private land would be affected, a high impact. Impacts to residential uses along portions of Segment E would be low. Impact to BLM lands would be low. The land crossed on the Hanford Reach National Monument and the Hanford Site has a Preservation land use designation. Since this alternative would require new ROW, the impact to preservation efforts would be high.	Impacts to land use would be high. The majority of land crossed is on the YTC. The new transmission line would eliminate the Department of Defense's ability to perform the training, aviation, and ground maneuvers that currently occur, which would be a high impact. The remaining land crossed is both public and private rangeland and a small portion of agricultural land. Impacts to rangeland would be low, and impacts to agricultural lands would be high. There would be a moderate to high impact on residential and quarry land uses, which is localized.	Impacts to land use would be moderate to high. Impacts to the YTC, residential, and quarry land uses are similar to the Preferred Alternative. Segment F would require new ROW, with 39.8% of the line crossing land administered by BLM for multiple land uses. Impact to the BLM lands would be low. The land crossed on Hanford Reach National Monument and the Hanford Site has a Preservation land use designation. Since this alternative would require new ROW, the impact to preservation efforts would be high.	No new impacts would occur.

Resource	Existing Conditions	Preferred (2)	Alternative 1	Alternative 3	Alternative 1A	No Action
Socioeconomics (See Sections 3.8, *Socioeconomics*, and 4.7, *Socioeconomics*.)	The rural character of central Washington is linked to the local socioeconomics. Agriculture is an important industry sector that influences local economies and demographic composition. Other industries important to the area include service, retail trade, and manufacturing sectors. In general, Kittitas, Grant, Yakima, and Benton counties are less racially diverse, have lower per capita and median household incomes, and have a lower percentage of income derived from work earnings than Washington state as a whole.	No impacts to local populations are expected to occur. A positive impact to local and state tax revenues and local economies would result from construction-related jobs and expenditures. A small negative impact in property tax revenues would occur from BPA's purchase of land to locate the new substation.	No impacts to local populations are expected to occur. A positive impact to local and state tax revenues and local economies would result from construction-related jobs and expenditures.	Impacts would be similar to the Preferred Alternative.	Impacts would be similar to Alternative 1.	The No Action Alternative would not directly or indirectly impact the local population, economy, or tax base. However, this alternative would have other socio-economic impacts to the local area and greater region, as a result of the lack of adequate transmission line infrastructure to support expected growth in the Pacific Northwest.
Visual Resources (See Sections 3.9, *Visual Resources*, and 4.8, *Visual Resources*.)	The area's visual character and quality are primarily natural and rural. It is defined by rolling mountains, steep and dramatic mountain ranges, consistent stretches of scrub-steppe vegetation, and agricultural uses such as orchards, vineyards, and crop circles.	Visual impacts would be low to moderate. Segment A in the Colockum Pass area would pass close to a number of residences. The proposed structures would not dominate the view. The route through Segments D would be clearly visible to residents, tourists, and recreationists in the Saddle Mountains area. Segment G would parallel the John Wayne Trail and be visible to users of this recreational feature.	Visual impacts would be low to moderate. Impacts would be similar to the Preferred Alternative, except Segment E's location in the Saddle Mountains area is slightly further from most viewers than the Segment D alignment.	Visual impacts would be low to moderate. Impacts to the Colockum Pass area would be similar to the Preferred Alternative.	Visual impacts would be low to moderate. Impacts would be similar to the Preferred Alternative, except Segment F would cross the north face of the Saddle Mountains furthest from most viewers, and has a sensitive siting relationship with the Saddle Mountains Ridge.	No new impacts are expected.

Resource	Existing Conditions	Preferred (2)	Alternative 1	Alternative 3	Alternative 1A	No Action
Recreation Resources (See Sections 3.10, *Recreation Resources*, and 4.9, *Recreation Resources*.)	Recreational activities in the area are dispersed.	Impacts to recreational resources would be low. No long-term effects to recreational resources are expected. All impacts would be temporary and related to construction.	Impacts would be low and similar to the Preferred Alternative.	Impacts would be low and similar to the Preferred Alternative.	Impacts would be low and similar to the Preferred Alternative.	No new impacts are expected.
Cultural Resources (See Sections 3.11, *Cultural Resources*, and 4.10, *Cultural Resources*.)	Cultural areas located in the study area include prehistoric camps, lithic scatters, prehistoric stone tool quarries, historic homesteads, historic railroad sites, and traditional root-gathering areas. There are no recorded sacred sites in the study area.	Thirty-six recorded cultural areas. All sites important, no levels given.	Thirty-eight recorded cultural areas. All sites important, no levels given.	Thirty-eight recorded cultural areas. All sites important, no levels given.	Forty recorded cultural areas. All sites important, no levels given.	No new impacts would occur.
Public Health & Safety (See Sections 3.12, *Public Health and Safety*, and 4.11, *Public Health and Safety*.)	Electric and magnetic fields are found around existing transmission lines. Corona-generated audible noise is present near existing transmission lines in the area. Hazardous and toxic materials are found in substation equipment and are used in maintenance activities.	Health and safety impacts would be low to moderate. Noise impacts would be low.	Impact would be similar to the Preferred Alternative.	Health and safety impacts would be low. Noise impacts would be low.	Impacts would be similar to Alternative 3.	No new impacts would occur.
Air Quality (See Sections 3.13, *Air Quality*, and 4.12, *Air Quality*.)	Air quality in the area is generally good. Wind-blown dust is the leading cause of diminished air quality.	Dust during construction activities would have a temporary low impact. There would be no long-term air quality impacts from this alternative.	Similar to Preferred Alternative.	Similar to Preferred Alternative.	Similar to Preferred Alternative.	No new impacts would occur.

Table 2.8-2
Comparison of Alternatives to Project Purposes

Purposes	Preferred (2)	Alternative 1	Alternative 3	Alternative 1A	No Action Alternative
Maintain transmission system reliability	• Provides another line north of the Hanford Substation. • Connecting two existing 500-kV lines and the new line to Wautoma Substation would reduce system impacts resulting from the potential loss of two existing lines south of the Hanford Substation. • Creates a new switching station for the 500-kV transmission grid.	• Provides another line north of the Hanford Substation.	• Provides another line north of the Hanford Substation. • Connecting the existing 500-kV lines and the new line to Wautoma Substation would reduce system impacts resulting from the potential loss of two existing lines south of the Hanford Substation. • Creates a new switching station for the 500-kV transmission grid.	• Provides another line north of the Hanford Substation. • May increase the risk of losing the existing and new line north of the Hanford Substation.	• Transmission system would remain at the existing level of capacity and reliability.
Optimize System Usage	• Would reduce loading of existing transmission lines west of the Cascades by 170 MW. • Would facilitate the integration of new generation.	• Would reduce loading of existing transmission lines west of the Cascades by 140 MW. • Would facilitate the integration of new generation.	• Would reduce loading of existing transmission lines west of the Cascades by 170 MW. • Would facilitate the integration of new generation.	• Would reduce loading of existing transmission lines west of the Cascades by 140 MW. • Would facilitate the integration of new generation.	• Would not off-load the existing transmission lines west of the Cascades. • Would not facilitate the integration of new generation.
Minimize environmental impacts *(See Table 2.8-1, Summary of Impacts)*	Would create the least environmental impacts of all alternatives. Segment D essentially expands existing ROW, reducing impacts to areas presently unaffected by transmission lines. Cumulative impacts less than constructing new roads in undisturbed areas.	Would create more environmental impacts than the Preferred Alternative. Segment E would cause impacts by establishing a new ROW in the vicinity of, but not directly adjacent to an existing ROW.	Would create a similar level of environmental impacts as Alternative 1A. Segment C would be a new ROW through the YTC causing impacts to plants and wildlife through the disturbance of the shrub-steppe ecosystem.	Would create a similar level of environmental impacts as Alternative 3. Segment F would be a new ROW along the Saddle Mountains causing impacts to plants and wildlife through the disturbance shrub-steppe lands.	Would not cause any construction related environmental impacts.

Purposes	Preferred (2)	Alternative 1	Alternative 3	Alternative 1A	No Action Alternative
Minimize costs	Estimated cost of $76,500,000.	Estimated cost of $88,000,000. The increased cost would be due to land costs to purchase of easements across farmland between Vantage and Hanford Substations.	Estimated cost of $67,000,000. This cost does not reflect all costs potentially associated with this alternative. No land costs were added to the estimate for the purchase of easements across the YTC. It is possible that in lieu of an easement payment, BPA would compensate the Army for the loss of the use of land used for maneuvers (i.e., purchasing adjoining land).	Estimated cost of $67,000,000. Segment F avoids much of the agricultural areas and thus reduces land costs.	No costs associated with this alternative.
Provide earliest energization date	Would meet the scheduled energization date of late 2004.	Would be difficult to meet the energization date. Acquiring easements across irrigated agricultural land could potentially delay the schedule. In addition, obtaining easements through Hanford Reach National Monument could also delay the schedule.	Would likely not meet the energization date due to Army reluctance to allow a new ROW to cross the military reservation. This land is also of high concern to the tribes.	Would be difficult to meet energization date. Obtaining easements through Hanford Reach National Monument could potentially delay the schedule.	Not applicable.

Chapter 3 — Affected Environment

In this Chapter:

- **Existing natural environment**
- **Existing human environment**
- **Protected resources**

This chapter describes the existing environment that may be affected by the alternatives. Each section describes a specific resource. The natural environment is discussed first, then the human environment.

Segments A through F, described in Chapter 2, *Alternatives*, and shown on Map 2, *Alternatives*, are used in most, but not all, of the resource discussions to help describe the existing environment.

3.1 Water Resources

3.1.1 Precipitation

Weather patterns in central Washington vary greatly with topography. Most of the study area is in the rain shadow of the Cascades, which results in a semiarid climate. Most precipitation in the study area falls as rain, with as little as 7 to 8 inches of precipitation per year at lower elevations. The amount of sediment in streams varies seasonally, and streams and rivers carry the most sediment when rain or snowmelts occur. Occasional intense summer rains also raise flows and the amount of sediment in rivers and streams.

3.1.2 Watersheds

River basins crossed by the project are the Central Columbia and Yakima. Within these basins the streams crossed by the line segments fall into five watersheds: the Lower Yakima, Upper-Columbia-Priest Rapids, Lower Crab, Upper Yakima, and Upper Columbia-Entiat. Some of the ***perennial streams*** crossed include Lower Crab Creek, Naneum Creek, and Wilson Creek, in addition to the Columbia River. See Map 4, *Water Resources*. Many smaller perennial and ***intermittent stream*** drainages and irrigation ditches may also be crossed. Table 3.1-1, *Potential Stream/Lake Crossings*, shows the stream crossings for each line segment and the associated watersheds.

For Your Information

Perennial streams *are streams that flow throughout the year, and* ***intermittent streams*** *are streams that flow only seasonally.*

Table 3.1-1
Potential Stream/Lake Crossings

		Watershed				
		Lower Crab	Lower Yakima	Upper Yakima	Upper Columbia Priest Rapids	Upper Columbia Entiat
Perennial Stream Crossing	**Segment A**					
	Caribou Creek			■		
	Coleman Creek			■		
	Cooke Canyon Creek			■		
	Naneum Creek			■		
	Schnebly Creek			■		■
	Wilson Creek			■		
	Parke Creek – Upper Yakima			■		
	Cave Creek – Upper Yakima			■		
	Segment B					
	Columbia River					■
	Johnson Creek					■
	Middle Canyon Creek					■
	Segment C					
	Alkali Creek				■	
	Cold Creek		■			
	Corral Creek				■	
	Hanson Creek				■	
	Johnson Creek					■
	Middle Canyon Creek					■
	Segment D					
	Cold Creek		■			
	Columbia River				■	
	Lower Crab Creek	■				
	Segment E					
	Columbia River				■	
	Lower Crab Creek	■				
	Nunnally Lake	■				
	Saddle Mountain Lake				■	
	Segment F					
	Columbia River				■	
	Lower Crab Creek	■				
	Nunnally Lake	■				
	Saddle Mountain Wasteway					■

The study area lies at the western edge of the Interior Columbia Basin. The area lies in the rain shadow of the Cascade Mountains, and thus receives very little precipitation. With the exception of the Columbia River, which bisects the study area, water is scarce. Streams are generally small and intermittent. The northern part of the study area near Ellensburg and including Segment A drains into the Yakima River. The remainder of the project (Segments B, C, D, E, and F) contains a number of local drainages that drain directly into the Columbia River.

The streams crossed in Segment A are all part of the Wilson-Naneum Creek sub-basin, a part of the Yakima basin. All streams in this sub-basin are heavily diverted on the Kittitas valley floor and have been channelized into an intricate drainage\irrigation system. There are over 200 unscreened diversions in this drainage (WDFW, 2001). Grazing and other agricultural practices extensively impact the riparian zone of the valley portions of these streams. In their upper reaches, these streams flow through timbered canyons with good year-round flows.

Segment B crosses two perennial drainages and the Columbia River between the northern end of Segment C and the Vantage Substation. The perennial drainages drain the northeastern corner of the Yakima Training Center (YTC). Extensive past grazing, military maneuvers, and other disturbances have caused changes in water flow and a general reduction in the quality of fish habitat within the two perennial drainages.

For Your Information

Regime *refers to the pattern and direction of the flow of the river.*

In Segment C, extensive past grazing, military maneuvers, and other disturbances have caused changes in flow ***regimes*** and a general reduction in the quality of fish habitat within the two perennial drainages crossed. In recent years, severe fires have damaged riparian vegetation and reduced the amount of vegetative cover on upland areas.

3.1.2.1 Water Quality

The Lower Yakima and Upper Columbia-Priest Rapids are identified as having serious water quality problems, such that aquatic conditions are well below state and tribal water quality goals (U.S. EPA 2000). The remaining three watersheds (Lower Crab, Upper Yakima, and Upper Columbia-Entiat) have less serious problems, although their aquatic conditions are also below state or tribal water quality goals (U.S. EPA 2000). Lower Crab Creek and the Columbia River are listed as ***water quality limited*** under Section 303(d) of the Federal Clean Water Act, due to extensive habitat modification. Corrective actions may currently be underway for these water bodies. It is possible that they are in compliance with state water quality

Water quality limited *under Section 303(d) of the Federal Clean Water Act refers to streams that do not meet current water quality standards.*

standards, despite the fact that they are presently listed as water quality limited.

Table 3.1-2, *303(d) – Listed Water Bodies*, lists the parameters of concern for the 303(d)-listed water bodies in the study area. Data for this table was taken from the Washington State Department of Ecology's Final 1998 Section 303(d) List of Impaired and Threatened Waterbodies provided to the EPA.

For Your Information

*A **PCB** is a family of industrial chemical compounds, noted as an environmental pollutant that accumulates in animal tissue.*

*A **DDE** is a product of the metabolic breakdown of DDT by an organism.*

Table 3.1-2
303(d) – Listed Water Bodies

	Water Quality Parameters						
	pH	Temperature	PCB	DDE	Dissolved Gas	Dissolved Oxygen	Fecal Coliform
Columbia River	■				■		
Crab Creek	■	■	■	■			
Mattawa Drain		■					

Source: Washington Department of Ecology 1998

Shorelines are lakes, including reservoirs, of 20 acres or greater; streams with a mean annual flow of 20 cubic ft per second or greater; marine waters; plus an area landward 200 ft from the ordinary high water mark of the resource; and all associated marshes, bogs, swamps, and river deltas.

3.1.2.2 Shorelines

The Washington State Shoreline Management Act allows for cities or counties to guide the planning and management necessary to prevent the potential harmful effects of uncontrolled development along the shorelines of Washington State. It is based on the idea that the shorelines of the State are among the most valuable natural resources and unrestricted development is detrimental to the preservation of these resources.

The various line segments cross one river (Columbia), two creeks (Naneum and Lower Crab), and one lake (Nunnally) that have been designated as shorelines. Table 3.1-3, *Shorelines Crossed*, lists the shoreline, the line segment(s) that cross it and the jurisdiction.

Table 3.1-3
Shorelines Crossed

Shoreline	Line Segment	County
Naneum Creek	A	Kittitas
Columbia River	B	Kittitas, Grant
Nunnally Lake	E and F	Grant
Lower Crab Creek	D, E, and F	Grant

See Map 4, Water Resources, for locations of water bodies.

Naneum Creek is crossed by Segment A in Section 20 and 21 of T19N R19E in Kittitas County. The environmental designation of the shoreline in this area is Rural, and is characterized primarily by agricultural activities with some compatible recreational uses.

In Kittitas County, Segment B crosses the west shore of the Columbia River in Section 20 of T16N R23E. The environmental designation of this area is Conservancy, which is characterized by uses primarily related to natural resource use. Recreational uses and low intensity recreational homes may be found within this designation. In Grant County, on the east side of the river (Section 21 of T16N R23E), the environmental designation of the shoreline is Rural.

Southeast of the Vantage Substation, Segments E (in Sections 25 and 36 of T16N R23E) and F (in Section 35 of T16N R23E) cross Nunnally Lake. This lake has a shoreline designation of Conservancy due to the lack of development around the lake.

Just south of Nunnally Lake is Lower Crab Creek. This east-west oriented creek is crossed by all three alternatives in Grant County, Segments D (in Section 2 of T15N R23E), E (in Section 2 of T15N R23E), and F (in Section 36 of T16N R23E). The environmental designation of the shoreline at all three of these crossings is Conservancy due to the lack of development around these areas of the creek.

Segment D, Segment E, and Segment F cross the Columbia River in the Hanford Reach National Monument (Segment D in Section 11 T13N R24E and Segment E and F in Sections 28 and 29, T14N, R26E). The Grant County and Benton County Shoreline Master Programs do not apply to the Columbia River in this area due to it being federal land. Therefore, the Columbia River is not considered a shoreline of statewide significance at these crossings.

3.1.2.3 Aquifers

Aquifers between Miocene basaltic rocks are prominent in the Columbia Plateau basaltic aquifer system. These aquifers consist of numerous flows of basaltic lava. Permeable zones between the lava flows form these aquifer layers. Groundwater quality in the proposed study area is variable, depending on the layer of basalt from which the groundwater is taken. Groundwater quality issues are mostly due to elevated concentrations of nutrients, trace organic compounds, and sodium and nitrates (USGS 1991 & Kevin Lindsay, May 23, 2001). Nitrates found in the groundwater are mostly associated with irrigated farming areas. The Columbia Plateau basaltic aquifer system is a major source of water for municipal, agricultural, and domestic uses (USGS 1991).

For Your Information

*An **aquifer** is a layer of underground sand, gravel, or spongy rock in which water collects.*

3.2 Floodplains and Wetlands

3.2.1 Floodplains

The Federal Emergency Management Agency (FEMA) identifies areas that have a one-percent chance of being flooded in a given year as 100-year floodplains. Areas identified as 100-year floodplains are shown on Flood Insurance Rate Maps. Areas where line segments would cross floodplains shown on FEMA maps are listed in Table 3.2-1, *Potential Crossings of 100-Year Floodplains*, and shown on Map 4, *Water Resources*.

Table 3.2-1
Potential Crossings of 100-Year Floodplains

Name of Water Feature	Line Segments					
	A	B	C	D	E	F
Wilson Spur/Naneum Creek crossings	■					
Cooke Canyon Creek	■					
Columbia River crossings		■		■	■	■
Lower Crab Creek (P)				■	■	■
Nunnally Lake					■	
Dry Creek			■	■		

The main water feature in the study area is the Columbia River. The 100-year floodplain is relatively narrow along the Columbia River because dams in the study area regulate flows. The largest flood in recent times occurred in 1948; it is very unlikely that large scale flooding would recur because of the construction of several flood-control/water-storage dams upstream of the study area since 1948.

Several FEMA floodplain areas are located in Segment A. In the Sickler-Schultz relocation area, Naneum and Wilson Creeks meander near each other eventually joining just south of the existing Schultz-Vantage line (see Figure 2.1, *Schultz Substation Area Redesign*). Near their intersection the two creeks essentially share one floodplain area, which is broad tree and shrub lined containing the braided channels of both creeks. At the northern crossing of Naneum Creek, the floodplain is located within a narrow canyon. The Cooke Canyon Creek floodplain crossing consists of several narrow, rocky creek channels in a fairly level area.

Segment B would cross the Columbia River south of Wanapum Dam and north of Priest Rapids Dam. See Map 4, *Water Resources*. In this portion of the river, the river is impounded and flows are regulated by discharges at Wanapum Dam. The structures on existing BPA transmission lines near the area where Segment B would cross are all outside the 100-year floodplain.

At the southern end of Segments C and D, the Dry Creek floodplain is located immediately to the south of the proposed Wautoma substation. The substation would be located outside of the area mapped as the 100-year floodplain along Dry Creek although one existing BPA structure is located within the floodplain.

Segments D, E, and F would cross the Columbia River downstream from Priest Rapids Dam. This portion of the Columbia River is the only unimpounded stretch of the Columbia River in the United States. Known as the Hanford Reach, flows fluctuate considerably but they are controlled by releases from Priest Rapids Dam. Existing BPA transmission lines span the Columbia River near each of the proposed crossings and all existing BPA structures are located outside the 100-year floodplain.

Two additional floodplains within the study area are identified on FEMA floodplain maps: Nunnally Lake, located north of Lower Crab Creek along Segment F; and the main channel of Lower Crab Creek crossed by Segments D, E, and F.

3.2.2 Wetlands

Many of the wetlands in the study area have been altered or disturbed by human activities. Examples of activities that have disturbed wetlands in the study area include road crossings, agricultural uses, and grazing. Once wetlands have been disturbed, they are susceptible to invasion by non-native species, such as Russian olive, saltcedar, exotic reed species and purple loosestrife. Often times, once a wetland has been invaded by non-native species, a ***monoculture*** is formed that out-competes native wetland species and reduces the habitat function.

For Your Information

*A **monoculture** is the growth of a single species, tending to exclude other species, resulting in a decrease in biodiversity.*

The presence of wetlands in the study area was initially investigated using National Wetlands Inventory (NWI) maps. NWI maps depict natural and human-made wetlands and water habitats. Aerial photographs were overlaid on a map of NWI wetlands for each segment to determine if known wetlands were present. Wetlands within approximately 500 feet of either side of the proposed line were considered within the wetland study area. Portions of the study area were visited or viewed during two brief field surveys. Information on wetlands found along each segment is summarized below and shown on Map 5, *Wetlands/Plant Associations*. Further characterization of these areas would occur prior to construction of the chosen alternative to verify that they meet soils, vegetation, and hydrology criteria for wetlands.

For Your Information

The NWI maps include intermittent streams that are not considered true wetlands. Each Segment crosses some of these intermittent streams:

Segment A	*22 Crossings*
Segment B_{north}	*3 Crossings*
Segment B_{south}	*3 Crossings*
Segment C	*11 Crossings*
Segment D	*7 Crossings*
Segment E	*9 Crossings*
Segment F	*12 Crossings*

Emergent wetlands *are wetlands dominated by herbaceous plants.*

Forested wetlands *are wetlands with a tree canopy.*

Scrub-shrub wetlands *are wetlands dominated by shrubby plants and low-growing woody species with multiple stems.*

3.2.2.1 Segment A

The 17 NWI mapped wetlands in Segment A are associated with either intermittent or perennial creeks (See Table 3.2-2, *Wetlands Located Along Segment A*). With the exception of Wilson, Naneum, and Cooke Canyon Creeks, all are located along narrow drainages, with a narrow band of vegetation.

Naneum and Wilson creeks would both be crossed twice. In the crossing to the north, the two creeks are separated by approximately 0.5 mi. Naneum Creek has a narrow band of ***emergent wetlands*** associated with it in the area of the proposed crossing, and Wilson Creek has several braided channels in the area of the proposed line. One creek channel of Wilson Creek has a narrow channel of ***forested wetland***. The NWI depicts the other channels of Wilson Creek as emergent wetlands.

Naneum and Wilson creeks flow very close to each other in the crossing to the south. This area is depicted as a ***scrub-shrub wetland*** area and it is vegetated with scattered shrubs, wavy-leaved alder, bittercherry, and occasional black cottonwoods.

Cooke Canyon Creek runs through a fairly level area and it consists of several narrow, rocky creek channels. The dominant woody species along Cooke Canyon Creek are black cottonwood, black hawthorn, and willows.

Table 3.2-2
Wetlands Located Along Segment A

Water Feature Name, if known	Perennial or Intermittent	Location	NWI Classification
Naneum Creek (north crossing)	P	T19N -R19E-20	riverine, palustrine, emergent, seasonally to permanently flooded
Wilson Creek (north crossing)	P	T19N -R19E-20	palustrine, emergent, seasonally flooded
Naneum/Wilson Creek crossing	P	T19N -R19E-20	palustrine, scrub-shrub, seasonally flooded, or riverine, open water, permanently flooded
Creek	I	T19N -R19E-21	
Cave Canyon Creek	P	T19N -R19E-28	palustrine, scrub-shrub wetland, seasonally flooded
Creek	I	T19N -R19E-27	riverine, seasonally flooded
Charlton Canyon Creek	I	T19N -R19E-27	riverine, seasonally flooded
Tributary of creek in Charlton Canyon	P	T19N -R19E-27	riverine, temporarily flooded
Creek in Schnebly Canyon	P	T19N -R19E-26	palustrine, scrub-shrub wetland, seasonally flooded
Coleman Creek	P	T19N -R19E-36	3 channels designated as riverine, open water, permanently flooded
Cooke Canyon Creek	P	T18N -R20E-6	palustrine, forested wetland, seasonally flooded
Trail Creek	P	T18N -R20E-5	riverine, seasonally flooded
Caribou Creek	P	T18N -R20E-8	palustrine, emergent wetland, seasonally to permanently flooded
Tributary of Caribou Creek	I	T18N -R20E-16	About 0.5 mile to the north: riverine, seasonally flooded About 0.5 mile to the south palustrine, scrub-shrub wetland, seasonally flooded
Parke Creek	I	T18N -R20E-27	riverine, seasonally flooded
Creek	I	T17N -R21E-20	palustrine, emergent wetland, with persistent vegetation, temporarily flooded

3.2.2.2 Segment B

Option B_{NORTH} – Two narrow wetlands along Option B_{NORTH} are associated with two unnamed creeks (See Table 3.2-3, *Wetlands Located Along Option B_{NORTH}*). One is classified an emergent wetland and the other as a riverine system. The Columbia River is noted on the NWI maps as a lake, but does not have wetlands on either side of it; rather a sparse upland plant community dominated by rabbitbrush and ***forbs*** grows almost to the edge of the water with occasional willows next to the water.

For Your Information

Forbs *are herbaceous species other than grass.*

Table 3.2-3
Wetlands Located Along Option B_{NORTH}

Name of Water Feature, if known	Perennial or Intermittent	Location	NWI Classification
Unnamed Creek	P	T16N-R22E-15	palustrine, emergent wetland, persistent vegetation, temporarily flooded
Unnamed Creek	I	T16N-R22E-23	riverine, seasonally flooded
Columbia River	P	T16N-R23E-20	lake, limnetic, open water, permanently flooded, and diked/impounded

Option B_{SOUTH} – According to the NWI, three narrow riverine wetlands are associated with tributaries of Johnson Creek along Option B_{SOUTH} (See Table 3.2-4, *Wetlands Located Along Option B_{SOUTH}*,). The Columbia River crossing is described in Option B_{north} above.

Table 3.2-4
Wetlands Located Along Option B_{SOUTH}

Name of Water Feature	Perennial or Intermittent	Location	NWI Classification
Tributary of Johnson Creek	I	T16N-R22E-21	riverine seasonally flooded
Tributary of Johnson Creek	I	T16N-R22E-22	riverine, seasonally flooded
Tributary of Johnson Creek	I	T16N-R22E-23	riverine, seasonally flooded
Columbia River	P	T16N-R23E-20	lake, limnetic, open water, permanently flooded, and diked/impounded

3.2.2.3 Segment C

Along Segment C there are 11 creeks that have wetlands associated with them (See Table 3.2-5, *Wetlands Located Along Segment C*). The NWI indicates that these creeks have a narrow band of wetland vegetation, with an abrupt transition to upland communities.

There are no forested wetlands along Segment C. One scrub-shrub wetland occurs in Corral Canyon on the YTC. The YTC Management Plan describes scrub-shrub wetlands on YTC as generally dominated by willows, which may be associated with other shrub species including chokecherry, mock orange, Wood's rose, and red-osier dogwood (USDOA, 1996).

Four emergent wetlands are mapped in the YTC portion of Segment C. Emergent wetlands on YTC are typically dominated by rushes, cattails, sedges, saltgrass, rabbitsfoot grass, mint, stinging nettle, and teasel (USDOA, 1996).

The remaining wetlands in Segment C include seven riverine wetlands, all characterized as intermittent, with a definite streambed. These areas may be riparian in nature. It is not known if any seeps or springs occur in the area of Segment C.

YTC has analyzed the condition of riparian areas and examined human activities that have had detrimental effects on water resources (USDOA, 1996). Past grazing has had the greatest effect on riparian/ wetland systems in the Cold Creek, Hanson, Johnson, and Middle Canyon drainages. Fire has had the greatest effect within the Corral Canyon drainage. The Alkali Canyon drainage has been affected by both fire and grazing. YTC reports that riparian conditions have improved over the past five years in the Alkali Canyon and Corral Canyon areas, while it has declined in all other watersheds in the study area. YTC has initiated riparian restoration projects that have improved riparian conditions in the study area.

Table 3.2-5
Wetlands Located Along Segment C

Name of Water Feature, if known	Perennial or Intermittent	Location	NWI Classification
Johnson Creek	P	T16N-R22E-20	palustrine, emergent wetland, with persistent vegetation, seasonally flooded
Hanson Creek	P	T15N-R22E-8	palustrine, emergent wetland, with persistent vegeta tion, seasonally flooded
Cottonwood Creek	I	T15N-R22E-21	riverine, seasonally flooded, mapped to the east of the proposed line; palustrine, emergent wetland, with persistent vegetation, seasonally flooded, mapped to the west
Unnamed creek	I	T15N-R22E-28	riverine, seasonally flooded (includes two forks of the creek)
Creek in Alkali Canyon	P	T14N-R22E-3	palustrine, emergent wetland, with persistent vegetation, seasonally flooded
Creek in Corral Canyon	P	T14N-R22E-15	palustrine, scrub-shrub wetland, with broadleaf deciduous vegetation, temporarily flooded
Tributary to creek in Corral Canyon	I	T14N-R22E-14	palustrine, emergent wetland, with persistent vegetation, seasonally flooded
Tributary to creek in Corral Canyon	I	T14N-R22E-23	riverine, seasona lly flooded
Creek in Sourdough Canyon	I	T14N-R22E-25	riverine, seasonally flooded
Cold Creek	I or P	T13N0-R23E-20	riverine, seasonally flooded
Tributary to Cold Creek	I or P	T13N-R23E-35	riverine, seasonally flooded
Dry Creek	I	T12N-R24E-20	riverin e, seasonally flooded

3.2.2.4 Segment D

The NWI maps depict six wetlands crossed by Segment D (See Table 3.2-6, *Wetlands Located Along Segment D*). One is a wide band of emergent wetlands on the north side of Lower Crab Creek. To the south of Lower Crab Creek, a wetland designated as open water, excavated area, is fed by irrigation outflow. The plant community in this area is mostly weedy species, with some natives (Beck, 2001).

Segment D spans the Columbia River. The NWI classifies it as lacustrine open water with no wetlands associated with it on either side.

On the summit of Umtanum Ridge, just south of the Midway area, an alkaline spring has been documented at the east end of the ridge (Soll, 1999). It is not known if this spring is in the area of the proposed line. Springs may be associated with wetland areas, even in high elevation, rocky areas.

South of the Columbia River, two narrow wetlands are associated with creeks. Both of these areas are riverine systems, with a definite streambed and intermittent flow.

Segment D would end at the site of the proposed Wautoma Substation. The proposed substation site does not have wetlands as described under Segment C above.

Table 3.2-6
Wetlands Located Along Segment D

Name of Water Feature, if known	Perennial or Intermittent	Location	NWI Classification
Lower Crab Creek	P	T15N-R23E-2	palustrine emergent wetland, persistent vegetation, seasonally to permanently flooded
Wetland	--	T14N-R24E-5	palustrine, open water, semi-permanently flooded, excavated
Columbia River	P	T13N-R24E-11	lacustrine, open water, permanently flooded; no adjacent wetlands on shore
Cold Creek	I	T13N-R24E-34	riverine, seasonally flooded
Unnamed Creek	I	T13N-R24E-34	riverine, seasonally flooded
Dry Creek	I	T12N-R24E-Sec 20	riverine, seasonally flooded

3.2.2.5 Segment E

Ten wetlands are indicated on the NWI that are crossed by Segment E (See Table 3.2-7, *Wetlands Located Along Segment E*).

To the north of Lower Crab Creek, a large wetland area is fed by an outflow channel from Nunnally Lake. In this wetland ***complex***, emergent wetlands are located in the area of the proposed line. Two emergent wetlands that are not connected to a watercourse are also located to the north of Lower Crab Creek. Along Lower Crab Creek, the NWI map depicts a wide band of emergent wetlands on the north side of the creek channel.

For Your Information

*A **complex** is a specific watershed area within the YTC. The YTC is divided into ten complexes.*

Within agricultural areas, four irrigation ditches have a riverine designation. Some appear to be historic creek channels, based on some natural looking meanders, while other areas appear to be straightened and may function as irrigation ditches.

A large wetland area known as the Saddle Mountain Wasteway is located immediately to the north of the Columbia River. A berm separates the river from this wetland so there is no surface water connection. The water feeding this wetland originates in irrigation ditches to the northeast. The irrigation outflow enters Saddle Mountain Lake, then leaves the lake through a stream channel, which then flows into the Saddle Mountain Wasteway. The NWI labels different portions of this wetland with different designations to indicate that it is composed of several different wetland types. Some of the wetland has been excavated; while other areas are labeled as either riverine or emergent wetlands.

The Columbia River is defined as an open water lake where Segment E crosses, but there are no adjacent wetland areas at the edge of the river.

Table 3.2-7
Wetlands Located Along Segment E

Name of Water Feature	Perennial or Intermittent	Location	NWI Classification
Wetland	--	T16N-R23E-35	palustrine, emergent, persistent vegetation, seasonally flooded
Wetland	--	T16N-R23E-Sec 35	palustrine, emergent, persistent vegetation, seasonally flooded
Wetland fed by outflow channel from Nunnally Lake	--	T16N-R23E-Sec 35	lacustrine, littoral, unconsolidated bottom, permanently flooded and diked/impounded
Lower Crab Creek	P	T15N-R23E-2	palustrine, emergent wetland, with persistent vegetation, seasonally to permanently flooded
Irrigation ditch	I	T15N-R24E-25	riverine, artificially flooded, seasonally flooded, excavated
Irrigation ditch	I	T15N-R25E-31	riverine, excavated
Irrigation Ditch	P	T15N-R25E-11	palustrine, open water, semi-permanently flooded, excavated
Irrigation Ditch	I	T14N-R26E-11	riverine, artificially flooded, seasonally flooded, excavated
Saddle Mountain Wasteway	--	T14N-R26E-20	riverine, semipermanently flooded
	--	T14N-R26E-20 & 29	palustrine, emergent, with persistent vegetation, seasonally flooded
Columbia River	P	T14N-R26E-29 & 28	lake, limnetic, open water, artificially and permanently flooded

3.2.2.6 Segment F

Segment F has nine wetland areas mapped by the NWI (See Table 3.2-8, *Wetlands Located Along Segment F*).

North of Lower Crab Creek, Nunnally Lake is mapped as an open water, lacustrine wetland. The NWI does not map adjacent wetland areas along the margins of the lake, as verified in the field through an aerial survey. A narrow band of shrubs and trees, probably black cottonwoods and willows, lines the edge of the lake and the plant community abruptly transitions to upland shrub-steppe.

Two emergent wetlands, located to the north of Lower Crab Creek, appear to be isolated wetlands that are not connected to a watercourse. Along Lower Crab Creek, the NWI depicts a wide band of emergent wetland north of the creek channel.

The estimated 12 intermittent creeks that drain down the south slope of the Saddle Mountains do not have adjacent wetland according to the NWI. At the base of the Saddle Mountains, an irrigation ditch is mapped on the NWI.

Two wetland areas occur on the Saddle Mountains Unit of the Hanford Reach National Monument. One is a narrow emergent wetland that was observed in the field and is not mapped on the NWI (St. Hilaire, 2001). The large wetland area to the north of Columbia River (Saddle Mountain Wasteway) and the Columbia River crossing are described under Segment E (See Section 3.2.2.5, *Segment E*).

Table 3.2-8
Wetlands Located Along Segment F

Name of Water Feature	Perennial or Intermittent	Location	NWI Classification
Nunnally Lake	P	T16N-R23E-25 & 36	lacustrine, limnetic, open water/unknown bottom, permanently flooded
Wetland	--	T16N-R23E-36	palustrine scrub-shrub wetland/emergent wetland with persistent vegetation, seasonally flooded
Wetland	--	T16N-R23E-36	palustrine, emergent wetland with persistent vegetation, seasonally flooded
Adjacent wetland north of Lower Crab Creek	--	T16N-R23E-36	palustrine, emergent wetland with persistent vegetation, seasonally flooded
Lower Crab Creek	P	T16N-R23E-36	riverine, lower perennial, open water, permanently flooded
Irrigation Ditch	P	T15N-R26E-21 & 28	palustrine, open water, semi-permanently flooded, excavated
Wetland	--	T14N-R26E-16 & 21	palustrine, emergent wetland
Saddle Mountain Wasteway	--	T14N-R26E-20	riverine, semipermanently flooded
	--	T14N-R26E-20 & 29	palustrine, emergent, with persistent vegetation, seasonally flooded
Columbia River	P	T14N-R26E-29 & 28	lake, limnetic, open water, artificially and permanently flooded

3.3 Soils and Geology

Diverse landforms and geologic features exist within the proposed study area, which is in the Columbia Plateau ***physiographic*** province. The landscape within the plateau consists mostly of large and small hills with flat tops, extensive plateaus, ***incised*** rivers, and ***anticline*** ridges. The ***Miocene Columbia River Basalt Group*** underlies the region and is interbedded by ***Neogene*** terrestrial sediments (DNR 1991).

The seismicity of the Columbia Plateau is relatively low compared to other regions in the Pacific Northwest. In 1936, the town of Milton-Freewater experienced an earthquake with a Richter scale magnitude of 5.75. This is the largest recorded earthquake known to have occurred in the Columbia Plateau (USDOE 1999). Closer to the Hanford Site near the central part of the Columbia Plateau, an earthquake with a 4.4 Richter scale magnitude occurred in 1918 and again in 1973. These earthquakes were located near Othello, north of the Hanford Site, and are the largest recorded earthquakes that have occurred near the Hanford Site (USDOE 1999).

Geologic hazards in the proposed study area include steep slopes and erosion. Soil blowing and water erosion are the most active erosion processes due to the area's high relief, steepness of slope, and restricted available water capacity for the production of ***forage*** (USDA 1984).

From the Schultz Substation at an elevation of 2,300 feet, Segments A, B_{NORTH}, and B_{SOUTH} would cross a broad plateau that extends to the Saddle Mountains in the northern portion of the YTC. Soils from the Schultz Substation to the Vantage Substation vary from shallow to deep, are well drained, and formed in a variety of parent materials including ***loess***, ***residuum***, ***alluvium***, and basaltic ***colluviums*** (Remote Sensing 1998).

From the northern portion of the YTC, the landscape is characterized by ridges and valleys (the Saddle Mountains, Umtanum Ridge, and the Yakima Ridge) that were from the underlying basalt layers being folded and faulted. These ridges and valleys were further modified by glaciers and flooding (USDOD Army 1996). Alluvial and wind-blown deposits of loess blanket the majority of the YTC.

From the Vantage Substation (elevation 900 feet) in Grant County, the area is generally smooth and southward sloping. The southward-sloping plain is deeply dissected and interrupted by the Saddle Mountains (approximate elevation 2,300 feet), and Crab Creek runs along its base (USDA 1984). The Saddle Mountains are primarily made of basalt that has buckled into anticlines that trend in an east to

For Your Information

Physiography *is the study of the structure and phenomena of the earth's surface.*

Rivers that have craved a path through the bedrock of an area are ***incised****.*

Anticline *is an arching fold in layered rocks.*

Miocene *is the period in the Neogene lasting from 23 million years ago to 5 million years ago.*

The ***Columbia River Basalt Group****, composed of the Grand Ronde Basalt and the overlying Wanapuma and Saddle Mountains Basalt, comprises most of the aquifer system (USGS 1994).*

Neogene *is the geological period lasting from 23 million years ago to present day.*

Forage *is food for domestic animals, i.e. cattle, sheep, etc.*

Loess *is a windblown deposit of fine-grained silt or clay.*

Residuum *is unconsolidated weathered mineral material that accumulated as consolidated rock and disintegrated in place.*

Alluvium *is sedimentary material deposited by flowing water as in a delta or riverbed.*

Colluvium *is soil and/or rock fragments moved by creep, slide, local wash and deposited at the base of steep slopes.*

west direction (Alt 1994). These mountains had considerable faulting in their geologic past. The slopes to the south of the mountains are gentle in comparison to the bold relief of the north-facing cliffs.

Soils in the Saddle Mountains range from deep and well drained to very shallow with rock outcrops. Deep soils are found mostly on the upland flat benches or on areas with rolling topography. Shallow soils are predominantly found on steep north- and south-facing slopes and ridge tops. The east-facing slopes tend to have deeper soils than the west-facing slopes, due to prevailing winds that deposit sand and silt on the leeward side of the hills (BLM 1997).

From the top of the Saddle Mountains the Wahluke Slope trends southward to the Columbia River and the Hanford Site. This slope is relatively flat-bottomed. The Wahluke Slope's soils are deep, well drained, and nearly level. The soils were formed from a variety of parent materials including gravelly glacial outwash, sand derived from mixed sources, and ***lacustrine deposits*** (USDA 1984).

For Your Information

Lacustrine deposits *are material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.*

Low-relief plains and the Yakima Ridge dominate the Hanford Site. Several enormous floods modified the topography of the Hanford Site, when ice dams in western Montana and northern Idaho breached, emptied their entire contents, and spread across eastern Washington. This flooding, which is known as the Missoula Floods, occurred between 12,700 and 15,300 years ago (WSDNR website) and left sediments and a mix of topography that is now known as the Channeled Scablands (USDOE 1999).

3.4 Vegetation

The diversity of plant species and quality of the vegetation in the study area can be assessed by determining the ***plant community***, found in different locations. A table in Appendix E, *Vegetation*, lists the scientific name for each plant species discussed below.

The vegetation type found in most of the study area is referred to as shrub–steppe, with some grasslands (Franklin, 1973). With the exception of some riparian areas, few trees are able to survive in this arid landscape. The dominant woody vegetation on most upland sites consists of shrub species, predominantly sagebrush species. The understory of herbaceous plants in shrub-steppe was dominated by native perennial bunchgrasses prior to European settlement. Within the project area, native bunchgrass dominated communities are no longer common due to invasion by annual grasses and weedy species after various types of disturbance (Quigley, 1999).

Shrub-steppe vegetation in the study area is characterized as a potential big sagebrush/bluebunch wheatgrass zone (Daubenmire, 1970). This is the community that is expected to occur without disturbance, alteration of habitat, or invasion by non-native species.

The dominant shrubs currently existing in upland areas commonly include several species of sagebrush, including big sagebrush, threetip sagebrush, stiff sagebrush, low sagebrush, bitterbrush, and rabbitbrush. In most areas today, non-native species, including cheatgrass, are now dominant.

In the study area, very few riparian areas have a tree overstory, and shrub-lined riparian areas are more common. Drier riparian areas are typically vegetated with upland shrubs, including sagebrush. Russian olive (an invasive species) is the most common tree species in riparian areas and wet areas.

The agricultural lands in the valley are mainly in cropland with small adjacent areas that may have some remnants of native plant communities.

For Your Information

The study area for vegetation includes an area approximately 0.25 mile on either side of each of the proposed segments, for a total of a 0.5-mile-wide strip centered on the proposed segment. Factors that influence the distribution of plant communities include aspect, slope, elevation, moisture source, and duration, and the type of soils, including rock content, and soil depth. The common names of plant species, rather than scientific names, are used in the discussion of vegetation that follows.

Plant communities *(also known as plant associations) are assemblages of species that grow together in similar habitats and are found repeated across the landscape.*

3.4.1 WNHP High Quality Plant Communities

The Washington Natural Heritage Program (WNHP) tracks the occurrence of "high quality plant communities" within "***high quality terrestrial ecosystems***" (WNHP Website). Two WNHP high quality plant communities occur along line segments (Map 5, *Wetlands/Plant Associations*). The Wyoming big sagebrush/bluebunch wheatgrass shrubland community occurs in one small location along Segment A.

To be considered a ***high quality terrestrial ecosystem****, an area must be dominated by native species, with little to no disturbance to vegetation, and have high ecological value, both in condition and viability, and the ability to persist on a site over time.*

The bitterbrush/Indian ricegrass shrubland community occurs in a broad band north of the Columbia River along segments D, E, and F.

3.4.2 Vegetation Cover Types

The USGS produces National Land Cover Data Maps that include some information on vegetation. These maps were used to calculate vegetation cover types along various project segments, presented in Table 3.4-1, *Vegetation Cover Types by Segment,* and Table 3.4-2, *Vegetation Cover Types by Alternative*. This data provides a measure of the amount of existing native vegetation along each segment. The two categories, Grasslands or Herbaceous and Shrubland, represent areas with plant communities that are likely to have some native species remaining although the condition of these areas could vary from fairly pristine to very degraded. Areas where agricultural activities occur are unlikely to recover and return to natural vegetation, even if abandoned (although efforts are made to convert back to native species while irrigation systems are in place can be successful). The information on tree cover illustrates how few trees exist in the study area and the importance of tree-lined riparian areas.

Table 3.4-1
Vegetation Cover Types by Segment

Vegetation Cover	Cover Along Each Segment (miles)						
	A	B_{NORTH}	B_{SOUTH}	C	D	E	F
Trees	0.68	0.00	0.00	0.19	0.18	0.05	0.00
Shrubland	26.22	6.17	6.69	22.07	10.09	12.82	23.01
Grasslands or Herbaceous	1.73	2.87	2.91	7.46	7.23	3.91	7.76
Agricultural	0.53	0.00	0.00	0.00	8.85	5.87	0.39

Source: USGS National Land Cover Data Maps, 2000

Table 3.4-2
Vegetation Cover Types by Alternative

Vegetation Cover	Cover Along Each Alternative (miles)					
	1 A, B_N, E	**1** A, B_S, E	**1A** A, B_N, F	**1A** A, B_S, F	**2** A, B_S, D	**3** A, C
Trees	0.73	0.73	0.68	0.68	0.86	0.87
Shrubland	45.21	45.73	55.40	55.92	43.00	48.29
Grasslands or Herbaceous	8.51	8.55	12.36	12.40	11.87	9.19
Agricultural	6.40	6.40	0.92	0.92	9.38	0.53

Source: USGS National Land Cover Data Maps, 2000

For Your Information

Lithosols *are rocky soils that usually develop in areas underlain by basalt.*

3.4.2.1 Segment A

The vegetation of Segment A is mainly shrubland, with very little grassland and agricultural lands. Portions of Segment A support an attractive shrub-steppe plant community known as a ***lithosol*** community (St. Hilaire, 2001). Because big sagebrush and many grass species cannot survive in rocky soils over basalt, the lithosol zone is known for having spectacular spring wildflower displays (Taylor, 1992). Portions of Segment A have areas of lithosols that support stiff sagebrush, Sandberg's bluegrass, and a variety of wildflowers species. Flowering plant species observed growing along Segment A include desert buckwheat, dwarf goldenweed, cushion phlox, biscuitroot, and yarrow (St. Hilaire, 2001).

Other portions of Segment A have adequate soils to support the big sagebrush/bluebunch wheatgrass community that is the dominant potential plant community throughout the study area. Because of past disturbance, native grasses have declined and the dominant grass species is generally cheatgrass. Diffuse knapweed, a weedy species, is common along roadsides within Segment A, as it is throughout the study area.

One area of Segment A covered by the big sagebrush/bluebunch wheatgrass community is sufficiently pristine to qualify as a WNHP high quality plant association, as discussed above. This is the only occurrence of this high quality plant association in the study area. It occurs along approximately 0.2 mile of Segment A. Other species found in this community include occasional stiff sagebrush, bitterbrush, and gray rabbitbrush.

Segment A has two tree-lined riparian areas. Naneum Creek, in the northern portion of Segment A, is lined by scattered black cottonwoods, bittercherry, wavy-leaved alder, and aspen with a shrub understory of willows, rose, and red osier dogwood. To the southeast, Cooke Canyon Creek has a black cottonwood-lined riparian area with areas of black hawthorn and scattered shrubs, including willows in wetter areas and ocean-spray in dry areas. Several intermittent creeks along Segment A support channel vegetation consisting mainly of upland shrubs, including ocean-spray, rose, hawthorn, and sagebrush, with an understory of cheatgrass, yarrow, chicory, and other species.

As a part of a potential reroute of the new line and the existing Schultz-Vantage line, the existing Schultz-Vantage line would be rerouted 1.30 miles, approximately 0.29 mile longer than it is now. The new line would parallel the Schultz-Vantage for a distance of 1.27 miles, approximately 0.23 mile longer than Segment A was originally planned. The reroute in Segment A would reduce impacts to forested lands and grasslands and increase the impacts to shrublands compared to Segment A. The existing Schultz-Vantage reroute would cause similar changes in impacts. Removal of the existing Schultz-Vantage line would cause additional impacts to vegetation along 1.01 miles from equipment passage and tower removal.

3.4.2.2 Segment B (Options B_{NORTH} and B_{SOUTH})

The vegetation of B_{NORTH} and B_{SOUTH} is mainly shrubland with some grasslands and has no agricultural land. Most of Options B_{NORTH} and B_{SOUTH} are covered with shrub-steppe vegetation dominated by sagebrush.

The area immediately to the west of the Columbia River is gravelly with very little vegetative cover, including a few willows scattered at the water's edge. The slope from the river leading up to the highway is vegetated with rabbitbrush, occasional sagebrush, and various grass species. Shrub-steppe tops the bare rocky cliff above the highway, extending to the west. On the east side of the Columbia River, a dry, level, sagebrush-dominated area extends along the river. Cheatgrass and knapweed are common in the understory with some native vegetation, including yarrow and buckwheat. Between the Columbia River and the Vantage Substation, the proposed line traverses a hilly, dry expanse of shrub-steppe.

3.4.2.3 Segment C

The vegetation of Segment C is mainly shrubland with some grasslands and no agricultural land. YTC categorizes their habitats as upland, riparian, alkali, or rocky habitats (USDOE, 1996). Five potential plant communities occur within these habitat types in all of the watersheds traversed by Segment C. Plant communities on YTC are generally not pristine and cheatgrass commonly replaces bluebunch wheatgrass in many areas due to past grazing.

The five plant communities within the YTC portion of Segment C include:

- **Big sagebrush/bluebunch wheatgrass**: This community is estimated to cover half of the uplands at YTC. It is found on ridgetops, hillsides, benches, and alluvial fans on shallow and deep soils. Associated species include gray and green rabbitbrush, desert buckwheat, three-tip sagebrush, and spiny hopsage associated with various grass species. Bitterbrush is co-dominant with big sagebrush in moist sites.

- **Three-tip sagebrush/bluebunch wheatgrass**: This community is typically found on northern exposed hillslopes, canyon walls, and ridgetops, with moderately deep to deep soils. Associated species include big sagebrush, desert buckwheat, with traces of spiny hopsage, purple sage, and various grass species.

- **Stiff sagebrush/bluegrass**: This low-growing community occurs on hillsides, ridgetops, and benches in shallow soils. The climax shrub canopy is dominated by stiff sagebrush and eriogonum with traces of Wyoming big sagebrush, slenderbush eriogonum, purple sage, and bitterbrush, with a grass understory.

- **Eriogonum/ bluegrass**: This low-growing community is found on hillsides, ridgetops, and on shallow soils. The climax shrub canopy is dominated by eriogonum and either stiff sagebrush or three-tip sagebrush with a trace of Wyoming big sagebrush and purple sage. The herbaceous understory is mainly composed of grasses.

- **Alkali habitat**: This habitat type, found only in the Hanson Creek watershed, is normally found in bottomlands adjacent to intermittent streams and is occasionally associated with riparian communities bordering perennial streams. This community consists of black greasewood with traces of gray rabbitbrush.

Within the YTC, the level and type of disturbance to vegetation varies depending on the location. Most portions of the study area were grazed until 1995. Grazing reduced cover by perennial grasses and native forbs, and increased the cover by sagebrush. Grazing also damaged the vegetation in riparian areas although YTC has implemented riparian restoration projects along some creeks in the study area. Roads are present within most portions of the watershed, serving to disperse weed species. Training maneuvers occur in portions of the study area, damaging vegetation. Some of the vegetation in the study area is still in the recovery process after several fires in the 1970's and 1980's damaged vegetation. Native species were replaced with non-native species and habitat conditions were altered due to erosion.

Although the proposed Wautoma substation site was once a shrub-steppe community, the site is currently dominated by herbaceous species with only occasional sagebrush and rabbitbrush (St. Hilaire, 2001). This area burned sometime in the past, as evidenced by charred shrub stumps and abundant soot in the soil. Two non-native weedy species, tumble mustard and cheatgrass, are the dominant species on the site, but other common weeds include diffuse knapweed, spotted knapweed, and kochia. Native forbs scattered on the site include chaenactis, green-banded star-tulip, curve-pod milk-vetch, Grays' desert parsley, scarlet globemallow, cushion daisy, phlox, and balsamroot, all relatively common shrub-steppe species.

3.4.2.4 Segment D

The vegetation of Segment D is mainly shrubland with some grasslands, and the most agricultural lands of any the segments. The riparian area along the north shore of Lower Crab Creek is described as willow-dominated wetland (WDFW, April 2, 2001). Along the southern shore of Lower Crab Creek, emergent wetlands are vegetated with rushes, cat-tails, grasses, and forbs. Some Russian olive, a non-native tree, occurs in the area. To the south, the rocky, steep slopes on the north side of Saddle Mountains are described as having sparse shrub-steppe vegetation in some areas with a gentler slope. In the valley to the south, the agricultural lands are intensively farmed with small adjacent areas that may have some remnants of native plant communities, but are more likely vegetated with non-native species.

To the north of the Columbia River, a WNHP high quality native plant association occurs along approximately 0.8 mile of Segment D. This community, the bitterbrush/Indian ricegrass community, occurs in dune areas where the sand tends to shift in the winds. This creates an unstable environment in which only certain species can survive, such as Indian rice grass, white-stemmed evening primrose, sand dock, and some short-lived annuals. In one portion of this community, big sagebrush is associated with bitterbrush and Indian ricegrass (USDOE, 2001). Wetland plant communities do not appear to occur along the Columbia River north of the Midway Substation, except possibly for a narrow herbaceous shoreline community.

The Midway Substation is a very dry site at the base of Umtanum Ridge. The area within and immediately adjacent to the substation has been cleared of natural vegetation, with sparse shrub-steppe extending to the base of Umtanum Ridge. Several plant communities are mapped on Umtanum Ridge and to the south (USDOE, 2001). Rocky areas include the rocky cliffs of Umtanum ridge and a narrow strip of talus (rock strewn area) on the top of the ridge. Rocky areas support a sparse community of plants that can exist in the small pockets of soil that accumulate in rock cracks, including several rare plant species (Section 3.4.4, *Rare Plants*). On the crest of Umtanum Ridge and to the south, several plant communities are mapped, including big sagebrush-spiny hopsage/Sandberg's bluegrass-cheatgrass and bunchgrass-cheatgrass communities.

On the Hanford Site and the proposed Wautoma substation, the vegetation is mainly shrub-steppe or grassland with some agricultural land. WDFW documents the presence of nearly pristine sagebrush/ bluebunch wheatgrass shrub-steppe on the summit of Yakima Ridge (WDFW, 2001a). Segment D would terminate at the proposed Wautoma substation. The vegetation at the proposed substation site is described in the Segment C discussion (See Section 3.4.2.3, *Segment C*).

3.4.2.5 Segment E

The vegetation of Segment E is mainly shrubland with some grasslands and agricultural lands. The large emergent wetland south of Lower Crab Creek Road is vegetated with cat-tails and bulrush. To the south, scattered willows line the northern shore of Lower Crab Creek. The south shore of Lower Crab Creek consists of an emergent wetland vegetated with rushes, cat-tails, grasses, forbs, with scattered Russian olive (WDFW, April 2, 2001). To the south, the rocky, steep slopes on the north side of Saddle Mountains are described as having sparse shrub-steppe vegetation in areas with gentler slopes. The agricultural lands in the valley are mainly in cropland with small adjacent areas that may have some remnants of native plant communities.

The Saddle Mountains Unit of the Hanford Reach National Monument is characterized as relatively undisturbed or recovering shrub-steppe habitat, with some sand dune areas dominated by grasses, and water influenced areas mapped as riparian areas (USDOE, 2001, Sackschewsky and Downs, 2001). Hanford Site plant community maps depict three communities in the northeastern portion of the Saddle Mountains Unit, including big sagebrush/bunchgrasses-cheatgrass, big sagebrush-spiny hopsage/bunchgrasses-cheatgrass, and a small area of rabbitbrush/bunchgrass. To the south, a large area of bitterbrush/bunchgrass sand dune complex is mapped between two large wetland areas. These communities are considered "Plant Communities of Concern on the Hanford Site" (USDOE, 2001).

The bitterbrush/Indian ricegrass shrubland north of the Columbia River is a WNHP high quality native plant community. This community extends along the river for several miles, including about 2.5 miles along Segment E. This sand dune community was described in Section 3.4.2.4, *Segment D*.

Wetland plant communities, dominated by herbaceous species and scattered shrubs, occur in the Saddle Mountain Wasteway, north of the Columbia River. Wetland plant communities do not occur along the shoreline of the Columbia River, except possibly for a narrow herbaceous wetland along the shoreline.

3.4.2.6 Segment F

The vegetation of Segment F is mainly shrubland with some grasslands and very little agricultural land. Immediately north of Lower Crab Creek, a dune/willow complex occurs in the area of the proposed line (WDFW, April 2, 2001). This area may be somewhat degraded due to ATV use. The south shore of Lower Crab Creek consists of an emergent wetland vegetated with rushes, cat-tails, grasses, forbs, with scattered Russian olive. To the south, the rocky, steep slopes on the north side of Saddle Mountains are described as having sparse shrub-steppe vegetation in areas with gentler slopes.

Segment F traverses the Saddle Mountains from west to east, mainly along BLM land. BLM has not mapped plant communities in this area (P. Camp, Pers. Comm. 2001). This dry south-facing slope is mainly vegetated with grasses, with very few shrubs due to fires in the past. Scattered shrubs occur, mainly in the drainageways of intermittent creeks.

As described under Segment D, the area to the north of the Columbia River, in the Hanford Reach National Monument, is characterized as relatively undisturbed or recovering shrub-steppe habitat, with some sand dune areas dominated by grasses, and water-influenced areas mapped as riparian areas (USDOE, 2001).

The bitterbrush/Indian ricegrass shrubland that occurs north of the Columbia River along Segment F is a WNHP high quality native plant community. This community extends along Segment F for approximately 0.3 mile.

3.4.3 Weed Species

Some plant species are designated as weeds by federal or state law. Past land uses in the proposed study area, such as grazing and road building, have disturbed native plant communities and favored the establishment of some weed species. Present land uses, such as the use of vehicles along dirt roads or off-road and the expansion of agriculture, continue to contribute to the spread of weed species. However, some weeds do not require disturbances in order to thrive and are able to invade natural areas quickly.

For Your Information

*A **monoculture** is the growth of a single species, tending to exclude other species, resulting in a decrease in biodiversity.*

***Biodiversity** refers to different species of plants and animals in an environment.*

Weed species have numerous detrimental effects, and their invasion of public and private lands is a matter of great concern. Weed species reduce the quality of shrub-steppe by replacing native species, and some form ***monocultures***, which displace the more diverse native plant communities and reduce ***biodiversity***. Weeds reduce the quality of wildlife habitat when they replace native food sources and plant cover species, and can have an economic impact on agricultural crops. Some contribute to the rapid spread of fire by providing fuel. In addition, most weeds are not as efficient as native species at binding soil, which contributes to soil erosion by water and wind.

In Washington, weed species are addressed on a county-by-county basis. Washington State law designates some particularly troublesome weeds as "noxious weed" species. The list of noxious weed species is divided into three classes (A, B, and C) within each county, based on the state of invasion. Table 3.4-3, *Weeds of Concern in Study Area*, lists the ***Class A*** and ***Class B*** weeds that are of concern within each project segment.

Class B and ***Class C weeds*** are also present in the study area and may be controlled as a local option, depending on the level of threat. Spiny cocklebur, a Class C weed found in Kittitas County, is present in some areas (Segments A, B_{SOUTH}, B_{NORTH}, and C). Bull thistle and Canada thistle are Class C or Education List weed species, found throughout the entire study area. They will spread into most disturbed areas.

Some weed species are monitored by the state when they are suspected to be a potential threat or if more information is needed on the species. Russian olive and saltcedar (a Class A Noxious Weed) as well as common reed are monitored in the state of Washington. It is found in some wetlands on Hanford Site (Segments E and F), where efforts are being made to eliminate known occurrences (D. Gonzales, Pers. Comm., 2001). Russian thistle, a weed known to occur on the YTC (Segment C), is also a monitor species (M. Pounds, Pers. Comm., 2001).

Table 3.4-3
Weeds of Concern in Study Area

Common Name *Scientific Name* **(Washington State Class*)**	**Kittitas County**	**Yakima County**	**Grant County**	**Benton County**
	Segments A, B, C	**Segment C**	**Segments D, E, F**	**Segments D, E, F**
Dalmatian toadflax *Linaria dalmatica* ssp. *dalmatica* (Class B)	X	X	--	--
Johnsongrass *Sorghum halepense* (Class A)	-	X	--	--
Knapweed, diffuse *Centaurea diffusa* (Class B) except Benton County – no class	X YTC	X YTC	X HAN BLM	X HAN
Knapweed, spotted *Centaurea biebersteinii* (Class B)	X YTC	X YTC	X BLM	X
Knapweed, Russian *Acroptilon repens* (Class B)	YTC	X YTC	X HAN	X HAN
Kochia *Kochia scoparia* (Class B)	YTC	YTC	--	X
Musk Thistle *Carduus nutans* (Class B)	X	X	X	--
Pepperweed, perennial *Lepidium latifolium* (Class B)	YTC	YTC	--	--

For Your Information

State and federal agencies were contacted for information on weed species of concern in the study area. Weed board personnel in Kittitas, Grant, Yakima, and Benton counties provided information on the species of particular concern in the study area.

Class A Weeds *are non-native species with a limited distribution in Washington. Preventing new infestations and eradicating existing infestations is the highest priority. Eradication is required by law.*

Class B Weeds *are noxious weeds that are not native to the state and are of limited distribution or are unrecorded in a region of the state and that pose a serious threat to that region.*

Class C Weeds *are widely established and have interest to the agricultural industry. Some of these weeds are controlled on a local basis, depending on local threats and the feasibility of control.*

Common Name *Scientific Name* (Washington State Class*)	Kittitas County Segments A, B, C	Yakima County Segment C	Grant County Segments D, E, F	Benton County Segments D, E, F
Puncturevine *Tribulus terrestris* (Class B) Grant County *Education list* Benton County	-	--	HAN	HAN
Purple loosestrife *Lythrum salicaria* (Class B)	X YTC	X YTC	--	HAN
Rush Skeletonweed *Chondrilla juncea* (Class B)	--	--	X BLM	X
Scotch thistle *Onopordum acanthoides* (Class B)	YTC	X YTC	--	--
Sowthistle, perennial *Sonchus arvensis* (Class B)	YTC	YTC	--	--

X species name provided by County Weed Board staff
BLM species name provided by BLM personnel
YTC species name found within the YTC Management Plan
HAN species name provided by Hanford Reach National Monument personnel

3.4.4 Rare Plants

Rare plant species vary depending on the land ownership. Table 3.4-4, *Rare Species Addressed in Different Land Ownership Categories*, identifies land ownership categories and the status of species that will be considered within each of these categories.

For Your Information

The study area for rare plants includes an area 1 mile on either side of each of the segment centerline, for a total of a 2-mile-wide strip. To address known occurrences of rare plant species that may be directly impacted by project activities, occurrences in the "immediate area" of the proposed line are those within 500 feet on either side of the line.

***Extirpated** is a species that is no longer known to occur in a given geographic area.*

Table 3.4-4
Rare Species Addressed in
Different Land Ownership Categories

Land Ownership/Management Category	Status of Plant Species
BLM	BLM sensitive species which includes federally listed, proposed, and candidate species and state rare species
All federally managed lands except BLM lands	Federally listed, proposed, and candidate species, federal species of concern, state listed species.
State owned Lands	Federally listed, proposed, candidate species, and species of concern; state endangered, threatened, and sensitive species, and a state category that includes species that are possibly extinct or **extirpated** in Washington
Private Lands	Federally listed, proposed, and candidate species

Information gathered on rare plant species includes the location of known occurrences and potential habitat for rare plant species. Information on known occurrences, habitat preferences, and potential habitats of federally listed and candidate rare plant species are discussed below. Information on federal species of concern, BLM sensitive species, and state rare plant species includes known occurrences of these species within the study area.

3.4.4.1 Federal Listed Plants

The USFWS identified a federally listed threatened species and three federal candidate species with the potential to occur within the study area (USFWS, 2001). Table 3.4-5, *Federal Status Plant Species with the Potential to Occur in the Study Area*, lists the habitat and known occurrences of federal status species within the vicinity of the study area. These plants are also listed by the State of Washington (See Table 3.4-8, *Known Occurrences of Rare Plant Species*). A detailed description of these species is in Appendix E, *Vegetation*.

Table 3.4-5
Federal Status Plant Species with the Potential to Occur in the Study Area

Common Name *Scientific Name*	Federal Status	Habitat Preference and Plant Associations	Known Occurrence(s) in the Vicinity of the Study area
Ute ladies' tresses *Spiranthes diluvialis*	Threatened	Low elevation wetlands in valleys - associated with spikerush, sedges, grasses, and rushes	None
Northern wormwood *Artemesia campestris* var. *wormskioldii*	Candidate	Grows only within the floodplain of the Columbia River in relatively level, arid, shrub-steppe, on basalt, compacted cobble, and sand - associated with sagebrush and grasses	None within 1 mile of line segments. Several occurrences within the floodplain of the Columbia River, several miles south of the Segment B river crossing.
Basalt daisy *Erigeron basalticus*	Candidate	Grows in crevices in basalt cliffs on canyon walls facing north, east, or west, from 1,250 to 1,500 feet in elevation - associated with a few grass and forb species	None within 1 mile of line segments. Occurs within Kittitas and Yakima counties along the Yakima River and Selah Creek; within the YTC, approximately 10 miles west of Segment C.
Umtanum wild buckwheat *Eriogonum codium*	Candidate	Found on the exposed tops of a ridgeline that is composed of basalt, from 1,100 to 1,320 feet in elevation - associated with cheatgrass and a variety of forbs.	One known population, on part of Umtanum Ridge, in Benton County.

Potential habitat for federal listed and candidate species occurs within the study area. Potential habitat includes any areas that meet the known habitat requirements for that species. Table 3.4-6, *Habitat for Federal Listed Plant Species*, lists the project segments that may contain potential habitat for federally listed and candidate species.

Because limited information is available on known occurrences of rare plant species, a preliminary rare plant field survey was conducted in August 2001 to determine where potential rare plant habitat occurs along the Preferred Alternative and to locate late blooming federally listed and candidate species. No federally listed plants were identified. The results of this survey will be used to plan additional rare plant surveys during the spring of 2002.

Table 3.4-6
Habitat for Federal Listed Plant Species

Common Name *Scientific Name*	Segments With Potential Habitat for Federal Listed and Candidate Rare Plant Species					
	A	B	C	D	E	F
Ute ladies' tresses *Spiranthes diluvialis*	■			■	■	■
Northern wormwood *Artemesia campestris var. wormskioldii*		■		■	■	■
Basalt daisy *Erigeron basalticus*			■	■		
Umtanum wild buckwheat *Eriogonum codium*				■		

3.4.4.2 Federal Species of Concern

Five federal species of concern were identified by the USFWS (See Table 3.4-8, *Known Occurrences of Rare Plant Species*). These species are also listed by the State of Washington.

3.4.4.3 BLM Sensitive Species

The Wenatchee Resource Area of the Spokane BLM District provided the sensitive species list for BLM lands within each of the four counties within the study area (See Appendix E, *Vegetation*). Because detailed rare plant surveys have not been conducted on BLM lands within the study area, the BLM district botanist cautioned that it is impossible to determine with certainty which sensitive species might occur in the study area, without conducting field surveys (P. Camp, Pers. Comm. 2001).

The list of BLM sensitive species with the potential to occur along Segment F is included in Table 3.4-7, *BLM Sensitive Rare Plant Species*. The other project segments cross only a few sections or smaller portions of sections of BLM land than Segment F. Information on the species that might occur along project segments other than Segment F is not available from the BLM (Camp, Pers. Comm. 2001). For the Preferred Alternative, the BLM sensitive plant list will be narrowed down based on the habitat preferences to determine which species might occur in the geographic area. This list of BLM sensitive species with potential habitat along the Preferred Alternative will form the basis for the field surveys during the appropriate season in 2002.

Table 3.4-7
BLM Sensitive Rare Plant Species

Species Common Name *Scientific Name*	Habitat Requirements
Geyer's milk-vetch *Astragalues geyeri*	Occurs in depressions in mobile or stabilized dunes, sandy flats, and valley floors within grey rabbitbrush/Indian ricegrass communities.
Bristle-flowered collomia *Collomia macrocalyx*	Dry, open habitats, on talus, rock outcrops, and lithosols, in sparsely vegetated areas with a low species diversity; within sagebrush dominated communities.
Gray cryptantha *Cryptantha leucophaea*	Occurs in sandy areas, on slopes associated with big sagebrush, and grasses, including Indian ricegrass, needle-and-thread grass, Sandberg's bluegrass, cheatgrass, and various forb species.
Common blue-cup *Githopsis specularioides*	Open places at lower elevation, on thin soils over bedrock outcrops, talus slopes and gravelly areas.
Hoover's desert-parsley *Lomatium tuberosum*	Occurs in loose talus, typically on east and north-facing slopes, within big sagebrush/bluebunch wheatgrass communities; also found in talus in drainage channels on south-facing slopes.
Nuttall's sandwort *Minuartia nuttallii* var. *fragilis*	Sagebrush dominated hills to high elevation slopes, found mainly on gravelly benches or talus slopes.
Cespitose evening-primrose *Oenothera cespitosa ssp. cespitosa*	Occurs in open sites on talus or on rocky slopes and may colonize road cuts; associated with big sagebrush, occurs in sagebrush dominated communities associated with gray rabbitbrush, Sandberg's bluegrass, needle and thread grass, Indian ricegrass, Junegrass, and forbs.
Wanapum crazyweed *Oxytropis campestris* var. *wanapum*	Occurs on the summit of the Saddle Mountains, descending down the north slope; in deep sand in the big sagebrush/blue bunch wheatgrass community.
Texosporum santi-jacobi	A pin-head lichen that occurs on soils as part of biological crust.

3.4.4.4 Washington State Rare Plant Species

Known occurrences of state rare species within each segment, along lands of all ownership and management categories, are listed in Table 3.4-8, *Known Occurrences of Rare Plant Species*, (WNHP, 2001). Five of these species are listed as federal species of concern. All state lands along the Preferred Alternative will be surveyed for state-listed and sensitive rare plant species. The list of rare plant species for each county along the Preferred Alternative, maintained by the WNHP, will be used to determine the species that may have potential habitat along the Preferred Alternative.

3.4.4.5 Known Rare Plant Occurrences by Segment

There are no known occurrences of federally listed species along any of the project segments. A federal candidate species, Umtanum wild buckwheat, occurs near part of Segment D. Federal species of concern and state status species occur in the area of all project segments.

Table 3.4-8, *Known Occurrences of Rare Plant Species*, lists known occurrences of rare plant species by segment. Known occurrences within the "immediate area" of the proposed line are estimated to be within 500 feet of either or both sides of the proposed line. A detailed description of the rare plant species found along each segment is found in Appendix E, *Vegetation*.

Table 3.4-8
Known Occurrences of Rare Plant Species**

Common Name *Scientific Name*	Federal Status	State Status	Known Occurrences of Rare Plant Species Along Segments						
			A	B NORTH	B SOUTH	C	D	E	F
Umtanum wild buckwheat *Eriogonum codium*	Candidate	Endangered					■*		
Columbia milk-vetch *Astragalus columbianus*	Species of Concern	Threatened		■*	■	■*	■*		
Gray cryptantha *Cryptantha leucophaea*	Species of Concern	Sensitive		■			■*	■*	
Hoover's desert-parsley *Lomatium tuberosum*	Species of Concern	Threatened					■*	■*	■*
Persistentsepal yellowcress *Rorippa columbiae*	Species of Concern	Threatened					■*		
Hoover's tauschia *Tauschia hooveri*	Species of Concern	Threatened	■						
Dwarf evening-primrose *Camissonia pygmaea*	--	Threatened		■					■*
Pauper milk-vetch *Astragalus misellus var. pauper*	--	Sensitive	■						
Naked-stemmed evening-primrose *Camissonia scapoidea*	--	Sensitive		■	■				
Bristle-flowered collomia *Collomia macrocalyx*	--	Sensitive		■	■				
Beaked cryptantha *Cryptantha rostellata*	--	Sensitive	■	■	■				
Piper's daisy *Erigeron piperianus*	--	Sensitive					■*		■
Longsepal globemallow *Iliamna longisepala*	--	Sensitive	■						
Suksdorf's monkey-flower Mimulus suksdorfii	--	Sensitive	■*	■	■			■*	
Nuttall's sandwort *Minuartia nutallii var. fragilis*	--	Sensitive							
Tufted evening-primrose *Oenothera cespitosa ssp. cespitosa*	--	Sensitive		■*	■	■	■		

*Occurrence in the immediate vicinity (within approximately 500 feet) of segment
**Does not include federal status plants that also have state status.

3.5 Wildlife

Approximately 150 wildlife species (birds, mammals, reptiles, and amphibians) are known to occupy shrub-steppe habitat (Johnson and O'Neil, 2001), which represents the majority of available habitat within the study area (See Section 3.4, *Vegetation*, for a detailed discussion of habitat types in the study area). Shrub-steppe is one of the most heavily fragmented habitat types in Washington, and has been designated a Priority Habitat by the State of Washington.

Of the 150 wildlife species known to occupy shrub-steppe habitats, approximately 50 are closely associated with shrub-steppe habitat, and the remaining species use shrub-steppe habitat occasionally or incidentally. These 150 species, however, do not represent the total number of species that may exist within the proposed study area. For example, a study of the Hanford Site documented 195 bird species in the general area where the project is proposed (Nature Conservancy, 1999). Many of these species are associated with open water habitats along the Columbia River.

For a complete discussion of the species and habitats present within the project area See Appendix F, *Fish and Wildlife Technical Report*.

3.5.1 Segment A

Wildlife populations along Segment A are generally typical of shrub-steppe habitats. The area is used as wintering grounds by large herds of mule deer (WDFW 2001a). The riparian areas of Wilson and Naneum creeks provide winter roosting and foraging habitat for bald eagles. A sagebrush vole was sighted near Schnebly Canyon (WDFW 2001a). Colockum Creek Canyon is a migration corridor for the Quilomene elk herd. East of Cooke Canyon, a sharp tailed grouse sighting within 1 mile of the proposed line was recorded in 1981 (WDFW 2001a). The area east of Cooke Canyon is also known to harbor nesting long-billed curlews.

The riparian zone of Wilson-Naneum Creek, where Segment A crosses, is in good condition with mature cottonwoods and a diverse assemblage of riparian shrubs. ***Large woody debris recruitment potential*** is higher in this area than in most of the rest of the watershed, due to the presence of large cottonwoods. The high quality of this particular section of Wilson and Naneum Creeks can be attested to by the fact that the area supports a large number of wintering bald eagles. The bald eagles rely on the large cottonwood trees for roosting and may use the open water areas of the stream to catch fish.

➡ For Your Information

Large woody debris recruitment potential *is the potential for large trees to fall into the stream and provide fish habitat.*

For Your Information

Sage grouse gather in the spring at specific locations, called ***leks****.*

Sage grouse have been repeatedly observed in the area surrounding the proposed line (Clausing, 2001). A sage grouse ***lek*** was observed in 1983 less than 1 mile southwest of the southern end of Segment A. White-tailed jackrabbits have also been observed near the southern end of Segment A.

The potential reroute of a portion of Segment A will change the location of the proposed alignment slightly to the south, but will not cross any significantly different wildlife habitat than the original location. Species present along the proposed reroute are expected to be similar to those discussed for the original Segment A alignment.

3.5.2 Segment B (Options B_{NORTH} and B_{SOUTH})

The affected environments for Options B_{NORTH} and B_{SOUTH} are effectively the same and are referred to as B. Segment B crosses three distinct areas:

- The majority of the proposed line crosses through the shrub-steppe of the YTC;
- At the eastern end, the proposed line crosses the steep cliffs and narrow riparian area of the Columbia River;
- The Vantage Substation lies on a plateau at the top of the east bank of the Columbia River.

The WDFW has indicated that sage grouse may be present in the area surrounding Segment B (Clausing, 2001). Loggerhead shrike, sage thrashers, sage sparrows, and Swainson's hawks are also known to occur in the general vicinity of the proposed ROW (Stepniewski, 1998, U.S. Army, 1996, WDFW 2001a).

For Your Information

The ***Pacific Flyway*** *is the path of migration for many different species of birds.*

Neotropical *is the biogeographic region that extends south, east, and west from the central plateau of Mexico.*

Numerous species more often associated with wetlands and riparian habitats are found along Segment B, including ring-billed and California gulls, Caspian and Forster's terns, and Canadian geese. This section of the Columbia River is located within the ***Pacific Flyway,*** and during the spring and fall months the area serves as a resting point for ***neotropical*** migrants, migratory waterfowl, and shorebirds. During the fall and winter months, large numbers of migratory ducks (>100,000) and geese (>10,000) find refuge in the Wanapum reservoir (WDFW 2001a). Other species present during winter months include American white pelicans, double-crested cormorants, and common loons. Bald eagles winter along the Columbia River. An historical sighting of a desert nightsnake within 1 mile of the proposed project was made on the west shore of the Columbia River (WDFW 2001a).

The area surrounding the Vantage Substation contains a unique complex of basalt cliffs, sand dunes, shrub-steppe, and small wetlands. High-quality riparian vegetation exists within the wetland areas. Species of special note have been recorded as using the area surrounding the Vantage Substation, including the striped whipsnake and the desert nightsnake (WDFW 2001a). Bird species often found along the Columbia River (see the Columbia River discussion above) also utilize the wetland areas.

3.5.3 Segment C

Seven distinct areas characterize the habitat of this route:

- Northern YTC area;
- Saddle Mountains;
- Central YTC area (including four drainage complexes);
- Umtanum Ridge;
- Cold Creek;
- Yakima Ridge; and
- Dry Creek.

The area between the Saddle Mountains and Umtanum Ridge is home to approximately 70 percent of the YTC mule deer population (300-400 deer). The upland areas near Hanson Creek support over 75 percent of the breeding populations of loggerhead shrike on the YTC, and also support Swainson's hawks (U.S. Army, 1996). The Hanson Creek riparian area on both sides of the proposed ROW has documented bald eagle winter roost sites (WDFW, 2001a, U.S. Army, 1996). Lewis's woodpeckers are also known to exist in the Hanson Creek Riparian area (U.S. Army, 1996). The Alkali Canyon Complex supports an historic sage grouse lek and known populations of nesting prairie falcons (U.S. Army, 1996). Cliffs in Corral Canyon downstream of the proposed route also have documented prairie falcon nests (U.S. Army, 1996, WDFW, 2001a). Breeding burrowing owls were sighted approximately 1.5 miles southwest of the proposed route between Corral Canyon and Sourdough Canyon in 1993 and 1994, but the nest was unoccupied in 1995-1997 (WDFW 2001a). Sage sparrows have also been observed in the Corral Canyon area (U.S. Army, 1996). Long billed curlews have been observed in the Corral Canyon Complex near the proposed route (Stepniewski, 1998).

Breeding sage grouse have been observed on the flatter areas of the south side of Umtanum Ridge. Several leks are located less than 1 mile west of the proposed route (WDFW 2001a). The WDFW indicates that this is considered the core area of one of the two remaining sage grouse populations in Washington (Clausing, 2001 and Schroeder, et. al. 2000). Merriam's shrews were caught in research traps at the top of Umtanum Ridge near the proposed route (Wunder, et. al., 1994).

The Cold Creek canyon contains an important mixture of native shrub-steppe vegetation and riparian areas between the Hanford Reach National Monument area and the YTC, which acts as a corridor for wildlife moving to and from these locations. In addition, the Cold Creek canyon is one of the most important flyways in Washington for migrating birds (Stepniewski, 1998, Visser, 2001). Elk, deer, sage grouse, loggerhead shrike, and jackrabbits all use the Cold Creek canyon as a local migration corridor between the Hanford Reach National Monument and the YTC. Neotropical migrants, waterfowl, raptors, and many other bird species use the canyon as a migration corridor, as part of their longer journeys between regions north and south of Central Washington (Stepniewski, 1998). Many of these migrants may stop and temporarily use the riparian or upland habitats. Breeding Swainson's hawks and loggerhead shrikes have been documented within 1 mile of the proposed route (WDFW, 2001a, U.S. Army, 1996).

The entire eastern end of Yakima Ridge is considered a part of the Cold Creek migration corridor. On the south side of the ridge, a breeding prairie falcon was observed in 1988 within 1 mile of the proposed route (WDFW 2001a). Multiple sightings of breeding burrowing owls have been made in an area adjacent to where the proposed route crosses Highway 24 (WDFW 2001a).

Segment C terminates at the new Wautoma Substation just south of Yakima Ridge. The only documented species of note is a breeding colony of burrowing owls located approximately 0.5 mile southwest of the proposed substation (Corkran, 2001). Prime wintering habitat for the Hanford elk herd is located several miles east of the site along Dry Creek. It is likely that the Hanford elk herd, unique among elk herds because it exists exclusively in shrub-steppe habitat, could travel as far upstream as the proposed substation, since the numbers of elk have dramatically increased over the past several years and numerous reports of straying animals have been documented (WDFW, 2000).

3.5.4 Segment D

This proposed route segment crosses ten distinct areas:

- Vantage Substation area;
- Beverly area;
- Lower Crab Creek;
- Saddle Mountains;
- The Wahluke Slope;

- The Columbia River;
- Umtanum Ridge;
- Cold Creek drainage;
- Yakima Ridge; and
- Dry Creek.

The proposed route would enter the new Wautoma Substation area from the north. This area was discussed in the previous section (Section 3.5.3, *Segment C*).

Nightsnakes and striped whipsnakes have been documented adjacent to Segment D near the Vantage Substation. Bird species associated with the Columbia River may be incidental visitors to this area.

The Lower Crab Creek area is one of the most important waterfowl breeding grounds in Washington (Clausing, 2001). Many bird species also use the open water and wetlands for resting and feeding during their annual migrations along the Pacific Flyway. Beaver are found in some open water areas.

The Saddle Mountains area provides a variety of wildlife habitats including cliffs, talus slopes, benches, open grassy slopes, and shrub-steppe habitats. The steep north side has many steep rocky outcroppings, mostly located on the top third of the slope. Habitat for bats and raptors is abundant here. The crest of the Saddle Mountains has a unique dwarf shrub-steppe vegetation community with a number of rare plant species (Fisher, 2001). The south side contains some high-quality shrub-steppe vegetation that is relatively undisturbed. A designated sage grouse movement corridor exists along the south slope of the Saddle Mountains, although no sage grouse have been observed recently in the area (Schurger, 2001, Visser, 2001).

Large populations of Brewer's vesper, sage sparrows, sage thrasher, and other passerine bird species can be found in the spring and summer on the south side of the Saddle Mountains. The cliffs on the north and west side are home to many raptor species, including red-tailed, Swainson's, ferruginous and rough-legged hawks; prairie falcons; American kestrels; bald and golden eagles, and ravens. A golden eagle nest site is located less than 1 mile west of the proposed line in the Sentinel Bluffs, which lie above and just east of the Columbia River (WDFW 2001a). A prairie falcon nest site is located on the north slope of the Saddle Mountains just below the crest within 0.25 mile of the proposed line (WDFW 2001a). A striped whipsnake was sighted at the crest of the Saddle Mountains near the proposed line in 1979 (WDFW 2001a).

In the Wahluke Slope, mammal species present are limited to those that can tolerate high levels of disturbance, such as coyotes, raccoons, and a variety of rodent species. Structures such as barns and sheds provide roosting habitat for a number of bat species. Bird species present on the Wahluke Slope are also limited to those species that can tolerate high levels of human disturbance. Pheasant and quail utilize croplands. Red-winged and yellow-headed blackbirds may use the limited wetland areas associated with irrigation practices. Near the southern end of the area, a breeding loggerhead shrike was observed within 1 mile of the proposed route in 1993 (WDFW 2001a).

Like the Columbia River crossing described in Segment B, this section supports large numbers of wintering waterfowl and is located within the Pacific Flyway. During the spring and fall months it serves as a resting point for neotropical migrants, migratory waterfowl, and shorebirds. Bald eagles are present throughout the Hanford Reach during the winter, and feed on waterfowl and salmon carcasses. Several Swainson's hawk nests have been documented on the China Bar south of the Columbia River approximately 1 mile east of the proposed route (WDFW 2001a).

The cliffs of the north side of Umtanum Ridge harbor a large number of raptor species. Segment D passes close to a known prairie falcon nest. Other known prairie falcon nests are located within 1 to 2 miles on both sides of the proposed route (WDFW 2001a). A loggerhead shrike was sighted at the crest of Umtanum Ridge in 1994 (WDFW 2001a). On the south slope of Umtanum Ridge, a Swainson's hawk nest was observed in 1990 within the proposed route (WDFW 2001a). Three other Swainson's hawk nests are located within 1 mile of the proposed route (WDFW 2001a).

The broad valley of Cold Creek in this area contains a mixture of grassy shrub-steppe and agriculture. Cold Creek itself does not contain much riparian habitat in this area, but does have areas of relatively undisturbed shrub-steppe vegetation. As discussed in Segment C, Cold Creek acts as an important migration corridor of relatively undisturbed shrub-steppe habitat between the YTC and the Hanford Site along Cold Creek. The Cold Creek Valley is also a major bird migration corridor.

The Cold Creek migration corridor is used by elk, mule deer, sage grouse, jackrabbits, songbirds, and other animals traveling between the YTC and the Hanford Site (WDFW, 2001a, Clausing, 2001, Stepniewski, 1998). Neotropical migrants, waterfowl, raptors, and many other bird species use the canyon as a migration corridor as part of their longer journeys between regions north and south of Central Washington (Stepniewski, 1998). Many of these migrants may stop and temporarily use the upland habitats. Nesting burrowing owls have been observed next to the proposed route near Highway 24 (WDFW 2001a). Prairie falcons, golden eagles, Swainson's hawks and Lewis' woodpeckers have all been observed using the Cold Creek valley for nesting or foraging near the proposed route crossing (Stepniewski, 1998).

3.5.5 Segment E

This proposed route segment crosses ten distinct areas:

- Vantage Substation area;
- Beverly area;
- Lower Crab Creek;
- Saddle Mountains;
- The Wahluke Slope;
- Hanford Reach National Monument/Columbia River;
- Umtanum Ridge;
- Cold Creek drainage;
- Yakima Ridge; and
- Dry Creek.

Segment E crosses the Vantage Substation, the Beverly area, Lower Crab Creek and the Saddle Mountains parallel to Segment D. It then crosses the Wahluke Slope through areas similar to those crossed by Segment D. The wildlife species and habitats in these areas have been discussed in the previous section (Section 3.5.4, *Segment D*).

In the northern part of the Hanford Reach National Monument where Segment E crosses Highway 24, burrowing owls have been observed (WDFW, 2001a). Near Saddle Mountain Lake, many observations of Woodhouse's Toads have been made. A herd of approximately 70 mule deer exists in the area east and south of Saddle Mountain Lake (WDFW, 2001a, Haas, 2001, Corkran, 2001). Closer to the Columbia River near the Saddle Mountain Wasteway, nesting Swainson's hawks and great blue herons have been observed. Sagebrush lizards and nightsnakes have been documented near the proposed ROW (Nature Conservancy, 2001). Sagebrush voles and pygmy rabbits are also known to exist in the Hanford Reach National Monument area near the proposed Segment E (Brunkal, 2001).

As with the rest of the Columbia River in central Washington, hundreds of thousands of waterfowl use the open water habitats and wetlands near proposed Segment E as breeding areas, over wintering areas, or stopovers on spring and fall migrations. These species, as well as neotropical migrants, may be present in or near the river. Communal bald eagle roosts are located within 3 miles of each side of the proposed crossing.

3.5.6 Segment F

The proposed line crosses the following distinct areas:

- Vantage area;
- Lower Crab Creek;
- Saddle Mountains
- The Wahluke Slope;
- Hanford Reach National Monument; and
- The Columbia River.

Near the Vantage area, an observation of an Ord's kangaroo rat caught in a trap was made in 1987 within the proposed ROW (see the Lower Crab Creek discussion below for more information on Ord's kangaroo rat). A ferruginous hawk nest was observed in 1995, approximately 1 mile east of Segment F (WDFW 2001a).

Segment F crosses Lower Crab Creek approximately 1 mile east of where proposed Segments D and E would cross. More extensive wetlands, including Nunnally Lake, are present in this area than exist near Segments D and E. As discussed in the Segment D section, Lower Crab Creek and its associated wetlands and riparian areas are among the most important waterfowl breeding grounds in Washington. Nunnally Lake is an important habitat for waterfowl. An area of sand dunes and willows exists just north of Lower Crab Creek.

Nunnally Lake supports a large population (3,000 to 4,000) of wintering ducks. Quail have been observed using the varied habitats along the valley bottom. Also, within 0.5 mile of the proposed line, a number of Ord's kangaroo rats were caught in 1996 and 1997 (Gitzen, et. al., 2001). This sighting and the observation, made in 1987, 2 miles north of Lower Crab Creek (see the preceding Vantage Area discussion) are significant because they represent new sightings in areas where this species was not previously recorded.

The habitats and species of the western end of the Saddle Mountains where Segment F crosses were described in discussions of Segments D and E. Where Segment F turns east and follows the lower slope of the Saddle Mountains, different habitat conditions are encountered. On the south slope, the vegetation community changes from a sagebrush-dominated community on the west end to a grass-dominated community on the east end. A number of canyons intersect the south slope, providing some rocky outcrop and talus slope habitats. No observations of unique wildlife species have been made in this area, however this may be due to the extremely limited access in the area. WDFW reports that sage grouse were historically present along the Saddle Mountains, and that the relatively intact shrub-steppe vegetation is still considered a migration corridor between the YTC and areas east of the Saddle Mountains (Clausing, 2001, Fisher, 2001). In addition, species such as prairie falcons, ferruginous hawks and loggerhead shrikes have been observed on the crest and the north slope of the Saddle Mountains, within several miles of the proposed line. The area surrounding the proposed ROW near the eastern most end of segment F supports one of the largest contiguous areas of occupied habitat for sage sparrows in Washington (Nature Conservancy, 1999).

South of Highway 24, the proposed Segment F drops over a steep slope approximately 200 feet into a large depression that contains Saddle Mountain Lake to the west. At the south end of the depression, the line intersects with proposed Segment E, and crosses the Columbia River. Near the top of this slope, a Swainson's hawk nest was observed near Segment F (WDFW, 2001a). A herd of approximately 40 mule deer was observed in the central part of the depression (Corkran, 2001). Near the southern end of the proposed segment, immature sage sparrows were observed within 1 mile of the proposed line in 1987 (WDFW, 2001a). Sagebrush lizards and nightsnakes have been documented near the proposed route (Nature Conservancy, 2001).

The proposed Segment F route crossing of the Columbia River follows the same alignment as Segment E. Wildlife habitats and species are the same as discussed in Segment E.

3.5.7 Threatened and Endangered Species

Four federally listed threatened, endangered, and proposed species were identified by USFWS as possibly occurring in the study area (See Table 3.5-1, *Possible Presence of State and Federal Listed Species Within Project Area*). These include the bald eagle, the Washington ground squirrel, the Mardon skipper, and the sage grouse. A detailed discussion of each species is presented in Appendix F, *Fish and Wildlife Technical Report.*

3.5.8 Federal Species of Concern and State Listed Species

A list of state and federal listed wildlife species that are known to exist within the four counties crossed by the proposed project is presented in Table 3.5-1, *Possible Presence of State and Federal Listed Species Within Project Area*. Table 3.5-1, *Possible Presence of State and*

Federal Listed Species Within Project Area, indicates which of these species could possibly occur along each line segment.

Table 3.5-1
Possible Presence of State and Federal Listed Species Within Project Area

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Document Occurrence Type
Birds				
Aleutian Canada goose	FSC	ST	B, D, E, F	M
Bald eagle	FT	ST	All segments	W
Golden eagle		SC	B, C, D, E, F	B
Ferruginous hawk	FSC	ST	All segments	B
Swainson's hawk		SM	All segments	B
Northern goshawk	FSC	SC	All segments	M
Peregrine falcon	FSC	SE	C, D, E, F	B
Swainson's hawk		SM	All segments	B
Osprey		SM	B, D, E, F	B
Prairie falcon		SM	All segments	B
Turkey vulture		SM	B, D, E, F	B
Prairie falcon		SM	C, D, E, F	B
Burrowing owl	FSC	SC	C, D, E, F	B
Northern Spotted Owl	FT	SE	None	N
Lewis' woodpecker		SC	A, C, D, E, F	B
Sage sparrow		SC	All segments	B
Sage thrasher		SC	All segments	B
Loggerhead shrike	FSC	SC	All segments	B
Long-billed curlew	FSC	SM	A, C, E, F	B
Western bluebird	FSC	SM	All segments	B
Ash-throated flycatcher	FSC	SM	None	N
Olive sided flycatcher	FSC		All segments	P
Little Willow flycatcher	FSC		All segments	P
Grasshopper sparrow	FSC	SM	C, E, F	B
Western sage grouse	FC	ST	A, C, F	B
Sharp tailed grouse	FSC	ST	None	H
American white pelican		SE	B, D, E, F	M
Harlequin duck	FSC		B, D, E, F	P
Common loon		SS	B, D, E, F	M
Marbled murrelet	FT	ST	None	N
Black tern	FSC	SM	B, D, E, F	M
Caspian tern		SM	B, D, E, F	M
Forster's tern		SM	B, D, E, F	M
Great blue heron		SM	B, D, E, F	B
Black-crowned night heron		SM	B, D, E, F	B
Mammals				
Gray wolf	FE	SE	None	N
Canada lynx	FT	ST	None	N
Grizzly bear	FT	SE	None	N

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Document Occurrence Type
California bighorn sheep	FSC		B, D, E, F	P
Pacific fisher	FSC	SE	None	N
Wolverine	FSC	SC	None	N
Western gray squirrel	FSC	ST	None	N
Washington ground squirrel	FC	SC	D, E, F	H
Pygmy rabbit	FSC	SE	None	H
Ord's kangaroo rat		SM	B, D, E, F	P
Northern grasshopper mouse		SM	All segments	P
Sagebrush vole		SM	All segments	P
White-tailed jackrabbit		SC	All segments	B
Merriam's shrew		SC	All segments	B
Ord's kangaroo rat		SM	All segments	B
Potholes meadow vole	FSC		None	N
Sagebrush vole		SM	All segments	B
Pacific western big-eared bat	FSC	SC	All segments	P
Long-eared myotis	FSC	SM	All segments	P
Long-legged myotis	FSC	SM	All segments	P
Fringed myotis	FSC	SM	All segments	P
Western small-footed myotis	FSC	SM	All segments	P
Yuma myotis	FSC		All segments	P
Pallid bat		SM	All segments	P
Insects				
Mardon skipper	FC	SE	None	N
Persius' duskywing		SM	E	P
Reptiles & Amphibians				
Cascades frog	FSC		None	N
Larch Mountain salamander	FSC	SS	None	N
Northern leopard frog	FSC	SE	D, E, F	P
Red-legged frog	FSC		None	N
Tailed frog	FSC	SM	None	N
Spotted Frog	FSC	SE	All segments	P
Night snake		SM	B, D, E, F	P
Woodhouse's Toad		SM	E, F	B
Sagebrush lizard	FSC		All segments	B
Night snake		SM	All segments	B
Striped whipsnake		SC	All segments	B

Source: US Fish and Wildlife County Species Lists for Benton, Grant, Kittitas and Yakima Counties

Federal Status
FE = Endangered
FT = Threatened
FC = Candidate
FSC = Species of Concern

State Status
SE = Endangered
ST = Threatened
SS = Sensitive
SC = Candidate
SM = Monitor

Presence
P = Present (general presence)
B = Breeding
M = Migrant
W = Winter Resident
N = Not Present
H = Historically Present, Not Present Now

3.6 Fish Resources

The study area includes creeks, lakes, and other water bodies that may support fish. Only streams or water bodies with perennial flows that are affected by the project are discussed (See Map 6, *Fisheries*). Some intermittent streams may have fish present at times during the year, but usually in limited areas near a source of perennial water.

The most significant fish resources found within the study area are endangered anadromous salmonids such as salmon and steelhead. These fish are born and reared in small streams, then migrate down the Columbia River to the ocean. After several years in the ocean, they migrate upstream back to their native streams to spawn. Resident salmonids such as bull trout and rainbow trout are also important resources, as are a number of other cold and warm water fish species.

3.6.1 Segment A

➡ For Your Information

Headwater *refers to the source of the river.*

Segment A crosses eight fish-bearing streams that drain the Wenatchee Mountains north of the study area. The major fish issue facing these streams is the lack of access between the Yakima River and the ***headwater*** areas due to obstructions from irrigation and agricultural operations in the lower sections.

3.6.1.1 Wilson-Naneum Creek Crossing

Anadromous *fish are ones that migrate up rivers from the sea to breed in fresh water.*

Salmonid *means belonging to the family Salmonidea, including salmon, trout, and whitefish.*

Non-anadromous *fish are ones that do not migrate to the sea and back during their life cycle.*

The Wilson-Naneum Creek Complex is one of the more productive small streams in the study area. Fish species present here include steelhead, spring Chinook salmon, western brook lamprey, rainbow trout, cutthroat trout, brook trout, mountain whitefish, three-spine stickleback, speckled dace, longnose dace, bridgelip sucker, mountain sucker, redside shiner, and torrent sculpin (WDFW, 2001). There are currently no adult ***anadromous salmonids*** or lamprey spawning in the upper part of the creek due to obstructions, but migratory juvenile salmonids use the lower 2.1 miles as rearing habitat. At the site of the proposed crossing, there are no anadromous fish present, however the ***non-anadromous*** species mentioned above are likely to be present.

Since the proposed crossing is at the very upper edge of the Kittitas Valley, the stream at this point is relatively unaffected by irrigation withdrawals and other agricultural activities. The habitat conditions near the proposed crossing are good, with clean substrate and good instream flows.

3.6.1.2 Schnebly Creek Crossing

Schnebly Creek is a small stream with little suitable fish habitat near the study area. In its upper reaches, the stream supports rainbow trout (WDFW, 2001a), but it is unlikely to harbor fish where the proposed line crosses it.

3.6.1.3 Coleman Creek Crossing

Fish species present in Coleman Creek are similar to those in Wilson and Naneum Creeks and include steelhead, spring Chinook salmon, western brook lamprey, rainbow trout, cutthroat trout, brook trout, mountain whitefish, three-spine stickleback, speckled dace, longnose dace, bridgelip sucker, mountain sucker, redside shiner, and torrent sculpin. Bull trout were last observed in 1970 (WDFW, unpub.). Coleman Creek has been channelized and diverted into Naneum Creek and no longer has its natural mouth. There are currently no adult anadromous salmonid spawning in this creek due to obstructions, but migratory juvenile salmonids use the lower 0.5 mile as rearing habitat.

The lower reach of Coleman Creek has some of the best salmonid rearing habitat in the northern Kittitas Valley area. Higher upstream, the riparian zone of the valley portions of this stream is extensively impacted by grazing and other agricultural practices. The proposed crossing of Coleman Creek is just above the Kittitas Valley floor. The stream flows through a shallow canyon with a narrow riparian area. Stream habitat is good, with clean substrates, good water quality and good year-round flows. WDFW PHS data (WDFW, unpub.) indicates that fish are present only from the mouth upstream to a point approximately 2 miles below where the proposed line crosses. However, Renfrow (2001), and WDFW (unpub.) have indicated that the stream near the proposed crossing probably contains many of the species present lower in the system, except anadromous fish.

3.6.1.4 Cooke Canyon Creek Crossing

Fish species present in Cooke Canyon Creek include rainbow trout, cutthroat trout, and brook trout. No anadromous salmonids are present due to downstream obstructions (WDFW, unpub.).

Segment A crosses Cooke Canyon Creek at Coleman Canyon Road. The stream is divided into multiple small channels in this area. A good riparian area with large cottonwoods and willows exists upstream of Coleman Canyon Road. Downstream of the road, the riparian vegetation consists of smaller shrubs and trees. Stream flow is good in this area, although the split channels may limit available fish habitat. Stream substrate appears clean and the riparian areas are good, although livestock are present in the area upstream of the crossing. Like Coleman Creek, the WDFW PHS data (2001a) indicates that fish species are probably only present downstream several miles from the proposed crossing. However, Renfrow (2001) indicated that the three trout species were probably present higher in the drainage above the study area, and may be present where the proposed line crosses.

3.6.1.5 Caribou Creek Crossing

Fish species present in Caribou Creek are probably limited to rainbow trout (WDFW, 2001a, WDFW unpub.). No anadromous salmonids are present due to downstream obstructions. Segment A crosses Caribou Creek adjacent to a large cultivated field. The creek here is very narrow, with a marginal riparian area and low flows. Fish habitat is marginal and it is unlikely that rainbow trout are present in large numbers in this area.

3.6.1.6 Parke Creek Crossing

Fish species present in Parke Creek are probably limited to rainbow trout (WDFW, 2001a, WDFW unpub.). No anadromous salmonids are present due to downstream obstructions. Segment A spans Parke Creek from high ridges on either side of it. The creek here is narrow and possibly intermittent, with a marginal riparian area. It is unlikely that rainbow trout are present in this reach of Parke Creek.

3.6.1.7 Cooke Canyon Crossing (Segment A Reroute)

Segment A reroute crosses Cooke Canyon Creek approximately 0.3 mile south of the original Segment A crossing at Coleman Canyon Road. The stream is divided into multiple small channels in this area. The stream flows through an open shrub-steppe area with very little riparian vegetation present. Stream flow is good in this area, although the split channels may limit available fish habitat. Like the Segment A crossing, it is possible that rainbow, cutthroat, or brook trout may be encountered near where the project crosses Cooke Canyon Creek (Renfrow, 2001). No anadromous fish are present this high in Cooke Canyon Creek (WDFW, unpub.).

3.6.2 Segment B

The affected environments for Options B_{NORTH} and B_{SOUTH} are very similar and are discussed together as Segment B. The proposed project would cross two perennial drainages and the Columbia River between the northern end of Segment C and the Vantage Substation. The perennial drainages drain the northeastern corner of the YTC. Extensive past grazing, military maneuvers and other disturbances have caused changes in flow regimes and a general reduction in the quality of fish habitat within the two perennial drainages.

3.6.2.1 Middle Canyon Creek

The only documented fish species in Middle Canyon Creek is rainbow trout (U.S. Army, 1996). However, the proposed line crosses the intermittent headwaters area of Middle Canyon, where no trout habitat is available.

3.6.2.2 Johnson Creek

Fish species present in Johnson Creek include rainbow trout, possibly steelhead, Chinook salmon, three-spine stickleback, prickly sculpin, large scale sucker, and redside shiner (U.S. Army, 1996). Chinook salmon utilize only the lower end of the creek near the Columbia River for juvenile rearing, and steelhead may be present in the lower reaches (Renfrow, 2001).

Base flows in Johnson Creek are low, due to an increase in storm runoff and a reduction in infiltration caused by compacted unvegetated soils from years of cattle grazing and military land uses. A general lack of riparian vegetation, coupled with low base flows, causes high water temperatures during the warmer months. This may limit the distribution of some fish species, particularly salmonids.

Segment B crosses in the middle reach of Johnson Creek, thus anadromous salmonids are unlikely to be present, although the other species known to exist in the creek are likely to be present.

3.6.2.3 Columbia River Crossing

The Columbia River hosts approximately 40 species of fish. Chinook salmon, sockeye salmon, steelhead, and Pacific lamprey use the Columbia River near the river crossing as a migration corridor between the ocean and upstream spawning areas, and for spawning and rearing. Fish commonly pursued for sport include whitefish, small-mouth bass, sturgeon, catfish, walleye and perch. Rough fish such as squawfish, carp, suckers, and shiners are also present in large numbers (USDOE, 1999).

The Wanapum dam ***tailrace***, located directly underneath the proposed crossing, is an important fall Chinook salmon spawning area (USDOE, 1999). The Columbia River is on the 303(d) list for high temperature, pH levels, and dissolved gas.

➡ For Your Information

Tailrace *is the part of the millrace below the turbine through which the spent water flows.*

3.6.3 Segment C

Segment C crosses six major drainages, all of which drain the interior of the YTC directly to the Columbia River. Fish are present in five of the six drainages crossed (no fish are present in Cold Creek).

3.6.3.1 Middle Canyon Creek

The crossing of Middle Canyon Creek is similar to that discussed in Segment B_{SOUTH}.

3.6.3.2 Johnson Creek

Fish species present in Johnson Creek include rainbow trout, possibly steelhead, Chinook salmon, three-spine stickleback, prickly sculpin, large scale sucker, and redside shiner (U.S. Army, 1996). Chinook salmon utilize only the lower end of the creek near the Columbia River for juvenile rearing. Steelhead may be present in the lower reaches of Johnson Creek (Renfrow, 2001). Segment C crosses in the middle reach of Johnson Creek; thus, anadromous salmonids are unlikely to be present, although the other species known to exist in the creek are likely to be present.

3.6.3.3 Hanson Creek

Fish species present in Hanson Creek include eastern brook trout and fall Chinook (U.S. Army, 1996). Chinook salmon utilize only the lower reach of the creek near the Columbia River for juvenile rearing, and are not present near the proposed crossing.

3.6.3.4 Alkali Canyon Creek

Fish species present in Alkali Canyon Creek include rainbow trout, eastern brook trout, and fall Chinook (U.S. Army, 1996). Chinook salmon utilize only the lower reach of the creek near the Columbia River for juvenile rearing, and are not present near the proposed crossing.

3.6.3.5 Corral Canyon Creek

Chinook salmon is the only fish species present in Corral Canyon Creek. They only utilize the lower reach of the creek near the Columbia River for juvenile rearing, and are not present near the proposed crossing (U.S. Army, 1996).

3.6.3.6 Cold Creek

No fish are known to be present in Cold Creek.

3.6.4 Segment D

Segment D crosses three drainages: Lower Crab Creek, the Columbia River, and Cold Creek. A series of irrigation canals and drains are crossed on the Wahluke Slope, however these are not considered fish habitat. Depending on conditions and the availability of stable flows, fish could exist temporarily in some canals, but would most likely be introduced by humans or carried by birds from other water bodies and would not continue to thrive.

3.6.4.1 Lower Crab Creek

Fish species present in Lower Crab Creek include rainbow trout, brown trout, Chinook salmon, and possibly a remnant steelhead population (WDFW, 2001a, Renfrow, 2001). Segment D crosses the extreme lower reach of Lower Crab Creek just upstream of its confluence with the Columbia River. Lower Crab Creek could be used by most of the 40 Columbia River fish species on a temporary basis as well.

3.6.4.2 Columbia River

The Columbia River is habitat for approximately 40 species of fish. Like the Segment B crossing, Chinook salmon, sockeye salmon, steelhead, and Pacific lamprey use the Columbia River near the river crossing as a migration corridor to upstream spawning areas and for spawning and rearing. Fish commonly pursued for sport include whitefish, small-mouth bass, sturgeon, catfish, walleye and perch. Rough fish such as squawfish, carp, suckers, and shiners are also present in large numbers (USDOE, HCP EIS, 1999).

The area directly under the Segment D crossing, just upstream from the Vernita Bridge, is an important spawning area for fall Chinook salmon. This area represents the northern extent of the naturally spawning Hanford Reach population of fall Chinook, which is approximately 50-60 percent of the total fall Chinook runs in the Columbia River (USDOE, HCP EIS, 1999).

3.6.4.3 Cold Creek

No fish are known to be present in Cold Creek in the vicinity of the Segment D crossing.

3.6.5 Segment E

Segment E crosses two lakes and only two major drainages: Lower Crab Creek and the Columbia River. Like Segment D, a series of irrigation canals and drains are crossed on the Wahluke Slope, however these are not considered to be fish habitat.

3.6.5.1 No Wake Lake

No Wake Lake is a private constructed lake just north of Lower Crab Creek used for water skiing. It contains warm water species of fish.

3.6.5.2 Lower Crab Creek

Segment E crosses Lower Crab Creek several hundred feet upstream of proposed Segment D. Fish habitat and species are similar to those discussed in the Segment D section.

3.6.5.3 Saddle Mountain Lake

Saddle Mountain Lake contains only warmwater fish species such as yellow perch, pumpkinseed, bluegill, and crappie.

3.6.5.4 Columbia River

Segment E crosses the Hanford Reach of the Columbia River. The fish species and habitats are similar to the crossing described for Segment D.

3.6.6 Segment F

Segment F crosses one lake and only two major drainages: Lower Crab Creek and the Columbia River. However, unlike Segments D and E, each drainage has wetland areas and ponds associated with each of these crossings.

3.6.6.1 Nunnally Lake

Nunnally Lake is a pothole lake in the Lower Crab Creek valley. It is a high-use recreational area. Rainbow trout are stocked for sport fishing purposes. Warmwater species such as yellow perch, pumpkinseed, bluegill, and crappie may be present.

3.6.6.2 Lower Crab Creek

Segment F crosses Lower Crab Creek several hundred feet upstream of proposed Segment D and E. Fish habitat and species are similar to those discussed in the Segment D.

3.6.6.3 Columbia River

Segment F crossing of the Columbia River uses the same alignment as proposed Segment E, and has similar fish habitat and species to those discussed in Segment D.

For Your Information

*An **Evolutionarily Significant Unit (ESU)** is a population of a species with a distinct evolutionary history as defined by the National Marine Fisheries Service.*

*A **Distinct Population Segment (DPS)** is a population of a species with a distinct evolutionary history as defined by the U.S. Fish and Wildlife Service.*

3.6.7 Threatened and Endangered Species

The project area is within the range of three species (which includes three **Evolutionarily Significant Units**, or ESU's and one **Distinct Populations Segment**, or DPS) of threatened or endangered fish: Upper Columbia River spring-run Chinook salmon, Upper Columbia River steelhead, Middle Columbia River steelhead, and bull trout (See Table 3.6-1, *Fish Species Presence*, for their distribution within the project area). A full description of these species can be found in Appendix F, *Fish and Wildlife Technical Report*.

Table 3.6-1
Fish Species Presence

Perennial Water Name[1]	Segment Intercepting Waterbody						Fish Species Present In Waterbody[2]	Comments
	A	B	C	D	E	F		
Wilson Creek	X						Chinook salmon (Federal Endangered, State Candidate), Mountain sucker (State Candidate), Rainbow trout, Cutthroat trout, Brook Trout, Mountain whitefish, 3-Spine stickleback, Speckled dace, Longnose dace, Redside shiner, Torrent sculpin, Brook lamprey	Wilson Creek has high quality fish habitat in the project area. Chinook salmon are only present in the lowest mile of the creek, and not in the project area. Mountain suckers are probably found in the project area.
Naneum Creek	X						**Chinook salmon (Federal Endangered, State Candidate)**, **Mountain sucker (State Candidate)**, Rainbow trout, Cutthroat trout, Brook Trout, Mountain whitefish, 3-Spine stickleback, Speckled dace, Longnose dace, Redside shiner, Torrent sculpin, Brook lamprey	Naneum Creek has high quality fish habitat in the project area. Chinook salmon are only present in the lowest mile of the creek, and not in the project area. Mountain suckers are probably found in the project area.
Cave Canyon Creek	X						None	Fish habitat is present, but fish are not documented in this creek.
Schnebly Creek	X						Rainbow trout	Rainbow trout are present in the project area.
Coleman Creek	X						**Chinook salmon (Federal Endangered, State Candidate)**, **Bull trout (Federal Threatened, State Candidate)**, Rainbow Trout	Chinook salmon habitat is high quality, but limited to the lowest three miles of the stream. Bull trout have not been observed since 1970.
Cooke Canyon Creek	X						Rainbow trout, Cutthroat Trout, Brook trout	Cooke Canyon Creek is split into several small channels in the project area, which may limit the available fish habitat.
Caribou Creek	X						Rainbow trout	Caribou Creek has marginal fish habitat in the project area.
Parke Creek	X						Rainbow trout	Rainbow trout are present in the project area.
Middle Canyon Creek		X					Rainbow trout	Project crosses the intermittent headwaters of Middle Canyon Creek. It is unlikely that habitat in this area is utilized by fish.
Johnson Creek		X	X				**Chinook salmon (Federal Endangered, State Candidate)**, **Steelhead trout (Federal Endangered/Threatened, State Candidate)**, Rainbow trout, 3-Spine stickleback, Prickly sculpin, Large scale sucker, Redside shiner	Juvenile Chinook salmon only use the lowest reach of the stream for resting as they migrate down the Columbia River. Steelhead may spawn and rear in the lowest reach near the mouth. Resident fish habitat is degraded in the project area due to military operations, grazing and fires, but fish are present.
Hanson Creek			X				**Chinook salmon (Federal Endangered, State Candidate)**, Rainbow trout, Brook trout	Juvenile Chinook salmon only use the lowest reach of the stream for resting as they migrate down the Columbia River. Resident fish habitat is degraded in the project area due to military operations, grazing and fires, but fish are present.

Perennial Water Name[1]	Segment Intercepting Waterbody						Fish Species Present In Waterbody[2]	Comments
	A	B	C	D	E	F		
Alkali Canyon Creek			X				**Chinook salmon (Federal Endangered, State Candidate)**, Rainbow trout, Brook trout	Juvenile Chinook salmon only use the lowest reach of the stream for resting as they migrate down the Columbia River. Resident fish habitat is degraded in the project area due to military operations, grazing and fires, but fish are present.
Corral Canyon Creek			X				**Chinook Salmon (Federal Endangered, State Candidate)**	Juvenile Chinook salmon only use the lowest reach of the stream for resting as they migrate down the Columbia River. Resident fish habitat is degraded in the project area due to military operations, grazing and fires, and fish are not present.
Cold Creek			X	X			None	Cold Creek is intermittent in the project area, and no fish are present.
Crab Creek				X	X	X	**Chinook salmon (Federal Endangered, State Candidate), Steelhead trout (Federal Endangered/Threatened, State Candidate)**, Rainbow trout, Brown trout, Various warmwater fish species	Crab Creek supports a wide variety of fish, including many of those found in the Columbia River.
Nunnally Lake						X	Rainbow trout, various warmwater species	Nunnally Lake is stocked with Rainbow trout for sportfishing.
Saddle Mountain Lake				X	X		Various warmwater species	Saddle Mountain Lake is an irrigation return flow lake.
Columbia River		X		X	X	X	**Chinook salmon (Federal Endangered, State Candidate)**, **Steelhead trout (Federal Endangered/Threatened, State Candidate)**, **Pacific lamprey**, Brook lamprey, Various warmwater species (40 different species all together)	The Columbia River supports approximately 40 different species of fish, and is the major migration corridor for anadromous species.

[1] Only streams or lakes that contain water year around are listed here.

[2] Fish species that may be present in the waterbody. In some cases fish may be present somewhere in the waterbody, but not where the proposed project crosses it. Bold species are federal or state listed species.

3.7 Land Use

The study area is defined as the proposed ROW width (150 feet) plus the separation distance, if necessary, between existing ROW and proposed ROW. The study area includes both private and public lands and avoids all incorporated areas (See Map 7, *Land Ownership*).

3.7.1 Location of Study Area

Line segments cross private lands and publicly administered lands in four Washington counties: Kittitas, Grant, Benton, and Yakima. See Table 3.7-1, *Counties Crossed by Segment*. Table 3.7-2, *Private and Publicly Administered Lands in Project Area*, lists the distance of private and publicly administered lands crossed. Map 7, *Land Ownership*, shows land ownership within the project area. Map 8, *Hanford Site*, shows a detail of public lands on the Hanford Site. Appendix G, *Local Plan Consistency*, discusses the local government regulations for these counties.

Table 3.7-1
Counties Crossed by Segment

Line Segment	County			
	Kittitas	Grant	Benton	Yakima
A	✓			
B	✓	✓		
C	✓		✓	✓
D		✓	✓	
E		✓	✓	
F		✓	✓	

Table 3.7-2
Private and Publicly Administered Lands in Project Area

Administering Agency	Distance and Percentage of Each Segment							Total Distance
	A	B_{NORTH}	B_{SOUTH}	C	D	E	F	
Private	**20.28 mi** **69.0%**	**1.75 mi** **18.4%**	**1.75** **16.9%**	**4.70 mi** **15.8%**	**15.44 mi** **56.7 %**	**7.71 mi** **33.3%**	**3.95 mi** **12.3%**	**55.58 mi** **34.4%**
DNR	*2.04 mi* *7%*	*0%*	*0%*	*0.45 mi* *1.5%*	*2.08 mi* *7.6%*	*0.56 mi* *2.4%*	*2.5 mi* *7.8%*	*7.63 mi* *4.7%*
WDFW	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0.8 mi* *2.5%*	*0.8 mi* *0.5%*
BLM	*1.5 mi* *5.1%*	*0%*	*0%*	*0.21 mi* *0.7%*	*2.87 mi* *10.6%*	*4.89 mi* *21.1%*	*12.77 mi* *39.8%*	*22.24 mi* *13.8%*
DOD	*5.6 mi* *19.0%*	*7.3 mi* *76.6%*	*8.13 mi* *78.5%*	*24.45 mi* *82.0%*	*0%*	*0%*	*0%*	*45.48 mi* *28.2%*
BOR	*0%*	*0.48 mi* *5%*	*0.48 mi* *4.6%*	*0%*	*2.46 mi* *9%*	*3.37 mi* *14.6%*	*4.35 mi* *13.6%*	*11.14 mi* *6.9%*
USFWS	*0%*	*0%*	*0%*	*0%*	*0.51 mi* *1.9%*	*0.96 mi* *4.2%*	*0%*	*1.47 mi* *0.9%*
USDOE	*0%*	*0%*	*0%*	*0%*	*3.87 mi* *14.2%*	*5.64 mi* *24.4%*	*7.69 mi* *24.0%*	*17.2 mi* *10.6%*
Total Public	**9.14 mi** **31.1%**	**7.78 mi** **81.6%**	**8.61 mi** **83.1%**	**25.11 mi** **84.2%**	**11.79 mi** **43.2%**	**15.42 mi** **66.5%**	**28.11 mi** **87.7%**	**105.96 mi** **65.6%**
Total Distance	**29.42 mi**	**9.53 mi**	**10.36 mi**	**29.81 mi**	**27.23 mi**	**23.13 mi**	**32.06 mi**	**161.54 mi**

3.7.1.1 Kittitas County

Kittitas County lies within the upper Yakima River watershed and on the east side of the Cascade Mountains. Mountains and steep hills ring an extensive irrigated area known as the Kittitas Valley where most of the County's residents live. Major irrigation projects of the 1940's and 50's distributed water to the valley floor, turning arid lands into productive farmland.

Segment A is entirely within the County. The majority of Segment B and a portion of Segment C are also within the County. Segments A and B cross both private lands and publicly administered lands. Segment C in Kittitas County would be located completely on publicly administered lands.

3.7.1.2 Grant County

The Columbia River flows in a deep valley along the west and southwestern boundary of Grant County. The County is a state and national leader in the production of wheat, corn, hay, potatoes, and several tree fruits and is a major livestock production center. Agricultural areas are concentrated throughout the County and the location of agriculture has been strongly influenced by the construction of irrigation facilities.

A small portion of Segment B and the majority of Segments D, E, and F are located within the County. These line segments cross both private lands and publicly administered lands.

3.7.1.3 Benton County

Benton County is located in the central part of the Columbia Basin. The principal land use is commercial dryland and irrigated agriculture with its related industries such as storage, shipping, processing, and sales of chemicals and equipment. Irrigated crop production and dryland agriculture is located throughout the agricultural lands designation. It is estimated that 17 percent of Benton County is irrigated land and 50 percent is range and dryland agriculture. Major crops in Benton County are wheat, corn, potatoes, apples, cherries, hops, mint, alfalfa hay, and wine grapes. Beef cattle are also raised in the County.

Of the overall study area, a small portion of Segment D and even smaller portions of Segments C, E, and F traverse through and terminate in Benton County. Segments C and D would cross both private lands and publicly administered lands. Segments E and F would only cross publicly administered lands.

3.7.1.4 Yakima County

Agriculture and related industries are the leading industries in Yakima County. The location of agriculture has been strongly influenced by the construction of irrigation facilities. Cultivated agriculture in Yakima County is heavily concentrated in and around the valley floors, while grazing lands and most orchards are located along many of the hillsides.

Only Segment C would pass through Yakima County, on private lands as well as publicly administered lands.

3.7.2 Land Uses in Study Area

Table 3.7-3, *Land Uses Crossed by Each Line Segment*, identifies the length of various land uses that are crossed by each segment. Public and private land uses are combined for this table.

Table 3.7-3
Land Uses Crossed by Each Line Segment

Land Use	Distance and Percentage of Each Segment							Total Distance
	A	B NORTH	B SOUTH	C	D	E	F	
Commercial, Industrial, and Transportation	0.26 mi 0.9%	0.01 mi 0.1%	0.01 mi 0.1%	0.03 mi 0.1%	0.49 mi 1.8%	0.03 mi 0.1%	0.09 mi 0.3%	0.92 mi 0.6%
Residential	0%	0%	0%	0.02 mi 0.1%	0.09 mi 0.3%	0.02 mi 0.1%	0%	0.13 mi 0.1%
Forest	0.68 mi 2.3%	0%	0%	0.19 mi 0.6%	0.18 mi 0.7%	0.05 mi 0.2%	0%	1.1 mi 0.7%
Range	27.95 mi 95%	9.04 mi 94.9%	9.87 mi 95.3%	29.55 mi 99.1%	17.32 mi 63.7%	16.91 mi 73.1%	30.99 mi 96.7%	141.6 mi 87.7%
Agricultural	0.53 mi 1.8%	0%	0%	0.01 mi >0.1%	8.85 mi 32.4%	5.87 mi 25.4%	0.39 mi 1.2%	15.6 mi 9.7%
Water	0%	0.48 mi 5%	0.48 mi 4.6%	0.02 mi >0.1%	0.3 mi 1.1%	0.25 mi 1.1%	0.59 mi 1.8%	2.12 mi 1.3%
Total Distance	**29.42 mi**	**9.53 mi**	**10.36 mi**	**29.81 mi**	**27.23 mi**	**23.13 mi**	**32.06 mi**	**161.54 mi**

The majority of land crossed by the various segments is rangeland, approximately 141.6 miles or 88 percent of the total lands crossed. The second most frequently crossed lands are used for agricultural purposes, approximately 15.6 miles or almost 10 percent of the total lands crossed.

Map 9, *Land Use Cover*, shows the various land uses along the different line segments.

3.7.2.1 Private Lands

As shown in Table 3.7-4, *Distance of Private Land Uses Crossed by Project Area*, roughly 35 percent of the study area is located on privately owned land. Private land ownership in the study area is characterized by open rangeland, agricultural land, open space, some rural residential, and a limited amount of quarrying. Table 3.7-4, *Distance of Private Land Uses Crossed by Project Area*, identifies the total distance each land use would be crossed by the various line segments on privately owned lands.

Table 3.7-4
Distance of Private Land Uses Crossed by Project Area

Land Use	Distance of Each Segment							Total Distance
	A	B_{NORTH}	B_{SOUTH}	C	D	E	F	
Commercial, Industrial, and Transportation	0.25 mi	0.01 mi	0.01 mi	0.03 mi	0.27 mi	0	0	**0.57 mi**
Residential	0	0	0	0	0.04 mi	0	0	**0.04 mi**
Forest	0.42 mi	0	0	0	0.13 mi	0	0	**0.55 mi**
Range	18.82 mi	1.29 mi	1.29 mi	5.08 mi	7.21 mi	3.92 mi	4.03 mi	**41.64 mi**
Agricultural	0.53 mi	0	0	0	7.78 mi	4.29 mi	0	**12.60 mi**
Water	0	0.45 mi	0.45 mi	0	0.04 mi	0.19 mi	0	**1.13 mi**
Total Distance	**20.02 mi**	**1.75 mi**	**1.75 mi**	**5.11 mi**	**15.47 mi**	**8.4 mi**	**4.03 mi**	**56.53 mi**

3.7.2.2 Public Agency Administered Lands

In addition to the privately held lands, there are seven public agencies that administer lands crossed in the four counties. The public land areas crossed are under the administration of two Washington State agencies, Department of Natural Resources (DNR) and Washington Department of Fish and Wildlife (WDFW), and five federal agencies: Bureau of Land Management (BLM), Department of Defense (DOD), Bureau of Reclamation (BOR), U.S. Fish and Wildlife Service (USFWS), and U.S. Department of Energy (USDOE). Table 3.7-5, *State and Federal Agency Land by County*, identifies the state or federal agencies that administer land crossed per county.

Table 3.7-5
State and Federal Agency Land by County

Agency	County			
	Kittitas	Grant	Benton	Yakima
DNR	✓	✓	✓	✓
WDFW		✓		
BLM	✓	✓	✓	
DOD	✓			✓
BOR	✓	✓		
USFWS		✓		
USDOE		✓	✓	

As shown in Table 3.7-6, *Distance of Public Land Uses Crossed by Project Area*, roughly 65 percent of the study area is located on publicly administered land. Public land uses in the study area are predominantly agricultural, rangeland, wildlife habitat, and recreation. The study area also includes crossing the BLM Saddle Mountains Management Area, the Saddle Mountains Unit of the Hanford Reach

National Monument, Hanford Site, and Yakima Training Center. Table 3.7-6, *Distance of Public Land Uses Crossed by Project Area*, identifies the total distance each land use would be crossed by the various line segments on lands administered by a public agency.

Table 3.7-6
Distance of Public Land Uses Crossed by Project Area

Land Use	Distance of Each Segment							Total Distance
	A	B_{NORTH}	B_{SOUTH}	C	D	E	F	
Commercial, Industrial, and Transportation	0.01 mi	0	0	0	0.25 mi	0.12 mi	0.09 mi	**0.47 mi**
Residential	0	0	0	0	0.05 mi	0	0	**0.05 mi**
Forest	0	0	0	0.19 mi	0.05 mi	0	0	**0.24 mi**
Range	9.13 mi	7.75 mi	8.58 mi	24.88 mi	10.11 mi	14.44 mi	27.05 mi	**101.94 mi**
Agricultural	0	0	0	0.01 mi	1.07 mi	0.48 mi	0.39 mi	**1.95 mi**
Water	0	0.03 mi	0.03 mi	0.02 mi	0.26 mi	0.38 mi	0.59 mi	**1.31 mi**
Total Distance	**9.14 mi**	**7.78 mi**	**8.61 mi**	**25.10 mi**	**11.79 mi**	**15.42 mi**	**28.12 mi**	**105.96 mi**

3.7.2.3 Aircraft Uses

Three airports were identified within the study area by segment (Table 3.7-7, *Airports within the Project Study Area*). None of the airports are located directly within the study corridors of the segments.

Table 3.7-7
Airports within the Project Study Area

Airport Name	Closest Segment	Approximate Location with Respect to Segment
Yakima Training Center	A, B, C	Segments cross areas where military flights take place during training exercises
Mattawa Airstrip	E	T14N, R25E, Sec 5
Christensen Brothers Wahluke Strip	D	T14N, R24E, Sec 10 & 15

Although outside of the study area, the Bowers Field Airport in Ellensburg is located approximately five miles south of the Vantage substation. The Bowers Field Airport utilizes the area for flight instruction, local general aviation, and transient general aviation.

In addition to the use of the airspace in the study area by commercial and private aircraft, the U. S. Army utilizes the airspace over the Yakima Training Center (YTC) for military training flights and support of ground maneuvers. During Fiscal Year 2001 (October 2000 – October 2001), the Army indicates there were 1,462 flights across the YTC. They expect this number to increase in the future.

3.7.3 Segment A

Segment A, approximately 29.4 miles, would be located entirely within Kittitas County and, as shown in Table 3.7-2, *Private and Publicly Administered Lands in Project Area*, would cross privately owned lands (roughly 69 percent of the segment) as well as publicly administered lands (roughly 31 percent).

3.7.3.1 Private Land

Rangeland is the predominate private land use along Line Segment A; approximately 18.8 miles of the 20 miles of private land crossed by the segment. Less than one-half mile of each of the following land uses — commercial, industrial and transportation, forest, and agricultural — would be crossed by this segment.

For Your Information

*A **steppe** habitat is a grass-dominated community found in arid areas*

*A **shrub-steppe** habitat is a shrub and grass dominated community found in arid areas.*

The rangeland is used for raising and grazing livestock and is predominately ***steppe*** and ***shrub-steppe*** over varied terrain consisting of numerous ridges and valleys that traverse the eastern side of Kittitas County.

Farm and agricultural uses are typified as dryland agricultural operations. The predominant crops are hay or wheat.

Vacation homes, and people seeking a rural lifestyle are increasing the residential development in the study area. Table 3.7-4, *Distance of Private Land Uses Crossed by Project Area*, does not reflect the presence of residential land uses along this segment because the land on which these residences are located is designated for rangeland or agricultural purposes; however, residential land uses are permitted in the area with minimum lot sizes of 20 acres.

Mineral resource lands of long-term commercial significance are not specifically zoned along the segment but have been identified on a Kittitas County Comprehensive Plan map. The Study area crosses an existing quarry operation along the south side of an existing transmission line.

There are some limited forest resources in the study area. However, these areas are not considered harvestable timber resources (Neil White, Kittitas County Planning Director, April 2001).

3.7.3.2 Public Land

Public land crossed by this segment is under the administration of one state agency, DNR, and three federal agencies, BLM, DOD, and BOR. Table 3.7-2, *Private and Publicly Administered Lands in Project Area*, provides the distance Segment A would cross these public lands (9.14 miles), and Table 3.7-6, *Distance of Public Land Uses Crossed by Project Area*, shows that the primary use of these public lands is rangeland (9.13 miles of the segment's 9.14 miles) on public lands.

Land Use along the reroute in Segment A consists primarily of private lands (96%). Public land (BLM) makes up the remainder of the land use for this segment (4%). Land use for the portion of the route through the tribal allotment consists of 91% private lands and 9% (BLM) public land.

DNR Lands – The majority of DNR lands crossed by the study area are located along the northern half of the line segment. This land is considered transition land by DNR and is designated as agricultural land. However, the land is managed for its highest and best use and for this particular area that use is rangeland.

BLM Lands – The BLM land along Segment A is used as rangeland and would support the land use activities consistent with this type of land at other locations along the other segments.

DOD Lands (YTC) – The largest area of federal land crossed by the study area is the YTC (5.6 miles). A U.S. military reservation, this area is administered by the U.S. DOD and is a sub-installation of Fort Lewis. The total size of the YTC is 511.64 square miles; split roughly in half between Kittitas and Yakima Counties.

The YTC is divided into 10 different watershed complexes and 5 different land use zones. Military training exercises vary according to the land use zones within the specific complexes and certain maneuvers in one complex may not be present in the same land use zone in a different complex.

Segment A would cross the northern border of the YTC and continue south through the Middle Canyon Complex ending just inside the Johnson Creek Complex; completely within Kittitas County. The segment crosses three land use zones; Land Bank Zone, General Use Zone (slopes 0 to 15 percent), and General Use Zone (slopes >15 percent). Typical training maneuvers in the study area consist of armor and mechanized infantry movements, firing exercises, tanks and other vehicle movements, and military training exercises.

Non-military land uses within the YTC include ***Native American traditional cultural practices*** by the Yakama Indian Nation and the Wanapum Band as well as limited recreational hunting and other outdoor activities.

Prime Farmlands – As Table 3.7-3, *Land Uses Crossed by Each Line Segment*, indicates, Segment A would cross a total of approximately 0.53 mile of agricultural lands. Along the north side of the existing transmission line roughly 0.2 mile of ***prime farmland*** would be crossed by this segment. Prime farmlands, therefore, make up roughly 38 percent of the total agricultural lands crossed by this segment.

Reminder

*A **complex** is a specific watershed area within the YTC. The YTC is divided into ten complexes.*

For Your Information

Native American traditional cultural practices *can include gathering plants and roots for medicinal use and religious ceremonies.*

Prime Farmland *is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, livestock, timber, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and/or labor. It does not include land already in or committed to urban development or water storage. (USDA, NRCS web page)*

The lists of unique, statewide, and locally important farmlands in Washington are in the process of being updated. They are not discussed in this document.

3.7.4 Segment B

Options B_{NORTH} and B_{SOUTH} are different in length, but cross the same types of lands and are discussed together.

3.7.4.1 Private Lands

Approximately 1.75 miles of Options B_{NORTH} and B_{SOUTH} would be located on lands not under the administration of a public agency. Of this amount, roughly two-thirds of this land is used as rangeland, with the Columbia River crossing, or open water, comprising all but 0.01 mile of the remaining portion.

The rangeland supports livestock activities and is predominately steppe and shrub-steppe over varied terrain, consistent with the rangeland activities and terrain along all other segments.

3.7.4.2 Public Lands

Public land crossed by this segment is under the administration of one state agency, DNR, and two federal agencies, DOD and BOR. Table 3.7-2, *Private and Publicly Administered Lands in Project Area*, provides the distance Option B_{NORTH} and B_{SOUTH} would cross these public lands (9.53/10.36 miles). Table 3.7-6, *Distance of Public Land Uses Crossed by Project Area*, shows that rangeland is the predominate land use.

DNR Lands – A very small portion of Option B_{NORTH} and B_{SOUTH} would cross DNR administered lands. The use of these lands is for the John Wayne Trail. Further discussion of this trail can be found in Section 3.10, *Recreation Resources*, of this document.

DOD Lands (YTC) – The majority of Options B_{NORTH} and B_{SOUTH} (roughly 76 to 78 percent of each option respectively) would be located within the YTC. Both options would traverse the Johnson Creek Complex and two land use zones, General Use Zone (slopes 0 to 15 percent) and General Use Zone (slopes > 15 percent), before exiting the YTC along its eastern border.

Tanks and other vehicle movements, as well as training exercises take place within the Johnson Creek Complex.

BOR Lands – Options B_{NORTH} and B_{SOUTH} also cross BOR lands. These lands are administered and managed to maintain and develop water distribution systems, such as irrigation canals, that move water to the fertile agricultural lands of the area.

3.7.5 Segment C

3.7.5.1 Private Lands

Segment C would cross privately owned lands in a scarcely populated area between the YTC in Yakima County and the new substation site in Benton County (Wautoma Substation). There is no private land crossed by Segment C in Kittitas County.

The area is within the Blackrock Valley and its terrain is gently rolling hills at the foot of the Saddle Mountains Range. While some parts of this area are used for dryland agriculture, the main use of the area that would be crossed by Segment C is rangelands.

For Your Information

For this document, agriculture is defined as row crops, pasture, fallow fields, orchards, crops and grains. Land that we refer to as rangeland is grassland and shrubland that may be used for grazing or the movement of livestock.

In Benton County, Segment C would cross land that is sparsely inhabited rural-agricultural land. The landscape is characterized by rolling hills cut by drainages from the Saddle Mountains Range. As in Yakima County, the area is more commonly used for rangeland instead of agricultural purposes.

None of the agricultural land is designated as prime farmland.

3.7.5.2 Public Lands

Public land crossed by this segment is under the administration of one state agency, DNR, and two federal agencies, BLM and DOD. Table 3.7-2, *Private and Publicly Administered Lands in Project Area*, shows that Segment C would cross 25.11 miles of public lands. Table 3.7-6, *Distance of Public Land Uses Crossed by Project Area*, shows that the predominate land use is rangeland.

DNR Lands – A small portion of Segment C would cross DNR administered lands (0.45 mile). This land is at the northern end of the segment where the John Wayne Trail is crossed, and near the southern end of the segment. The DNR land at the southern end is used as rangeland.

Reminder

See Map 7, Land Ownership, for location of the John Wayne Trail.

DOD Lands (YTC) – The majority of Segment C (roughly 82 percent) would be located in the YTC. The segment would traverse three land use zones, Land Bank Zone, General Use Zone (slopes 0 to 15 percent) and General Use Zone (slopes >15 percent) and five watershed complexes, Johnson Creek, Hanson, Alkali Canyon, Corral Canyon, and Cold Creek.

The land use activities in Johnson Creek would be the same as those describe for Segment B.

The military conducts ground maneuvers, live fire artillery, mortar training, and water exercises within the Hanson Complex.

Live fire training for the infantry, tanks, and helicopters as well as light infantry maneuvers and small unit operations are conducted within the Alkali Canyon and Corral Canyon Complexes. Due to the steep slopes in these two complexes, parachute drops are used to deliver supplies to the infantry.

Cold Creek Complex supports track vehicle and light infantry maneuvers.

Throughout these complexes low flying aircraft such as helicopters, F-18s and A-10s are used to support the ground maneuvers.

3.7.6 Line Segment D

3.7.6.1 Private Lands

Segment D would cross 7.78 miles of private agricultural lands. This is the largest amount of agricultural lands crossed by any of the line segments. The segment would also cross 7.21 miles of rangeland. The segment would cross less than one-half mile of each of the following land uses: commercial, industrial and transportation, residential, forest, and water.

➡ Reminder

See Map 9, Land Use Cover.

About 29 percent of the land along the segment is privately owned land used for agricultural purposes. The agricultural areas are composed mainly of irrigated lands with highly productive soil that is generally suited to crops, such as grains and vegetables, agricultural-related industries, and livestock maintenance. Vineyards and orchards are also present along the segment.

Dryland agricultural practices also occur along the study area for Segment D. Dryland agricultural land is primarily for grain or feed crop production.

As Table 3.7-3, *Land Uses Crossed by Each Line Segment*, indicates, Segment D would cross 8.85 miles of agricultural land, roughly 2.7 miles of which are designated as prime farmland. There is 0.9 mile in Grant County and 1.8 miles in Benton County. Prime farmlands make up about 31 percent of the total agricultural lands crossed by this segment.

Private rangeland accounts for approximately 26 percent of the lands crossed by this line segment. This land is used for livestock and is predominately steppe and shrub-steppe over varied terrain.

The remaining portions of this segment would cross areas of Grant County that have been designated as rural in nature. Such areas are those not suitable for intensive farming and generally do not attract large residential development. Some areas near the western end of

Crab Creek have been designated as open space, which further limits the ability to develop the land.

Limited rural-residential structures are also located along the segment. Maximum residential density in the rural areas of Grant County is one dwelling unit per 20 acres.

3.7.6.2 Public Lands

Public lands crossed by this segment are under the administration of one state agency, DNR, and four federal agencies, BLM, BOR, USFWS, and USDOE. Table 3.7-2, *Private and Publicly Administered Lands in Project Area*, provides the distance Segment D would cross these public lands (11.79 miles) and Table 3.7-6, *Distance of Public Land Uses Crossed by Project Area*, shows that the predominate land use is rangeland (10.11 miles) and 1.6 miles of the public lands are agricultural, commercial, industrial and transportation, residential, and open water.

DNR Lands – DNR lands would be crossed by Segment D (2.08 miles) in Grant County and Benton County. In Grant County this land is managed for agricultural purposes and in Benton County it is used as rangeland.

BLM Lands (Saddle Mountains Management Area) – Roughly 2.87 miles of BLM land would be crossed by this segment. This BLM land is located north of the agricultural areas in Grant County and is the western end of the Saddle Mountains Management Area. This land is managed for multiple purposes, such as mining, rangeland, recreation, and wildlife habitat.

BOR Lands – The BOR lands that would be crossed by this segment are located at the north end of the segment and along the south face of the Saddle Mountains. These lands are administered and managed to maintain and develop the water distribution system, such as irrigation canals, that move water to the fertile agricultural lands of the area.

USFWS Lands (Columbia National Wildlife Refuge) – Segment D would cross the westernmost part of the Columbia National Wildlife Refuge near Crab Creek. This area is an isolated ¾ of a Section between Crab Creek and the base of the Saddle Mountains. This land is managed for wildlife habitat.

USDOE Lands (Hanford Site and Hanford Reach National Monument) – Map 7, *Land Ownership*, illustrates the boundaries of the Hanford Site and its management units. The Hanford Reach National Monument is also shown on Map 7, *Land Ownership*. The land crossed on the Hanford Site is made up of large tracts of land originally used by the USDOE as a protective buffer zone for safety and security purposes. The area remains largely undisturbed, preserving a biological and cultural resource setting unique in the Columbia Basin region.

The Hanford Reach National Monument forms a C-shaped region bisected by the Hanford Reach of the Columbia River. The lands within the monument are divided into three major management units: Fitzner-Eberhardt Arid Lands Ecology Reserve, Saddle Mountains Unit, and the Columbia River Islands.

Segment D crosses the far western part of the Saddle Mountains Unit of the Hanford Reach National Monument and has a land use designation of Preservation.

3.7.7 Segment E

3.7.7.1 Private Lands

Agricultural lands and rangeland make up about 98 percent of the private land uses crossed by Segment E, 4.29 miles and 3.92 miles, respectively. The remaining 2 percent would cross open water.

The agricultural lands and rangelands are used for the same purposes as described above for Segment D.

As Table 3.7-3, *Land Uses Crossed by Each Line Segment*, indicates, Segment E would cross 5.87 miles of agricultural lands, roughly 2.7 miles, which are designated as prime farmlands and which are all located in Grant County. Prime farmlands make up about 46 percent of the total agricultural lands crossed by Segment E.

3.7.7.2 Public Lands

Public lands crossed by this segment are under the administration of one state agency, DNR, and four federal agencies, BLM, BOR, USFWS, and USDOE. Table 3.7-2, *Private and Publicly Administered Lands in Project Area*, provides the distance Segment E would cross these public lands (15.42 miles) and Table 3.7-6, *Distance of Public Land Uses Crossed by Project Area*, shows that the predominate land use is rangeland (14.44 miles) and approximately 1mile of the public lands are agricultural, commercial, industrial and transportation, and open water.

DNR Lands – Segment E would cross roughly 0.56 mile of DNR lands that are located north of the Wahluke Slope in Grant County. This land is managed for agricultural purposes.

BLM Lands (Saddle Mountains Management Area) – BLM lands that would be crossed by Segment E are the western portion of the Saddle

Mountains Management Area. It is managed by BLM for multiple purposes, such as mining, rangeland, recreation, and wildlife habitat.

BOR Lands – The BOR lands crossed by this segment support the same land uses as those described above for Segment D.

USFWS Lands (Columbia National Wildlife Refuge) – Segment E would cross the westernmost part of the Columbia National Wildlife Refuge near Crab Creek. This area is an isolated ¾ of a Section between Crab Creek and the base of the Saddle Mountains. This land is managed for wildlife habitat.

USDOE Lands (Saddle Mountains Unit of the Hanford Reach National Monument and Hanford Site) – A general description of the USDOE lands has been provided above for Segment D.

Segment E, however, would cross through the Saddle Mountains Unit portion of the Wahluke Slope before crossing the Columbia River and terminating on the Hanford Site.

The Saddle Mountains Unit is managed by the USFWS under an agreement with the USDOE. The area is uninhabited wildlife habitat that has remained largely undisturbed since the 1940's. It has a land use designation of Preservation and is managed for the preservation of archaeological, cultural, ecological, and natural resources.

This segment ends at the Hanford Substation, which is approximately one-quarter mile from the Columbia River. The area within one-quarter mile of the Columbia River has a land use designation of Preservation; beyond one-quarter mile, the land use designation is Industrial. The area to the northeast of the termination site of this segment is currently used by the USDOE as an operating and facilities area. The remaining surrounding area is open rangeland.

3.7.8 Segment F

Segment F, approximately 32.06 miles, would be located within Grant and Benton Counties and, as shown in Table 3.7-2, *Private and Publicly Administered Lands in Project Area*, would cross privately owned lands (roughly 12 percent of the segment) as well as publicly administered lands (roughly 88 percent).

3.7.8.1 Private Lands

All the private land crossed by this segment is open rangeland or rangeland used for raising and grazing of livestock (4.03 miles). No privately owned agricultural areas would be crossed.

3.7.8.2 Public Lands

Public lands crossed by this segment are under the administration of two state agencies, DNR and WDFW, and three federal agencies, BLM, BOR, and the USDOE. Table 3.7-2, *Private and Publicly Administered Lands in Project Area*, provides the distance Segment F would cross these public lands (28.11 miles) and Table 3.7-6, *Distance of Public Land Uses Crossed by Project Area*, shows that the predominate land use is rangeland (27.05 miles) and approximately 1 mile of the public lands are agricultural, commercial, industrial and transportation, and open water.

DNR Lands – Segment F would cross roughly 2.5 miles of DNR lands that are located intermittently along the segment on the north and south side of the Saddle Mountains. These lands are managed for agricultural and rangeland purposes.

WDFW Lands – Roughly 0.8 mile of WDFW administered lands would be crossed by this segment. These lands are managed for rangeland purposes and are typical of the shrub-steppe lands of the area.

BLM Lands (Saddle Mountains Management Area) – The largest amount of public lands that would be crossed by this segment, nearly 40 percent of the total segment or 12.77 miles, would be the Saddle Mountains Management Area administered by the BLM. Unlike Segments D and E that would cross only the western end of the management area, Segment F would cross east and west through the majority of the area. As a result, nearly all the multiple land uses of the area, such as rangeland, recreation, and wildlife habitat, would be crossed by the segment.

BOR Lands – The BOR lands crossed by this segment support the same land uses as those described above for Segment D.

USDOE Lands (Saddle Mountains Unit of the Hanford Reach National Monument and Hanford Site) – The majority of this segment would cross the Saddle Mountains Unit in a different location than Segment E. The land uses along Segment F are different than those for Segment E, since Segment F crosses the former Wahluke Slope Wildlife Recreation Area, which has been and continues to be open to public access.

Also, since Segment F would cross the Columbia River and terminate at the same location as Segment E, the land uses present on the Hanford Site (south of the Columbia River) would be the same as for Segment E.

3.8 Socioeconomics

For Your Information

For socioeconomic considerations the study area is defined as the proposed ROW boundaries of the line segments, as well as nearby adjacent lands.

The rural character of central Washington is linked to the local socioeconomics. Agriculture is an important industry sector that influences local economies as well as demographic composition. Correspondingly, the booms and busts of agricultural dependent industries are reflected in population and economic growth of the area. Other industries important to the area include service, retail trade, and manufacturing sectors. Kittitas, Grant, Yakima, and Benton counties, in general, are less racially diverse, have lower per capita and median household incomes, and have a lower percentage of income derived from work earnings than the state.

In Kittitas County, the study area is comprised of rural-agricultural and grazing land uses on private lands and military exercises at the YTC. Segment A is mostly contained within the YTC with a small portion crossing private, undeveloped shrub-steppe lands. Segments that cross Grant County comprise a mix of developed agricultural and grazing lands, undeveloped private lands, BLM- and DNR-administered lands, and the Saddle Mountains Unit of the Hanford Reach National Monument. Benton County is crossed by segments on the Hanford Site as well as on private lands that are a mix of grazing or undeveloped lands. (See Section 3.7, *Land Use*, for more detail.)

3.8.1 Population

Data sources for population statistics included in this section include the Washington State Office of Financial Management and the U.S. Census Bureau. Estimates for 2000 statistics are used unless otherwise noted.

The population within the study area is primarily located in sparsely populated rural areas. In Grant and Kittitas counties, population densities per square mile are 26.7 and 14.2, respectively, compared to the statewide density of 87.2 per square mile. These densities are representative of the portions of private lands in Grant and Kittitas counties within the study area and are similarly representative of the private lands crossed in Benton and Yakima counties. Public lands are predominantly uninhabited in the study area. Over half the population of Grant and Kittitas counties live in rural areas. Similarly, the study area within Benton and Yakima counties lies within rural areas, which are considerable distances away from the cities of Yakima, Richland, and Kennewick. No urban areas lie within the study area. Nearby population centers include Ellensburg (estimated population 14,340) and Mattawa (estimated population 1,955). (Data sources include the U.S. Census Bureau, 1990 Census of Population and Housing, Washington, D.C., and the Washington State Office of Financial Management. 2000. Population Trends. Olympia, WA).

Caucasians comprise approximately 95 percent of the total population in Benton, Grant, and Kittitas counties. With a minority population of 11 percent, Washington State is more diverse than these counties. In Yakima County, however, Native Americans form 7 percent and Caucasians form 88 percent of the population. Hispanic origin varies greatly across the area: 11 percent of Benton County, 27 percent of Grant County, 5 percent of Kittitas County, and 37 percent of Yakima County as compared to a statewide composition of 6 percent.

Washington State has experienced steady population growth over the last fifty years, averaging nearly 20 percent increases each decade. Population growth within the study area, however, has not been as stable or positive (Table 3.8-1, *Population Growth for Washington State and Affected Counties, 1950-2000*). The fluctuation in county populations tends to be linked to boom and bust cycles of natural resource dependent economies as well as the policies associated with the Hanford Site in Benton County.

Table 3.8-1
Population Growth for Washington State and Affected Counties, 1950-2000

Year	Washington State		Benton County		Grant County		Kittitas County		Yakima County	
	Pop.	Percent Change	Pop.	Percent Change	Pop.	Percent Change	Pop.	Percent Change	Pop.	Percent Change
1950	2,378,963	–	51,370	–	24,346	–	22,235	–	135,723	–
1960	2,853,214	19.9	62,070	20.8	46,477	90.9	20,467	(8)	145,112	6.9
1970	3,413,244	19.6	67,540	8.8	41,881	(9.9)	25,039	22.3	145,212	0.1
1980	4,132,353	21.1	109,444	62.1	48,522	15.9	24,877	(0.7)	172,508	18.8
1990	4,866,663	17.8	112,560	2.9	54,798	12.9	26,725	7.4	188,823	9.5
2000	5,803,400	19.3	140,700	25	71,500	30.5	32,500	21.6	214,000	13.3

Source: Washington State Office of Financial Management (2000)
U.S. Census Bureau (2000)

For Your Information

Data sources for economic statistics include the Washington State Employment Security Department and the U.S. Bureau of Economic Analysis. Estimates for 1998 statistics are used unless otherwise noted.

3.8.2 Economy

The service, retail trade, manufacturing, and agriculture sectors drive the central Washington economy in the private industry. Employment and income derived from government and government services also plays a major role in the local economies. In Grant and Kittitas counties, government provides 20 percent and 33 percent, respectively, of the local jobs compared to 18 percent at the state level. The value of these government jobs is critical to these counties in terms of the percent of total wage and salary earnings: 27 percent for Grant County and 46 percent for Kittitas County, compared to 19 percent for the state. Benton and Yakima counties have a slightly lesser proportion of government jobs (16 percent and 14 percent, respectively) and a slightly higher proportion of income derived from this sector (19 percent and 20 percent) than the state as a whole.

Per capita incomes in the study area are substantially lower than the $28,719 statewide average: $24,315 for Benton County; $20,301 for Grant County; $20,241 for Kittitas County; and $20,718 for Yakima County. With the exception of Benton County, the lower per capita incomes in this area are evidence of the loss of high-paying jobs and the restructuring of resource-based industries trend throughout the Pacific Northwest since the 1980's. Benton County has a higher reliance on the high wages earned through the utilities sector, primarily those associated with the Hanford Site, to offset resource-based recessions.

Kittitas County has the lowest median household income ($26,770) compared to $30,979 in Grant County, $31,522 in Yakima County, and $44,219 in Benton County. All study area counties are lower that the state median household income of $46,080.

Earnings account for a lesser portion of local residents' income in Grant County (68 percent), Kittitas County (58 percent), and Yakima County (64 percent) than the state (72 percent). Benton County is slightly higher (74 percent). Kittitas County residents report a higher income received from dividends, interest and rent (24 percent) compared to the state (19 percent). This may indicate that a higher proportion of retired or semi-retired people reside in Kittitas County. Benton, Grant, and Yakima counties have lower percentages of this income than the state.

Transfer payments in Benton County (13 percent) are comparable to the state (12 percent). Grant, Kittitas, and Yakima counties, however, are substantially higher at 18 percent, 17 percent, and 19 percent, respectively. Higher levels of income from transfer payments and dividends, interest and rent in Kittitas County is indicative of a higher proportion of retired and semi-retired population compared to other counties and the state.

Agriculture is an important sector for Grant and Yakima counties. In Grant County, agriculture provides one out of four jobs; in Yakima County, it provides one out every five jobs. Wages, though, are relatively less than other industries. Jobs in agriculture account for 16 percent of the wage earnings in Grant County and 13 percent of the wage earnings in Yakima County. Agriculture is less important in Benton County and Kittitas County (4 percent and 5 percent of the total earned wages, respectively).

Unemployment rates within the study area vary dramatically. The average unemployment rate for the state in 2000 was 4.8 percent, whereas Benton County was 5.9 percent, Grant County was 9.3 percent, Kittitas County was 5.3 percent, and Yakima County was 9.8 percent. The higher rates are likely associated with the seasonal work

For Your Information

The data source for tax information is the Washington State Department of Revenue. Tax rates indicated are for 2000 unless otherwise noted.

Excise taxes *are internal taxes imposed on the production, sale, or consumption of a commodity or the use of a service.*

periods in the agricultural sector, which is a primary employer in Grant and Yakima counties.

3.8.3 Taxes

The State of Washington relies on a variety of taxes to fund state and local government programs. These taxes include a combined state and local sales and use tax, a business and occupation tax and public utility tax, property tax, and several other ***excise***, real estate, and estate taxes.

3.8.3.1 Retail Sales and Use Tax

A combined state and local retail sales tax is collected on the sale of tangible personal property. A use tax is assessed on the value of personal property and services for which a sales tax has not been assessed. The retail sales and use tax applies to most items purchased by consumers, but does not apply to food items or prescription drugs. Utility services and most personal services (e.g., medical, dental, legal) and real estate are not subject to these taxes. However, construction services and building materials are subject to the retail sales tax.

The amount of the retail sales and use tax varies by locality. The state tax base is 6.5 percent, which each locality can assess 0.5 to 2.1 percent additional tax. Combined state and local tax rates for the study area range from 7.6 to 7.9 percent.

As a federal agency, BPA is not subject to Washington taxes (Dittrich, 2001). However, contractors performing work for the federal government are required to pay sales or use tax on all materials incorporated into the construction project. Contractors are also required to pay sales or use tax on all consumable supplies and tools used on the project (WAC 458-20-17001).

3.8.3.2 Business and Occupation Tax and Public Utility Tax

Most businesses operating in the state are subject to the business and operation (B&O) tax. However, power, water, and gas companies and carriers by air, water, rail, and motor are taxable under the public utility tax. The B&O tax is typically assessed on the gross income or proceeds of sales or the value for privilege of doing business. Contractors doing construction work for BPA are classified as government contractors for B&O tax purposes. Contractors are subject to the B&O taxes. Typically, the measure of tax is the gross contract price (WAC 458-20-17001).

The public utility tax is typically assessed on the gross operating revenue of public and privately owned public service firms (utilities). Tax rates are based on the classification of business and utility.

Utilities in the power business are taxed at a rate of 3.873 percent (Washington State DOR, 2000c). The utility tax is levied on the person making the final distribution within the state. If a non-federal entity makes a charge for transmission, that charge is subject to the utility tax. BPA, as a federal agency, is exempt from this tax (Dittrich, 2001).

3.8.3.3 Property Tax

Real and personal property is subject to property tax. Real property includes land and any improvements, such as buildings, attached to the land. The primary characteristic of personal property is mobility. Examples of personal property are machinery, equipment, supplies, and furniture. Personal property tax typically applies to personal property used when conducting business.

The property tax is a combined state and local tax. The state property tax rate is $3.27 per $1,000 of assessed property value (Washington State DOR, 2000c). Local tax rates vary depending on regular and special levies. The state average for local property tax rates is $10.12 per $1,000 assessed value (Washington State DOR, 2000c).

BPA acquires land rights (easements) from private property owners for building, operating, and maintaining transmission facilities with the exception of substations, which BPA acquires in fee. The easement rights are for a specific purpose, and the underlying property owner retains ownership of the property. Because the landowner retains ownership, the landowner continues to pay property tax on the entire parcel, including that within any BPA easement. Because BPA is a federal agency, and exempt from paying local property taxes, improvements owned by BPA, such as transmission facilities and any property acquired in fee for substations, would also be exempt.

BPA acquires land grants instead of easements from federal agency land managers. In the study area, federal lands include the Saddle Mountains Unit of the Hanford Reach National Monument, the Yakima Training Center, and the Hanford Site. Because federal land management agencies are also exempt from state and local property tax, no property taxes would be paid for the grants acquired on these federal lands.

3.8.3.4 Other Taxes

Various other taxes are assessed at the state levels, which include excise tax on fuels, tobacco products, liquor, timber, rental cars, and others. Other local excise taxes include hotel/motel taxes and municipal business taxes and licenses. The sale of most real property is subject to a real estate tax that is paid by the seller. Other taxes levied by the state or local municipalities include an estate and transfer tax, vehicle licensing fee, and watercraft excise tax. No personal income tax is levied in the state of Washington.

3.8.4 Property Value

Real property is assessed a value by the local county assessor. This property value is referred to as the market value or assessed value, and is defined as the amount of money that a willing buyer would pay a willing seller in an arms length transaction, and neither of whom is under any unusual pressure to buy or sell.

Washington State law (RCW 84.52) requires assessors to appraise property at 100 percent of its true and fair market value in money, according to the highest and best use of the property (Washington State Department of Revenue, 1998). Each county assessor values real property using one or more of three professional appraisal methods:

- Market or sales comparison method uses sales to provide estimates of value for similar properties.
- Cost approach method considers what it would cost to replace an existing structure with a similar one that services the same purpose. The cost method is also used in valuing new construction.
- Income method is used primarily to value business property when the property tends to be worth its income-producing potential (Washington State Department of Revenue, 1998).

Property value is used to determine property tax. It is also used as one factor in determining the worth of the property if it is to be sold.

The only exceptions to the information cited above include Washington State law RCW 84.33 and RCW 84.34.

RCW 84.33 addresses the value for Forest land. These values are calculated rather than utilizing the market, cost or income approach to value. The factors affected value include species, stocking percentage, site index, and operability class.

RCW 84.34 addresses the value for Open Space. Two values are considered including the use value and the market value. Taxation is based on the use value, rather than the market value. These properties include agriculture, timber, and open space (a conservation type of category).

3.9 Visual Resources

Typically, ***visual resources*** are more conceptual, esoteric, and open to wider interpretation than other resources. They include the scenery and landscapes that, due to their natural features or relatively undisturbed state, have "outstanding or remarkable value" to the general public. Examples of scenic resources could include outstanding natural features, dramatic vantage points, or pristine landscapes (*Hanford Reach Interim Action Plan, August 28, 1998*).

The study area's visual character and quality are primarily natural and rural, defined by rolling as well as steep and dramatic mountain ranges, consistent stretches of sagebrush and rabbitbrush, and agricultural uses including orchards, vineyards and ranches. Its visual character and quality are also defined by dispersed residential areas, existing transmission and generation facilities, the natural beauty of the Columbia River, and the way topography and vegetation relate to the sky and the changing patterns of light throughout the day and year. All of these factors contribute to the area's visual interest and perceived visual quality.

The visual resources for each segment are described below. Visually Sensitive Viewpoint locations are shown on Map 10, *Visual Analysis,* as well as the location of visual simulations.

3.9.1 Visually Sensitive Viewpoints

Three locations that are visually sensitive have been identified due to their visual quality, uniqueness, cultural significance, or ***viewer characteristics***. These areas include:

- **Viewpoint A**, the area near Colockum Pass, due to the number of residences with **foreground** views of the transmission line project;
- **Viewpoint B**, the north face of the Saddle Mountains near the Columbia River and Crab Creek, due to its unique and striking landform, relationship to adjacent water bodies and number of viewers on Route 243; and
- **Viewpoint C**, the Saddle Mountains Ridgeline, due to its striking landform, recreational value and potential impact from a ridgeline transmission line corridor placement.

For Your Information

Visual resources *are the physical features that make up the visible landscape, including land, water, vegetative, and man-made elements (Guidance Material, USDOT, undated).*

The study area is defined as areas within 5 miles of the line segments that contain residences, recreation areas, public lands, and highways, and have a visual connection to the line segment.

Viewer Characteristics

Low Visual Sensitivity refers to most motorists, who would see transmission lines at limited locations from roads that they traverse.

Moderate Visual Sensitivity refers to some recreationalists, such as bird watchers, hikers and/or recreationalists whose activity is specific to a finite geographic location, who are sensitive to man-made structures and their impact on the view of the natural environment.

High Visual Sensitivity refers to residential viewers who own property within 500 ft of the proposed corridors and are concerned about transmission structures and how they impact the view of the natural environment.

Foreground *is within 0.25 to 0.5 mile of the viewer.*

3.9.1.1 Viewpoint A, Colockum Pass

Segment A passes close to a number of residences that have expressed concerns about the visual impact of the project. Viewers would mainly be residents and visitors to the cabins nearby.

Photo 3.9-1. Looking northeast and east along Gage Road towards Colockum Road (Viewpoint A)

For Your Information

*The **middleground** is from the foreground to about 5 miles from the viewer.*

***Photo 3.9-1** has been simulated in Chapter 4, Environmental Consequences, to show a new transmission line. See Photo 4.8-2.*

***Photo 3.9-2** has been simulated in Chapter 4, Environmental Consequences, to show a new transmission line. See Photos 4.8-4.*

3.9.1.2 Viewpoint B, North Face of Saddle Mountains

In this area, Segments D, E, and F would cross natural water bodies and scale the north face of this dramatic, natural landform. These three segments would be clearly visible (primarily in the ***middleground***) to many viewers including residents, tourists, and recreationalists traveling through the area.

Photo 3.9-2. Looking east to Saddle Mountains from Highway 243 (Viewpoint B)

3.9.1.3 Viewpoint C, Saddle Mountains Ridgeline

Due to its striking landform and recreational value, the Saddle Mountains Ridgeline along Segment F is considered a visually sensitive resource. The high quality of the visual environment is due to the dramatic landform and proximity to Columbia River and Crab Creek, as well as the number of viewers on SR 243, and the presence of residential and tourist viewers in the area. Viewers would mainly be motorists, residents and tourists.

Photo 3.9-3. Looking Northwest towards Saddle Mountain from Wahluke Slope (Viewpoint C)

3.9.2 Segment A

Segment A parallels the Schultz-Vantage 500-kV line through the Kittitas Valley along the edge of rural, agricultural lands and the base of the Wenatchee Mountains. This area is mostly rolling hills of sagebrush and rabbitbrush. Segment A crosses the gentle slope of the Wenatchee Mountains, the YTC, the Middle Canyon at the base of the Boylston and Saddle Mountains, see Map 2, *Alternatives*.

For Your Information

Photo 3.9-3 *has been simulated in Chapter 4, Environmental Consequences, to show a new transmission line. See Photo 4.8-6.*

Photo 3.9-4. View from Carlson and Fairview Road looking east

For Your Information

*The **background** is over 5 miles from the viewer.*

__Photo 3.9-5__ has been simulated in Chapter 4, Environmental Consequences, to show a new transmission line. See Photo 4.8-1.

Typical views in this area are generally foreground and middleground views of valley agricultural lands, and rolling hills of sagebrush and rabbitbrush. ***Background*** views are of the Wenatchee, Boylston, and Saddle Mountains and sky.

Viewers would be residents of the low-density, scattered valley homes, dispersed recreationalists, and motorists on Vantage Highway, Highway 90, Colockum, and other rural roads in the area. Approximately 25 residences occur within 500 feet of the line segment.

Segment A would generally be in the background and adjacent to the existing Schultz-Vantage 500-kV transmission line, or at or near the base of the surrounding mountain ranges.

Photo 3.9-5. View of Schultz-Vantage transmission line crossing of Vantage Highway (View 1 on Map 9)

For Your Information

Photo 3.9-5 *has been simulated in Chapter 4, Environmental Consequences, to show a new transmission line. See Photo 4.8-1.*

Photo 3.9-6. Aerial view of Schultz-Vantage Middle Canyon approaching the Columbia River

3.9.3 Segment B

Option B_{NORTH} – Option B_{NORTH} would parallel the existing Schultz-Vantage 500-kV transmission line down Middle Canyon to the Columbia River, passing gently rolling sagebrush and rabbitbrush, steep cliffs, the Columbia River to the Vantage Substation (Map 2, *Alternatives*). Although numerous lines converge here, the substation is generally out of view due to its location to the east and up-slope from Route 243.

In Middle Canyon, the Schultz-Vantage 500-kV line is typically out of view, but emerges at the east end of the canyon and cuts perpendicular across the Columbia River, becoming visible although not dominating the view for motorists on Route 243. It is part of the foreground with the Columbia River and Wanapum Dam, and middleground with the Columbia River, its adjacent bluffs, the Saddle Mountains, and sky.

Viewers would be motorists on Route 243 and other rural roads in the area, residents of the low density, scattered homes, dispersed recreationalists and visitors of the Wanapum Dam.

Photo 3.9-7. Existing Schultz-Vantage transmission line crossing of the Columbia River looking west toward the Saddle Mountains (View 2 on Map 9)

Option B_{SOUTH} – This line option begins as the same alignment as the north end of Segment C, travels south approximately 1 mile, then turns east and runs down Middle Canyon to the Columbia River, where it would parallel the Vantage-Raver line on the south side.

In Middle Canyon, the existing ROW is typically out of view from most viewers except where it emerges at the east end of the canyon and cuts perpendicular across the Columbia River. In this area, it would be visible, yet, not dominant in the view, to motorists on Route 243 as part of the foreground with the Columbia River and Wanapum Dam and middleground with the Columbia River, its adjacent bluffs, Saddle Mountains and sky. Recreational users of the John Wayne Trail would also have foreground views of the new line for the first two miles, just east of Segment C.

Viewers are motorists on Route 243 and other rural roads in the area, residents of the low density, scattered homes, dispersed recreationalists and visitors of the Wanapum Dam.

3.9.4 Segment C

Segment C would require new ROW across the YTC. The YTC is comprised of four parallel basaltic ridges, with associated valleys that run northwest to southeast. Topography at the YTC varies from low plains to escarpments, and tends to be more rugged in the eastern portions that drain to the Columbia River. Vegetation is typically dominated by sagebrush and rabbitbrush.

Photo 3.9-8. View from Route 24 looking north towards Yakima Ridge

Segment C would cross steep, rugged terrain of big sagebrush and grassland areas, the crest of the western portion of the Saddle Mountains Ridge, the steep, rugged terrain of the four parallel basaltic ridges, the Yakima Ridge, rolling terrain of sagebrush and grasslands, and orchards and vineyards (Map 2, *Alternatives*).

Photo 3.9-9. Aerial view of eastern edge of Yakima Training Center looking South

Segment C would be remote from most potential viewers, although tribal users and dispersed recreationalists are sometimes permitted into areas of the YTC. Segment C could potentially be visible as it crosses Yakima Ridge in the background from SR 243, but would not be dominant in the view. At the southern end of this segment, the proposed route would become visible to motorists for a short distance, as it crosses SR-24 on its way to the new Wautoma Substation.

3.9.5 Segment D

Segment D would parallel or replace the existing Vantage-Midway 230-kV line from the Vantage Substation up and over the Saddle Mountains, down through rolling range land, across heavily used agricultural areas on the Wahluke Slope, through the western corner of the Saddle Mountains Unit of the Hanford Reach National Monument, and over the Columbia River to the Midway Substation. South of the Midway Substation, it would parallel the existing Big Eddy - Midway 230-kV line up the steep slope of the Umtanum Ridge, across rolling, sagebrush, grassland and agricultural areas, and up and over the Yakima Ridge to the proposed Wautoma Substation (Map 2, *Alternatives*).

Due to the length of Segment D and the diversity of terrain and viewers, smaller portions of the segment are discussed in more detail below.

3.9.5.1 Wanapum Dam/Vantage Substation to Crab Creek

This area generally consists of foreground and middleground views of sagebrush, grasslands, orchards, transmission lines, and the Columbia River and background views of the surrounding mountains and sky. Viewers would be the few residents of Beverly and Schwana, motorists on Highway 243, some dispersed recreationalists who use the Columbia River and adjacent areas, and dedicated recreationalists at the Wanapum Dam. Four residences are within 500 feet of the proposed ROW.

Photo 3.9-10. View of Vantage-Hanford transmission line from Vantage Substation looking south towards the Saddle Mountains

3.9.5.2 North Face of Saddle Mountains

The north face of the Saddle Mountains consists of foreground and middleground views of the steep, rocky, dry, slopes of the Saddle Mountains, Crab Creek and adjacent Columbia River, with background views of the sky and distant views through the pass. Viewers would be motorists on Route 243, the few residents of Beverly and Schwana, some dispersed recreationalists who use the Columbia River, Crab Creek Wildlife Area, Milwaukee Road Corridor and the Saddle Mountains, and tourists at the Wanapum Dam.

Photo 3.9-11. Aerial view of agricultural areas and existing transmission line east of Mattawa looking north to Saddle Mountains

3.9.5.3 Wahluke Slope

This area consists of foreground and middleground views of agricultural lands and transmission lines, and background views of the surrounding mountain ranges and sky. Viewers would be agricultural workers, a few residents, dispersed recreationalists, and local motorists.

3.9.5.4 Bluff Above Highway 243 to Midway Substation

This area consists of foreground views of the Columbia River and sagebrush areas, middleground views of sagebrush, the adjacent bluff and the Hanford Site facilities, and background views of the sky. Viewers would be motorists on Route 243 and some dispersed recreationalists, such as boaters on the Columbia River.

3.9.5.5 Midway Substation to the New Wautoma Substation

Typical views in this area consist of foreground and middleground views of sagebrush, grasslands, and agriculture; and background views of mountains and sky. The Big Eddy-Midway transmission line is generally not the dominant view. It crosses open sagebrush and agricultural areas, and is only visible from a short section of Route 24. Viewers would be motorists on Route 24 and local agricultural workers.

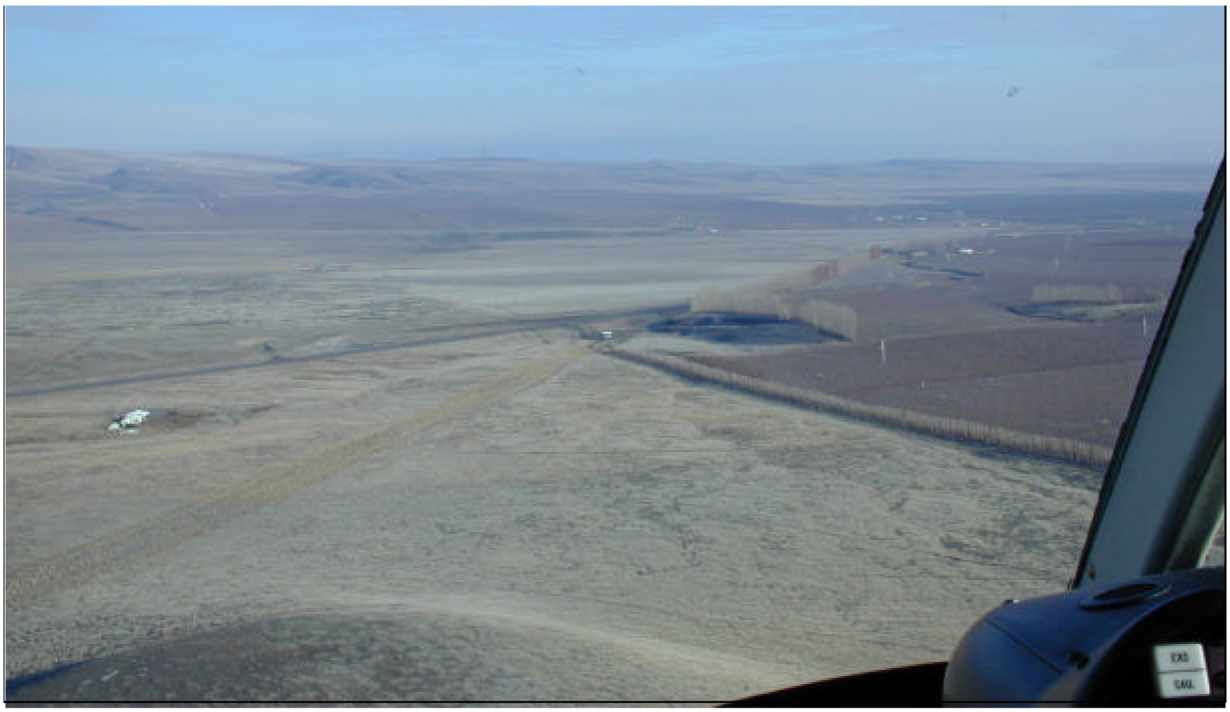

Photo 3.9-12. Aerial view of valley between Umtanum and Yakima Ridge Big Eddy-Midway transmission line

Photo 3.9-13. View looking southeast from Route 24 towards the Saddle Mountains Unit at Vantage-Hanford transmission line crossing

3.9.6 Segment E

Segment E would parallel the existing Vantage-Hanford 500-kV transmission south from the Vantage Substation, near the Wanapum Dam, cross over the Saddle Mountains, down rolling range land, across heavily used agricultural areas on the Wahluke Slope, through the middle of the Saddle Mountains Unit of the Hanford Reach National Monument, and over the Columbia River to the Hanford Substation.

Photo 3.9-14. Existing view of No Wake Lake near Crab Creek looking south toward Vantage-Hanford

3.9.6.1 Wanapum Dam/Vantage Substation to Crab Creek

Segment E would travel south for 4 miles across gently sloping terrain of sagebrush and grasslands, several orchards and open water areas with associated wetlands. A few residences occur near Beverly and Schwana to the west. Highway 243 runs parallel and west of the proposed route.

Typical views in this area consist of foreground views of sagebrush and grasslands, middleground views of sagebrush, grasslands, orchards and the Columbia River, and background views of the surrounding mountains. Viewers would be the few residents of the area, motorists on Highway 243, and dispersed recreationalists. One residence occurs within 500 feet of the proposed route.

3.9.6.2 North Face of Saddle Mountains

Segment E would cross a very steep, rocky, dry, north-facing slope at the western edge of a naturally formed cut in the Saddle Mountains Ridge that runs east/west. The existing Vantage-Hanford 500-kV line scales this rocky slope. The cut in the Saddle Mountains Ridge is formed by the Columbia River and possesses good scenic qualities. Typical views in this area generally are foreground and middleground views of the steep, rocky, dry slopes and adjacent Columbia River, and background views of the sky and distant views through the pass. Viewers would be the few residents, motorists on Route 243, dispersed recreationalists, and dedicated recreationalists at the Wanapum Dam.

3.9.6.3 Wahluke Slope

At the top of the Saddle Mountains, Segment E would travel south across the rugged terrain of big sagebrush and grassland areas into heavily agricultural areas, orchards, vineyards and local roads that stretch across the Wahluke Slope to the southeast, and ends at Highway 24 at the edge of the Saddle Mountains Unit of the Hanford Reach National Monument. Typical views in this area generally are foreground and middleground views of agricultural uses, and background views of the surrounding mountain ranges and sky. Viewers would be agricultural workers, a few residents, dispersed recreationalists, and local motorists.

Photo 3.9-15. View looking northeast from 24 SW near L Street SW

3.9.6.4 Saddle Mountains Unit of the Hanford Reach National Monument

Segment E would cross sagebrush areas that transition to grasslands near the Columbia River. The existing Vantage-Hanford transmission line is generally not the dominant view. Typical views in this area consist of foreground and middleground views of adjacent sagebrush and agricultural lands and background views of the sky. Viewers would include motorists on Route 24.

3.9.6.5 Columbia River Crossing to Hanford Substation

From the Columbia River to the Hanford Substation, Segment E crosses grass and sedge with some small willows near the river's edge, and open water to the heavily disturbed landscape at the Hanford Substation. Typical views in this area consist of foreground and middleground views of the Columbia River, sagebrush, and Hanford Site facilities and background views of the horizon and sky. Viewers would be workers at the Hanford Site and dispersed recreationists (boaters) on the Columbia River.

3.9.7 Segment F

Segment F runs east from the Vantage Substation, south up to the top of the Saddle Mountains, and then parallels the ridgeline until it reaches the existing Grand Coulee-Hanford 500-kV transmission line, where it crosses rolling rangeland at the edge of heavily used agricultural areas on the Wahluke Slope, the Saddle Mountains Unit of the Hanford Reach National Monument, and the Columbia River to the Hanford Substation (Map 10, *Visual Analysis*).

3.9.7.1 Vantage Substation to Crab Creek

From the Vantage Substation to Crab Creek, Segment F, (a new corridor), would cross gently sloping terrain of sagebrush and grasslands, several orchards and open water areas with associated wetlands. There are a few residences near Beverly and Schwana to the west. Highway 243 runs parallel and west of the proposed route. Typical views consist of foreground views of sagebrush and grasslands, middleground views of sagebrush, grasslands, orchards and the Columbia River, and background views of the surrounding mountains. Viewers would include the few residents, motorists on Highway 243, and dispersed recreationalists.

Photo 3.9-16. View of area near Vantage Substation

3.9.7.2 North Face of Saddle Mountains

Segment F would cross a very steep, rocky, dry, north-facing slope at the western edge of a naturally formed cut in the Saddle Mountains Ridge. Although existing transmission lines scale this rocky ridge to the west, Segment F would create a new corridor on a relatively undisturbed mountain face. Typical views consist of foreground and middleground views of the steep, rocky, dry slopes, Crab Creek and adjacent Columbia River, and background views of the sky. Viewers would include the few residents, motorists on Route 243, and dispersed recreationalists.

Photo 3.9-17. The north face of the Saddle Mountains (View 3 on Map 10)

3.9.7.3 Saddle Mountains Ridge

Segment F would create a new corridor across rolling and steep big sagebrush areas on the south side of the Saddle Mountains, parallel to the ridgeline. Typical views consist of foreground and middleground views of sagebrush, and background views of the Saddle Mountains and sky. Viewers would include local motorists, the few residents, Wahluke Slope agricultural area workers, and dispersed recreational users of the Saddle Mountains.

➡ For Your Information

Photo 3.9-17 *has been simulated in Chapter 4, Environmental Consequences, to show a new transmission line. See Photo 4.8-5.*

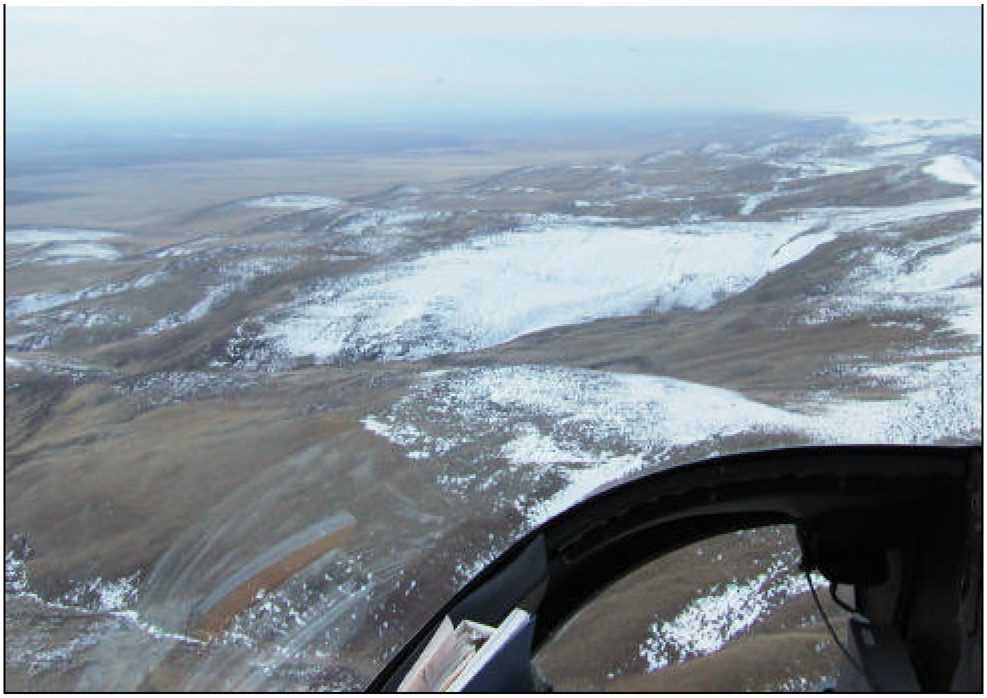

Photo 3.9-18. Aerial view of the south slope of the Saddle Mountain Ridge looking southwest towards Mattawa

3.9.7.4 Wahluke Slope

For Your Information

***Photo 3.9-19** has been simulated in Chapter 4, Environmental Consequences, to show a new transmission line. See Photo 4.8-7.*

Segment F would parallel the existing Grand Coulee-Hanford transmission line and be only visible for a short distance for most viewers. Typical views consist of foreground views and middleground views of agricultural uses and sagebrush and background views of the Saddle Mountains and sky. Viewers are motorists on Highway 24 and the few local roads, and dispersed recreationalist users of the Saddle Mountains Unit of the Hanford Reach National Monument.

Photo 3.9-19. View of Grand Coulee–Hanford line looking north near Highway 24 (View 4 on Map 9)

Photo 3.9-20. View looking south from top of bluff overlooking the Saddle Mountains Unit of the Hanford Reach National Monument adjacent to Grand Coulee–Hanford line

3.9.7.5 Hanford Reach National Monument/Hanford Site

Segment F crosses big sagebrush, descends a 200 feet bluff to a flat area where the landscape transitions to grasslands/sedge/ small willows near the Columbia River, crosses over the Columbia River and ends at the Hanford Substation. Typical views consist of foreground and middleground views of the grasslands and background views of distant mountains and sky. The transmission line would only be visible for short distances. Viewers would include motorists on Route 24, workers at the Hanford Site, and dispersed recreational users (boaters) on the Columbia River.

3.10 Recreation Resources

This section describes recreation activities within one mile of the line segments. The activities described occur both under and near the existing and proposed transmission lines. In many cases, these activities have not been formalized, permitted, or sanctioned by the landowner or easement holder. Recreational activities within the study area are dispersed and include hunting, off-road vehicle use, fishing, hiking, rock hounding, horseback riding, primitive camping, snowshoeing, and snowmobiling. Recreationists are predominantly full-time residents (Neil White, 2001).

For Your Information

Dispersed Recreation *refers to recreation activities that are not limited to a finite location. These types of activities do not require improvements that commit resources to a particular type of recreation.*

Dedicated Recreation *refers to activities that are limited to a finite geographic location and are supported by improvements that commit the resource to a specific recreational activity.*

Table 3.10-1, *Recreation Resources*, lists recreation sites and categorizes activities as either ***dispersed*** or ***dedicated*** recreation. Map 7, *Land Ownership*, illustrates the proximity of recreation sites to the segments.

3.10.1 Yakima Training Center

Recreation activities on the YTC depend on the season and geographic location. To the north of the site is a 17-mile segment of the John Wayne Trail; an abandoned railroad ROW that has been converted to a multi-use trail extending 110 miles from North Bend, Washington to the Columbia River. Hiking, mountain biking, and horseback riding is permitted along the trail within the YTC.

Other dispersed recreation allowed on the YTC includes hunting, falconry, horseback riding, and mountain biking as well as organized activities such as field dog training and trials, horse endurance rides, and wildlife viewing. Hunting continues throughout the year and is the most popular recreation activity. Falconry also continues throughout the year and is a permitted use throughout most of the YTC. Horseback riding is limited to existing roads and trails, and may be restricted seasonally according to wildlife needs. Mountain biking is allowed on designated roads and in the John Wayne Trail corridor. Field dog training and trials are permitted September through January. Horse endurance rides typically occur during the late spring and early fall. Wildlife viewing of the Western Sage grouse occurs only once a year.

3.10.2 Columbia River near Vantage

Dispersed recreation activities near the Columbia River include sightseeing, wildlife viewing, off-road vehicle use, fishing, hiking, boating, and water sports. Interpretive facilities are provided at the Wanapum Dam, as part of the Native American Heritage Center and the Dam Powerhouse, and are considered dedicated recreation activities.

Table 3.10-1
Recreation Resources

Line Segment	Resource	Dispersed Recreation Activities	Dedicated Recreation Activities
A	Open Range	Hunting, off-road vehicles, fishing, hiking, rock hounding, horseback riding, primitive camping, snowshoeing, snowmobiling	
A	Charlton Canyon Schnebly Canyon and Creek Cooke Canyon Creek Burnt Canyon Cave Canyon Trail Gulch Parke Creek Trail Creek	Hunting, off-road vehicles, fishing, hiking, rock hounding, horseback riding, primitive camping, snowshoeing, snowmobiling	
B, C	YTC ***All activities on the site area subject to geographic and seasonal restrictions.***	Hunting, falconry, horseback riding, wildlife viewing, field dog training, mountain biking	John Wayne Trail (hiking, horseback riding, mountain biking)
B, D, E, F	Columbia River	Sightseeing, wildlife viewing, off-road vehicle, fishing, hiking, boating, water sports	
D	Wanapum Dam		Heritage Center tours and activities, Power house tours
D, E, F	Crab Creek Wildlife Area	Hunting, fishing, wildlife viewing	
D, E, F	Milwaukee Road Corridor	Hiking, mountain biking, horseback riding, primitive camping	
D, E, F	Saddle Mountains (includes BLM managed areas)	Hunting, off-road vehicles, rock hounding, hand gliding, paragliding, horseback riding, hiking, camping, falconry, mountain biking, bird watching	
D, E, F	Hanford Reach of the Columbia River	Boating, fishing	***No landing on Hanford Site allowed***
D, E, F	Hanford Reach National Monument	Wildlife observation, photography, fishing hunting, environmental education, sightseeing	

Source: Neil White, per comm.
Billie Sumrall, per comm.
Wanapum Dam Heritage Center website
James Munrone, per comm.
BLM, 1997
CH2M HILL, 1998
U.S. Department of the Army, 1996

On the east side of the Columbia River near Vantage, the John Wayne Trail is called the Milwaukee Road Corridor. The trail follows the Chicago Milwaukee St. Paul and Pacific railroad line for the majority of its length. At a few locations, the trail departs from the abandoned railroad corridor because of private ownership. Recreational use of the trail requires a permit from the DNR. Along the trail, recreation is dispersed and includes hiking, mountain biking, horseback riding, and primitive camping. Within the Crab Creek Wildlife Area, dispersed recreation focuses on the pristine natural environment and includes fishing, hunting, and wildlife viewing.

3.10.3 Saddle Mountains

The portion of the Saddle Mountains Management Area that is managed by the BLM is remote and far from major transportation corridors, so sightseeing is limited. However, other dispersed recreation activities occur in the area. Hang gliders come to this area from all over the state for the updrafts along the north slope of the range. This area has an even greater geographical pull for rock hounding, with visitors from as far north as British Columbia, the Oregon Coast and other areas within the U.S. Because there are over 80 miles of roads and trails on public lands (most were constructed to access power transmission lines), mountain biking opportunities are also available. Overall, recreational opportunities within this area draw a wide range of both local and regional recreation user groups (BLM 1997).

3.10.4 Hanford Reach National Monument

The Hanford Reach boasts some of the best salmon fishing in the entire Columbia River watershed. Anglers travel great distances to fish these waters during the peak of the fishing season. The Hanford Reach also offers dispersed water-related recreation including boating and fishing. However, no landing on the Hanford Site is allowed.

The Saddle Mountains Unit is on the north side of the Hanford Reach National Monument and within this area, recreational activities are prohibited.

Recreation in the Hanford Reach National Monument is dispersed and includes sightseeing from major transportation corridors, hunting hiking, wildlife observation, photography, fishing, and environmental education. This area lacks interpretive and service facilities typical of a national monument.

3.11 Cultural Resources

Cultural resources located in the proposed study area include prehistoric camps, ***lithic*** scatters, prehistoric stone tool quarries, historic homesteads, historic railroad sites, and traditional root-gathering areas. There are no sacred sites recorded at this time in the study area.

The Columbia, Kittitas, Wanapam, Wenatchee, and Yakama peoples lived in the vicinity of the study area at the time of the Lewis and Clark expedition of the Snake and Columbia rivers in 1805 en route to the Pacific (Ray 1936). These people were Sahaptan and Salish speakers, part of what would later be described as the Plateau culture. Their life was focused on an annual round anchored by specific times for gathering, hunting, fishing, and trading, but also for religious activities, visiting, courting, storytelling, dancing, and other such activities. Additional ethnographic descriptions of Plateau groups are available in Mooney (1896), Ray (1936, 1939), Relander (1956) and Spier (1935).

A period of exploration and trapping followed, with early travelers such as Wilson P. Hunt of the Astor Company, David Thompson of the Northwest Company, Alexander Ross, Ross Cox, and many others arriving in this area between 1805 and 1815. The Hudson's Bay Company opened Fort Nez Perces in the 1820's, which was later called Old Fort Walla Walla in the 1830's. Many interesting and informative historical accounts of this period are available, such as Franchere (1969), Glover (1962), Thwaites (1959), and Symons (1882).

Gold mining brought many Europeans, Euroamericans, and Chinese through the study area beginning around 1850, but it was ranching that kept them there. The area's grass provided sustenance for cattle and their owners alike (Splawn 1917). Transportation – particularly river crossings – provided the means for expansion. The Columbia River, the Caribou Trail, wagon roads, and later the railroads, all served to bring travelers and supplies to this area, providing residents with the opportunity to serve as merchants. Camels were even used for several years to bring gold mining supplies from this area to Idaho and Montana (Lewis 1928).

Horse ranching and fruit farming increased in the latter half of the last century, but it was not until more efficient irrigation systems were organized about the turn of the century that fruit farming really became a major activity in this region.

The world's first dual-purpose nuclear reactor (the N-Reactor) was built on the Hanford Site in 1963-1969 (Rice 1983). Some of the

For Your Information

Cultural resources *are those historic and archaeological properties, properties of traditional and cultural significance, sacred sites, Native American human remains and associated objects, and cultural landscapes which are entitled to special consideration under federal statute, regulations, and/or executive orders.*

Lithic *relates to stone tools.*

Hanford Site structures are now old enough to be considered historic sites.

A search of recorded sites was conducted in the study area. Cultural resources are categorized as historic and archaeological properties, properties of traditional and cultural significance, sacred sites, and cultural landscapes, which are all recognized and protected under federal mandates.

For Your Information

Debitage *is the flaking by-products that result from working rough stone into tools.*

Archaeological lithic scatters produced during stone tool manufacture or modification are the most common archaeological site type in the project area. Flaked tools and ***debitage*** are the overwhelmingly the most common cultural material present at these sites, although ground, pecked, and battered stone tools also are found. Campsites, which include a number of material types and features and which represent longer-term use and multiple activities, make up the second most common site type. Other common archaeological site types include resource procurement and processing activities, such as quarries, butchering sites and root gathering areas. A cultural resource survey, which will be done before construction, will likely locate additional prehistoric sites of these kinds.

Historic sites recorded in this area include historic homesteads, dumps, trails, railroad-related features and earthen structures. These sites include both historic structures and artifact scatters.

Map 11, *Cultural Areas*, shows the areas of known cultural areas. For further detail see Appendix H, *Phase I Cultural Resource Assessment*.

3.12 Public Health and Safety

Transmission facilities provide electricity for heating, lighting, and other services essential for public health and safety. These same facilities can potentially harm humans. Contact with transmission lines can injure people and damage aircraft. This section describes public health and safety concerns, such as shocks and noise, related to transmission facilities. More detailed information can be found in Appendix I, *Electrical Effects*.

3.12.1 Electric and Magnetic Fields

Transmission lines, like all electrical devices and equipment, produce ***electric and magnetic fields*** (EMF). The voltage, or force that drives the ***current***, is the source of the electric field. Electric fields are expressed in units of volts per meter (V/m) or kilovolts per meter (kV/m). The current, or movement of electrons in a wire, produces the magnetic field. The strength of magnetic field depends on the current, design of the line, and the distance from the line. Field strength decreases rapidly with distance. Electric fields can be reduced significantly by the presence of conducting objects. Thus, inside houses and automobiles, electric fields are lower than outside because of shielding.

Electric and magnetic fields are found around any electrical wiring, including household wiring and electrical appliances and equipment. Throughout a home, the electric field strength from wiring and appliances is typically less than 0.01-kV/m. However, fields of 0.1-kV/m and higher can be found very close to some electrical appliances.

Average magnetic field strength in most homes (away from electrical appliances and home wiring, etc.) is typically less than 2 ***milligauss (mG)***. Very close to appliances carrying high current, fields of tens of hundreds of milligauss can be present. Unlike electric fields, magnetic fields from outside power lines are not reduced in strength by trees and building material. Because of this, transmission lines can be a major source of magnetic field exposure throughout a home located close to the line. Typical electric and magnetic field strengths for some BPA transmission lines are given in Table 3.12-1, *Typical Electric and Magnetic Field Strengths*.

For Your Information

Electric and magnetic fields *(EMF) are the two kinds of fields produced around the electric wire or conductor when an electric transmission line or any electric wiring is in operation.*

Current *is the amount of electrical charge flowing through a conductor.*

A ***milligauss*** *is one thousandth of a gauss.*

A ***gauss*** *is a unit of magnetic induction.*

kV/m = kilovolt per meter
mG = milligauss

Table 3.12-1
Typical Electric and Magnetic Field Strengths

Transmission Lines	Electric Fields (kV/m)	Magnetic Fields (mG)	
		Maximum[1]	Average[2]
115-kV			
Maximum on ROW	1	62	30
Edge of ROW	0.5	14	7
200 feet from center	0.01	1	0.4
230-kV			
Maximum on ROW	2	118	58
Edge of ROW	1.5	40	20
200 feet from center	0.05	4	2
500-kV			
Maximum on ROW	7	183	87
Edge of ROW	3	62	30
200 feet from center	0.3	7	3

[1] Under annual peak load conditions (occurs less than 1 percent of the time)

[2] Under annual average loading conditions

Note: The information above was obtained from a BPA study to characterize nearly 400 transmission lines located in the Pacific Northwest. Based on 1992 data (Sterns. et. al.).

There are currently no national standards in the United States for electric and magnetic fields from transmission lines. Some states have established electric and/or magnetic field standards for 60-Hz electric and magnetic fields. The state of Washington does not have limits for either electric or magnetic fields from transmission lines. The BPA has maximum allowable electric fields of 9-kV/m on the ROW and 5-kV/m at the edge of the ROW. The BPA also has maximum allowable electric field strengths of 5-kV/m, 3.5-kV/m, and 2.5-kV/m for road crossings, shopping center parking lots, and commercial/industrial parking lots, respectively.

Both electric and magnetic fields induce currents in conducting objects, including people and animals. The magnitude of the induced current in objects under lines depends on the electric- or magnetic-field strength and the size and shape of the object. The currents induced in people, even from the largest transmission lines are generally too weak to be felt. However, under certain circumstances, contact to a grounded object by a well-insulated person in a high electric field can result in a perceived nuisance shock or spark discharge. Similarly, contact of a grounded person with an ungrounded large conducting object, such as a truck or tractor, in an electric field can result in a perceived nuisance shock due to the induced currents in the object. Transmission lines are designed and built so that such shocks occur infrequently and if they do, are no higher than the nuisance level and that they occur infrequently. Stationary conducting objects, such as metal buildings and fences, near transmission lines are grounded to prevent them being a source of shocks.

The possibility of health effects from long-term exposure to 60-Hz electric or magnetic fields has been researched for several decades. The consensus of scientific panels reviewing this research is that the evidence does not support a causal relationship between electric or magnetic fields and any adverse health outcomes, including childhood cancer, adult cancer, reproductive outcome, or other diseases. However, investigation of a statistical association between magnetic field exposure and childhood leukemia continues. It has not yet been possible to exclude a role for magnetic fields above 4 mG given the small number of persons studied with exposures at these levels and the problems of selecting appropriate control groups. Although uncertainty about possible effects of EMF on health has been considerably reduced in the past few years, concerned individuals can take low or no cost actions to reduce long-term exposures.

The research literature published to date has shown little evidence that exposure to EMF leads to adverse effects on domestic animals, wildlife and plants. (See Appendix J, *Assessment of Research Regarding EMF and Health and Environmental Effects*.)

3.12.2 Noise

3.12.2.1 Transmission Line Noise

Audible noise can be produced by transmission line ***corona***. In a small volume near the surface of the conductors, energy and heat are dissipated. Part of this energy is in the form of small local pressure changes that result in audible noise. Corona-generated audible noise can be characterized as a hissing, crackling sound that under certain conditions is accompanied by a 120-Hz hum.

Corona-generated audible noise is of concern primarily for contemporary lines operating at voltages of 345-kV and higher during foul weather. The conductors of high-voltage transmission lines are designed to be corona-free under ideal conditions. However, a protrusion on the conductor surface – particularly water droplets on or dripping off the conductors – cause electric fields near the conductor surface to exceed corona onset levels, and corona occurs. Therefore, audible noise from transmission lines is generally a foul-weather (wet-conductor) phenomenon. However, during fair weather, insects and dust on the conductors can also serve as sources of corona.

For Your Information

Corona *is an electrical discharge, at the surface of a conductor. A technical definition is included in Chapter 9, (Glossary and Acronyms).*

3.12.2.2 Substation Noise

The Schultz Substation is surrounded by rangeland, with some agricultural land to the south and one rural residence approximately 0.25 to 0.5 mile to the southeast. The site is relatively quiet, and due to the distance from the nearest residence, does not affect the surrounding area.

The Vantage Substation is located east of the Columbia River and is surrounded by open shrub-steppe habitat land and rangeland. As with the Schultz Substation, this site is relatively quiet.

The Midway Substation is located along the northern base of Umtanum Ridge, a short distance south of the Columbia River. The area to the west, east, and north between the substation and the river is open shrub-steppe habitat land. Like the Schultz and Vantage Substations, this site is also relatively quiet.

The Hanford Substation is located along the southeast side of the Columbia River. Except for facilities associated with the retired N-Reactor adjacent to the substation site to the north/northeast, the area surrounding the site is open shrub-steppe habitat land. The retired N-Reactor is not operating. The only noise produced is from workers who perform surveillance and maintenance at the site.

Sound varies at the substation sites, as a result of weather and other factors such as background noise and the kind of equipment operating, and could be higher or lower on any given day or at any given time at these substations.

The site of the new Wautoma Substation is currently an open field. Noise at this site is primarily background noise from wind and weather, with the sound of an occasional truck or automobile on the dirt road or distant Highway 24.

3.12.3 Radio and TV Interference

➡ For Your Information

Electromagnetic interference (EMI) *is high-frequency electrical noise that can cause radio and television interference.*

Corona on transmission line conductors can generate electromagnetic noise in the frequency bands used for radio and television signals. In rare circumstances, corona-generated ***electromagnetic interference*** (***EMI***) can also affect communication systems and sensitive receivers. Interference with electromagnetic signals by corona-generated noise is generally associated with lines operating at voltages of 345-kV or higher. This is especially true of interference with television signals.

Radio reception in the AM broadcast band (535 to 1,604 kilohertz (kHz)) is most often affected by corona-generated EMI. FM radio reception is rarely affected. Generally, only residences very near transmission lines can be affected by radio interference.

Corona-caused television interference occurs during foul weather and is generally of concern only for conventional receivers within about 600 feet of a line. Cable and satellite television receivers are not affected.

Spark gaps on distribution lines and on low-voltage transmission lines are a more common source of radio and television interference than is corona from high-voltage transmission lines. This gap-type interference is primarily a fair-weather phenomenon caused by loose hardware and wires.

3.12.4 Toxic and Hazardous Materials

Minimal amounts of hazardous waste result from routine maintenance procedures performed on substation equipment and transmission lines. The type and volume of waste such as oily rags, minor leaks from vehicles, etc., depend on maintenance procedures.

The areas with the most human activities, specifically the YTC, the Wahluke Slope, and the Hanford Site are most likely to have hazardous materials issues.

The military conducts live-fire training and maneuvers at the YTC. Hazardous materials that might be encountered along the proposed routes through the YTC include live and spent ammunition, unexploded ordinance, petroleum products, and other military chemicals or explosives.

The Wahluke Slope, excluding the Hanford Reach National Monument, supports an intensive agricultural area. Hazardous materials that may be encountered in this area are related to agricultural operations, and include pesticides, fertilizers, and petroleum products. Pesticides and fertilizers may be encountered in their bulk form in storage or illegal disposal sites, in the form of spills, or after they have been applied to crops.

The Hanford Site includes retired radioactive material production facilities and active research and radioactive waste management facilities. These areas are well characterized because of the locations within the Hanford Site that are being considered for this proposal; therefore, radioactive materials should not be unexpectedly encountered.

Hazardous materials could be encountered anywhere along the proposed route and could include such things as illegally dumped waste, drug lab chemicals, spilled petroleum products, pesticides, and other wastes.

The 500-kV Schultz Substation has no transformers on site. A small amount of oil is in the power circuit breaker compressors and in the series capacitor cans. Contaminated oil, or polychlorinated biphenyl (PCB), may be present in the power circuit breakers and capacitor cans. There is no oil spill containment system for this substation, but BPA does have a Spill Prevention Control and Countermeasure Plan that puts in place protocols and procedures for response in case a spill or leak occurs.

The 500-kV Hanford Substation also has no transformers on site. Similar to the Schultz Substation, a small amount of oil is in the power circuit breaker compressors and in the shunt capacitor cans. PCBs may be in the compressors, but no PCBs are present in the shunt capacitor. This substation site also has a diesel tank that runs an engine generator. There is no oil spill containment system at this substation, but like Schultz Substation, BPA has a Spill Prevention Control and Countermeasure Plan in case a spill or leak occurs.

The 230/500-kV Vantage Substation includes a number of transformers on site that may contain PCBs. There are also two oil tanks on site. Unlike the Schultz and Hanford Substations, this substation does have an oil spill containment system in place for the two 500-kV transformer banks on site. It also has a Spill Prevention Control and Countermeasure Plan.

3.12.5 Fire

Numerous wildfires have occurred on private and public land in and around the proposed routes over the past several years. They may have been caused by human actions such as vehicle ignitions from roads, unattended campfires, burning of adjacent agricultural lands and arson, or by natural causes such as lightning.

Between 1980 and 1997, there were six different wildfires that either started on or threatened public land in the Saddle Mountains Management Area. The cause of these fires ranged from lightning strikes to equipment use and railroad operations (BLM 1997). Fires have also affected the Saddle Mountains Unit of the Hanford Reach National Monument from similar causes.

Due to the nature and intensity of the training that occurs at the YTC, the incidence of fire is higher on YTC land than on adjacent lands. The risk of fires at the YTC is largely dependent on the intensity, duration, and season of training activities taking place. The use of tracers and pyrotechnic devices as well as live-firing activities increases the fire risk (U.S. Army 1996). Fire management is addressed in the management plan for the YTC (U.S. Army 1996).

The Hanford Reach National Monument was established in June 2000. A Fire Management Plan has been completed that will provide for the perpetuation of natural conditions and processes within the monument/refuge, while managing wildlife fire to protect life, property, and cultural resources. This plan will help reduce hazards associated with unplanned fire events (U.S. DOI/USFWS 2001).

Farmers throughout the state, including those in central Washington near the line segments, burn agricultural fields to remove the remaining plant material after harvest and prepare for planting the next crop. In order to meet the requirements of the Washington State Clean Air act of 1991, a statewide agricultural burning permit program has been implemented. This program includes permit conditions on when burns may occur and what materials may be burned (WAC 173-430). BPA does not expect to conduct any outdoor burning.

For Your Information

There are no air quality monitoring sites within the study area. The nearest monitoring sites are located around the City of Yakima to the west/southwest, in the Wenatchee Valley to the north/northeast, and in the City of Ellensburg to the west. The sites in the Wenatchee Valley and Ellensburg were installed as a result of special monitoring studies that showed the potential for violations in several new areas across the State, including Wenatchee, Ellensburg, and parts of the Columbia plateau (DOE Overview 1997-1999).

*A **nonattainment area** is a geographic region designated by EPA in which federal air quality standards are not or were not met by a certain date. There are six air pollutants that are monitored; particular matter (PM), carbon monoxide (CO), ozone (O3), nitrogen dioxide (NO2), sulfur dioxide (SO2), and lead (Pb).*

*Section 160 of the federal Clean Air Act requires the preservation, protection, and enhancement of the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic or historic value. The 1977 Clean Air Act amendments called for a list of existing areas to be protected under section 160. These are called **Class 1 areas**.*

3.13 Air Quality

In Washington, local clean air authorities have the primary responsibility for improving air quality. In areas with no local clean air authorities, the Washington Department of Ecology (WDOE) assumes responsibility. In the four counties where the study area is located, two local clean air authorities and two regional WDOE offices work together to control, monitor, and prevent air pollution:

- Benton Clean Air Authority: Benton County
- Yakima Regional Clean Air Authority: Yakima County
- USDOE Central Regional Office: Kittitas County
- USDOE Eastern Regional Office: Grant County

In 2000, the sources of air pollution in Eastern Washington were motor vehicles (53 percent), industry emissions (12 percent), agricultural (11 percent), outdoor burning (11 percent), wood stoves (7 percent), and other (6 percent) (WDOE, *Washington Environmental Health 2000* website).

Data from air quality monitoring sites has shown that air quality is improving across the State of Washington. However, there are still a few ***nonattainment areas*** scattered throughout the State. These nonattainment areas are not located within the study area.

Statewide trends for particulate matter show decreasing levels of PM-10. Some eastern Washington areas showed increased levels in 1999, although the overall trend tended to decrease or remain constant (WDOE *1999 Air Quality Trends*). The majority of the times when the PM-10 air quality standards are exceeded, it is a result of natural events (dust storms).

Air quality has a direct effect on visibility. The Federal Clean Air Act (Section 160) and its amendments require that air quality be preserved, protected, and enhanced in specific areas of national or regional natural, recreational, scenic, or historic value.

These areas are designated as ***Class 1***. There are eight mandatory Class 1 areas in the State of Washington where the protection of visibility is required. In these areas, there are restrictions on the use of land and resources in order to avoid damaging visibility, plants, and other resources. There are no Class 1 areas in the study area.

Chapter 4 — Environmental Consequences

In this Chapter:

- **Specific impacts from alternatives**
- **Recommended mitigation**
- **Cumulative impacts**

This chapter discusses the potential environmental impacts of the Agency Preferred Alternative (Alternative 2), other construction alternatives (Alternatives 1, 3, and 1A) and the No Action Alternative. Each alternative is composed of line segments discussed in Chapter 2, *Alternatives*, Section 2.1, *Segments*. Existing resources along each line segment are discussed in Chapter 3, *Affected Environment*. Like Chapter 3, this chapter discusses resources associated with the natural environment first and then the human environment. Impacts are discussed by alternative with reference to segments. A few resources (e.g., Air Quality) discuss the project as a whole because, for that resource, the impacts are the same for each alternative.

For Your Information

Please review Chapter 2, Alternatives, for a full description of the alternatives.

Refer to Map 2, Alternatives, to review locations of the line segments and alternatives.

To analyze potential impacts for construction, operation, and maintenance activities, resource specialists have analyzed actions using a scale with four impact levels: high, moderate, low, and no impact. Because definitions of these impact levels vary with each resource, explanations are provided with each of the resource discussions.

Specialists have considered the direct and indirect impacts of the alternatives, over the short and long term. Direct impacts are caused by and occur at the same time and place as construction, operation, and maintenance activities. Indirect impacts are caused by the same activities but occur later in time or are farther removed in distance. However, these impacts are still reasonably foreseeable.

Impact discussions include recommended ***mitigation*** that could reduce both the direct, indirect, and ***cumulative impacts*** of the proposed alternatives. The level of detail for the impact discussions of each resource depends on that resource's character, and the significance of the issue. Additional detail for some resources is included in appendices.

Mitigation *describes measures that could be taken to lessen the impacts predicted for each resource. These measures may include reducing or minimizing a specific impact, avoiding it completely, or rectifying or compensating for the impact.*

Cumulative impacts *are created by the incremental effect of a specific action when added to other past, present, or reasonably foreseeable future actions.*

Construction of the alternatives would be typical of other BPA transmission line projects (for details, see Appendix B, *Construction and Maintenance Activities*). General construction steps are summarized and information on structure site activities are given in the boxes below.

Construction Steps

Typical transmission line construction steps include:

- improving or constructing access roads
- clearing ROW
- preparing structure sites
- excavating and installing structure footings
- delivering structures to the sites (steel, insulators, conductors, and other miscellaneous equipment)
- assembling and erecting structures
- stringing and tension conductor, ground wire, and fiber optic cable
- installing counterpoise

Structure Site Activities

All vegetation would be removed from structure sites. Sites would be graded, if needed, to provide a level work area. An average area of about 100 ft by 100 ft would be disturbed at each structure site.

Each leg of a tower has a footing. Footings for suspension towers generally occupy an area of about 6 ft by 6 ft, to a depth of 12 ft. Footings at angle points would be larger and deeper, about 15 ft by 15 ft and 16 ft deep.

4.1 Water Resources, Soils, and Geology

For Your Information

For related water quality effects, see separate discussions under Sections 4.2, Floodplains and Wetlands; 4.4, Wildlife; and 4.5, Fish Resources.

Impacts to water, soils, and geology are interrelated and discussed as a group in this section.

4.1.1 Impact Levels

A **high** impact would occur where:

- a water body that supports sensitive fish, waterfowl, and animal habitat, or human uses such as drinking water would be extensively altered so as to affect its uses or integrity.
- the possibility of oil spills from substation equipment reaching groundwater would be high, such as in shallow groundwater areas, highly permeable soils, and where no secondary spill containment or protective measures are used.
- water quality would be degraded below state or federal agency standards and site conditions would be so unfavorable that major reclamation, special designs, or special maintenance practices would be required.
- road or facility construction or clearing would be required on sites that are prone to mass movement or have very high susceptibility to erosion.
- soil properties would be so unfavorable or difficult that standard mitigation measures, including revegetation, would be ineffective.
- long-term impacts associated with accelerated erosion, sedimentation, or disruption of unstable slopes would occur.

A **moderate** impact would occur where:

- water quality degrades below state or federal standards, but can be partially mitigated to lessen impacts. Site conditions require special planning and design.
- construction and clearing takes place near a water body on erodible soils that have moderate revegetation potential.
- new roads would be constructed across a stream or where existing stream crossings are inadequate and would require rebuilding.
- impacts would continue to occur until disturbed areas are reclaimed and sediment is no longer transported to surface waters.
- soil properties and site features are such that mitigation measures would be effective in controlling erosion and sedimentation within acceptable levels.
- impacts would be primarily short-term, with an increase in normal erosion rates for a few years following soil disturbance until erosion and drainage controls become effective.
- there would be little possibility of oils or other pollutants affecting groundwater because their level is deep, soils are relatively non-porous, and facilities have some minor spill protective measures.

A **low** impact would occur where:

- impacts to water quality could be easily mitigated to state or federal standards with common mitigation measures.
- there would be little or no possibility of oil or other pollutants affecting groundwater because their level is deep, soils are relatively non-porous, and facilities have good oil spill containment protective measures.
- structures or access roads near water bodies would be in stable soils on gentle terrain, with little or no clearing.
- structures would be away from water banks and little or no sediments would reach the water.
- there would be no construction or major reconstruction of roads.
- road and facility construction and clearing would be required on soils with low to moderate erosion hazard, and the potential for successful mitigation would be good using standard erosion and runoff control practices.

- erosion levels would be held near normal during and following construction.

No impact would occur where water quality and soils would remain unchanged.

4.1.2 Impacts Common to Construction Alternatives

Impacts to soils and geology are generally based on a site's susceptibility to long-term degradation. The following factors can increase a site's susceptibility:

- being prone to erosion and mass movement.
- having soils that are susceptible to compaction.
- having steep slopes.
- undergoing extensive clearing and access road construction.
- disturbing the soil surface and subsurface and removing vegetation increases the risk of soil erosion and mass movement, and may change soil productivity.

For Your Information

Turbidity *is a reduction in the clarity of water from suspended materials such as clay, mud, organic material, or other materials.*

There are several general impacts of concern relating to hydrology and water quality:

- Runoff can increase sedimentation and water ***turbidity***.
- Road improvements and vehicular traffic at stream crossings can increase turbidity and alter stream channels.
- When agriculture soils are disturbed, nutrients leached from the soil or transported on soil particles can stimulate the growth of undesirable aquatic vegetation.
- Clearing streamside vegetation can increase a stream's exposure to sunlight, possibly raising water temperature.

Direct impacts would be caused by access road construction and improvements, maintenance activities, ROW clearing, and site preparation for structures and other facilities. Canals and creek crossings, including one shoreline of the State (Naneum Creek) crossing, would use existing bridges fords and culverts, or would have new fords or culverts installed in coordination with U.S. Fish and Wildlife Service (USFWS), Corps of Engineers (COE), and appropriate state agencies. New crossings would disturb the soil surface; increase erosion, runoff, and sedimentation in nearby watercourses; impair soil productivity; and remove land from production. At this time, exact crossing locations are not known. Until final designs are completed, the amount of soil exposed by project construction can only be estimated. Table 4.1-1, *Area of Ground Disturbance*, summarizes the area of ground disturbance, and Table 4.1-2, *Access Road Distances*, summarizes the length of new access roads and improvements to existing access roads.

It is not anticipated that impacts to ***303(d) streams*** would alter those parameters for which they are listed, as described in Section 3.1.2.1, *Water Quality*. In addition, impacts to aquifers are not anticipated, provided that the proposed project would comply with local ordinances and laws and state and federal water quality programs that prevent degradation of the quality of aquifers and do not jeopardize their usability as a drinking water source.

Table 4.1-1
Area of Ground Disturbance

BNORTH / BSOUTH	Preferred (2) (acres)	Alternative 1 (acres)	Alternative 3 (acres)	Alternative 1A (acres
Access Road	–	446.3	585.2	473.2
	340.7	453.4		480.3
Towers	–	62.2	61.5	73.9
	71.1	63.1		74.8
Total	–	508.5	646.7	547.1
	411.8	516.5		555.1

Table 4.1-2
Access Road Distances

BNORTH / BSOUTH	Preferred (2) (miles)	Alternative 1 (miles)	Alternative 3 (miles)	Alternative 1A (miles)
New Construction	–	93.4	130.4	111.4
	64.7	94.9		112.9
Improvements to Existing	–	84.2	98.0	69.9
	74.6	85.5		71.2
Total Length	–	177.6	228.4	181.3
	139.3	180.4		184.1

Some of the new access for the proposed project would be in steeply sloped terrain, which would increase soil exposure. Following construction, implementation of optimum erosion controls and revegetation of disturbed sites (cut and fill slopes and structure sites) would reduce the amount of soil exposure by about 60-70 percent. Impacts would be greatest in local sensitive areas susceptible to ***rill*** and ***gully*** erosion, and areas of unstable soil and rock. Short-term impacts during and following construction would be most intense. The intensity of long-term impacts would be directly proportional to the success of revegetation, and erosion and runoff control efforts. With implementation of ***Best Management Practices*** (BMPs),

For Your Information

Section 303(d) streams, *as defined by the Federal Clean Water Act, are water quality limited streams that fall short of state surface water quality standards and are not expected to improve within the next four years.*

Reminder

Rill erosion *is mild water erosion caused by overland flow producing very small and numerous channels.*

Gully erosion *is rapid erosion, usually in brief time periods, that creates a narrow channel that may exceed 100 ft. in depth.*

Best Management Practices *are a practice or combination of practices that are the most effective and practical means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.*

sedimentation could be reduced to acceptable levels and would not cause degradation of water quality below the Washington Department of Ecology (WDOE) standards. Impacts to water and soils are summarized in Table 4.1-3, *Impacts to Water and Soil Resources.*

Table 4.1-3
Impacts to Water and Soil Resources

Alternative	Actions	Impacts to Soil	Impacts to Water Resources
Preferred (2)	Construction of structures and access roads, use of fords or culverts at stream crossings, removal of structures, crossing of areas with 25-50% slopes	Low to moderate erosion and loss of productive soils. Some increased runoff and sedimentation.	Short-term moderate sedimentation and increased runoff, short-term turbidity. Water bodies: Caribou, Coleman, Cooke Canyon, Naneum, Cave, Parke, Schnebly, Wilson, Columbia River[1,2,5], Johnson, Middle Canyon
1	Construction of structures and access roads, use of fords or culverts at stream crossings, removal of structures, crossing of areas with 25-50% slopes, crossing adjacent to Saddle Mountain Lake	Low to moderate erosion and loss of productive soils. Some increased runoff and sedimentation.	Short-term moderate sedimentation and increased runoff, short-term turbidity. Water bodies: Caribou, Coleman, Cooke Canyon, Naneum, Cave, Parke, Schnebly, Wilson, Columbia River[1,2,5], Johnson, Middle Canyon, Lower Crab [1,2,3,4,] Nannully Lake, Saddle Mountain Wasteway, various canals
3	Construction of structures and access roads, use of fords or culverts at stream crossings, removal of structures, crossing of areas with 25-50% slopes or greater.	Moderate erosion, increased runoff. Loss of productive soils.	Moderate sedimentation, short-term turbidity, increased runoff. Water bodies: Caribou, Coleman, Cooke Canyon, Naneum, Cave, Parke, Schnebly, Wilson, Alkali, Cold, Hanson, Johnson, Middle Canyon, Corral, various canals
1A	Improvements to existing access roads only, use of ford or culvert at Cold Creek crossing, crossing areas with 25 to 45% slopes, double-circuit in agricultural lands	Low erosion, loss of productive soils	Short-term low sedimentation Water bodies: Cold (intermittent at crossing during summer months), Lower Crab Ck[1,2,3,4], Columbia River[1,2,5], various canals, Mattawa Drain[2]: Nannully Lake, Saddle Mountain Wasteway, various canals
No Action	Ongoing maintenance	None to low, localized soil disruption	Continued vehicle and machinery use and vegetation management practices.

303(d) listings for: 1-pH, 2-Temperature, 3-PCB, 4-DDE, 5-Dissolved gas, 6-DO, 7-Fecal Coliform

Increased sediment in streams is expected from the construction of an alternative. The volume of peak flow and the amount of sediment entering streams would depend on site-specific conditions. Mitigation measures proposed for construction of the line would help reduce the chance of large amounts of sediment entering streams.

The new line would be constructed to prevent interference with ongoing farm conservation efforts to control erosion and maintain water quality. Although minor, localized increases in erosion, runoff, and sedimentation are expected from construction and maintenance. These increases would have a low impact on the area's soil resources and water quality, and would not impair the current beneficial use of any water body.

4.1.3 No Action Alternative

The impacts currently associated with ongoing maintenance activities for the existing transmission line, substations, and ROW would continue. These impacts include localized soil disturbance and potential sedimentation due to vehicular traffic, transmission structure replacement, vegetation management activities, and access road improvements. In addition, vehicle and machinery use, and vegetation management practices could contribute minor amounts of pollutants (e.g., fuel, oil, grease, rubber particulate, woody debris) that could be transported to streams.

4.1.4 Recommended Mitigation

Standard mitigation would use measures best suited to each individual location, in order to reduce erosion and runoff and stabilize disturbed areas during and after construction. The following measures, used alone or in combination, would minimize soil disturbance and the effects of increased erosion and surface runoff created by access road improvements and transmission line construction:

- Properly space and size culverts; use crossdrains, water bars, rolling the grade, and armoring of ditches; drain inlets and outlets.
- Coordinate all culvert and ford installations with the COE and other appropriate state agencies.
- Preserve existing vegetation where possible, and stabilize disturbed portions of the site. As soon as practicable, stabilization measures would be started where construction activities have temporarily or permanently ceased.
- Seed disturbed sites at the appropriate times to minimize the invasion of non-native species using a native herbaceous seed mixture suited to the site. Work with WDFW and USFWS to determine appropriate planting times and methods.
- Use vegetative buffers and sediment barriers to prevent sediment from moving off site and into water bodies.

For Your Information

Compaction affects soil productivity, reduces infiltration capacity, and increases runoff and erosion. Sub soiling, normal farming, cultivation and cropping, and freeze-thaw cycles restore soils to their pre-construction condition.

***Sub soiling** is plowing or turning up the layer of soil beneath the topsoil.*

- Discuss with farm operators ***sub soiling*** to restore soil productivity and monetary compensation.
- Design and construct all fords and bridges to minimize bank erosion. Specific locations and measures would be determined when road and line design are finalized.
- Schedule maintenance operations during periods when precipitation and runoff possibilities are at a minimum, in order to reduce the risk of erosion, sedimentation, and soil compaction.
- Design substation facilities to meet regional seismic criteria.
- If needed to stabilize the roadbed, consider ***full-bench road construction*** and hauling excess sidecast material on slopes exceeding 55 percent. Prior to construction, suitable waste areas should be located where excess materials can be deposited and stabilized.
- Use the BMPs that would prevent further impairment of water quality limited (WQL) drainages.
- Avoid riparian areas, drainage ways, canals, and other water bodies. When these areas cannot be avoided, apply sediment reduction practices in order to prevent degradation of riparian or stream quality. Riparian plantings may be used where needed, to restore streamside vegetation and ensure stream bank stability.
- Restrict road construction to the minimum needed and obliterate roads in agricultural land.
- Avoid or mitigate water quality and fish habitat degradation. Design and maintain roads so that drainage from the road surface does not directly enter live streams, ponds, lakes, or impoundments. Direct water off of roads into vegetated areas, or control it through other sediment-reduction practices. Restrict road construction to areas that are physically suitable, based on watershed resource characteristics. Design stream crossings to avoid adverse impacts to stream hydraulics and deterioration of stream bank and bed characteristics.
- Avoid the discharge of solid materials, including building materials, into US waters. Off-site tracking of sediment and the generation of dust shall be minimized. Vegetative buffers would be left along stream courses to minimize erosion and bank instability.

For Your Information

Full-bench road construction *is cutting into the hillside to accommodate the whole road prism.*

- Prepare a stormwater pollution prevention plan (as required under the National Pollution Discharge Elimination System General Permit).
- Near all water bodies, set crossing structures as far back from stream banks as possible. Avoid refueling and/or mixing hazardous materials where accidental spills could enter surface or groundwater. This information will also be included in the Project Plan.
- Design the project to comply with state and federal water quality programs, in order to prevent degradation of the quality of aquifers and not jeopardize their usability as a drinking water source.

For measures required for stormwater regulations, see Section 5.14, *Discharge Permits under the Clean Water Act*.

4.1.5 Cumulative Impacts

Current and future agriculture, YTC activities, and other land development activities in the watersheds crossed might increase peak flows and introduce sediment into streams. Increased sediment in streams is expected from construction of the project in addition to agricultural and other land disturbing activities. The volume of peak flow and the amount of sediment entering streams would depend on site-specific conditions. Mitigation measures proposed for construction of the line would help reduce the chance of large amounts of sediment entering streams. This project would be constructed to prevent interfering with ongoing farm conservation efforts to control erosion and maintain water quality. Although minor, localized increases in erosion, runoff, and sedimentation are expected from construction and maintenance, these increases would have a low impact on the area's soil resources and water quality and would not impair the current beneficial use of any water body.

4.2 Floodplains and Wetlands

4.2.1 Impact Levels

Impacts would be considered **high** where:

- a wetland area would be destroyed by permanently filling all or most of it, or by altering wetland hydrology.
- a wetland area would be destroyed that serves as habitat for a rare plant or animal species, or that is considered a rare wetland type.
- one or more significant wetland functions would be destroyed, such as the ability to provide wildlife habitat, improve water quality, detain water during peak flows, recharge groundwater, trap sediment, serve as a recreational use, or provide an aesthetically pleasing landscape.
- wetland vegetation cover type(s) would be permanently affected through altering soils or hydrology, such as converting a **scrub-shrub wetland** to an open-water area.
- all or most of the native wetland vegetation would be replaced with weedy, non-native species.
- the connectivity of a wetland to other wetlands, surface waterways, or sub-surface water features would be destroyed.
- a wetland ***buffer area*** would be destroyed, resulting in impaired wetland functions, such as the ability to provide wildlife habitat.
- The amount of flood storage in a floodplain would be significantly decreased, or the course of flood waters would be altered.

For Your Information

Scrub-shrub wetlands *are wetlands dominated by shrubby plants.*

*A **Buffer Area** is a strip of vegetation surrounding a stream or wetland that provides habitat for wildlife, reduces or traps sediments, and slows runoff velocity.*

Impacts would be considered **moderate** where:

- a portion of a wetland area would be filled such that the majority of the wetland would still able to function as a wetland (e.g., for a road crossing through an adjacent wetland along a creek).
- a rare or unique wetland type would be degraded.
- one or more significant wetland functions would be degraded or impaired.
- the diversity of native plant species within a wetland would be significantly decreased.

- native trees in ***riparian*** areas that pose a safety hazard to transmission lines would be removed.
- a native wetland plant community would be degraded through the introduction of weedy, non-native species.
- hydrology would be decreased such that a wetland would decrease in size, or the vegetation cover type would be partially altered.
- the connectivity of a wetland to other waters would be diminished.
- a wetland buffer area would be partially destroyed or degraded, resulting in impaired wetland functions.
- the amount of flood storage in a floodplain would be moderate decreased.

Impacts would be considered **low** where:

- a wetland would be temporarily filled or wetland hydrology, soils, or vegetation would be altered. This would be followed by restoring the area to its former condition or enhancing the area (as demonstrated through subsequent monitoring activities).
- a wetland function or value would be temporarily disrupted or partially diminished.
- the amount of flood storage in a floodplain would slightly decrease (e.g., due to erecting a structure in a floodplain).

No impact would occur where:

- direct impacts to wetlands would be avoided.
- wetland hydrology, vegetation, or soils would not be affected by nearby activities.
- the functions of a wetland area would not be affected by nearby activities.
- direct impacts to floodplains would be avoided.

4.2.2 Impacts Common to Construction Alternatives

Floodplains within the study area may be directly impacted by the placement of structures in several locations. However, impacts would be avoided by placing structures in areas adjacent to floodplains. It is not expected that constructing access roads to these structures would impact floodplains, because this would not alter the amount of flood storage or the course that flood waters would take.

Reminder

Riparian *refers to vegetated areas surrounding streams, rivers, lakes, or wetlands.*

Impacts to wetland areas generally impair or remove wetland functions, either temporarily or permanently. These impacts generally decrease a wetland's ability to provide food, water, or cover for wildlife. Building structures or roads near wetland areas could destabilize soils and slopes, and increase sedimentation in wetlands. Wetland areas overloaded with sediments may lose their ability to filter nutrients and pollutants, which affects water quality. Filling wetlands, even partially, may decrease the area that can be used for stormwater storage and wildlife habitat. When wetlands adjacent to creeks are impacted, their ability to slow in-stream flow and decrease streambank erosion can be impaired.

It is unlikely that any wetlands within the study area would be directly impacted by the placement of structures. Most of the wetlands within the study area are not extensive, and can be spanned by structures placed in upland areas adjacent to wetlands.

An unavoidable direct impact to wetlands would result from building access roads. Some portions of wetland areas along creeks would need to be filled for road crossings. Roads and culvert crossings would be designed to minimize impacts to wetland areas. The placement of culverts and roads in riparian areas constitutes a moderate level of impact.

It is likely that some of the stream crossings do not have adjacent wetlands. In areas where creek channels are dry for most of the year, it may be possible for access roads to ford these streams without impacting wetlands.

The ongoing maintenance of transmission lines and access roads would impact wetlands in several ways. Some trees may need to be removed for safety reasons. Because trees are uncommon along riparian areas in shrub-steppe communities, they serve an important function as nesting and perching habitat for birds. For this reason, removing or topping trees is considered a moderate level of impact. Roads serve as a corridor for invasion by some weed species that tend to grow in wet areas. If ***noxious weeds*** were introduced into riparian or wetland areas as a result of project activities, this would be a moderate level of impact. Spraying of weeds along roads would affect water quality, a low level of impact. Road maintenance and grading may increase sedimentation into waterways, a low level of impact.

➡ Reminder

Noxious weeds *are particularly troublesome weeds designated by Washington State law. The list of noxious weed species is divided into three classes (A, B, and C) within each county, based on the state of invasion.*

If any impacts to wetlands cannot be avoided through careful design, BPA would engage in the permitting process with the COE and the WDOE. Appropriate mitigation would be proposed and coordinated with these agencies.

4.2.3 Preferred Alternative (Alternative 2)

4.2.3.1 Segment A

Structures along Segment A would not be placed in any wetlands or riparian areas. Some trees may need to be cut along Wilson, Naneum, and Cooke Canyon Creeks if they pose a safety hazard. This would be a moderate level of impact.

For Your Information

NWI: *National Wetland Inventory*

The ***NWI*** depicts 16 narrow wetlands associated with intermittent and perennial creeks in Segment A. Seven of these may need to be crossed by an access road, which would be a moderate level of impact. Eight others have existing crossings which may need to be improved. One wetland would not be crossed by an access road (See Table 4.2-1, *Segment A Impacts to NWI Mapped Wetlands*.) Floodplain impacts will be minimized by designing and placing road crossing structures to maintain existing channel properties and floodplain function. Nonetheless, placing structures such as culverts or bridges may alter flood flows, a high impact.

The reroute in Segment A would result in the same impacts as shown in Table 4.2-1, *Segment A Impacts to NWI Mapped Wetlands*. Cooke Canyon Creek would be crossed further to the south, resulting in a moderate impact.

Table 4.2-1
Segment A Impacts to NWI Mapped Wetlands

Name (if known)	Location Quad Name Township, Range, Section	Potential Impacts (Level of Impact)
Naneum Creek (north crossing)	Naneum Canyon T19N, R19E, Sec 20	Existing Access Road Crossing, May Need Improvement (Moderate)
Wilson Creek (north crossing)	Naneum Canyon T19N, R19E, Sec 20	Existing Access Road Crossing, May Need Improvement (Moderate) Possible Tree Removal (Moderate)
Naneum/Wilson Creek crossing	Colockum Pass SW T19N, R19E, Sec 20	No Road Crossing (No Impact) Possible Tree Removal (Moderate)
Unnamed creek	Colockum Pass SW T19N, R19E, Sec 21	Possible Access Road Crossing (Moderate)
Cave Canyon	Colockum Pass SW T19N, R19E, Sec 28	Existing Access Road Crossing, May Need Improvement (Moderate)
Unnamed creek	Colockum Pass SW T19N, R19E, Sec 27	Possible Access Road Crossing (Moderate)
Charlton Canyon	Colockum Pass SW T19N, R19E, Sec 27	Possible Access Road Crossing (Moderate)
Tributary of creek in Charlton Canyon	Colockum Pass SW T19N, R19E, Sec 27	Possible Access Road Crossing (Moderate)

Reminder

Mapped wetlands are shown on Map 5, Wetlands/Plant Associations.

Name (if known)	Location Quad Name Township, Range, Section	Potential Impacts (Level of Impact)
Creek in Schnebly Canyon	Colockum Pass SW T19N, R19E, Sec 26	Existing Access Road Crossing, May Need Improvement (Moderate)
Coleman Creek	Colockum Pass SW T19N, R19E, Sec 36	No Road Crossing (No Impact)
Cooke Canyon Creek	Colockum Pass SW T18N, R20E, Sec 6	Existing Access Road Crossing, May Need Improvement (Moderate) Possible Tree Removal (Moderate)
Trail Creek	Colockum Pass SE T18N, R20E, Sec 5	Possible Access Road Crossing (Moderate)
Caribou Creek	Colockum Pass SE T18N, R20E, Sec 8	Existing Access Road Crossing, May Need Improvement (Moderate)
Tributary of Caribou Creek	Colockum Pass SE T18N, R20E, Sec 16	Possible Access Road Crossing (Moderate)
Parke Creek	Colockum Pass SE T18N, R20 E, Sec 27	Existing Access Road Crossing, May Need Improvement (Moderate)
Unnamed creek	Boylston T17N, R21E, Sec 20	Possible Access Road Crossing (Moderate)

4.2.3.2 Segment B

The Preferred Alternative would follow Option B_{SOUTH} of Segment B. Option B_{NORTH} would not be used for this alternative.

Option B_{SOUTH} – Option B_{SOUTH} would span all wetlands and riparian areas. Three narrow wetlands associated with creeks, are mapped along Option B_{SOUTH}. Structures would be placed outside riparian areas, but these creeks may be traversed by an access road, a moderate level of impact. Structures would not be placed within the Columbia River floodplain, resulting in No Impact. (See Table 4.2-2, *Option B_{SOUTH} Impacts to NWI Mapped Wetlands*.)

Table 4.2-2
Option B_{SOUTH} Impacts to NWI Mapped Wetlands

Name (if known) (P=Perennial I=Intermittent)	Location Quad Name Township, Range, Section	Potential Impacts (Level of Impact)
Tributary of Johnson Creek	Doris T16N, R22 E, Sec 21	Possible Access Road Crossing (Moderate)
Tributary of Johnson Creek	Doris T16N, R22 E, Sec 22	Possible Access Road Crossing (Moderate)
Tributary of Johnson Creek	Doris T16N, R22 E, Sec 23	Possible Access Road Crossing (Moderate)
Columbia River	Beverly T16N, R23E	No Impact

4.2.3.3 Segment D

Structures along Segment D would avoid all wetlands and riparian areas, however, access roads may be required across two of the six wetland areas, a moderate level of impact (See Table 4.2-3, *Segment D Impacts to NWI Mapped Wetlands*.). Depending on the location and the species, there may be some trees in the riparian areas that would need to be removed or topped to ensure transmission line safety, a moderate level of impact. Floodplain impacts will be minimized by designing and placing road crossing structures to maintain existing channel properties and floodplain function. Nonetheless, placing structures such as culverts or bridges may alter flood flows, a high impact.

Dry Creek, immediately to the south of the proposed new Wautoma Substation, would be avoided, resulting in no wetland impacts. The proposed Wautoma Substation will be built above the floodplain, therefore no impacts to the floodplain will occur.

Table 4.2-3
Segment D Impacts to NWI Mapped Wetlands

Name (if known)	Location Quad Name Township, Range, Section	Potential Impacts (Level of Impact)
Lower Crab Creek	Beverly T15N, R23E, Sec 2	No Road Crossing (No Impact) Possible Tree Removal (Moderate)
Wetland	Priest Rapids NE T14N, R24E, Sec 5	No Impact
Columbia River	Priest Rapids NE T13N, R24E, Sec 11	No Impact
Cold Creek	Emerson Nipple 99/3-99/4 T13N, R24E, Sec 34	Possible Access Road Crossing (Moderate)
Unnamed creek	Emerson Nipple T13N, R24E, Sec 34	Possible Access Road Crossing (Moderate)
Dry Creek	Emerson Nipple T12N, R24E, Sec 20	No Impact

4.2.4 Alternative 1

Impacts to wetlands along Segment A would be the same as described under the Preferred Alternative (see Section 4.2.3.1, *Segment A*).

Reminder

Segments A and B would have a moderate impact to wetlands.

4.2.4.1 Segment B

The Preferred Alternative would follow Option B_{NORTH} of Segment B. Option B_{SOUTH} would not be used for this alternative.

Option B_{NORTH} – Option B_{NORTH} would span all wetlands and riparian areas. Two narrow wetlands associated with creeks are located along Segment B. Although structures would be placed outside riparian areas, these creeks may be traversed by an access road, which would be a moderate level of impact. Structures would not be placed within the Columbia River floodplain, resulting in No Impact. (See Table 4.2-4, *Option B_{NORTH} Impacts to NWI Mapped Wetlands*.) Floodplain impacts will be minimized by designing and placing road crossing structures to maintain existing channel properties and floodplain function. Nonetheless, placing structures such as culverts or bridges may alter flood flows, a high impact.

Table 4.2-4
Option B_{NORTH} Impacts to NWI Mapped Wetlands

Name (if known)	Location Quad Name Township, Range, Section	Potential Impacts (Level of Impact)
Unnamed creek	Doris T16N, R22E, Sec 15	Possible Access Road Crossing (Moderate)
Unnamed creek	Doris T16N, R22E, Sec 23	Possible Access Road Crossing (Moderate)
Columbia River	Beverly T16N, R23E	No Impact

4.2.4.2 Segment E

No structures along Segment E would be constructed within a wetland or riparian area. There may be trees in riparian areas that would need to be removed or topped for safety, a moderate level of impact. Floodplain impacts will be minimized by designing and placing road crossing structures to maintain existing channel properties and floodplain function. Nonetheless, placing structures such as culverts or bridges may alter flood flows, a high impact.

In the valley agricultural areas, the proposed line would cross four irrigation ditches that have National Wetland Inventory (NWI) designations. Structures would be situated to avoid these ditches, although they may be crossed by access roads, a moderate level of impact. (See Table 4.2-5, *Segment E Impacts to NWI Mapped Wetlands*.)

Table 4.2-5
Segment E Impacts to NWI Mapped Wetlands

Name (if known)	Location Quad Name Township, Range, Section	Potential Impacts (Level of Impact)
Wetland	Beverly T16N, R23E, Sec 35	No Impact
Wetland	Beverly	No Impact

Name (if known)	Location Quad Name Township, Range, Section	Potential Impacts (Level of Impact)
	T16N, R23E, Sec 35	
Wetland fed by outflow channel from Nunnally Lake	Beverly T16N, R23E, Sec 35	No Impact
Lower Crab Creek	Beverly T15N, R23E, Sec 2	No Road Crossing (No Impact) Possible Tree Removal (Moderate)
Irrigation ditch	Beverly SE T15N, R24E, Sec 25	Possible Access Road Crossing (Moderate)
Irrigation ditch	Vernita Bridge T15N, R25E, Sec 31	Possible Access Road Crossing Moderate)
Irrigation Ditch	Vernita Bridge T15N, R25E, Sec 11	Possible Access Road Crossing (Moderate)
Irrigation Ditch	Coyote Rapids Sec 11	Possible Access Road Crossing (Moderate)
Saddle Mountain Lake	Coyote Rapids T14N, R26E, Secs. 20 & 29	No Impact
Columbia River	Coyote Rapids Secs. 29 and 28	No Impact

4.2.5 Alternative 3

Impacts to wetlands along Segment A would be the same as described under the Preferred Alternative (see Section 4.2.3.1, *Segment A*).

Structures along Segment C would avoid all wetlands and riparian areas. The NWI depicts 11 narrow wetlands associated with streams. Access roads may need to be constructed across most of these streams, a moderate level of impact. (See Table 4.2-6, *Segment C Impacts to NWI Mapped Wetlands*.) Floodplain impacts will be minimized by designing and placing road crossing structures to maintain existing channel properties and floodplain function. Nonetheless, placing structures such as culverts or bridges may alter flood flows, a high impact.

Reminder

Segment A would have a moderate impact to wetlands.

Table 4.2-6
Segment C Impacts to NWI Mapped Wetlands

Name (if known)	Location Quad Name Township, Range, Section	Potential Impacts (Level of Impact)
Johnson Creek	Doris T16N, R22E, Sec 20	Possible Access Road Crossing (Moderate)
Hanson Creek	Doris T15N, R22E, Sec 8	Possible Access Road Crossing (Moderate)
Cottonwood Creek	Doris T15N, R22E, Sec 21	Possible Access Road Crossing (Moderate)
Unnamed creek	Doris T15N, R22E, Sec 28	Possible Access Road Crossing (Moderate)
Creek in Alkali Canyon	Black Rock Spring NE T14N, R22E, Sec 3	Possible Access Road Crossing (Moderate)

Creek in Corral Canyon	Black Rock Spring NE T14N, R22E, Sec 15	Possible Access Road Crossing (Moderate)
Tributary to creek in Corral Canyon	Black Rock Spring NE T14N, R22E, Sec 14	Possible Access Road Crossing (Moderate)
Tributary to creek in Corral Canyon	Black Rock Spring NE T14N, R22E, Sec 23	Possible Access Road Crossing (Moderate)
Creek in Sourdough Canyon	Black Rock Spring NE T14N, R22E, Sec 25	Possible Access Road Crossing (Moderate)
Cold Creek	Cairn Hope Peak T13N, R23E, Sec 20	Possible Access Road Crossing (Moderate)
Tributary to Cold Creek	Cairn Hope Peak T13N, R23E, Sec 35	Possible Access Road Crossing (Moderate)
Dry Creek	Emerson Nipple T12N, R24E, Sec 20	No impact

4.2.6 Alternative 1A

➡ Reminder

Segments A and B would have a moderate impact to wetlands.

Impacts to wetlands along Segment A would be the same as described under the Preferred Alternative (see Section 4.2.3.1, *Segment A*). Impacts to wetlands along Segment B (Option B_{NORTH}) would be the same as described under Alternative 1 (see Section 4.2.4.1, *Segment B*).

Structures along Segment F would avoid all wetlands and riparian areas. There are nine wetlands depicted on the NWI maps. Access roads may need to be constructed across two of these streams, a moderate level of impact. Some of the trees that line the edge of Nunnally Lake might need to be topped or removed, a moderate level of impact. Floodplain impacts will be minimized by designing and placing road crossing structures to maintain existing channel properties and floodplain function. Nonetheless, placing structures such as culverts or bridges may alter flood flows, a high impact.

Roads and structures would avoid two emergent wetland areas north of Lower Crab Creek. The wetlands along Lower Crab Creek would be spanned, but there may be trees in the riparian area that would be removed or topped, a moderate level of impact.

In the valley agricultural areas, an access road would cross an irrigation ditch that has a NWI designation and possibly a wetland, a moderate impact. (See Table 4.2-7, *Segment F Impacts to NWI Mapped Wetlands*.)

Table 4.2-7
Segment F Impacts to NWI Mapped Wetlands

➡ Reminder

Mapped wetlands are shown on Map 5, Wetlands/Plant Associations.

Name (if known) (P=Perennial I=Intermittent)	Location Quad Name Township, Range, Section	Potential Impacts (Level of Impact)
Nunnally Lake	Beverly	No Road Crossing (No Impact)

Name (if known) (P=Perennial I=Intermittent)	Location Quad Name Township, Range, Section	Potential Impacts (Level of Impact)
	T16N, R23E, Sec 25-36	Possible Tree Removal (Moderate)
Wetland	Beverly T16N, R23E, Sec 36	No Impact
Wetland	Beverly T16N, R23E, Sec 36	No Impact
Wetland north of Lower Crab Creek	Beverly T16N, R23E, Sec 36	No Impact
Lower Crab Creek	Beverly T16N, R23E, Sec 36	No Road Crossing (No Impact) Possible Tree Removal (Moderate)
Irrigation Ditch	Wahatis Peak T15N, R26E, Secs. 21 and 28	Possible Access Road Crossing (Moderate)
Wetland	Coyote Rapids T14N, R26E, Secs. 16 and 21	Possible Access Road Crossing (Moderate)
Saddle Mountain Lake	Coyote Rapids T14N, R26E, Secs. 20 and 29	No Impact
Columbia River	Coyote Rapids Secs. 29 and 28	No Impact

4.2.7 No Action Alternative

Current levels of disturbance to wetlands and floodplains would continue under this alternative. The impacts currently associated with ongoing maintenance activities for the existing transmission line, substations, and ROW would continue. These impacts include localized soil disturbance and potential sedimentation due to vehicular traffic, transmission structure replacement, vegetation management activities, and access road improvements. In addition, vehicle and machinery use, and vegetation management practices could contribute minor amounts of pollutants (e.g., fuel, oil, grease, rubber particulate, woody debris) that could be transported to wetlands.

4.2.8 Recommended Mitigation

If required for permit purposes, a wetland delineation would be performed for the Preferred Alternative. This delineation would provide the location and aerial extent of all wetlands and waterways along the ROW. If a permit is not required, sensitive areas would be flagged in the field for avoidance. Wetlands would be mapped, along with buffer areas to avoid direct and indirect impacts if possible.

During the design phase, efforts would be made to avoid directly impacting wetlands, riparian areas and their buffers. This would be done by placing project elements, such as structures and roads, outside wetland areas and their associated buffers, whenever a feasible upland alternative exists.

Before and during construction, the following procedures and construction practices would be adopted to ensure that designated wetland and riparian areas are not impacted:

- Workers would receive instruction in construction practices that minimize wetland impacts.
- Workers would be informed of which areas are restricted and must not be impacted.
- Restricted wetland and riparian areas would be mapped.
- The boundaries of restricted areas, such as protected wetland and riparian areas, would be flagged by a wetland scientist prior to construction, using designated flagging to ensure that workers do not unintentionally enter restricted wetland areas.
- Wetland impacts from road crossings would be minimized through proper culvert design, timing, and methods of installation.
- Indirect impacts to wetlands and waterways from sedimentation and erosion would be minimized, by erecting silt fences around areas where soil would be disturbed.
- To minimize temporary impacts, avoid compacting wet soils, and minimize harm to herbaceous vegetation, vehicle crossings of wetland areas would be restricted to the time of year when seasonal wetlands are dry or appropriate cover would be provided (for vehicular traffic) that would be removed after construction.
- BPA will work with USFWS to identify sites that are sensitive to vehicular travel during different weather conditions (e.g., to minimize rutting during muddy conditions or minimize soil and cryptogamic crust disturbance during dry conditions) and will limit travel in these areas during the time of year they are most vulnerable to disturbance.

For Your Information

*The **Section 404 Removal/Fill Permit**: Federal permit issued by the U.S. Army Corps of Engineers that regulates wetland areas.*

Efforts will be made to restore wetland areas that have been disturbed by construction if disturbance is temporary. Wetland hydrology would be restored and the grade returned to pre-construction conditions where possible, as stated in the ***Section 404 Removal/Fill Permit*** for the activity. Monitoring of the reestablishment of wetland hydrology and vegetation would also take place as stated in the permit.

Ongoing maintenance practices would be conducted with a sensitivity to the issues of wetland and riparian areas. Road grading and other disturbances to the road surface would be minimized near riparian areas. If any weeds occur along roads adjacent to wetlands and riparian areas, only herbicides approved for aquatic use would be used.

4.2.9 Cumulative Impacts

Wetlands would be impacted by any projects within the Columbia Basin that affect wetland functions and values, including the filling of wetland areas. Projects such as land development, agriculture, and pipeline development may impact wetlands in the study area. Wetland loss and floodplain impacts reduce flood storage capacity and effects water quality. As development occurs, the need for flood storage increases.

Information is available that quantifies wetland impacts in central Washington (Pers. Comm. Catherine Reed, WDOE, 2001). Between July 1, 2000 and July 1, 2001, two permits were issued in Benton, Grant, Kittitas and Yakima Counties for projects that disturbed wetlands, for a total of 0.83 acre of disturbed area. This information on the number of permitted wetland impacts may not accurately reflect wetland loss. This is partly because wetland impacts can occur illegally, outside the formal permitting process. Some people are unaware that ***ephemeral wetlands*** exist or meet wetland criteria, and fill them without permits.

For Your Information

Ephemeral wetlands *are wetlands that are only filled with water for a brief time during the spring.*

Some wetlands are created by irrigation waters along leaky canals or pipes or in outflow areas. As the acreage of lands being irrigated increases in the study area, the acreage of wetlands created by irrigation waters has increased. However, the creation of wetlands in agricultural areas does not compensate for wetland losses in terms of acreage, type, or quality of wetlands.

One of the most common types of wetland impacts in the study area are road crossings. One of the main impacts from roads crossing wetlands and waterways is the spread of weed species into previously undisturbed areas, a major problem in central Washington (Pers. Comm. Catherine Reed, WDOE, 2001).

4.3 Vegetation

4.3.1 Impact Levels

➡ Reminder

high quality plant communities *are areas of native vegetation with little or no disturbance or exotic species.*

Impacts would be considered **high** where:

- the quantity or quality of a unique or ***high quality plant community*** would be significantly reduced.
- the substrate would be altered such that recovery of a unique or high quality plant community would not be likely.
- the diversity within a high quality native plant community would be significantly decreased.
- impacts would result in the taking of a federally listed, proposed, or candidate plant species.
- noxious weeds would be introduced into a high quality native plant community.

Impacts would be considered **moderate** where:

- native plant communities would be permanently removed through removal of plant parts and/or altering the substrate.
- the diversity within a native plant community would be decreased or the community would be degraded as a result of altering physical characteristics (e.g., increasing erosion).
- Native tree species in riparian areas would be removed or topped.
- impacts to a federally listed, proposed, or candidate plant species would not affect the viability of local populations of that species.
- impacts to rare or ***endemic*** plant species (including federal species of concern, ***BLM*** sensitive species, and state listed species) could only be partially lessened by mitigation.

Endemic *is a naturally occurring species that is limited to a particular geographic area.*

BLM*: U.S. Bureau of Land Management*

Impacts would be considered **low** where:

- native plant communities would be temporarily disturbed or altered such that natural recovery to pre-disturbance conditions would be likely.
- the life history of native plant species would be temporarily impaired through disturbance to vegetative portions, impairing the functioning of pollinator species, or decreasing reproductive potential.

- vegetation would be permanently removed from a plant community dominated by non-native species.
- a rare plant species would be temporarily impacted, but could be completely mitigated (as demonstrated through subsequent monitoring).
- the density of noxious weeds or other undesirable non-native species would be increased in areas where they were already present.

No impact would occur where:

- direct or indirect disturbance to native plant communities would be avoided.
- the habitats of rare or endemic plant species would be completely avoided.
- there would be no increase in the cover or distribution of weedy, non-native species.

4.3.2 Impacts Common to Construction Alternatives

4.3.2.1 Construction Impacts

Plant communities would be directly and indirectly impacted as a result of various project activities, and these impacts may be temporary or permanent. Some impacts to vegetation from construction activities would be fairly consistent among all the alternatives, such as the potential spread of weed species into disturbed areas.

The amount of disturbance to vegetation caused by a particular activity would depend on a variety of factors, including the type of vegetation and site characteristics (e.g., soil type, slope, elevation, ***aspect***, and amount of moisture). In general, shrub-steppe plant communities are slow to recover from disturbance. Although little is known about how well they recover or how long it takes, the effects of disturbance are well documented.

For Your Information

When referring to vegetation, ***aspect*** *is the direction a slope is facing.*

Riparian areas are particularly vulnerable to disturbance. The removal of vegetation along waterways causes an increase in water temperature, increases water velocity, and decreases wildlife habitat. Disturbance of soil in or near riparian areas may lead to erosion of stream banks, which increases the deposition of sediment into waterways. In riparian areas where trees or tall growing vegetation pose a safety hazard to transmission lines, they would need to be topped or removed (a moderate level of impact).

For Your Information

***Biological crusts** are groups of living organisms that coat the soil or live just below the soil surface.*

In relatively undisturbed areas, soil disturbance decreases the soil cover provided by ***biological crusts***. Disturbance of biological crusts decreases soil fertility and increases the likelihood that an area would be invaded by non-native species. It is difficult to determine the extent of this impact, because the location and quality of biological crusts within the study area is not known. The disturbance of biological crusts in native plant communities would be a moderate level of impact.

The construction of access roads would involve clearing the proposed road area to a width of at least 25 feet. Impacts in the area of the finished roadbed and shoulder would be permanent. In the area beyond the finished roadbed, impacts would be essentially permanent in areas of shrub-steppe, because this area is not likely to recover. The construction of access roads would create a high level of impact in areas with high quality native plant communities. A moderate level of impact would result in less pristine native plant communities. In disturbed areas or in agricultural areas, the impacts to areas adjacent to roads would be temporary, and the impact level would be low to none.

Reminder

Please refer to Chapter 2, Alternatives, for further detail on project construction activities.

The construction or replacement of structures would require the removal of vegetation. The size of the cleared area would vary depending on site characteristics, but the area that may be cleared and leveled by grading would be approximately 100 by 100 feet. During construction, heavy machinery would enter the area around structures, which would compact soils. Structures are generally built on the slopes or ridges above riparian areas. Construction of structures can decrease slope stability, which can lead to degradation of plant communities on the slope and in the riparian area. Depending on the type of plant community present, the construction of structures would create a moderate to high level of impact in all segments.

Some construction-related impacts would be temporary. Heavy machinery may enter portions of the new ROW outside the cleared area during tensioning of the conductor. Although the aboveground portion of shrubs would be broken or crushed, the roots and soils would not be disturbed, and vegetation would eventually return to pre-disturbance conditions. Depending on the type of plant community present, the temporary impacts resulting from movement of vehicles would be a low to moderate level of impact in all segments.

Rare plant species may be directly or indirectly impacted by construction activities. They can be directly impacted when the plants or their habitat are destroyed or altered such that they can no longer survive. Rare plants growing outside the construction zone may be harmed if the effects of the activities degrade their habitat. This could occur through soil erosion, decrease in slope stability, or other alterations of physical conditions that make it difficult for the species to survive. One important cause of habitat degradation is invasion by non-native species from adjacent disturbed areas. The level of impact would depend on the status of the species, and whether mitigation could be implemented to lessen the impact.

4.3.2.2 Operations and Maintenance Impacts

Access roads would need to be maintained and repaired. Maintenance vehicles traveling on access roads may contribute to the spread of weed species. Please refer to the following *Weed Invasion Impacts* (Section 4.3.2.3) for further detail. Maintenance vehicles may also need to travel off of established access roads. Because these impacts would occur in areas already impacted by construction activities, the level of impact would be low to moderate.

For Your Information

Specific impacts caused by maintenance activities are discussed in the BPA Transmission System Vegetation Management Program Final EIS (May 2000). This document focuses on the tools to be used in maintaining vegetation on BPA facilities.

4.3.2.3 Weed Invasion Impacts

After disturbance, bare land would likely be invaded by non-native species. Seeds may be blown in, transported in by animals or water, or introduced inadvertently on the clothing, equipment, or vehicles of construction or maintenance workers. Because non-native species usually lack the soil-binding characteristics of native species, cover by non-native species may result in increased erosion. This type of degradation over time can decrease the soil's ability to support a healthy native plant community (YTC Management Plan). Disturbed plant communities generally show a reduction in native plant species cover, particularly bunchgrasses and forbs (Franklin, 1973).

Some of the non-native species that invade disturbed land would be weed species. An increase in weed species, principally cheatgrass and diffuse knapweed, can be expected during the growing season following any ground disturbance within the study area (Pers. Comm. D. Stout and M. Sackschewsky, 2001).

Cheatgrass is a strong competitor that rapidly colonizes disturbed sites and once established, it outcompetes other grasses and ***forbs***. It has invaded much of the study area and would increase in density with any disturbance. Diffuse knapweed is already present in all project segments. The spread of this aggressive species is of great concern because it quickly occupies disturbed sites and tends to outcompete desirable native species. This species also moves from disturbed sites into adjacent undisturbed areas. This type of invasion can be a major threat to sensitive species habitat. Because of their poor soil-holding capabilities, knapweed species such as diffuse knapweed contribute to soil erosion (YTC Management Plan).

Reminder

*A **forb** is an herbaceous plant that is not a grass*

The use of access roads for ongoing maintenance increases the probability of weed invasion. Roads are known to contribute to the spread of noxious weeds by forming a corridor for weed dispersal. Weeds are dispersed when parts of weeds or the entire plant break off and get stuck to the undercarriages of vehicles. Weeds get dragged into new areas, and if the plant has formed seed heads, the seeds are dispersed as the vehicle travels. Because access roads cross riparian areas, weed seeds may fall into riparian areas, be dispersed by water, and beginning to grow in the moist soil. Wetlands and riparian areas are particularly susceptible to invasion by non-native species.

Introducing noxious weeds into a high quality native plant community is a high level of impact. The introduction of noxious weeds or undesirable non-native species into areas where they are already present, as in much of the study area, is a low level of impact.

4.3.3 Preferred Alternative (Alternative 2)

4.3.3.1 Segment A

Native vegetation within Segment A that would be impacted includes areas within the 26.2 miles (195.4 acres) of shrub-steppe and 1.7 miles (12.9 acres) of grasslands that occur along this segment. Impacts would be moderate to low.

Reminder

WNHP: *Washington Natural Heritage Program*

Federally listed, proposed, or candidate species *are species designated or in the process of being designated under the Endangered Species Act as endangered or threatened.*

Federal species of concern *are species that may be rare or declining, but are not formally listed under the ESA.*

Basalt lithosols *are soils with very high rock content.*

Wyoming big sagebrush/bluebunch wheatgrass, a high quality plant community tracked by the ***WNHP***, occurs along 0.2 mile of Segment A. Permanent impacts to this community caused by removal of vegetation for structures or roads would be a high level of impact. Degradation of this community through a decrease in diversity, degradation of the physical environment, or an increase in non-native species would be a moderate level of impact.

There are no known occurrences of ***federally listed, proposed, or candidate species*** along Segment A. The only species with potential habitat along Segment A is Ute ladies' tresses. However, because the habitat of Ute ladies' tresses is wetland areas, which would be avoided, there would be no direct impact to this species.

Hoover's tauschia, a ***federal species of concern***, is known to occur about 0.5 mile from the proposed ROW in ***basalt lithosols***. This habitat also occurs along Segment A. If this species occurs along the proposed line and impacts cannot be avoided, it would be a moderate impact (if impacts could only be partially lessened by mitigation) or a low impact (if successful mitigation is implemented).

Segment A crosses several sections of BLM managed land and there are occurrences of known BLM sensitive species in the area. One BLM sensitive species, Suksdorf's monkey-flower, occurs in the area of the proposed ROW and could be impacted by construction activities. Two BLM sensitive species, Pauper milk-vetch and beaked cryptantha, are known to occur within 1 mile of the proposed ROW. Because surveys have not been done by the BLM on the land they manage within Segment A, there may be other BLM sensitive species that could be impacted. Unavoidable impacts to BLM sensitive species would be a moderate level of impact if they could only be partially lessened by mitigation. The impact level would be low if successful mitigation is implemented.

The Segment A reroute would cross Cooke Canyon Creek further to the south where the riparian vegetation is less extensive, resulting in less of an impact to riparian areas than the original alignment (removing trees for conductor clearance will not be required on the reroute but may be required on the original alignment). The remainder of the area is shrub-steppe, similar to the original alignment. However, the proposed reroute is slightly longer than the original route, so slightly more shrub-steppe area would be disturbed for access road and tower construction purposes.

4.3.3.2 Segment B

The Preferred Alternative would only use Option B_{SOUTH} of Segment B. Option B_{NORTH} would not be used in this alternative.

Option B_{SOUTH} – Native vegetation that would be impacted by Option B_{SOUTH} includes 7.0 miles (63.8 acres) of shrub-steppe and 2.9 miles (26.7 acres) of grasslands. There are no high quality plant communities tracked by WNHP in Option $B_{SOUTH.}$ Impacts to plant communities would be moderate to low.

There are no known occurrences of federally listed or candidate species or potential habitat for these species within Option B_{SOUTH}. Hoover's desert parsley occurs in the immediate vicinity of Option B_{SOUTH}. If impacts to this species could not be avoided, it would constitute a moderate level of impact. Impacts could be reduced to a low level with mitigation.

B_{SOUTH} would cross the Columbia River in the same location as B_{NORTH} and would result in no impact.

4.3.3.3 Segment D

Segment D has more agricultural lands than other segments. Fewer impacts to native plant communities or rare species are expected in agricultural lands because only remnants of native vegetation remain and rare species are unlikely to survive. Plowing and planting have destroyed most of the native vegetation in the valley, and what remains has likely been invaded by non-native species. Native vegetation that would be impacted by Segment D includes 10.1 miles (36.2 acres) of shrub-steppe and 7.2 miles (25.9 acres) of grasslands.

Bitterbrush/Indian ricegrass, a high quality plant community tracked by WNHP, occurs along 0.8 mile of Segment D. Permanent impacts to this community caused by removing vegetation for structures or roads would be a high level of impact. Degradation of this community through a decrease in diversity, degradation of the physical environment, or an increase in non-native species would be a moderate level of impact.

A known occurrence of Umtanum buckwheat, a federal candidate species, is located near Segment D on part of Umtanum ridge. This ridge may also be habitat for basalt daisy, a federal candidate species that grows in crevices in basalt cliffs on canyon walls. Roads would not be built in the steep, rocky terrain of Umtanum ridge, but it is possible that structures could be placed in habitat areas. Because Umtanum buckwheat grows in a narrow strip (generally less than 100 feet wide) west of the proposed line, habitat areas would be avoided. Indirect impacts could be avoided by placing structures outside the habitat area or replacing existing structures (double-circuiting) in this portion of the line. Because direct impacts will be avoided, the project will have a moderate to low impact on Umtanum wild buckwheat.

Wetlands are potential habitat for Ute ladies' tresses (threatened species). The floodplain of the Columbia River is habitat for northern wormwood (candidate species). Because wetlands and the area immediately adjacent to the Columbia River would be avoided, there would be no impact to this species.

Four federal species of concern occur in the immediate vicinity of Segment D: Columbia milk-vetch, persistentsepal yellowcress, gray cryptantha, and Hoover's desert parsley. If impacts to these species cannot be avoided, it would constitute a moderate level of impact. Impacts could be reduced to a low level through mitigation.

A small amount of BLM managed land is located within Segment D. There are several known occurrences of BLM sensitive species within the study area. If impacts to these species cannot be avoided, it would be a moderate level of impact. Impacts could be reduced to a low level if successful mitigation is implemented. Mitigation could include placement of structures and roads to avoid populations, timing restrictions, or transplantation, if feasible.

In the area of the new Wautoma Substation, all vegetation would be permanently removed from an area 850 by 500 feet in size. Because this area is grassland dominated by non-native species with no occurrences of rare species, building the substation would be a low level of impact to vegetation.

Impacts to shrub-steppe and grassland communities along Segment D would be moderate to low.

4.3.4 Alternative 1

Impacts to vegetation to Segments A would be the same as described for the Preferred Alternative (see Section 4.3.3.1, *Segment A*).

Reminder

Impacts to vegetation from Segments A and B include:

- *No impact to T&E species*
- *Moderate to low impact to shrub-steppe and grassland communities*
- *High impact to Wyoming big sagebrush/bluebunch wheatgrass plant community*

4.3.4.1 Segment B

Alternative 1 would follow Option B_{NORTH} only and would not use Option B_{SOUTH}.

Option B_{NORTH} – Native vegetation that would be impacted by Option B_{NORTH} includes 6.2 miles (56.3 acres) of shrub-steppe and 2.9 miles (26.2 acres) of grasslands. There are no high quality plant communities tracked by WNHP in Option B_{NORTH}. Impacts to plant communities would be moderate to low.

Potential habitat for northern wormwood, a candidate species, occurs in the floodplain of the Columbia River. Because structures would be placed well outside the habitat area for this species, there would be no impacts. There is no potential habitat for other federally listed, proposed, or candidate species.

Two federal species of concern, Columbia milk-vetch and gray cryptantha, are known to occur within 0.25 mile of the proposed project. If impacts could not be avoided, a moderate level of impact would occur if full mitigation could not be implemented. Impacts could be reduced to a low level if mitigation is successful.

There would be no impacts to BLM sensitive species along Option B_{NORTH}.

4.3.4.2 Segment E

Native vegetation within Segment E that would be impacted includes 12.9 miles (112.4 acres) of shrub-steppe and 3.9 miles (34.1 acres) of grassland. Impacts to shrub-steppe and grassland plant communities would be moderate to low.

A high priority plant community, Bitterbrush/Indian ricegrass shrubland is found along a 2.8-mile stretch. Permanent impacts caused by removing vegetation for structures or roads would result in a high impact. Degradation of the community through a decrease in diversity, degradation of the physical environment, or an increase in non-native species would have a moderate impact.

There are no documented occurrences of federally listed species along Segment E, however, wetlands along Lower Crab Creek and in the valley are potential habitat for Ute ladies' tresses and the Columbia River floodplain is habitat for northern wormwood. Because wetlands and the area immediately adjacent to the Columbia River would be avoided, there would be no impact to these species.

Two federal species of concern occur in the immediate vicinity of Segment E: Hoover's desert-parsley and gray cryptantha. If impacts to these species could not be avoided, this would constitute a moderate level of impact. Impacts could be reduced to a low level with mitigation.

There are several known occurrences of BLM sensitive species within Segment E. Species that might be impacted by construction activities include the federal species of concern Nuttall's sandwort, and other BLM sensitive species that have potential habitat within the study area. If impacts to these species could not be avoided, on BLM managed lands, it would be a moderate level of impact. Impacts could be partially lessened by mitigation.

➡ Reminder

Impacts to vegetation from Segment A include:

- *No impact to T&E species*
- *Moderate to low impact to shrub-steppe and grassland communities*
- *High impact to Wyoming big sagebrush/bluebunch wheatgrass plant community*

4.3.5 Alternative 3

Impacts to Segment A would be the same as described for the Preferred Alternative (see Section 4.3.3.1, *Segment A*).

Native vegetation along Segment C that would be impacted includes 22.1 miles (316.5 acres) of shrub-steppe and 7.5 miles (107.0 acres) of grasslands. Impacts to shrub-steppe and grassland plant communities would be moderate to low. There are no high quality plant communities tracked by WNHP in Segment C.

There are no known occurrences of federally listed or candidate species along Segment C. Some structures might be located on basalt cliffs within Segment C, which could provide habitat for basalt daisy (candidate species). If basalt daisy is present and habitat areas could not be avoided, this would be a moderate to high level of impact, depending on whether mitigation can be implemented.

Columbia milk-vetch (species of concern) occurs in the immediate vicinity of the Segment C route. This species could be impacted by construction activities. If this species could not be avoided, it would constitute a moderate level of impact if full mitigation could not be implemented, or a low level if fully mitigated.

A small amount of BLM managed land (less than 0.25 mile) is located within Segment C. There are several known occurrences of BLM sensitive species along the proposed ROW. Impacts to BLM sensitive species would be a moderate level of impact if the impacts could only be partially lessened by mitigation or a low level if successful mitigation is implemented.

Impacts at the new Wautoma Substation would be the same as discussed in the Preferred Alternative.

4.3.6 Alternative 1A

Impacts to vegetation to Segment A would be the same as described for the Preferred Alternative (see Section 4.3.3.1, *Segment A*), and impacts to Segment B (Option B_{NORTH}) would be the same as described for Alternative 1 (see Section 4.3.4.1, *Segment B*).

Native vegetation within Segment F that would be impacted includes 23.0 miles (173.0 acres) of shrub-steppe and 7.8 miles (58.3 acres) of grassland. Impacts to shrub-steppe and grassland plant communities would be moderate to low.

As in Segment D, Bitterbrush/Indian ricegrass shrubland, a high quality plant community tracked by WNHP, occurs along 0.8 mile of Segment F. Impacts would be high to moderate, as discussed in Segment D.

There are no known occurrences of federally listed or candidate species along Segment F. Similar to Segments D and E, wetlands along Lower Crab Creek and in the valley are potential habitat for Ute ladies' tresses, and the Columbia River floodplain is habitat for northern wormwood. Because wetlands and the area immediately adjacent to the Columbia River would be avoided, there would be no impact to these species.

One species of concern, Hoover's desert parsley, occurs in the vicinity of the proposed line. A lichen *(Texosporum santi-jacobi)* species (federal species of concern) could also occur in this area. If impacts to these species could not be avoided, it would constitute a moderate level of impact. Impacts could be reduced to a low level with mitigation.

Reminder

Impacts to vegetation along Segments A and B include:

- *No impact to T&E species*
- *Moderate to low impact to shrub-steppe and grassland communities*
- *High impact to Wyoming big sagebrush/bluebunch wheatgrass plant community*

There are 12.8 miles of BLM managed land within Segment F, along the south slope of the Saddle Mountains. Known occurrences of three BLM sensitive species, Hoover's desert-parsley, Piper's daisy, and dwarf evening primrose could be impacted by project activities. Other BLM sensitive species with the potential to occur in this area include gray cryptanthera, Wanapum crazyweed, Geyer's milk-vetch, bristle-flowered collomia, blue cup, Nuttall's sandwort, Canadian St. John's wort, tufted evening-primrose, and the lichen species *Texosporum santi-jacobi.* If impacts to BLM sensitive species could not be avoided, it would be a moderate level of impact. Impacts could be partially lessened by mitigation.

4.3.7 No Action Alternative

The impacts currently associated with ongoing maintenance activities for the existing transmission line, substations, and ROW would continue. These impacts include localized soil disturbance due to vehicular traffic, transmission structure replacement, vegetation management activities, and access road improvements. No new impacts to vegetation are expected as a result of this alternative.

4.3.8 Recommended Mitigation

4.3.8.1 Site-Specific Surveys

To determine whether rare species occur along the Preferred Alternative, a survey of known and potential habitat would be done prior to construction.

Rare plant surveys were initiated in August 2001 to identify late-blooming rare species and to search for potential habitat for other rare species habitat to be surveyed in 2002. A professional botanist skilled at identifying plants in the Columbia Basin, has been retained to conduct rare plant surveys during the correct time of year to identify the species with the potential to occur in each area. The survey would be done at a level of intensity to ensure that if rare species are present, it is likely they would be found. If rare plant species are found, the boundaries of the occurrence would be accurately mapped on aerial photographs and located by **GPS** so they can be accurately depicted on project maps. Basic information on rare plant communities would be collected in order to identify any high quality native plant communities that are not within the WNHP database.

Reminder

GPS*: Global Positioning Systems*

4.3.8.2 Native Plant Communities

High quality native plant communities would be avoided where possible and impacts to these communities would be minimized by locating structures and roads outside them, where possible. Maps of high quality communities would be provided to engineers designing the proposed line. Impacts to native plant communities would be minimized during construction by implementing the following practices:

- Construction activities would be restricted to the area needed to work effectively. Construction crews would be instructed to restrict vehicles to designated areas.
- Designated areas would be used to store equipment and supplies. The contractor would follow state and federal regulations to protect plant communities.
- In areas of known sensitive species, topsoil would be stockpiled when the footings of structures are put in place or an area for placement of a structure is graded. After construction, the topsoil would be replaced on the surface of the soil and the surface would be restored to the former grade, where possible.
- After construction, disturbed areas not needed for ongoing access or maintenance would be reseeded.
- Construction specifications would designate which species are appropriate for reseeding in certain areas. Inquiries would be made to determine which commercially available native seed has been used with some success. The option of using non-invasive, non-natives would be explored.

4.3.8.3 Rare Species

Rare plant species habitat would be avoided if possible and unavoidable impacts would be minimized as much as possible. Maps of all rare species occurrences would be provided to engineers designing the proposed line. Structures and roads would be placed to avoid impacting rare species occurrences if possible. Impacts to rare species would be minimized during construction and subsequent maintenance, by implementing the following practices:

- Boundaries of rare species populations would be flagged in the field with an appropriate buffer, to ensure areas that are designated to be avoided during construction are not impacted.
- If impacts are temporary, it may be sufficient to restrict the time of year that various activities take place. Many plants in the study area flower and fruit very early in the spring, then remain dormant under the ground for much of the year. The underground parts may not be disturbed during certain time

periods by certain types of activities, such as driving through an area.

- Information on rare plant species occurrences would be given to BPA maintenance personnel to be considered during the planning and implementation of future maintenance activities. The location of rare plant occurrences would be placed on BPA maps and documents so that maintenance personnel are aware of their location. A written description of restrictions, precautions, or special procedures within rare plant habitat would be attached to maps and documents for that area.
- On state and federal land where rare plants are known to occur, the procedures used to control weeds would be restricted to those that minimize harm to rare plant species. The decision on the best actions to take to control weeds would be made on a case-by-case basis with consultation with the respective state or federal land manager.

4.3.8.4 Minimize the Introduction and Spread of Weeds

Throughout the project, efforts would be made to minimize the introduction or spread of weeds, by implementing the following activities and practices. These activities and practices would be included in a Weed Management Plan for this project:

- To determine the extent of the weed problems along the Preferred Alternative, a pre-construction weed survey would be done to document current conditions.
- Some weed control or eradication activities may occur prior to construction or even during the weed survey if construction would exacerbate an existing weed problem.
- After construction, the seeding of disturbed areas would help decrease weed invasion by providing competition for space.
- A post construction weed survey would be done so that pre- and post-construction weed distributions can be compared. If weed problems exist or are increasing over pre-construction conditions, BPA would cooperate with county weed boards or federal land management agencies to eradicate or control any species that invade disturbed areas.
- To control weeds, BPA would use the procedures outlined in the BPA's *Transmission System Vegetation Management Program Record of Decision* (August 2000) to address weed problems in subsequent maintenance activities.

Reminder

This document is available for review on the Web at http://www.efw.bpa.gov/cgi-bin/PSA/NEPA/SUMMARIES/VegetationManagement_EIS0285.

- Because weeds can be spread by vehicles, BPA would restrict access to the newly constructed access roads where possible, by using gates.

4.3.9 Cumulative Impacts

The loss of shrub-steppe may result from a myriad of projects within the Columbia Basin that involve clearing land and converting it to other uses. The loss of shrub-steppe in Washington State attributable to agriculture has been estimated at 60 percent (Dobler, 1992, Columbia Basin Ecosytem Management Project, EOE-RL, 1996). Due to the high value of some agricultural lands in the study area, the loss of shrub-steppe has accelerated. Within the study area, the ***DNR*** continues to offer leases to state-owned lands for agricultural uses. In Washington, the continued loss of shrub-steppe in the next 50 years is projected to be high (Andelman and Stock, 1994).

Impacts to rare plant species on federal lands may occur due to land use such as grazing or training exercises, but it likely that federal agencies will prioritize the protection of rare species habitats. Much of the rare plant species habitat managed by federal agencies within the study area is relatively inaccessible. Environmental documents produced by these agencies address the needs of rare plant species and staff members are assigned to deal with rare plant issues.

Rare plant species in private areas receive little to no protection under federal and state rare and endangered species legislation. Rare species may be impacted by a variety of land uses typical of private lands, including farming, ranching and development.

The project would contribute to the spread of weeds in the study area as a result of ground disturbance. The invasion by weeds is considered one of the biggest threats to biodiversity in the study area (TNC, 1999). Continued invasion by weed species would accelerate as development occurs and as new weed species invade the area.

Reminder

Cumulative Impacts *are created by the incremental effect of a specific action when added to other past, present, or reasonably foreseeable future actions.*

DNR*: Washington State Department of Natural Resources*

4.4 Wildlife

4.4.1 Impact Levels

➡ Reminder

*A **take** is to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct.*

*To **harm** is to injure directly, or cause significant habitat modification or degradation that results in death or injury to a species.*

High impacts would occur when an action creates a significant adverse change in wildlife habitat, populations, or individuals. High impacts may result from actions that:

- cause the ***take*** of a federally listed or proposed threatened or endangered wildlife species.
- cause a significant reduction in the population, habitat or viability of a federal or state listed wildlife species of concern or sensitive wildlife species, which would result in trends towards endangerment or the need for federal listing.
- cause a significant long-term (more than two years) reduction in the quantity or quality of habitat critical to the survival of local populations of common wildlife species.
- ***harm*** or kill a significant number of individuals of a common wildlife species.

Moderate impacts would occur when an action creates a moderate adverse change in wildlife habitat, populations or individuals. Moderate impacts may result from actions that:

- create an effect on federally listed or proposed threatened or endangered wildlife species that could be partially mitigated.
- cause a reduction in the population, habitat or viability of a federal or state listed wildlife species of concern or sensitive wildlife species, without resulting in trends towards endangerment or the need for federal listing.
- harm or kill a small number of individuals of a common wildlife species.

Low impacts would occur when an action creates a minor adverse change in wildlife habitat, populations or individuals. Low impacts may result from actions that:

- create an effect on federally listed or proposed threatened or endangered wildlife species that could be largely or completely mitigated (i.e., seasonal restrictions on construction activities) or are temporary and benign (i.e., temporary disturbance by construction noise).
- cause a minor short-term (less than two years) reduction in the quantity or quality of the habitat of a federal or state listed wildlife species of concern or sensitive wildlife species,

without resulting in trends towards endangerment and/or the need for federal listing.

- cause a significant short-term (less than two years) reduction in the quantity or quality of habitat critical to the survival of local populations of common wildlife species.

Minimal impacts would occur when an action creates a temporary or minor adverse change in wildlife habitat or individuals. Minimal impacts may result from actions that:

- cause a temporary (less than two weeks) disturbance or displacement of a federal or state listed wildlife species of concern or sensitive wildlife species.
- cause a short-term (less than one year) disturbance or displacement of a common wildlife species.

No impacts would occur when an action has no effect or fewer impacts than the minimal impact level on wildlife habitat, populations or individuals.

4.4.2 Impacts Common to Construction Alternatives

The construction, operation, and maintenance of the proposed transmission line would impact wildlife populations residing in or near the proposed study area. The extent of impact would depend on the species, habitat requirements, and availability of suitable habitat in and around the construction and ROW area.

4.4.2.1 Construction Impacts

Construction impacts can be generally categorized as short-term disturbances related to construction noise, dust, human intrusion, or long-term physical habitat changes or harm to individual animals.

Short-term construction disturbances, depending on the time of year and location, could impact a wide variety of species including mule deer, elk, wintering bald eagles, passerine bird species, waterfowl, raptors, small rodents and amphibian species. Nesting raptors are easily disturbed by construction noise and human presence, and may abandon their nests if the disturbance is severe. Short-term disturbance of a federally listed species may constitute a take, which is considered a high impact. However, with mitigation (e.g., construction timing restrictions), short-term construction-related disturbances would result in only low or minimal impacts to wildlife species.

Long-term construction impacts would mostly stem from habitat loss, due to clearing for ROW or roads. Clearing would mostly impact species that use shrub-steppe habitats, although some limited areas of riparian vegetation may need to be removed. Clearing would be required for structure sites, new substations, expanded substations and access roads.

In areas of relatively undisturbed, native shrub-steppe habitat, clearing would constitute a high impact, because high value habitat for state or federally listed shrub-steppe-dependant species (e.g., sage sparrows, sage thrashers and loggerhead shrikes) would be reduced. In areas of degraded shrub-steppe vegetation (e.g., vegetation infested with weed species), clearing would constitute a moderate impact, since the habitat is already degraded. Clearing in areas previously cleared or severely disturbed (such as agricultural lands) would result in minimal impacts to wildlife species.

Clearing areas of native shrub-steppe vegetation, especially linear corridors such as roads can increase the risk of predation for shrub-steppe dependant small mammal, reptile and bird species. With less cover available and an easy corridor for predators to travel into previously unbroken habitat, these species can be at increased risk of predation from coyotes, raptors, and other predators (Brunkal, 2001). Species most susceptible to increased predation include jackrabbits, sagebrush voles, sagebrush lizards, striped whipsnakes, nightsnakes, and sage grouse.

Riparian areas are generally located in narrow strips along small streams and often in canyons. Since the proposed transmission line would either span these narrow areas or would be located upslope of stream channels, little or no riparian vegetation would need to be removed for transmission line clearance and structure construction. However, since riparian areas are extremely important wildlife habitat, clearing riparian vegetation for ROW or access road construction would cause moderate to high impacts to wildlife species, by disrupting movement corridors, removing nesting or foraging habitat, and compacting stream banks.

4.4.2.2 Operation and Maintenance Impacts

Impacts to wildlife from the operation and maintenance of the proposed project are generally related to the temporary disturbance of wildlife (caused by maintenance equipment and human presence), or the physical presence of the structures.

Maintenance Impacts – Maintenance of the proposed project may include periodic vehicle and foot inspections, helicopter surveys, structure and line repair, clearing of ROW, and other disturbances. Depending on the time of year and the location, maintenance activities could impact a wide variety of species, including mule deer, elk, wintering bald eagles, passerine bird species, waterfowl, raptors, small rodents and amphibian species. Raptors frequently use transmission line structures for nesting and perch sites, and because the towers are the tallest part of the landscape, they may be the preferred hunting site for some species. Nesting raptors are easily disturbed by equipment noise and human presence and may abandon their nests if the disturbance is severe. Periodic ROW clearing would be limited to riparian areas, where the impact would be high.

Operation and Avian Collision Impacts – Operation of the proposed project would have the greatest impact on bird species, due to the collision threat posed by structures, transmission lines, and ground wires. Most other wildlife species would not be as significantly impacted, since the presence of the transmission lines, structures, and access roads generally does not present barriers to migration, create excessive noise, or otherwise cause major behavior changes. Some species with small home ranges or limited dispersal ability might experience a greater negative impact.

Some bird species, usually waterfowl, are prone to collisions with powerlines, especially the grounding wires located at the top of the structures (Meyer, 1978, James and Haak, 1979, Beaulaurier, 1981, Beaulaurier et al., 1982, Faanes, 1987). Four main factors influence avian transmission line collisions: the current level of risk, power line configuration, amount of bird use in a particular area, and the tendency of certain bird species to collide with wires. Collisions usually occur near water or migration corridors and more often during inclement weather. Raptor species are less likely to collide with power lines, perhaps due to their excellent eyesight and tendency to not fly at dusk or in low visibility weather conditions (Olendorff and Lehman, 1986). Smaller migratory birds are at risk, but generally not as prone to collision because of their small size, their ability to quickly maneuver away from obstacles, and the fact that they often migrate high enough above the ground to avoid transmission lines. Permanent-resident birds that fly in tight flocks, particularly those in wetland areas, may be at higher risk than other species.

4.4.3 Preferred Alternative (Alternative 2)

The Preferred Alternative would include Segment A, Segment B (Option $B_{SOUTH)}$ and Segment D.

4.4.3.1 Segment A

Along Segment A, approximately 208 acres of shrub-steppe and grassland vegetation would need to be cleared for structure sites and access roads. Also, approximately 5 acres of forest vegetation, including some riparian vegetation, would need to be cleared.

Riparian vegetation removal would constitute a high impact to wildlife, since riparian areas are scarce and provide important habitat to species such as bald eagles and Lewis' woodpeckers.

Nesting habitat for sagebrush obligate species such as the sage sparrow and sage thrasher would be removed, as would known nesting habitat for long-billed curlew (moderate impact). Sharp-tailed grouse have been documented in the past near the west end of Segment A, and if they still exist, would be moderately impacted by vegetation removal. Sage grouse are known to exist in the southern end of this segment, although no occurrences have been documented closer than 1 mile from the proposed ROW. Disturbance to sage grouse from vegetation removal and construction noise may result from this project (moderate to high impact).

The increase in risk to raptors, waterfowl, and passerine bird species from collision with transmission lines and structures would be low, since no major migration corridors or bodies of water are located along this segment (minimal impact). If the project were constructed during the winter, the potential for disturbing roosting bald eagles (threatened species) would be high near the Wilson and Naneum Creek crossings (high impact).

Also, wintering deer and elk might be temporarily disturbed by construction noise and activity (minimal impact). However, the increase in potential habitat for perching raptors may cause an increase in predation risk for shrub-steppe dependent animals, a moderate impact.

The Segment A reroute would have the same impacts to wildlife species as the original alignment discussed above.

4.4.3.2 Segment B (Option B_{SOUTH})

The Preferred Alternative would follow Option B_{SOUTH} of Segment B. Option B_{NORTH} would not be used for this alternative.

Approximately 90.4 acres of shrub-steppe and grassland vegetation would need to be cleared for structure sites and access roads along Segment B (Option B_{SOUTH}). If the new line was constructed during the winter, the potential for disturbing roosting bald eagles (threatened species) would be high near the Columbia River crossing (high impact). In the upland areas, wintering deer and elk might be disturbed by construction activity (minimal impact). Sage grouse are known to exist near the western end of this segment and might be impacted (moderate to high impact). Nightsnakes have been observed near the proposed ROW and might be impacted (minimal impact). Near the Columbia River, waterfowl, pelicans, and other birds using the area as a migration corridor might be at increased risk of collision with the transmission line spanning the river (moderate impact).

4.4.3.3 Segment D

Segment D has the most varied terrain, and thus the most diverse group of habitats of all the proposed segments. Approximately 62 acres of shrub-steppe and grassland habitat would need to be cleared for structure sites and access roads. Segment D crosses Lower Crab Creek and the Columbia River, which are both migration corridors for birds and areas of high waterfowl concentrations. The risk of avian collisions would be increased in these areas, although the proposed line would be located adjacent to an existing line (moderate impact). The Saddle Mountains have documented occurrences of nesting prairie falcons and golden eagles that could be disturbed by construction activities (low impact). Other species in the Saddle Mountains include the striped whipsnake, chukar, passerine bird species, and a variety of small mammals. Impacts to these species would be moderate, due to the removal of shrub-steppe and dwarf shrub-steppe plant communities.

Segment D crosses the Wahluke Slope over mostly agricultural lands, with no native shrub-steppe habitat present. Construction and operation of the project in this section of the proposed segment would have no impact on species that depend on shrub-steppe habitat and would have minimal to no impact on other wildlife species.

The southern third of Segment D crosses the Columbia River and climbs over Umtanum Ridge. On the steep north face of Umtanum Ridge, nesting prairie falcons and other raptor species have been documented. Swainson's hawks, loggerhead shrikes, and burrowing owls have all been documented nesting near or on the proposed ROW south of Umtanum Ridge. Clearing in this area would cause high impacts to burrowing owls and moderate impacts to other shrub-steppe-dependant species. In addition, the southern end of the proposed line crosses the Cold Creek wildlife migration corridor, which is one of the most important bird migration corridors in Washington and an important corridor for wildlife migrating between the YTC and the Hanford Site. Disturbance to this area could disrupt the migration patterns of these species and increase the hazard of avian collisions with transmission lines and structures (moderate impact).

➡ Reminder

Impacts to wildlife would be moderate to high along Segments A and B.

4.4.4 Alternative 1

Alternative 1 would include Segment A, Segment B (Option B_{SOUTH}) and Segment E.

Impacts to wildlife and wildlife habitat along Segment A would be the same as described for the Preferred Alternative (see Section 4.4.3.1, *Segment A*).

4.4.4.1 Segment B (Option B_{NORTH})

Alternative 1 would follow Option B_{NORTH} of Segment B. Option B_{SOUTH} would not be used for this alternative. Approximately 82.4 acres of shrub-steppe and grassland vegetation would need to be cleared for structure sites and access roads along Segment B (Option B_{NORTH}). Impacts to wildlife species present along Option B_{NORTH} are similar to those discussed under Segment B in the Preferred Alternative (see Section 4.4.3.2, *Segment B (Option B_{SOUTH})*)

4.4.4.2 Segment E

Along Segment E, approximately 147 acres of shrub-steppe and grassland habitat would need to be cleared for structure sites and access roads. Segment E crosses Lower Crab Creek and the Columbia River, which are both migration corridors for birds and areas of high waterfowl concentrations. The risk of avian collisions would be increased in these areas, although the proposed line would be located adjacent to an existing line (moderate impact). The Saddle Mountains have documented occurrences of nesting prairie falcons and golden eagles that could be disturbed by construction activities (low impact). Other species in the Saddle Mountains include the striped whipsnake, chukar, passerine bird species, and a variety of small mammals. Impacts to these species would be moderate, due to the removal of shrub-steppe and dwarf shrub-steppe plant communities. The upper edge of the Wahluke Slope, just below the Saddle Mountains crest where the line heads southeast, has not been converted to agriculture and remains shrub-steppe. Shrub-steppe-dependant species in this area would be moderately impacted. The line crosses the remainder of the Wahluke Slope over mostly agricultural lands that have little native shrub-steppe habitat present. Construction and operation of a new line in this section of the proposed segment would have no impact on species that depend on shrub-steppe habitat, and minimal to no impact on other wildlife species. The project may have a low positive impact for raptor species due to an increase in nesting, perching, and roosting habitat.

The shrub-steppe habitat in the Hanford Site is relatively undisturbed, although invasive, species are present due to past grazing practices. A herd of mule deer, uncommon in the central shrub-steppe region, is present in this area and may be disturbed by construction activity (low impact). Shrub-steppe-dependant species such as the sage sparrow would be disturbed by construction and habitat removal during clearing (moderate impact). Burrowing owls have been documented near the proposed line and may be impacted by clearing and construction (moderate impact). Raptors (including Swainson’s hawks) are present. A new line might have a low positive impact for raptors, since the towers are the tallest structures within many miles and make excellent perching, roosting, and nesting habitat. However, the additional habitat available for perching raptors could increase the predation risk for small shrub-steppe dependent species such as sage sparrows, sage thrashers, mice, and voles, a moderate impact.

A large wetland complex called Saddle Mountain Wasteway, just west of Segment E, is home to great numbers of waterfowl, great blue herons, and other wetland species. The new line would cross a channel and the associated wetland complex leading east from the lake. Woodhouse’s toads have been documented in large numbers within this area and might be impacted (low impact). The proposed line would avoid the riparian area (minimal impact to riparian species), but increase the collision hazard for waterfowl and other bird species (moderate impact). The crossing over the Columbia River into the Hanford Substation would also increase the collision hazard for waterfowl and other bird species using the migration corridor (moderate impact).

4.4.5 Alternative 3

➡ Reminder

Impacts to wildlife would be moderate along Segment A.

Alternative 3 would include Segment A and Segment C.

Impacts to wildlife and wildlife habitat along Segment A would be the same as described for the Preferred Alternative (see Section 4.4.3.1, *Segment A*).

4.4.5.1 Segment C

Along Segment C, approximately 424 acres of shrub-steppe and grassland habitat would need to be cleared for structure sites and

ınd
nent B.

access roads. Sage grouse, burrowing owls, wintering bald eagles, and loggerhead shrike are all known to be present near the proposed ROW, and would be impacted by construction of the new line (high impact). The southern end of the segment crosses Cold Creek, which one of the most important bird migration corridors in Washington. The southern portion is also an important area for deer, elk, coyote, jackrabbit, and other species migrating between the YTC and the Hanford Site. Disturbance to this area could disrupt the migration patterns of these species, and increase the hazard of avian collisions with transmission lines and structures (moderate impact).

4.4.6 Alternative 1A

Alternative 1A would include Segment A, Segment B (Option B_{NORTH}) and Segment F.

Impacts to wildlife and wildlife habitat along Segment A would be the same as described for the Preferred Alternative (see Section 4.4.3.1, *Segment A*). Impacts to wildlife and wildlife habitat along Segment B (Option B_{NORTH}) would be the same as described for Alternative 1 (see Section 4.4.4.1, *Segment B (Option B_{NORTH})*.

4.4.6.1 Segment F

Along Segment F, approximately 231.3 acres of shrub-steppe and grassland habitat would need to be cleared for structure sites and access roads.

Impact levels in the area between the Vantage Substation and the crest of the Saddle Mountains would be similar to those described for Segments D and E. Below the crest of the Saddle Mountains, the area is relatively undisturbed, with the exception of historic grazing and some motorized recreation activities. A historic sage grouse sighting was made near the study area, and a possible historic (pre-1978) Washington ground squirrel colony was located in the general vicinity of the proposed ROW. The top of the Saddle Mountains is a historic sage grouse corridor. If either of these species are still present, construction and clearing of the project would cause a high impact to them.

From the Saddle Mountains, Segment F cuts south across the Wahluke Slope. This section of the Wahluke Slope is not used for agriculture and is relatively undisturbed shrub-steppe habitat. Swainson's hawks are known to nest along this section and might be positively impacted by construction and operation of the project (low positive impact). Other shrub-steppe-dependant wildlife species would be moderately impacted by removal of shrub-steppe vegetation during structure placement and road clearing.

After crossing Highway 24, Segment F enters the Hanford Site. The impacts to wildlife in this area would be similar to those impacts associated with Segment E.

4.4.7 No Action Alternative

The No Action Alternative would not change any existing conditions, and therefore would have no impact on wildlife species. The impacts currently associated with ongoing maintenance activities for the existing transmission line, substations, and ROW would continue. These impacts include localized disturbance to wildlife and habitat due to vehicular traffic, transmission structure replacement, vegetation management activities, and access road improvements. No new impacts to wildlife and wildlife habitat are expected as a result of this alternative.

4.4.8 Threatened and Endangered Species

This section describes the impacts that the proposed project would have on the four wildlife species that are either federally listed or proposed for listing: the bald eagle, Mardon skipper, Washington ground squirrel, and sage grouse. A Biological Assessment is being prepared separately, and determination of the effects for each of these species will be presented in that document. The effects determination will be included in the final EIS document.

4.4.8.1 Bald Eagle

Bald eagles are not known to nest within the study area. Wintering bald eagles are present in the area north of Ellensburg near Wilson and Naneum creeks, in the YTC near Hanson and Alkali Canyon Creeks, and near the Columbia River crossings at Vantage, Midway and the Hanford Site. Construction near known bald eagle roost sites might disturb wintering bald eagles (high impact). In areas away from roost sites, the disturbance of bald eagles from construction will result in a minimal impact. It is unlikely that eagle habitat would be removed. With mitigation, the proposed project would have no impact on bald eagles.

4.4.8.2 Mardon Skipper

The closest known location of historic and current Mardon skipper populations is approximately 50 miles southwest of the study area. The Ponderosa pine/fescue habitat type that the Mardon Skipper favors does not occur within the study area boundaries, although this habitat type may exist near the northern end of the study area. The project would have no impact on the Mardon Skipper.

4.4.8.3 Washington Ground Squirrel

The Washington ground squirrel is listed as both a state and federal species of concern. Much of the study area is located west of the Columbia River, outside of the Washington ground squirrels' known historic range. One historical occurrence (pre-1978) was noted near Segment F in the Saddle Mountains (Betts, 1990). The nearest known existing population is approximately 5 miles east of Segment F north of the Saddle Mountains crest (Nature Conservancy, 2001). Suitable Washington ground squirrel habitat may exist within the study area east of the Columbia River, especially near Lower Crab Creek (Hill, 2001) and the Wahluke Slope (Nature Conservancy 2001). If Washington ground squirrel colonies exist within or adjacent to the study area, construction of a new line and access roads would cause a high impact. If no colonies exist, there would be no impact. With mitigation, construction of a new line and access roads would have a moderate or low impact on any Washington ground squirrel colonies that might exist within the study area.

4.4.8.4 Sage Grouse

For Your Information

*A **lek** is an open area where sage grouse gather in the spring to perform courtship dances.*

The sage grouse is a candidate for federal listing. The Washington Department of Fish and Wildlife (WDFW) lists the sage grouse as threatened. In Washington, sage grouse have historically ranged from the Columbia River, north to Oroville, west to the foothills of the Cascades, and east to the Spokane River. Within the study area, they are known to exist within each of the six drainages in the YTC that are crossed by sections of Segments A, B, and C. Sage grouse are known to nest in the Alkali Canyon and Corral Canyon drainages. A historic ***lek*** in the Johnson Creek drainage has not been used since 1987. Most of the core sage grouse habitat in the YTC is west of the proposed route. Historic sage grouse migration corridors exist along the top of the Saddle Mountains and along Cold Creek, although they have not been sighted in the Saddle Mountains area recently. Construction of Segments A, B, and C would cause a high impact to sage grouse. Construction of Segments D, E, and F would cause a low impact. With mitigation, construction of Segments A and B would cause a moderate impact to sage grouse. Segment C, since it crosses core sage grouse habitat through relatively undisturbed shrub-steppe, could not be mitigated, and would be a high impact.

4.4.9 Special Status Species

Table 4.4-1, *Impacts to Special Status Species*, lists state and federal special status species that may be present within each segment of the proposed study area and indicates the possible impact the project may have on them.

Table 4.4-1
Impacts to Special Status Species

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Documented Occurrence Type	Potential Impact	Mitigated Impact
Birds						
Aleutian Canada goose	FT[1]	ST	B, D, E, F	M	M	M
Bald eagle	FT	ST	ALL SEGMENTS	W	H	L
Golden eagle		SC	B, C, D, E, F	B	M	L
Ferruginous hawk	FSC	ST	ALL SEGMENTS	B	M	L
Swainson's hawk		SM	ALL SEGMENTS	B	M	L
Northern goshawk	FSC	SC	ALL SEGMENTS	M	N	N
Peregrine falcon	FSC	SE	C, D, E, F	B	L	L
Swainson's hawk		SM	ALL SEGMENTS	B	M	Mn
Osprey		SM	B, D, E, F	B	L	Mn
Prairie falcon		SM	ALL SEGMENTS	B	M	Mn
Turkey vulture		SM	B, D, E, F	B	L	Mn
Burrowing owl	FSC	SC	C, D, E, F	B	H	M
Northern Spotted Owl	FT	SE	NONE	N	N	N
Lewis' woodpecker		SC	A, C, D, E, F	B	M	L
Sage sparrow		SC	ALL SEGMENTS	B	H	M
Sage thrasher		SC	ALL SEGMENTS	B	H	M
Loggerhead shrike	FSC	SC	ALL SEGMENTS	B	M	M
Long-billed curlew	FSC	SM	A, C, E, F	B	H	M
Western bluebird	FSC	SM	ALL SEGMENTS	B	M	M
Ash-throated flycatcher	FSC	SM	NONE	N	N	N
Olive sided flycatcher	FSC		ALL SEGMENTS	P	M	L
Little Willow flycatcher	FSC		ALL SEGMENTS	P	M	L
Grasshopper sparrow	FSC	SM	C	B	M	M
Western sage grouse	FSC	ST	A, C, F	B	H	M
Sharp tailed grouse	FSC	ST	NONE	H	N	N
American white pelican		SE	B, D, E, F	M	M	M
Harlequin duck	FSC		B, D, E, F	P	M	M
Common loon		SS	B, D, E, F	M	M	M
Marbled murrelet	FT	ST	NONE	N	N	N
Black tern	FSC	SM	B, D, E, F	M	M	M
Caspian tern		SM	B, D, E, F	M	M	M
Forster's tern		SM	B, D, E, F	M	M	M
Great blue heron		SM	B, D, E, F	B	M	M
Black-crowned night heron		SM	B, D, E, F	B	M	M
Mammals						
Gray wolf	FE	SE	NONE	N	N	N
Canada lynx	FT	ST	NONE	N	N	N
Grizzly bear	FT	SE	NONE	N	N	N
California bighorn sheep	FSC		B, D, E, F	P	L	L
Pacific fisher	FSC	SE	NONE	N	N	N
Wolverine	FSC	SC	NONE	N	N	N
Western gray squirrel	FSC	ST	NONE	N	N	N
Washington ground squirrel	FC	SC	D, E, F	H	H	M-N
Pygmy rabbit	FSC	SE	D, E, F	H	H	M-N
Ord's kangaroo rat		SM	B, D, E, F	P	M	L
Northern grasshopper mouse		SM	ALL SEGMENTS	P	H	M
Sagebrush vole		SM	ALL SEGMENTS	P	H	M
White-tailed jackrabbit		SC	ALL SEGMENTS	B	H	M
Merriam's shrew		SC	ALL SEGMENTS	B	H	M
Potholes meadow vole	FSC		NONE	N	N	N
Pacific western big-eared bat	FSC	SC	ALL SEGMENTS	P	M	M

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Documented Occurrence Type	Potential Impact	Mitigated Impact
Long-eared myotis	FSC	SM	ALL SEGMENTS	P	M	M
Long-legged myotis	FSC	SM	ALL SEGMENTS	P	M	M
Fringed myotis	FSC	SM	ALL SEGMENTS	P	M	M
Western small-footed myotis	FSC	SM	ALL SEGMENTS	P	M	M
Yuma myotis	FSC		ALL SEGMENTS	P	M	M
Pallid bat		SM	ALL SEGMENTS	P	M	M
Mardon skipper	FC	SE	NONE	N	N	N
Persius' duskywing		SM	E	P	Mn	Mn
Reptiles & Amphibians						
Cascades frog	FSC		NONE	N	N	N
Larch Mountain salamander	FSC	SS	NONE	N	N	N
Northern leopard frog	FSC	SE	D, E, F	P	Mn	Mn
Red-legged frog	FSC		NONE	N	N	N
Tailed frog	FSC	SM	NONE	N	N	N
Spotted Frog	FC	SE	ALL SEGMENTS	P	Mn	Mn
Woodhouse's Toad		SM	E, F	B	Mn	Mn
Sagebrush lizard	FSC		ALL SEGMENTS	B	H	M
Nightsnake		SM	B, D, E, F	P	H	M
Striped whipsnake		SC	ALL SEGMENTS	B	H	M

Federal Status
FE = Endangered
FT = Threatened
FC = Candidate
FSC = Species of Concern

State Status
SE = Endangered
ST = Threatened
SS = Sensitive
SC = Candidate
SM = Monitor

Presence
P = Present (general presence)
B = Breeding
M = Migrant
W = Winter Resident
N = Not Present
H = Historically Present, Not Currently Present

4.4.10 Recommended Mitigation

To reduce the impacts to wildlife associated with the construction, operation and maintenance of the proposed project, a number of mitigation measures would be implemented.

4.4.10.1 Big Game Disturbance

- Avoid construction on Segments A, E, and F during extreme winter weather or unusually heavy snow accumulations, when big game species are less mobile and more vulnerable to disturbance.
- Coordinate with WDFW to ensure that construction does not significantly interfere with big game wintering or migration.
- Gate and sign new or existing roads to prevent human encroachment into big game wintering areas or significant migration corridors.

4.4.10.2 Avian Collision Mitigation

Where possible, line up new structures with existing structures to minimize vertical separation between sets of transmission lines.

Install appropriate line markers in high risk areas, such as crossings of the Columbia River, Lower Crab Creek, the Cold Creek migration corridor, high ridge crossings such as the Saddle Mountains, Umtanum Ridge and Yakima Ridge and on Hanford Reach National Monument lands.

Monitor potential problem areas after construction to ensure that line markers are functioning properly.

4.4.10.3 Raptor Disturbance Mitigation

Time project construction to avoid critical nesting periods in known raptor nest locations, as determined by USFWS and WDFW.

Time project construction to avoid disturbing wintering bald eagles. Perennial stream and river crossings and the areas 1 mile on either side of these crossings should be avoided from early November through mid-March. Known eagle wintering locations include Wilson and Naneum Creeks, all Columbia River crossings and perennial creeks in the YTC.

4.4.10.4 Shrub-Steppe Habitat Loss Mitigation

To minimize the impacts to shrub-steppe, a Priority Habitat, minimize the construction area to the extent possible at structure sites and roads.

Install construction “envelopes”: silt fencing or other barrier materials surrounding the construction site to prevent vehicle turnaround, materials storage, or other disturbance outside the designated construction area.

Do not clear vegetation for temporary vehicle travel or equipment storage outside of designated construction areas; crushing is preferable to removal.

When possible, avoid the use of access roads in steep terrain during unusually wet or muddy conditions or extremely dry conditions.

Prevent the spread of noxious weeds by revegetating disturbed areas using native seed mix at appropriate planting times as indicated by USFWS and WDFW and selectively applying herbicide as needed.

Carry fire fighting equipment in all vehicles and observe seasonal fire restrictions on construction. Park vehicles in areas free from dry grass or other vegetation.

4.4.10.5 Wildlife Disturbance Mitigation

Prior to initiating construction activities, conduct field surveys to identify areas of listed, candidate, or federal species of concern wildlife populations or colonies such as burrowing owls, sage grouse leks, and ground squirrels.

If possible, avoid locating structures, roads, construction staging areas, substations, or other disturbances in known colonies of small animal species.

Gate and sign new or existing roads to prevent human encroachment into areas containing significant wildlife populations or relatively undisturbed wildlife habitat.

Construction and operation and maintenance activities should be timed to avoid entry into sensitive wildlife habitats during critical breeding or nesting periods (as determined by USFWS and WDFW).

Vegetation removal would be limited to only the amount required to safely construct new access roads. Riparian vegetation would be removed only where absolutely necessary.

4.4.11 Cumulative Impacts

The proposed project could potentially impact the existing environmental conditions of current concern in eastern Washington, especially from the loss/fragmentation of native shrub-steppe plant and dependant wildlife communities.

The shrub-steppe habitat type has been significantly reduced from historic levels in Washington, and much of the remaining habitat is heavily disturbed by grazing, fire, or other land uses. It is generally recognized that preserving large, unbroken tracts of high quality shrub-steppe vegetation is important for maintaining populations of shrub-steppe dependant species such as sage grouse, sage sparrow, Washington ground squirrel and others (Johnson and O'Neil, 2001). WDFW has declared the shrub-steppe habitat type as a Priority Habitat.

Construction of structures and access roads through shrub-steppe vegetation would increase the existing levels of habitat fragmentation and reduce the amount of shrub-steppe vegetation available for wildlife habitat. Over time, native shrub-steppe vegetation may recolonize the disturbed areas. However, construction of the proposed project would increase the potential for the linear spread of noxious weeds into previously undisturbed areas. The presence of noxious weeds makes the recolonization of disturbed areas with native vegetation extremely difficult, and generally leads to a long-term reduction in quality wildlife habitat.

4.5 Fish Resources

4.5.1 Impact Levels

High impacts to fish would occur when an action creates a significant adverse change in fish habitat, populations or individuals. High impacts might result from actions that:

- cause the ***take*** of a federally listed or proposed threatened, endangered fish species.
- cause a significant long-term (more than two years) adverse effect on the populations, habitat and/or viability of a federal or state listed fish species of concern or sensitive species, which would result in trends towards endangerment and/or the need for federal listing.
- ***harm*** or kill a significant number of individuals of a common fish species at the local (stream reach or small watershed) level.

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Moderate impacts to fish would occur when an action creates a moderate adverse change in fish habitat, populations or individuals. Moderate impacts might result from actions that:

- without causing a take, cause a temporary (less than two months) reduction in the quantity or quality of localized (stream reach or small watershed) aquatic resources or habitats at a time when federally listed threatened, endangered, or proposed fish species are **not likely** to be present (i.e., during non-spawning or rearing times).
- cause a short-term (up to two years) localized (stream reach or small watershed) reduction in population, habitat and/or viability of a federal or state listed fish species of concern or sensitive species, without causing a trend towards endangerment and the need for federal listing.
- harm or kill a small number of individuals of a common fish species at the local (stream reach or small watershed) level.

Low impacts to fish would occur when an action creates a minor or temporary adverse change in habitat, populations, or individuals. Low impacts might result from actions that:

- cause a temporary (less than two months) localized (stream reach or small watershed) reduction in the quantity or quality of aquatic resources or habitats of state listed fish species of concern or sensitive species, without causing a trend towards endangerment and the need for federal listing.

- cause a short-term (up to two years) disturbance or displacement of common fish species at the local (stream reach or small watershed) level.

No impacts to fish would occur when an action has no effect or fewer impacts than the low impact level on fish habitat, populations or individuals.

4.5.2 Impacts Common to Construction Alternatives

The construction, operation and maintenance of the proposed transmission line will impact fish populations that reside in or near the study area. The extent of impact would depend on the fish species, its distribution, its habitat requirements, and the availability of suitable habitat in and around the construction and study area (See Table 4.5-1, *Water Crossings and Fish Presence*).

Table 4.5-1
Water Crossings and Fish Presence

Line Segment	Preferred (2)	Alternative 1	Alternative 3	Alternative 1A
Intermittent Drainages[1]	44	41	68	38
Canals and Drains[2]	9	4	0	1
Lakes	1	2	1	2
Perennial Streams	11	11	20	11
Fish Bearing Streams[3]	10	11	17	11

1 Intermittent drainages were determined from USGS 7.5 minute quad maps. These drainages may be seasonally intermittent or only contain water during storm events. It is assumed that these drainages do not contain fish.

2 Canals and drains were determined from USGS 7.5 minute quad maps. Although fish may be periodically observed, it is assumed that canals and drains do not contain fish.

3 Perennial streams that are known to contain fish. Where the ROW crosses the intermittent headwaters of a perennial stream that is known to contain fish, it is assumed that fish are present and could be affected by the project.

4.5.2.1 Construction Impacts

Short-term construction disturbances, depending on the time of year and the location, could impact various fish species by causing sedimentation, habitat and/or individual fish disturbance, or the release of hazardous materials into a waterway. The following would be potential short-term impacts:

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- Damage to fish or fish habitat from construction sediments entering streams.
- Soil from roads, cleared areas, excavations, stockpiles or other construction sources might enter streams and cause an increase in ***sediment load*** and/or ***sediment deposition*** in spawning gravels.

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- Concrete washing or dumping might allow concrete waste to enter streams and cause an increase in sediment load.
- Other construction materials (metal parts, insulators, wire ends, bolts, etc.) might enter streams and cause changes in flow or other unknown effects.
- Mechanical disturbance of fish habitat from equipment operating in, crossing, or passing streams.
- Streambank compaction or sloughing might reduce the streambank's ability to support vegetation, or cause sediment input or increased runoff.
- Heavy equipment moving across a stream (or repeated travel by light equipment) might cause substrate disturbance, including sediment release or substrate compaction.
- Riparian vegetation destruction or removal (this would be incidental only; planned vegetation removal for new ROW and roads is a long-term impact) may cause a loss of fish habitat (cover), loss of stream shading, removal of large woody debris sources, and reduction in ***buffer*** capacity.
- Disturbance of individual fish from equipment operating in or near streams.
- Vibration or shock from equipment operating in or near streams would drive fish to less suitable habitat or to areas where predation is more likely. In marginal conditions such as extreme low flows and high water temperatures, stress from repeated disturbance may cause death.
- Mechanical injury or death from equipment crossing or operating in streams, especially to fish that live in or on the bottom of the stream (such as sculpins).
- Injury or death of fish or their prey from hazardous materials spills.
- Petroleum fuel products, hydraulic oil, and other hazardous materials typically associated with construction activities may enter the stream, causing fish kills, aquatic invertebrate kills, and death or injury to a number of other species that fish depend on for food. Spills may also create pollution "barriers" to fish migration between stream reaches.

*A **buff** riparian stream polluta*

Depending on the location and the fish species present, short-term impacts would range from low to high. Short-term disturbances such as those listed above would constitute a high or medium impact on most species. However, since most of the project construction will occur away from streams and include mitigation (such as construction timing restrictions and spill prevention and erosion measures), short-term construction-related disturbances should result in low or no impacts to all fish species.

4.5.2.2 Operation and Maintenance Impacts

Long-term impacts resulting from ongoing operation and maintenance would result mostly from habitat alteration due to clearing of riparian vegetation, changes in runoff and infiltration patterns (from upland vegetation clearing), sedimentation from cleared areas, and maintenance access across streams.

Since the new transmission line would span narrow riparian areas or be located upslope of stream channels, little or no riparian vegetation would be removed. Where access roads are required to cross streams, riparian vegetation may be removed. Since riparian areas are extremely important in providing stream shading and cover for fish, and are a source of large woody debris in streams, any clearing of stream-side riparian vegetation would likely cause moderate to high impacts to fish species, should they be present.

The area cleared for structure construction and access roads in upland areas could change runoff and infiltration patterns to the extent that flow regimes in creeks would be altered, especially in smaller drainages. A decrease in groundcover from vegetation removal can cause an increase in sheet flow during storm events, with correspondingly less infiltration. This can cause higher flood flows in creeks and reduce the amount of infiltrated water that can support base flows. Higher flood flows cause more erosion and deposition of fine materials, which may affect fish habitats or cause physical damage to fish through gill abrasion. Lower base flows, in areas where base flows are already low, may cause streams to dry up in some places or result in warmer water temperatures, which can cause harm or be lethal to fish.

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Clearing for roads and structure sites increases the risk of sediment input due to the erosion of soil that is normally stabilized by vegetative cover. Sedimentation of streams can cause a degradation of spawning areas, by filling the ***interstitial spaces*** in spawning gravels. This reduces the flow of oxygenated water necessary for egg and ***alevin*** survival.

Creating new vehicle access across streams can cause bank compaction, repeated sediment disturbance, disturbance or physical damage to fish (if present), a conduit for sediment input, and the possible release of automotive wastes such as fuel or hydraulic oil into a stream. Stream crossings of intermittent drainages would be accomplished by constructing fords where possible. Ford construction would involve removing a portion of the streambed below grade, then backfilling it with crushed rock or other suitable rocky material to the original streambed level. Ford approaches would be stabilized with crushed rock to reduce erosion and provide an all weather surface. Drainages that are too incised or steep to ford may be fitted with culverts or bridges to provide water and debris passage.

Perennial streams would be crossed using existing crossings, where possible. In areas where adequate crossings or alternative routes do not currently exist, bridges or culverts would be used to maintain fish passage and stream flows, while providing vehicle access. Approaches to crossings would be stabilized with crushed rock to reduce erosion and provide an all weather surface. Access roads would experience intense use during construction, but use should not increase much over current threshold levels once construction is complete.

Operation of the proposed project would be limited to energizing the conductors. Normal operation of the project would have no impact on fish species (see Appendix F Addendum for more information).

Maintenance of the project might include periodic vehicle and foot inspections, helicopter surveys, tower and line repair, ROW clearing, and other disturbances. Depending on the time of year and location, maintenance activities could impact fish species or habitat. Periodic ROW clearing will be mostly limited to riparian areas, where the impact might be high. Maintenance impacts will be similar to those impacts related to short-term construction (Section 4.5.2.1, *Construction Impacts*).

4.5.3 Preferred Alternative (Alternative 2)

The Preferred Alternative would include Segment A, Segment B (Option B_{SOUTH}) and Segment D.

4.5.3.1 Segment A

Segment A would cross 28 intermittent drainages and eight perennial streams, seven of which are known to be fish bearing. Wilson Creek, Naneum Creek, Schnebly Creek, Coleman Creek, Cooke Canyon Creek, Caribou Creek, and Parke Creek are all known to contain fish. Cave Canyon Creek does not contain fish.

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Both Wilson Creek and Naneum Creek are in steep canyons. Structures would be placed high up and well away from both streams. Access would be through existing county and access roads. Since no new construction would occur near the streams, no impacts to fish are expected. The increase in traffic along the existing roads would be insignificant.

Schnebly Creek and Coleman Creek both have existing access from county and access roads, and the structures would be constructed high up and away from the creek edges. No impacts to fish are expected.

Cooke Canyon Creek, near the proposed crossing, has several channels and lies in a wide floodplain that is mostly pasture. One or more structures might need to be located in the pasture/floodplain, and access to these structures using a bridge or culvert might be needed across one channel of the creek. Removal of riparian vegetation would most likely be required for the access and possibly for overhead clearance. This would create a moderate impact to rainbow trout, cutthroat trout, and brook trout. With mitigation (see Section 4.5.10, *Recommended Mitigation*), this impact could be reduced to low.

Caribou Creek and Parke Creek both have access from either side of the creek, eliminating the need for new crossings. Structures would be located well away from the creek. No impacts to fish are expected.

The proposed reroute of part of Segment A would move the crossing of Cooke Canyon Creek south by approximately 0.3 mile to an area with much less riparian vegetation and multiple channels. Less riparian vegetation would have to be removed in this area; therefore impacts to fish would be less than the original alignment.

4.5.3.2 Segment B (Option B_{SOUTH})

The Preferred Alternative would only use Option B_{SOUTH} of Segment B. Option B_{NORTH} would not be used. Segment B (Option B_{SOUTH}) would cross five intermittent drainages, two fish-bearing perennial streams (Middle Canyon Creek and Johnson Creek), and the Columbia River, which is also fish bearing.

Middle Canyon Creek and Johnson Creek would both be crossed in their headwaters, where conditions are generally unsuitable for fish survival during most times of the year. Therefore, there would be no direct impacts to fish (injury, disturbance from equipment, etc.). However, since both creeks would need to be crossed with a ford, the streambed would be disturbed during creation of the ford, which would have the potential to cause increased sediment input, bank destabilization, and riparian vegetation removal. Also, hazardous materials spills from equipment traveling across the fords could move downstream to where fish are present, should the stream be flowing.

Thus, indirect impacts to fish could be high depending on the nature and quantity of the spill and the time of year it occurs. With mitigation such as construction during ***in-water work windows*****,** spill control and erosion controls (see Section 4.5.10, *Recommended Mitigation*), impacts to fish in these streams should be low.

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The Columbia River would be crossed by a long span, with structures set well away from the banks. Since the structures and access roads would be far away from the edge of the river, sediment or other materials would not be able to reach the water. Therefore, there would be no impacts to any fish species in the Columbia River along Segment B.

4.5.3.3 Segment D

Segment D crosses 11 intermittent drainages, nine canals or drains, one perennial stream, and the Columbia River. Lower Crab Creek, and the Columbia River both contain fish.

The Lower Crab Creek crossing would have structures placed over 200 feet from the stream bank. Access would be from either side, so no new crossings of Lower Crab Creek are proposed. Since no new construction will occur near Lower Crab Creek, impacts to fish (Chinook salmon, steelhead, rainbow trout, brown trout and warm water fish) are expected to be low.

The proposed crossing of the Columbia River would parallel the existing transmission lines. The structures would be set over 200 feet from the edge of the river, and access would be from existing roads on either side of the river. Since no new access roads near the river would be built and there is sufficient distance from the structures to the river, no sediments spills or other materials would be able to easily enter the river. Impacts are expected to be low.

4.5.4 Alternative 1

Alternative 1 would include Segment A, Segment B (Option $B_{NORTH)}$ and Segment E.

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Impacts to fish resources along Segment A would be the same as described for the Preferred Alternative (see Section 4.5.3.1, *Segment A*).

4.5.4.1 Segment B (Option B_{NORTH})

Alternative 1 would only use Option B_{NORTH} of Segment B. Option B_{SOUTH} would not be used. Segment B (Option $B_{NORTH)}$ would cross five intermittent drainages, two fish-bearing perennial streams (Middle Canyon Creek and Johnson Creek), and the Columbia River, which is also fish bearing. Impacts to fish species would be the same as those discussed in Alternative 1 (see Section 4.5.3.2, *Segment B (Option B_{SOUTH})*)

4.5.4.2 Segment E

Segment E crosses eight intermittent streams, four canals or drains, two lakes, one perennial stream, and the Columbia River. Both lakes, the stream, and the Columbia River contain fish. Segment E would parallel Segment D from the Vantage Substation to the top of the Saddle Mountains, then head southeast into the Hanford Site.

No Wake Lake is a private constructed lake used for water skiing. It contains warm water species of fish. Structures may be placed close to the water, but access would be from either side. The land surrounding the lake is relatively flat, which would limit the erosion potential from structure and access road construction, and limit the potential for spills to enter the lake. No impacts to fish are expected at this location.

Since Segment E would cross Lower Crab Creek near the locations where Segment D would cross, impacts would be similar for this area to those described for Segment D. Towers would be placed over 200 feet from the banks and no access road crossing would be installed.

Saddle Mountain Lake would be crossed at its eastern end, near where the overflow channel (Saddle Mountain Wasteway) exits. An existing access road crosses the wasteway and could be used for access. Structures would be placed over 200 feet from either side of the edge of the lake. Riparian vegetation is relatively low, although some trees may need to be removed for overhead access. The lake supports warm water fish only. Since no new access roads would be built, structures would be located away from the lake. No sensitive fish species are present, so impacts would be low.

The Columbia River crossing into the Hanford Site would be accessed from either side of the river. Structures would be placed well back from the edge of the river. There is very little riparian vegetation in this area and none of it would need to be cleared. Impacts to fish species in the Columbia River at this location would be low.

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4.5.5 Alternative 3

Alternative 3 would include Segment A and Segment C.

Impacts to fish resources along Segment A would be the same as described for the Preferred Alternative (see Section 4.5.3.1, *Segment A*).

4.5.5.1 Segment C

Segment C construction would cross 40 intermittent drainages and six perennial steams, five of which are fish bearing. Middle Canyon Creek, Johnson Creek, Hanson Creek, Alkali Canyon Creek, and Corral Canyon are all known to contain fish. No fish are present in Cold Creek.

Middle Canyon Creek and Johnson Creek would be crossed with fords in their headwater sections. Impacts to fish in these two creeks would be similar to those described for Segment B.

Hanson Creek and Alkali Canyon Creek both contain rainbow trout and brook trout throughout their lower and middle reaches. Both of these creeks and Corral Canyon Creek support Chinook salmon in their very lowest reaches near the Columbia River. These creeks are in steep canyons, so the structures would be placed on either side of the canyons well above the creek. No impacts are expected from structure construction and placement. However, all three of these streams would need to have bridges or culverts placed in them to allow vehicular access. Impacts to fish, especially Chinook salmon, from construction of these access roads and structures could be high, depending on when the construction occurs, if sediments or spills enter the creek, and if fish are present. With mitigation such as in-water work during work windows, erosion and spill control measures, and construction of structures that allow fish passage (see Section 4.5.10, *Recommended Mitigation*), impacts to rainbow trout, brook trout, and Chinook salmon would be low.

4.5.6 Alternative 1A

Impacts t Segments

Alternative 1A would include Segment A, Segment B (Option B_{NORTH}) and Segment F.

Impacts to fish resources along Segment A would be the same as described for the Preferred Alternative (see Section 4.5.3.1, *Segment A*). Impacts to fish resources along Segment B (Option B_{NORTH}) would be the same as described for Alternative 1 (see Section 4.5.4.1, *Segment B (Option B_{NORTH})*).

4.5.6.1 Segment F

Segment F would cross 30 intermittent drainages, one canal, one lake, one perennial stream, and the Columbia River. Nunnally Lake, Lower Crab Creek, and the Columbia River all contain fish.

Nunnally Lake is a closed depression north of Lower Crab Creek that has been filled with water and contains rainbow trout and various warmwater fish species. It is managed as a recreational fishery.

Access roads would be routed around the lake, and structures would be located on either side, over 200 feet from the edge of the lake. Since no new access roads would be constructed near the lake, structures would be placed far away from the edge. No riparian vegetation would be removed, so the impact to fish in Nunnally Lake would be low.

Segment F would cross Lower Crab Creek approximately one mile upstream of where Segment D and E cross. No access road would be construction across the creek and the towers would be placed over 200 feet away from the stream. Impacts to fish are expected to be low.

Segment F would use the same crossing of the Columbia River as described in Segment E, so impacts to fish would be similar to those described in that section.

4.5.7 No Action Alternative

The impacts currently associated with ongoing maintenance activities for the existing transmission line, substations, and ROW would continue. These impacts include localized soil disturbance and potential sedimentation of streams due to vehicular traffic, transmission structure replacement, vegetation management activities, and access road improvements. In addition, vehicle and machinery use, and vegetation management practices could contribute minor amounts of pollutants (e.g., fuel, oil, grease, rubber particulate, woody debris) that could be transported to streams. No new impacts to fish resources are expected under the No Action Alternative.

4.5.8 Threatened and Endangered Species

Table 4.5-2, *Impacts to Fish Species*, contains listed fish species present within the study area. A discussion of the impacts to federally listed threatened, endangered, or candidate species follows. A Biological Assessment is being prepared separately, which will present effects determinations for each of these species.

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4.5.8.1 Chinook Salmon (Upper Columbia River Spring Run ESU)

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Upper Columbia River Chinook salmon (a federally listed endangered species) are present in the study area only in the Columbia River, where the Preferred Alternative and Alternatives 1, 3, and 1A (specifically, Segments B_{NORTH}, B_{SOUTH}, D, E, and F) cross it. The construction and operation of all alternatives (specifically, Segment A, and C) would have no impact on Upper Columbia River Chinook salmon, since they are not present in the Yakima River basin and the streams that these segments cross.

Construction of any of the three Columbia River crossings associated with the Preferred Alternative and Alternatives 1, 3, and 1A would also have no impact on Upper Columbia River Chinook salmon. This is because structures would be built far enough away from the river bank and riparian areas to eliminate the potential for sediments, spills or other materials to enter the river. New structures at river crossings would parallel existing structures, which range from 200 to 1,000 feet from the edge of the river. Access to the structures would be limited to the landside of the structures and would not enter the riparian zone. Riparian vegetation removal would not be required at any of the Columbia River crossings.

4.5.8.2 Steelhead Trout (Upper and Middle Columbia River ESUs)

Middle Columbia River ESU steelhead (a federally listed threatened species) are present in the Yakima River basin, but are not known to exist in the streams along Segment A. However, these streams are federal designated critical habitat. Upper Columbia River ESU steelhead (a federally listed endangered species) are present in the lower reaches of two streams crossed by Segments B_{NORTH}, B_{SOUTH}, C, D, E, and F. They also exist in the Columbia River where Segments B_{NORTH}, B_{SOUTH}, D, E, and F cross it.

The streams along Segment A in the Yakima River basin might have minor impacts to water quality, should construction cause sediments or other materials to enter these stream, causing a moderate impact to Middle Columbia River steelhead. However, with mitigation (see Section 4.5.10, *Recommended Mitigation*), no impacts to Middle Columbia River Steelhead would be expected. The Columbia River crossings (described in the Chinook Salmon section above) would have no impact on Upper Columbia River steelhead. Crossings of Johnson Creek on Segments B_{NORTH}, B_{SOUTH}, C, and G would not directly impact Upper Columbia River steelhead, since this creek does not support steelhead where these proposed segments cross it. However, the lower reach of Johnson Creek does support steelhead, and indirect impacts could occur from sediments, spills, or other materials entering the creek, or removal of upland and riparian vegetation that might change flow regimes and increase stream temperatures. The area of Lower Crab Creek where Segments D, E, and F cross it may support steelhead; however, the construction of structures and access roads would not occur within 200 feet of Lower Crab Creek, and no riparian vegetation would be removed. Thus, with mitigation (see Section 4.5.10, *Recommended Mitigation*), no impacts to Upper Columbia River steelhead would be expected.

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4.5.8.3 Bull Trout Columbia River DPS

Bull trout (a federally listed threatened species) are not known to currently exist within any of the streams, lakes or rivers crossed by the project, although all streams and rivers are designated as critical habitat. Coleman Creek, near Ellensburg, is known to have historically contained bull trout, but none have been observed since 1970 and it is unknown whether any are still present. No historical records of bull trout are documented in any of the other proposed stream crossings. No new access roads would be constructed across Coleman Creek and the structures would be placed well away from the creek. Since construction would occur far from the creek, and no sediments, spills, or other materials would be likely to enter the creek, the project would have no impact on bull trout. (See Table 4.5-2, *Impacts to Fish Species*.)

Table 4.5-2
Impacts to Fish Species

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Documented Occurrence Type	Potential Impact	Mitigated Impact
Chinook Salmon (Upper Columbia River Spring Run ESU)	FE	SC	B_{NORTH}, B_{SOUTH}, D, E, F	P	High	Low
Steelhead Trout (Middle Columbia River ESU)`	FT	SC	A	P	No Impact	No Impact
Steelhead Trout (Upper Columbia River ESU)	FE	SC	B_{NORTH}, B_{SOUTH}, C, D, E, F	P	High	Low
Bull Trout	FT	SC	A	H	No Impact	No Impact

FE = Endangered SC = Candidate P = Present (general presence)
FT = Threatened H = Historically Present, Not Currently Present

4.5.9 Special Status Species

Table 4.5-3, *Impacts to Special Status Fish Species*, lists state and federal special status species that may be present within each segment of the study area and indicates the possible impact the project may have on them.

Table 4.5-3
Impacts to Special Status Fish Species

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Documented Occurrence Type	Potential Impact	Mitigated Impact
Coastal Cutthroat Trout	FP		NONE	N	N	N
Westslope Cutthroat Trout	FSC		A	P	M	L
Interior Redband Trout (Rainbow)	FSC		ALL SEGMENTS	P	H	L
Margined Sculpin	FSC		NONE	N	N	N
Pacific Lamprey	FSC		B_{NORTH}, B_{SOUTH}, D, E, F	P	L	N
River Lamprey	FSC		A	P	L	N

Federal Status
FE = Endangered
FT = Threatened
FC = Candidate
FSC = Species of Concern

State Status
SE = Endangered
ST = Threatened
SS = Sensitive
SC = Candidate
SM = Monitor

Presence
P = Present (general presence)
B = Breeding
M = Migrant
W = Winter Resident
N = Not Present
H = Historically Present, Not Currently Present

4.5.10 Recommended Mitigation

The following mitigation measures would be implemented in order to reduce or eliminate impacts to fish species from the construction, operation, and maintenance of the proposed project.

To minimize short- and long-term impacts to fish from structure construction:

- To reduce the possibility of sediments or spills entering streams or lakes, structures would be placed over 200 feet (where possible) from the edge of streams or lakes that are known to contain fish.
- Sediment and stormwater controls including silt fence, waterbars, and dust control would be implemented, if necessary, on construction sites located near fish bearing water bodies.

- To prevent spills of fuel or hazardous materials from entering streams and/or groundwater, a spill prevention and spill response plan would be developed and implemented prior to construction. Spill kits would be carried in all equipment and vehicles.
- To prevent erosion and sediment movement, vegetation removal would be limited to the amount required for safe working conditions and tower placement. Where possible, vegetation (even if temporarily disturbed but not destroyed) would be left in place.
- To reduce the amount of exposed soils that could be eroded, site restoration would occur following construction. Disturbed areas would be planted with native vegetation suitable for the local area. Vegetation would be planted only during appropriate local planting seasons as indicated by USFWS and WDFW.

To minimize short- and long-term impacts to fish from access road construction and use during maintenance activities:

- To protect certain life-stages of fish species, in-water work would only occur during WDFW in-water work windows, or as otherwise authorized or directed by WDFW. Work near sensitive spawning areas, such as those found near the Columbia River crossings would occur only when spawning fish are not present.
- To prevent damage to stream banks and reduce the potential for sediment or hazardous material input to streams, access roads would be placed as far away from creeks as terrain and ROW will allow.
- Where fish-bearing streams must be crossed, existing access roads would be used where available. New crossings would be constructed using culverts or bridges that allow for uninterrupted fish passage. Fords would be limited to intermittent non-fish-bearing streams and the intermittent headwaters of fish-bearing streams.
- Approaches to stream crossings would be rocked with crushed gravel or other material suitable to prevent erosion and minimize road damage from vehicles and equipment during wet conditions.
- Temporary sediment controls such as silt fence would be installed prior to construction, and monitored for proper function until completion of construction and site restoration. Permanent stormwater and sediment controls like ditches and

waterbars would be installed on slopes and maintained periodically.

- Vegetation removal would be limited to only the amount required to safely construct new access roads. Riparian vegetation would be removed only where absolutely necessary.
- Cutbanks, fill banks, and other areas of disturbed soils other than the traveled way would be reseeded as soon as possible after completion of construction.
- Access control structures such as gates, large waterbars and eco blocks would be placed at access road entrances, to limit the amount of vehicular traffic that might create erosion problems or other disturbance to streams containing fish.

4.5.11 Cumulative Impacts

The proposed action may contribute to localized, short-term, and long-term disturbance to fish resources, as a result of increased sediment input and possible hazardous materials spills. Erosion and sedimentation of streams within the study area has increased over the past 100 years due to land use practices such as grazing, agriculture, road building, land clearing, military operations, and other disturbances. This has contributed to a reduction in the quality and availability of fish habitat in many streams. Increased access and human activity around streams during this time period has also increased the frequency of hazardous material spills entering streams. While spill events are relatively rare and generally confined to a single stream or stream reach, their effects can be devastating to fish resources.

Riparian vegetation has been significantly reduced from historic levels in Washington, and much of the remaining habitat is heavily disturbed by grazing, fire, and other land uses. Some riparian habitat would be lost as a result of the proposed project, adding cumulatively to the degradation of fish habitat.

4.6 Land Use

4.6.1 Impact Levels

Impacts would be considered **high** where an action would:

- convert prime farmlands (as defined in the Farmland Protection Policy Act (FPPA) (7 U.S.C. 4201 et seq.) to a non-farm land use.
- convert other active and productive farmlands to a non-farm land uses.
- create areas of non-inhabitable land where residential uses already exist or are permitted.
- prevent the use of the land according to existing or approved land management plans.

Impacts would be considered **moderate** where an action would:

- adversely affect existing prime or other farmlands by limiting farm production or the types of farm uses.
- adversely affect residential, commercial, or industrial properties by eliminating or limiting the potential for residential development to occur around or underneath the transmission lines and/or structures.
- adversely affect commercial or industrial properties by introducing additional or new inconveniences to business operations.
- alter the use of the land according to existing or approved land management plans.

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Impacts would be considered **low** where an action would:

- create short-term disturbances such as minor crop damage during construction or restrict improvements to previously affected areas (e.g., existing structure locations).
- create short-term disturbances, but still allow the continued use of the land according to existing or approved land management plans.

No impact would occur when land uses would be able to continue as currently exists.

4.6.2 Impacts Common To Construction Alternatives

Heavy machinery used for construction would temporarily damage crops, compact soils, and disrupt land use activities on approximately 0.3 acre around each structure. Since this disturbance would be temporary and pre-construction conditions would be re-established, the impact level to land uses from construction would be low.

To construct and maintain the proposed transmission line, some existing access roads would need to be improved and new access roads would need to be constructed. The road improvements would occur across lands that support a number of different land uses. Improvements to existing roads would not impact existing land uses. New roads would have a low impact because those within agricultural fields would be temporary, others would be constructed around agricultural fields and residential uses, landowners would be able to use the roads across rangeland and the movement of livestock would not be hindered, and they would not disrupt activities on public land such as the Yakima Training Center and the Saddle Mountains Unit of the Hanford Reach National Monument.

Table 4.6-1, *Structure and Access Road Impacts to Existing Land Uses*, provides estimated number of acres that would be used in association with the placement of structures and construction or improvement of access roads by land uses for each alternative. In addition to these impact quantities, there would be some impacts to land uses associated with the presence of overhead conductors.

Table 4.6-1
Structure and Access Road Impacts to Existing Land Uses

	Structure and Access Road Impacts (est. acres)			
Existing Land Use	**Preferred (2)**	**Alternative 1**	**Alternative 3**	**Alternative 1A**
Commercial, Industrial, or Transportation	3.81	2.1	2.3	2.7
Residential	0.3	0.2	0.3	0
Forest	5.7	5.5	7.8	5.1
Range	360.7	446.3	632.0	531.6
Agricultural	35.6	55.2	3.9	6.8
Total	**406.1**	**509.3**	**646.3**	**546.2**

The area that would become new ROW would have limitations on the types of crops that may be located under the transmission lines. Non-structure supported agricultural crops must be kept at a height of less than 10 feet. As a result, the impact to agricultural lands with these types of crops would be moderate. A special agreement between BPA and the landowner may be reached that allows the growing of ornamental or orchard trees as well as structure supported crops under the transmission lines. If this agreement were in place the impact level would become low.

Rangeland is the highest percentage land use for all alternatives. However, the existing use of these lands for such things as grazing would be able to continue around the structures, underneath the transmission lines, and over any necessary access roads. Therefore, even though rangeland is the land use with the greatest amount of acres crossed per alternative, the impact level to rangeland would be low.

U.S. Bureau of Reclamation (BOR) administered lands are crossed by all alternatives. The BOR manages water resources and maintains and develops water distribution systems, such as irrigation canals, that move water to farmlands. Impacts to BOR land would be low as long as the structures were located in areas that did not disrupt the existing irrigation distribution system or in locations that would hinder the development of future systems.

All construction alternatives begin at the existing Schultz Substation. There would be no impact from the addition of this new bay and equipment since no new land outside the existing substation boundary is needed.

4.6.2.1 Aircraft Safety

The Federal Aviation Administration (FAA) is responsible for oversight of air safety in the United States and issue regulations (FAR) regarding marking and lighting of potential obstructions to air navigation. The regulations call for marking and/or lighting any temporary or permanent object that is taller than 200 feet (61 m) above ground level or that exceeds the obstruction standard contained in FAR Part 77, Subpart C. Certain obstructions may not require marking and/or lighting if a FAA aeronautical study indicates they do not impair aviation safety.

FAA regulations also require notification of construction or alteration in buffer zones around airports, including military airports. An airport with runways less than 3,200 feet requires a buffer of 10,000 feet; for runways greater than 3,200 feet, a 20,000-foot buffer is required. Within these buffers the FAA has set standards for the height of objects and notification to the FAA of construction or alteration is required.

Options to meet the FAA safety standards are routing the transmission line outside the buffer zone, using low-profile towers, placing the line underground in the affected area, or marking and/or lighting the towers and/or conductors.

General BPA policy is to follow FAA recommendations with respect to airway marking and lighting near all airports.

Overhead transmission lines represent a hazard to low-flying aircraft such as those used in the military training exercises conducted at the YTC. Segments A and B would parallel existing transmission lines as they cross the YTC. Segment C would cross the YTC in areas where no transmission lines currently exist.

On the YTC overhead transmission towers and conductors would pose a hazard and affect the ability to operate the low flying aircraft (helicopters, F-18s, and A-10s). These aircraft are used for training and ground support during training exercises conducted on the YTC. The towers and conductors would also affect the parachute drops used to bring in supplies during maneuvers.

To reduce the profile of the proposed line where it crosses the YTC, the proposed towers and conductors in the YTC will be at a lower height above ground than elsewhere along the route. This is accomplished by orienting the conductor bundles in a flat configuration at the same height above the ground. Two overhead ground wires are located above the conductor bundles. This design results in a lower profile for the transmission line than does the standard delta (triangular) configuration with overhead ground wires used elsewhere.

In the YTC standard airway marker balls would be installed on the overhead ground wires to enhance visibility of the conductors. At present the technology for lighted marker balls is not reliable.

4.6.3 Preferred Alternative (Alternative 2)

4.6.3.1 Segment A

Reminder

In Segment A, the new and existi transmission lines would have a separation of up to 1,400 feet.

A small portion of Segment A, roughly 0.53 mile (2 percent), would cross agricultural lands. The agricultural land along this segment is predominantly dryland farming with hay or wheat as the prime crop. It is estimated that just over 3.9 acres of agricultural land would be impacted by this segment. Even though the total quantity of agricultural land being affect is relatively limited, the impact to this land would be high due to the land being converted from its agricultural use. No prime farmland would be impacted since the transmission facility would most likely be able to span the designated soils.

Along the north side of the existing transmission line there is an area of lots that contain log cabin residences that would be crossed by the proposed segment. The impact to these residential uses and properties would be high. Locating the segment across the planned subdivision area would impact approximately 11 acres and would alter the development by reducing the number of residential units. The impact to residential land uses would be high.

A commercial quarry operation near the Vantage Highway would be crossed by Segment A. Structure locations may be designed to have a moderate impact on the quarry by placing them outside the area of use. Impacts to quarry operations would also be moderate as long as facility operations were able to continue within and across the transmission line right-of-way.

A small portion of Segment A, approximately 2.04 miles (7 percent) would traverse lands administered by the DNR. The land in the area of this segment is considered transition lands by DNR and is used as rangeland for livestock. As with all rangeland crossed by the various segments, the impact to this land use would be low since the use activities would be able to continue relatively uninterrupted.

An even smaller portion of Segment A, roughly 1.5 miles (5.2 percent), would traverse lands administered by the BLM. This land is also used as rangeland and, again, the impact to this land use is low since the use activities would be able to continue relatively uninterrupted.

The southern end of this segment crosses the northern border of the Yakima Training Center (YTC) and continues through the Middle Canyon Complex of the YTC for roughly 5.6 miles before it ends just inside the northern border of the Johnson Creek Complex. The U.S. military conducts armor and mechanized infantry movements, tanks and other vehicle movements, and force-on-force maneuver exercises in these two complexes. The existing Schultz-Vantage line that Segment A would parallel were in place prior to this land area becoming part of the YTC. As a result, the military has tailored the type of maneuvers that occur in these two complexes so that the presence of these transmission lines only slightly restricts the maneuverability of the military units. However, a new transmission line parallel to but 1,200 feet away from the existing lines would create additional long-term impacts to the military training mission and would have an impact on land use and land use planning on the installation. Therefore, the impact to the YTC in this area would be moderate.

The proposed Segment A reroute of approximately 1.3 miles would cross 1.2 miles of private land and 0.1 miles of BLM land. Impacts to these land uses would be the same as those impacts described along the original Segment A alignment.

4.6.3.2 Segment B

Option B_{SOUTH} – Option B_{SOUTH}R would traverse roughly 8.13 miles (78.4 percent) of the Johnson Creek Complex of the YTC with the remaining portion traversing rangeland and open water.

The impact to rangeland would be low. There would be no impact to open water crossed because the transmission line would span water bodies.

The existing transmission lines that Segment B would parallel immediately adjacent to through the Johnson Creek Complex were in place prior to this land area becoming part of the YTC. The U.S. military has tailored its use of this area to accommodate these existing transmission line facilities. Since the new transmission line would be adjacent to an existing line, the impacts to the YTC along B_{SOUTH} would be low.

4.6.3.3 Segment D

Reminder

The first number in BPA structure numbers is the transmission line mile and the second number is th structure in that mile.

Segment D would parallel or replace the existing Midway-Vantage 230-kV line and parallel the Midway-Big Eddy 230-kV line from the Vantage Substation to the new Wautoma Substation (about 27.3 miles). The portion of the segment that would replace a single-circuit 230-kV line with a double-circuit 230/500-kV line would occur through an agricultural area located in Grant County, south of the Saddle Mountains ridge and north of the Columbia River. The double-circuit portion from structure 11/1 to 2/4, a total of 8.2 miles, would minimize the impact to the agricultural fields. The existing crops are expected to continue being grown underneath the transmission lines.

Roughly 0.85 mile of prime farmland would be crossed by this segment in Grant County. However, this prime farmland is in the area of the double-circuiting, where the new structures would be placed in the same location as the existing structures, minor impacts to this land would be expected.

The remaining agricultural lands crossed by Segment D are located in Benton County south of Umtanum Ridge and north of Cold Creek. Roughly 1.8 miles is designated as prime farmland. Through this area, which consists mainly of vineyards and orchards irrigated through canals instead of circle irrigation, Segment D would parallel the existing Midway-Big Eddy line. It is estimated that six transmission structures would be located within the prime farmland areas for an estimated impact of 2.3 acres. Impacts to agricultural land (including the prime farmland) would be minimized by locating new structures on the edges of fields, vineyards, or existing roads. The impact to agricultural lands south of Umtanum Ridge would be high because of the loss of farm land.

The total miles of agricultural land crossed by Segment D would be approximately 8.85 miles. Double-circuiting and the placement of structures at the edge of fields or roads in the remaining agricultural areas would result in a moderate impact to agricultural uses.

The Preferred Alternative would terminate at the new Wautoma Substation. This facility would require converting approximately 25 acres of agricultural land from an agricultural use to a utility use. Removing 25 acres of agricultural land from production would be a high impact.

Residential uses along the double-circuit section would not be impacted. Residential uses would continue in their present location. North of the double-circuit section there are two residences along the west side within 200 feet of the existing transmission line. However, the impact to these residences would be low as long as the new structures were located to avoid the residences. The overall impact to residential land uses would be low.

Less than one mile of Segment D would cross through a section of the Columbia National Wildlife Refuge located on the north side of the Saddle Mountains and along the south side of Lower Crab Creek. Paralleling an existing transmission line through this area would result in a moderate impact due to some loss and degradation of wildlife habitat, increased fragmentation, and increased human disturbance to wildlife.

Segment D would cross approximately 2.87 miles of the western end of the Saddle Mountains Management Area. This land is located north of the agricultural areas in Grant County. BLM manages this land for multiple land uses, such as mineral resources, rangelands, recreation, and wildlife habitat. The area crossed by this segment is used predominantly as rangeland with some off-road vehicle recreation use. As with all rangeland crossed by the various segments, the impact to this land use would be low since the uses would be able to continue relatively uninterrupted. The impact to off-road vehicle use would also be low since vehicles would be able to move under and around the transmission line. One of the six management objectives of the Saddle Mountains Management Area is to keep public lands open for purposes such as rights-of-way. The overall impact to land uses on BLM lands would be low.

Segment D would cross a small portion of DNR administered land, approximately 2.08 miles (7.6 percent). Roughly 1 mile of this land is used for agricultural purposes and would be in the area of the double-circuiting. The impact to this agricultural land would be low. The remaining portion of DNR land is predominantly rangeland. The overall impact to DNR lands would be low.

Reminder

The land use designation Preservation on the Hanford Reservation is intended to provide protection for sensitive areas or species of concern from impacts associated with intensive land-disturbing activities.

Segment D would also cross a small portion of the Saddle Mountains Unit of the Hanford Reach National Monument before crossing the Columbia River into Benton County and continuing south through the west side of the Hanford Site. Like Segment E, the area crossed has a land designation of Preservation. The policies of the Final Hanford Comprehensive Land Use Plan EIS state that existing utility corridor rights-of-way are the preferred routes for expanded capacity. Still, since Segment D would expand an existing ROW by 150 feet to accommodate the new line, some loss and degradation of wildlife habitat, increased fragmentation, and increased human disturbance to wildlife would occur. As a result, the impact to the Preservation area of the Saddle Mountains Unit of the Hanford Reach National Monument and the Hanford Site would be moderate. (See Table 4.6-2, *Preferred Alternative – Land Use Impacts*.)

Table 4.6-2
Preferred Alternative – Land Use Impacts

Land Use	Impact Level	Main Issue
Agricultural	High	Conversion of prime and non-prime farmlands to non-farmland use
Residential	High	Log cabin vacation residences and planned 200-acre subdivision
Quarry	Moderate	May affect quarry operations
BLM	Low	Rangeland and recreational uses
DNR	Low	Rangeland AND Agricultural land crossed by double-circuit construction method and rangeland
YTC	Moderate/Low	Military maneuvers already structured around the presence of existing transmission lines
USFWS	Moderate	Disturbance to wildlife and wildlife habitat
Hanford Site	Moderate	Impacts area of refuge for wildlife by expanding an existing utility corridor through an area designated for Preservation
Overall Impact from Preferred Alternative MODERATE to HIGH		

4.6.4 Alternative 1

For a discussion of land use impacts associated with Segment A, please see Section 4.6.3.1, *Segment A*.

4.6.4.1 Segment B (Option B_{NORTH})

Option B_{NORTH} – The majority of B_{NORTH}, roughly 7.3 miles (76.6 percent), traverses the Johnson Creek Complex of the YTC with the remaining portion traversing roughly 1.75 miles of rangeland and a 0.48 mile of open water.

➡ Reminder

gments A and B would have the lowing land use impacts:
sidential: High
ricultural: High
ıarry: Moderate
M: Low
NR: Low
C: Moderate/Low

***;DOE** is the U. S. Department of ergy.*

The impact to rangeland would be low. There would be no impact to open water crossed because the transmission line would span water bodies.

As with Segment A, the existing transmission lines that Segment B would parallel through the Johnson Creek Complex, at a distance of 1,200 feet, were in place prior to this land area becoming part of the YTC. The U.S. military has tailored its use of this area to accommodate these existing transmission line facilities. Still, the new lines would create additional long-term impacts to the military training mission and would have an impact on land use and land use planning on the installation. Therefore, the impact to the YTC in this area would be moderate.

4.6.4.2 Segment E

Segment E crosses approximately 5.87 miles (25 percent) of agricultural land. Segment E would parallel an existing transmission line through agricultural areas. Roughly 2.7 miles of prime farmland would be crossed by this segment, resulting in an estimated 4.6 acres of impact to lands designated as prime farmland. Impacts to agriculture could be reduced by constructing new access roads along the edges of agricultural fields and by locating structures at the edges of fields or between crop circles. Even with these measures, it would not completely eliminate the conversion of agricultural land to a non-agricultural use. Therefore, the impact to agricultural lands would be high.

Segment E, the new and existing nsmission lines would have a paration of approximately 200 ft.

Roughly one mile of Segment E would cross through a section of the Columbia National Wildlife Refuge located on the north side of the Saddle Mountains and along the south side of Lower Crab Creek. Paralleling an existing transmission line through this area would result in a moderate impact due to some loss and degradation of wildlife habitat, increased fragmentation, and increased human disturbance to wildlife.

Segment E would also cross a small portion of DNR administered land that is used predominantly for agricultural purposes. This land, approximately 0.56 mile, would experience the same impacts as the rest of the agricultural land. Therefore, impacts to DNR lands would be high.

There would be two residential structures located between the existing transmission line and Segment E. There would also be two separate migrant worker, residential compounds located between the two transmission lines. In one compound the structures would be over 200 feet from Segment E; the other compound would have structures within 200 feet of the transmission line. Locating the structures as far away from the compound as possible would allow the land use to continue. The impact to residential land uses would be low.

Segment E would parallel the existing Vantage-Hanford line through approximately 4.89 miles of BLM-administered land. This land is located north of the agricultural areas in Grant County and is the western end of the Saddle Mountains Management Area. BLM manages this land for multiple land uses, such as mineral resources, rangelands, recreation, and wildlife habitat. The area crossed by this segment is used predominantly as rangeland and wildlife habitat with some off-road vehicle recreation use. As with all rangeland crossed by the various segments, the impact to this land use would be low since the uses would be able to continue relatively uninterrupted. The impact to off-road vehicle use would also be low since the vehicles would be able to continue operating under and around the transmission facility. One of the six management objectives of the Saddle Mountains Management Area is to keep the public lands open for purposes such as rights-of-way. The impact to land uses on BLM lands along Segment E would be low.

Segment E would cross the Saddle Mountains Unit of the Hanford Reach National Monument before crossing the Columbia River and terminating at the existing Hanford Substation, which is approximately one-quarter mile from the Columbia River, on the Hanford Site. This area has a land use designation of Preservation for land within one-quarter mile of the Columbia

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Reminder

Segment A would have the following land use impacts:
Residential: High
Agricultural: High
Quarry: Moderate
BLM: Low
DNR: Low
YTC: Moderate

Training maneuvers that occur in the complexes crossed on the YT include force-on-force maneuver exercises; light infantry maneuver and small unit operations; live fir artillery, gunnery, and mortar training; and live fire training for infantry units, tanks, and helicopters.

For this document, agriculture is defined as row crops, pasture, fallow fields, orchards, crops and grains. Land that we refer to as rangeland is grassland and shrubland that may be used for grazing or the movement of livestock

River and a designation of Industrial beyond one-quarter mile of the Columbia River. The policies of the Final Hanford Comprehensive Land Use Plan EIS state that existing utility corridor rights-of-way are the preferred routes for expanded capacity. Segment E would be a new utility corridor 1,200 feet north of an existing transmission line. The new corridor would result in an increased loss and degradation of wildlife habitat, increased fragmentation, and increased human disturbance to wildlife. As a result, locating Segment E through this area would have a high impact on the effort to preserve the ecological, archaeological, cultural, and natural resources of the area as well as the effort to utilize this area as a refuge for wildlife.

Alternative 1 would terminate at the existing Hanford Substation. There would be no impact from substation work since no new land outside the existing substation boundary would be needed.

The evaluation of impacts to various land uses shows Alternative 1 would have a high impact on agricultural and residential land uses. Alternative 1 would have a high impact to Washington State Department of Natural Resources (DNR) and U.S. Department of Energy (USDOE) land, which is managed by the USFWS. The DNR land covered is predominantly agricultural. Alternative 1 would convert some agricultural land to a non-agriculture use. Alternative 1 would create a new corridor through an area designated as Preservation by USDOE. (See Table 4.6-3, *Alternative 1 – Land Use Impacts*.)

Table 4.6-3
Alternative 1 – Land Use Impacts

Land Use	Impact Level	Main Issue
Agricultural	High	Conversion of prime and non-prime farmlands to non-farmland use. Double-circuiting not an option through prime and non-prime farmland
Residential	High	Log cabin vacation residences and planned 200-acre subdivision. Towers could be located to minimize impact.
Quarry	Moderate	May affect quarry operations.
BLM	Low	Rangeland, recreational uses, and wildlife habitat
DNR	High	Predominantly agricultural land
YTC	Moderate/Low	Military maneuvers already structured around the presence of existing transmission lines.
USFWS	Moderate	Disturbance to wildlife and wildlife habitat
Hanford Site	High	Impacts area of refuge for wildlife by constructing a new utility corridor through an area designated for Preservation
Overall Impact from Alternative 1: HIGH		

4.6.5 Alternative 3

For a discussion of land use impacts associated with Segment A, please see Section 4.6.3.1, *Segment A*.

4.6.5.1 Segment C

About 24.1 miles (80.9 percent) of Segment C is located on the YTC. Beginning where Segment A ends, this segment heads south through the Johnson Creek, Hanson, Alkali Canyon, Corral Canyon, and Cold Creek Training Complexes before exiting from the southeast corner of the YTC. Due to the steep slopes in the Alkali Canyon and Corral Canyon, supplies and support materials for maneuvers are delivered to exercises in the area via parachute drops.

When the military needs to run power to its training areas where live gunnery, artillery, and mortar fire training occurs, which is a stated use in three of the five complexes crossed by this segment, the military has a standing practice of burying their utility lines through those areas. Aboveground transmission lines would eliminate the ability to conduct live mortar fire exercises.

Overhead transmission lines would also affect the ability to operate low flying aircraft (helicopters, F-18s, and A-10s) that are used as ground support and the parachute drops used to bring in supplies. The presence of a transmission line would force ground maneuvers to work around the structures, which would break up the continuity of the maneuvers and reduce their effectiveness.

Unlike Segments A, B_{NORTH}, and B_{SOUTH}, Segment C would be a new transmission line in an area where training maneuvers are not currently setup to work around such facilities. It would eliminate the ability to have live gunnery, artillery, and mortar training and have a high affect on aviation and ground maneuvers. As a result, Segment C would have a high impact on the land uses in the YTC.

The portion of Segment C not located on the YTC crosses private rangeland and a small portion of rangeland administered by DNR (less than 0.5 mile) and BLM (about 0.2 mile), and approximately 0.01 mile of agricultural land. As with all rangeland crossed by the various segments, the impact to this land use would be low since the uses would be able to continue relatively uninterrupted. The total expected impact to agricultural lands would be less than one-half acre. None of this land is designated as prime farmland. Still, Segment C would convert agricultural land to a non-agricultural use and, therefore, the impact would be high.

Since the majority of Segment C would be located within the YTC, and would have such a high level of impact on military operations and maneuvers, the overall impact on land use for this segment would be high. (See Table 4.6-4, *Alternative 3 – Land Use A Impacts*.)

Alternative 3 would terminate at the new Wautoma Substation. This facility would require converting approximately 25 acres of agricultural land from an agricultural use to a utility use. Removing 25 acres of agricultural land from production would be a high impact.

Table 4.6-4
Alternative 3 – Land Use A Impacts

Land Use	Impact Level	Main Issue
Agricultural	High	Conversion of prime and non-prime farmlands to non-farmland use
Residential	High	Log cabin vacation residences and planned 200-acre subdivision
Quarry	Moderate	May affect quarry operations
BLM	Low	Rangeland
DNR	Low	Rangeland
YTC	High	Live gunnery, artillery, and mortar fire training, aviation maneuvers, and ground maneuvers
Overall Impact from Alternative 3: HIGH		

Reminder

Segments A and B would have the following land use impacts:
Residential: High
Agricultural: High
Quarry: Moderate
BLM: Low
DNR: Low
YTC: Moderate/Low

4.6.6 Alternative 1A

For a discussion of land use impacts associated with Segment A please see Section 4.6.3.1, *Segment A.* For a discussion of land use impacts associated with Segment B (Option B_{NORTH}) please see Section 4.6.4.1, *Segment B (Option B_{NORTH})*.

4.6.6.1 Segment F

Transmission structures and access road improvements along Segment F would impact less than three acres (approximately 2.9 acres) of agricultural land. None of this land is designated as prime farmland. By locating the structures and new access roads at the edge of fields, these impacts could be reduced. Still, some agricultural lands would be converted from an agricultural use to a non-agricultural use and, therefore, the impact to agricultural lands would be high.

There would be a small portion of DNR administered land crossed by Segment F, approximately 2.5 miles (7.8 percent). This land is predominantly rangeland. As it is on all line segments, the impact to rangeland would be low.

A large portion of Segment F, roughly 12.77 miles (39.7 percent), of the total segment, would run east-west through the Saddle Mountains Management Area administered by BLM. This segment would traverse nearly the entire length of this management area within new ROW. BLM manages this land for multiple land uses, such as mineral resources, rangelands, recreation, and wildlife habitat. The types of land use activities occurring in the area would be able to continue relatively uninterrupted under and around the new line. One of the six management objectives of the Saddle Mountains Management

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Area is to keep public lands open for purposes such as rights-of-way. As a result, the impact to land use activities on BLM lands would be low.

Segment F would cross 7 miles of the Saddle Mountains Unit of the Hanford Reach National Monument before crossing the Columbia River and terminating at the existing Hanford Substation, which is approximately one-quarter mile from the Columbia River, on the Hanford Site. This area has a land use designation of Preservation for land within one-quarter mile of the Columbia River and a designation of Industrial beyond one-quarter mile of the Columbia River. Segment F would require new ROW 1,200 feet east of the existing Grand Coulee-Hanford line. The new corridor would result in a loss and degradation of wildlife habitat, fragmentation, and increased human disturbance to wildlife. As a result, Segment F would have a high impact on the effort to preserve the ecological, archaeological, cultural, and natural resources of the area as well as the effort to utilize this area as a refuge for wildlife.

The impact to agricultural lands and the Saddle Mountains Unit would be high. However, due to the limited amount of agricultural lands that will experience a high impact (just over 1 percent of the total lands in Segment F), and since the Saddle Mountains Unit lands are less than 25 percent of the total lands crossed by the segment, the overall impact to land uses from Segment F would be moderate. (See Table 4.6-5, *Alternative 1A – Land Use Impacts*.)

Alternative 1A would terminate at the existing Hanford Substation. There would be no impact from substation work since no new land outside the existing substation boundary would be needed.

Table 4.6-5
Alternative 1A – Land Use Impacts

Land Use	Impact Level	Main Issue
Agricultural	High	Conversion of agricultural land to non-agricultural land use
Residential	High	Log cabin vacation residences and planned 200-acre subdivision
Quarry	Moderate	May affect quarry operations
BLM	Low	Rangeland, recreational uses, and wildlife habitat
DNR	Low	Rangeland
YTC	Moderate/Low	Military maneuvers already structured around the presence of existing transmission lines
Hanford Site	High	Impacts area of refuge for wildlife by constructing a new utility corridor through an area designated for Preservation
Overall Impact from Alternative 1A: MODERATE to HIGH		

4.6.7 No Action Alternative

The impacts currently associated with the ongoing operations and maintenance activities for the existing transmission line, substations, and ROW would continue. However, under this alternative, no new impacts to land uses would be expected.

4.6.8 Recommended Mitigation

- Work closely with the various land managers and landowners to minimize conflicts and inconvenience from construction and maintenance activities.
- Locate the new line as far away from residential and commercial land uses as possible.
- Locate structures outside of agricultural fields and on the edges of existing roads where possible or next to existing structures.
- Construct new access roads around agricultural fields and in locations that may benefit the landowner.
- Schedule activities to avoid or minimize crop damage.
- Keep gates and fences closed and in good repair to contain livestock.
- Compensate farmers for crop damage, help them control weeds and restore compacted soils.
- Enter into special agreements with landowners to allow the growing of ornamental or orchard trees as well as other structure-supported crops under the transmission lines.
- Strive to meet substantive requirements of Benton, Grant, Kittitas, and Yakima County development regulations.

4.6.9 Cumulative Impacts

The expansion of utilities and other non-agricultural land uses would lead to further removal of valuable agricultural lands and rangelands from production, resulting in an incremental increase in lands lost to previous development and to future development that were not necessarily intended to be used for utilities.

This region of Washington, especially Kittitas County due to its proximity to the Seattle urban area, is experiencing an increase in new rural residential structures being constructed by people seeking the benefits of rural living and as vacation homes or resort destinations. As the rural areas are developed for purposes other than agricultural, more people will be living in proximity to the transmission lines. Expanding utility infrastructure in these areas will continue to cause conflicts with various land uses.

Expanding the transmission system in this region may also contribute to the gradual urbanization of the rural landscape. As more power becomes available, areas may begin to experience an increase in development. This new development would impact agricultural and range lands by decreasing the quantity of this land available for production.

The miles of improved and new access roads, necessary in order to gain access to transmission lines during maintenance and repair activities, would provide increased access opportunities to areas previously inaccessible by motorized vehicles. These new roads could lead to increased recreational activities such as hunting, wildlife viewing, and off-road vehicle operating in areas unaccustomed to such activities. This increased activity would impact the existing use of the land for preservation or natural habitat purposes.

Aside from increased access opportunities into certain preservation areas, establishing a new ROW through an area such as the Saddle Mountains Unit of the Hanford Reach National Monument may make it easier to construct future lines through the same corridor. As the number of transmission lines through the area increases, the ability to successfully preserve the ecological, archaeological, cultural, and natural resources of the area may decrease.

4.7 Socioeconomics

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4.7.1 Impact Levels

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A **positive** impact would occur when an alternative produces one or more of the following effects: provides employment, increases tax revenues, increases property values, or creates other similar effects on the social and economic vitality of affected communities.

A **negative** impact would occur when an alternative produces one or more of the following effects: reduces employment, reduces a tax base, takes land out of production without compensation, exceeds current capacities for housing and public services, or creates other similar effects on the social and economic vitality of affected communities.

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No impact would occur if employment levels, tax revenues, property values, land production, demand for housing and public services, or other similar effects remain unchanged or would be of short duration.

4.7.2 Population

Constructing a new transmission line would not encourage population growth in the area, but rather would be a response to growth that is already occurring in central Washington and the Pacific Northwest. The local population has not and would not increase because of the availability of electric power. However, population growth would likely slow and could lead to a population decline if transmission system capacity is not increased (see also Section 4.7.12, *No Action Alternative*).

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From an assessment of ***demographic*** data and aerial photography, it has been determined that places where minority and low-income populations may reside, work, or otherwise spend large parts of their days are not highly or disproportionately concentrated within the study area. None of the alternatives would have a detrimental effect on minorities or economically disadvantaged groups in the area (see also Section 5.8, *Executive Order on Environmental Justice*).

No impact to the population would occur as a result of the proposed project.

4.7.3 Economy and Industry

Because transmission line construction requires specialized labor, construction crews would likely be brought in from outside the local area. Specialized workers may come from outside the region such as Spokane or Seattle, Washington; Portland, Oregon; Boise, Idaho; or from other parts of the United States or the world. The primary construction contractor may hire local contractors to fill less specialized roles such as roadwork and ROW clearing.

Construction would likely occur over one year, with one or two primary contractors. About 100 people would be needed to construct a project of this scale on this timeline. This would be a positive impact on employment in general, but not necessarily a local impact if workers do not come from the study area.

Constructing a new transmission line would not impact the distribution of jobs within industry sectors, personal and household incomes, or industry earnings.

4.7.4 Housing and Public Services

Socioeconomic impacts to temporary housing facilities are relatively minor for transmission line construction projects in most areas. Most construction workers would likely provide their own housing (e.g., campers and trailers) or seek temporary commercial lodging. Recreational vehicle (RV) parks are available throughout the area. These facilities are typically available by the day, week, month, or season. Because of the relatively small number of construction crews who would build the project, there should be few negative impacts to the temporary housing supply in the area.

Impacts to public services such as police, fire, and medical response, would be of short duration during the construction phase.

4.7.5 Retail Sales and Use Tax

The major cost of any transmission line project is labor and materials. A combined state and local sales and use tax would be levied on materials purchased for the project by the contractor. Although BPA, as a federal agency, is exempt from Washington state taxes, they agree to pay a fee to the counties based on the materials purchased for the project. This fee is generally 7.8 percent, or approximately $2,400,000. This would be a positive impact to local and state revenues.

The sales and use tax would also be assessed on incidental purchases by the contractor, crews, and subcontractors. Because crews would be in the area only temporarily, incidental purchases would be limited to provisions such as food (tax exempt), lodging, fuels, tools, clothing, and other minor purchases. These purchases would be in small amounts and any sales or use tax collected would be a positive but minor impact.

4.7.6 Business and Occupation Tax and Public Utility Tax

For Business and Occupation (B&O) tax purposes, contractors performing work for BPA are classified as government contractors and are subject to the B&O tax. The gross contract price is subject to this tax. Therefore, the Preferred Alternative would generate about $145,000 in B&O tax. Other alternatives would result in similar amounts of tax. This would be a positive impact to state revenues.

Final distribution of a utility is subject to the public utility tax. BPA is exempt from this tax; thus no impact to the state or local revenues would result.

4.7.7 Property Tax

BPA, as a federal agency, is exempt from paying local property taxes. None of the alternatives would impact local property tax revenues, except in the case of acquiring real property to build a new substation.

The Preferred Alternative and Alternative 3 would terminate at a new substation site. Any land purchased by BPA to construct a new substation would reduce the taxable land base. The extent of this reduction is approximately 25 acres for the substation and would be for the duration of the facility, which is about 50 years. The corresponding tax revenues for this acreage reduction is $20.24 based on the state average millage tax rate of $10.12 for every $1,000 of value. Losses to the taxable land base would have a small negative impact on local counties and to an even lesser extent on the state school fund.

Alternatives 1 and 1A would terminate at the existing Hanford Substation, which would be expanded to make room for an additional bay. Enough land is already available and owned by BPA to expand this substation. No additional land would be needed at Schultz, Vantage, or Midway Substations. Therefore, no impact to local or state property tax revenues would occur.

4.7.8 Property Value

Any new transmission line or access road easements would be appraised, and landowners would be offered the fair market value for these land rights. Some short-term adverse impacts on property value and salability along the new ROW may occur on individual properties. However, these impacts are highly variable, individualized, and unpredictable. The new line is not expected to cause overall long-term adverse effects on property values. See

Appendix D, *Property Impacts*, for more information on impacts to property values.

4.7.9 Land Taken Out of Production

Activities such as farming, that do not interfere with the transmission line or endanger people, are usually not restricted.

In cases where productive lands cannot be avoided, some land may be taken out of production. This includes the placement of structures in productive lands, reduction in irrigated land use (i.e., reconfigured irrigation circles), and locating the new Wautoma Substation in productive land. Constructing new towers in productive lands and changes to existing irrigation circles would have a negative impact on individual landowners. Locating the new Wautoma Substation in productive lands would take up to 25 acres of land out of production; a negative impact to taxable land base. Landowners would be compensated for any lands taken out of production.

4.7.10 Other Taxes

Other state taxes that would be assessed include ***excise*** taxes on fuel, cigarettes, tobacco products, liquor, timber, and rental cars. Local excise taxes that would be applicable to the project include hotel/ motel taxes and municipal taxes and licenses. The contractor, crews, and subcontractors would likely bear the expense of these taxes. Revenues generated from these miscellaneous taxes would have a positive impact on state and local revenues, but are expected to be small due to the limited crew size involved in this type of construction.

Reminder

Excise *taxes are internal taxes imposed on the production, sale, or consumption of a commodity the use of a service.*

Sales of privately owned property to BPA for a new substation would be subject to the real estate tax. The seller pays this tax. Local real estate revenues generated by the project would have a small, positive impact on local counties.

4.7.11 No Action Alternative

The No Action Alternative would not directly or indirectly impact the local population, economy, or tax base. However, this alternative would have other socioeconomic impacts to the local area and greater region, as a result of the lack of adequate transmission line infrastructure to support expected growth in the Pacific Northwest. The lack of transmission capacity could cause seasonal localized power deficiencies. The development of clean power generation in areas that can support it may be offset by combustion generation closer to load centers.

The No Action Alternative would potentially have negative socioeconomic effects in the greater Pacific Northwest region.

4.7.12 Recommended Mitigation

- BPA would compensate private landowners for the fair market value of any land taken out of production.
- BPA would work with landowners and land managers to site the new line to minimize impacts.

4.7.13 Cumulative Impacts

It is unclear whether the introduction of more transmission capacity would be a catalyst to population growth. Other infrastructure (such as water or sewer), local economies, and employment opportunities would play an important role in whether an area can absorb population increases. The alternatives could contribute, along with other factors, to increased growth in the region.

4.8 Visual Resources

Reminder

Visually sensitive locations have been identified based on their visual quality, uniqueness, cultura significance, or viewer characteristics (Sevi, USDOT/ FHWA Memo "Esthetics and Visu Quality", 8/86).

Potential impacts to visual and aesthetic resources consist of a combination of changes in the visual environment and their effect on viewers who are sensitive to these changes. Transmission line projects are generally not perceived as providing visual enhancement to the landscape. However, they can be built in ways that minimize visual impacts so that their benefits (i.e., improved service reliability, increased transmission capacity, and new jobs) can be realized.

The following analysis discusses areas that are considered typical to this project, for which visual simulations have been created. Three locations within the project area were determined to be Visually Sensitive Locations. Visual simulations were also created for these sensitive locations and the viewpoint for each is shown on Map 10, *Visual Analysis*.

4.8.1 Impact Levels

Although the visual resource impacts of transmission line projects are not locally regulated within the study area, the construction of a new transmission line will change the physical appearance of the landscape and affect viewer groups. To assess the visual impacts of this project, the following set of criteria was used.

Impacts would be considered **high** where:

- the transmission line(s) would become a view's dominant feature or focal point.
- a large number of highly sensitive viewers would see the line(s) in predominantly the ***foreground*** and ***middleground***.

Foreground: *within 0.25 to 0.5 mile of the viewer*

Middleground: *from the foreground to about five mile of t viewer*

Impacts would be considered **moderate** where:

- the transmission line(s) would be clearly visible but not the dominant feature of the view.

Background: *over five mile from the viewer*

- a large number of sensitive viewers would see the line(s) mostly in the middleground.

Impacts would be considered **low** where:

- the transmission line(s) would be somewhat visible but not evident in the view.
- few sensitive viewers would see the transmission line(s) because they would be either screened or predominantly seen in the middleground and **background**.

No impact would occur where:

- the transmission line would be isolated, screened, not noticed in the view, or seen from a great distance.
- views would be of short duration.
- no visually sensitive resources would be affected.

4.8.2 Impacts Common to Construction Alternatives

Transmission line facilities would be seen from a variety of potential viewpoints along all of the proposed routes, including private residences, highways, and recreation areas. The construction, operation, and maintenance of the proposed transmission line and substation facilities would have short- and long-term effects on visual resources. Structures, conductors, insulators, spacers, aeronautical safety markings, vegetation clearing, access roads, ground preparation for structures, and pulling sites for the conductor would all create visual effects. A transmission line's visual presence would last from construction throughout the life of the line.

4.8.3 Preferred Alternative (Alternative 2)

The Preferred Alternative is made up of sagebrush and agricultural landscapes. View 1 (Photo 4.8-1) simulates crossing the Vantage Highway in Segment A. See Map 10, Visual Analysis, for location. The sagebrush terrain is characteristic of most of Segments A and B. In this location, the addition of a new line would be clearly visible and would briefly extend the motorist's visual experience of the transmission corridor, but it is expected that sensitive viewers will not find this objectionable because the additional line would not become the dominant feature of this relatively common view.

Photo 4.8-1. Visual simulation of Segment A crossing Vantage Highwa
(General View 1 — See Photo 3.9-5 for original photo)

The area near Colockum Pass (Segment A) is a Visually Sensitive Area due to the number of residences with foreground views of the transmission line project (see photo below and location of Viewpoint A on Map 10, *Visual Analysis*). In the Colockum Pass area, Segment A would pass close to a number of residences whose owners have expressed concerns about the visual impact of the project. Residential viewers would notice the additional structures and conductors during and after construction. However, the proposed structures would not dominate or become the focal feature because they would be located parallel to an existing transmission line that already impacts the views.

Photo 4.8-2. Visual simulation looking northeast and east along Gage Road towa
(Visually Sensitive Viewpoint A — See Photo 3.9-1 for original ph

Visual impacts to this Visually Sensitive Area would be moderate.

The reroute in Segment A is in the area of the Colockum Pass Visually Sensitive Area. The reroute would result in both the existing and new transmission lines being located closer to Gage Road and to some viewers. The transmission line structures would be parallel to Gage Road on the north side, closer than what is shown in Photo 4.8-2. Moving the transmission line to the south would still result in a moderate impact to this Visually Sensitive Area.

View 2 (Photo 4.8-3) simulates crossing the Columbia River, south of the Wanapum Dam in Segment B. It illustrates how the addition of a new line would replicate the visual experience of the existing line and transmission ROW. It is expected that sensitive viewers will not find this objectionable, since the additional line would not become the dominant feature in this view.

imulation of Segment B looking west across the Columbia River near the Vantage Substation (General View 2 — See Photo 3.9-7 for original photo)

The north face of the Saddle Mountains (Segment D) near the Columbia River and Lower Crab Creek is a Visually Sensitive Area due to its unique and striking landform, relationship to adjacent water bodies, and the number of viewers on Route 243. See photo 4.8-4 below and location of Viewpoint B on Map 10, *Visual Analysis*.

In this area, the new transmission line would be clearly visible (primarily in the middleground) to most viewers including residents, tourists, and recreationalists traveling through the area. Three of the alternatives would scale the Saddle Mountains in this general area. The Preferred Alternative would be closest to most viewers. Viewers would notice the additional structures and conductors during and after construction, but the transmission line would not become the dominant feature in any view. There are existing transmission lines in the area, and the scale of the mountain would greatly minimize the perceived size of the proposed structures.

Visual impacts in this Visually Sensitive Area would be moderate.

Photo 4.8-4. Visual simulation looking east to Saddle Mountains from Hi
(Visually Sensitive Viewpoint B — See Photo 3.9-2 for original pho

Overall, the impact to visual resources would be low to moderate for the Preferred Alternative. Visual impacts for the majority of the alternative would be low excluding the two Visually Sensitive Locations where the impacts would be moderate.

4.8.4 Alternative 1

Impacts to visual resources along Segment A and B would be the same as described for the Preferred Alternative.

In Segment E, the new transmission line would cross a combination of agricultural fields and sagebrush landscape. Where Segment E climbs the north face of the Saddle Mountains is a Visually Sensitive Area similar to the area seen in

Viewpoint B, above. Alternative 1 would be slightly further from the road than the Preferred Alternative. Viewers would notice the additional structures and conductors during and after construction, but the transmission line would not become the dominant feature in any view. There are existing transmission lines in the area, and the scale of the mountain would greatly minimize the perceived size of the proposed structures.

Visual impacts to this Visually Sensitive Area would be moderate.

Overall, the impact to visual resources would be low to moderate for Alternative 1. Visual impacts for the majority of the alternative would be low with a two Visually Sensitive Areas where the impacts would be moderate.

4.8.5 Alternative 3

Impacts to visual resources along Segment A would be the same as described for the Preferred Alternative.

There would primarily be two sets of viewers of Segment C. Army personnel on maneuvers would have a foreground view of the new transmission line; however, these viewers are not deemed to be sensitive to aesthetics while on maneuvers. The other set would be viewers from across the Columbia River. There is no existing line in the area that Segment C would be built; therefore, Segment C would change an existing landscape view. The new transmission line would be in the mid- to background for most of these viewers, and due to the varied terrain elevation, sitings of the towers and conductors would not be continuous. Impacts to Segment C would be low to moderate.

Overall, the impact to visual resources would be low to moderate for Alternative 3. Visual impacts for the majority of the alternative would be low with one Visually Sensitive Area where the impacts would be moderate.

4.8.6 Alternative 1A

Impacts to visual resources along Segment A and B would be the same as described for the Preferred Alternative.

In Segment F, the new transmission line would cross the south face of the Saddle Mountains and sagebrush landscape. Where Segment F climbs the north face of the Saddle Mountains is a Visually Sensitive Area similar to the area seen in Viewpoint B

(Photo 4.8-4). Alternative 1A would be farther east than the other alternatives and in an area that does not have existing transmission lines. View 3 simulates looking across Lower Crab Creek at Segment F ascending the north face of the Saddle Mountains (Photo 4.8-5). Although the new line would be clearly visible and impact a seemingly undisturbed portion of the mountain, the large scale of the landform dominates the view. Furthermore, it would also be in an area that would not have as many viewing opportunities.

Visual impacts to this Visually Sensitive Area would be moderate.

Photo 4.8-5. Visual simulation of Segment F ascending the north face of Saddle Mountai (General Viewpoint 3 — See Photo 3.9-17 for original photo)

Due to its striking landform and recreational value, the Saddle Mountains Ridgeline is considered a Visually Sensitive Area (Viewpoint C on Map 10, *Visual Analysis*). Locating the transmission line on top of the ridgeline would change the view of the landform and have a high visual impact. However, locating Alternative 1A near the base of the mountains would easily mitigate this sensitivity. A simulation of this placement is shown in Photo 4.8-6, below.

With proposed placement of line, visual impacts would be low.

'isual simulation looking northwest towards Saddle Mountains from Wahluke Slope
(Visually Sensitive Viewpoint C — See Photo 3.9-3 for original photo)

View 4 (Photo 4.8-7) simulates Segment F, looking north toward the Saddle Mountains (See Map 10, *Visual Analysis*, for location). The structure in the middle of the photo is part of the existing line, the new line simulation is on the left. Although the addition of a new line would replicate the visual experience of the existing line and transmission corridor (which is clearly visible but not the dominant feature), this view will be seen by relatively few viewers.

Photo 4.8-7. Visual simulation looking north toward the Saddle Mountains, of Segment F, parallel to the Grand Coulee-Hanford transmission line (General View 4 — See Photo 3.9-19 for original photo)

Overall, the impact to visual resources would be low to moderate for Alternative 1A. Visual impacts for the majority of the alternative would be low with three Visually Sensitive Locations where the impacts would be moderate for Viewpoints A and B, and low for Viewpoint C.

4.8.7 No Action Alternative

Existing transmission lines would continue to be seen from a variety of views. Visual effects would continue as they currently exist.

4.8.8 Recommended Mitigation

Mitigation includes enhancing positive effects as well as minimizing or eliminating negative effects. Potential mitigation measures include:

- using a non-specular conductor and insulator to reduce visual impacts that cannot be avoided in sensitive areas.
- locating facilities in relationship to landforms so that they will screen transmission line features.
- avoiding highly erodable soils, if possible.
- revegetating disturbed areas with native plant communities.

4.8.9 Cumulative Impacts

Generally, the construction of additional structures, lines, roads and substations would add physical features (and thus, visual effects) to the landscape. Cumulatively, although these effects are considered minor, they will alter and contribute to an ever-increasing manmade visual presence on the natural landscape of the study area.

4.9 Recreation Resources

4.9.1 Impact Levels

Impacts would be considered **high** where transmission facilities would:

- preclude existing or planned ***dispersed*** recreational uses during and after construction of transmission lines or access roads.
- alter or eliminate ***dedicated*** recreational activities during and after construction of transmission lines or access roads.

Impacts would be considered **moderate** where transmission facilities would:

- temporarily preclude or limit dispersed and dedicated recreation opportunities during peak use periods, during construction of transmission line and/or access roads.

Impacts would be considered **low** where transmission facilities would:

- temporarily preclude or limit dispersed and dedicated recreation opportunities during off-peak use periods during construction of transmission line and/or access roads.
- require minor relocation of dispersed recreational activities to equal or better location during or after construction of transmission line and/or access roads.

No impact would occur to recreation areas if there was no effect upon the location or safety of recreational uses during and after construction.

4.9.2 Impacts Common to Construction Alternatives

All of the alternatives would have temporary impacts related to construction. For safety reasons, during construction, recreation would not be allowed within the construction area. This could result in a temporary closure of existing access roads and trails and, consequently, temporarily limit access to some recreation areas. During conductor stringing, activities such as sightseeing, watersports, and boating would be limited in the construction area.

Dispersed recreation such as hunting, off-road vehicle use, fishing, hiking, ***rock hounding***, horseback riding, camping, snowshoeing, snowmobiling, sightseeing, wildlife viewing, falconry, mountain biking, bird watching, hang gliding, paragliding, and field dog training and trials might experience low impacts during construction. Although peak season for these activities correlates with the typical construction season, potential impacts are considered low because these dispersed activities aren't limited to a specific area and could undergo a minor relocation without much interruption.

The low intensity nature of most dispersed activities could allow them to continue even within close proximity to construction. In particular, fishing, hiking, rock hounding, horseback riding, camping, snowshoeing, sightseeing, wildlife viewing, falconry, bird watching mountain biking and some watersports are all unmotorized activities that move at relatively slow speeds and can therefore quickly adjust for minor disturbances.

The reroute in Segment A would not increase the level of impact to recreational activities.

Following construction of transmission lines and access roads, recreation activities may resume without impacts. Recreational use of areas that were temporarily closed during construction would resume as before construction. Also, with improved and/or additional access roads, better connections to recreational opportunities may be made available.

4.9.3 John Wayne Trail

All construction alternatives would cross the John Wayne Trail at least once. The trail, which follows the old railroad grade, is in a series of cuts and fills in the area of Segments B_{NORTH}, B_{SOUTH} and C. Views are limited approximately 50 percent of the time by the cut walls on either side of the trail. From fill portions of the trail, two other transmission lines are easily seen. B_{NORTH} would cross the trail in two places, with the view being localized to the crossings. B_{SOUTH} would follow on the south side of the trail and an existing transmission line. Impacts to the trail would be low. The trail in the area of these segments would be temporarily closed during construction.

Photo 4.9-1. John Wayne Trail along Segment B_{SOUTH}

Once the transmission line is constructed, users of the trail will continue to use the trail as before. There would be short-term evidence of construction activities until disturbed areas are revegetated.

4.9.4 No Action Alternative

No impacts would be expected to recreation resources under this alternative.

4.9.5 Recommended Mitigation

- During construction, provide information at trailheads informing recreationalists of any trail reroutes and any intensive construction in the area so recreationalists can plan accordingly.
- On public lands, designate restricted areas for hunting and off-road vehicles during construction and communicate with hunting and off-road vehicle user groups.
- Inform local visitor associations of potential delays along major roadways.
- Discuss locations of new structures, conductor lines, and access roads with land managers and owners in order to avoid sensitive recreation areas.

4.9.6 Cumulative Impacts

Generally, this region of Washington is rural in nature and is characterized by agricultural uses and striking natural landforms. However, it is experiencing increased development growth by people looking for the benefits of rural living and as a vacation destination. The construction of a new transmission line would add physical features to the landscape and contribute to the ever-increasing manmade presence on the natural landscape. All of these factors affect the type and experience of recreation activities.

Development provides access opportunities to areas previously inaccessible. New access roads could lead to increased recreational opportunities such as hunting, wildlife viewing, sightseeing, and off-road vehicle operating in areas unaccustomed to such activities.

Providing access to new areas reduces the areas available for recreationalists looking to experience nature.

4.10 Cultural Resources

This section assesses the project's potential impacts on cultural resources in the study area. This assessment is based on information gathered from:

- literature searches.
- compilation and assessment of records and reports of sites that would be potentially impacted by the four route alternatives.
- identification of areas that have a high probability of containing cultural sites, but which have not been surveyed.
- a comparison of potential impacts to these sensitive areas.

A discussion of both generalized and site-specific impacts is included in this section, and general recommendations for mitigation of potential impacts are presented.

4.10.1 Impact Levels

Because cultural resources are considered invaluable, any impact to them would be considered to be equally important. For this reason, we have not given potential impacts the relative ratings of high, medium, or low, but discuss them in general terms.

4.10.2 Impacts Common to Construction Alternatives

Any ground-disturbing activity within the boundaries of a significant cultural resource would be destructive, resulting in the permanent, irreversible, and irretrievable loss of scientific information and/or cultural value.

Non-ground-disturbing activities, such as cutting vegetation and road easements, may or may not have negative impacts on cultural resources depending on the type of resource involved and the proximity of the activity to the resource.

4.10.2.1 Construction

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New Right-of-Way – The addition of new ROW would potentially affect cultural resources by changing access and use. In general, grants of easement for new ROW could increase public access and use of areas that were previously restricted or difficult to access. Increased access and use could have negative impacts on traditional cultural properties and sacred sites by interfering with natural auditory features and ***viewsheds***. Increased access could also contribute to an increase in the rate of vandalism and disturbance to archaeological and historic sites.

Clearing Vegetation – The clearing of vegetation may include ground-disturbing and/or non-ground-disturbing activity. As stated before, ground-disturbing activity within the boundaries of significant cultural resources would be destructive and could result in permanent, irreversible damage. Non-ground-disturbing vegetation clearing may result in damage to cultural resources through the compaction of cultural deposits within archaeological sites and historic sites.

Clearing vegetation, with or without ground disturbance, would affect most types of ***traditional cultural properties (TCP)***. Natural vegetation is an integral part of many TCPs, including traditional gathering areas, and may be relevant to some sacred sites as well. Clearing vegetation in a traditional gathering area or within the viewshed of a ***vision quest*** site would most likely have a negative effect on these resources.

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Natural and modified vegetation is also often a critical component of cultural landscapes. Clearing or cutting vegetation in these areas would have some impact on these resources, although the nature and extent of the effect would depend on the specific resource.

Grading and Backfilling – Grading and backfilling are ground-disturbing activities that would most likely result in permanent, irreversible damage to archaeological and historic sites. These activities include, but are not limited to:

- preparation of construction sites and staging areas
- materials delivery
- road and structure construction
- site restoration and clean-up
- ongoing project maintenance

Traditional cultural properties and cultural landscapes could also be negatively affected, although the nature and extent of these effects would depend on the specific resource. Impacts could vary in degree, from some restorable or replaceable negative effects to permanent damage. The source locations of materials used in backfilling and road construction would need to be surveyed before being disturbed.

Use of Heavy Equipment – In addition to the impacts caused by ground-disturbing activities, compaction caused by heavy machinery can cause the destruction of archaeological and historic sites and traditional cultural properties. This compaction damage would most likely be irreversible.

The use of heavy equipment would also cause auditory and visual disturbance to some TCPs and sacred sites. In addition, the continued use of heavy equipment near a sacred site (such as a vision quest site) would make the site unusable for contemporary Native American practitioners.

Reseeding – Reseeding would in most cases have little effect on archaeological and historic sites, depending on the methods used. Reseeding could impact TCPs and cultural landscapes by changing the existing vegetation stands or communities. (see *Clearing Vegetation*, above.)

Construction of Structures – The construction of structures is a ground-disturbing activity that could result in permanent, irreversible damage to archaeological and historic sites, and could also threaten burial sites. Construction of structures at the location of TCPs and cultural landscapes could have negative effects on these resources.

Construction within the viewshed of TCPs and cultural landscapes could also have negative effects. These could include a temporary negative effect due to increased auditory and visual disturbance during construction activities, but could also include permanent auditory and visual disturbances (e.g., the disruption of the natural view, and artificial noise caused by transmission lines). The nature and extent of these effects would depend on the specific resource as well as the nature and proximity of the structure, and could vary from some restorable or replaceable negative effects to permanent damage.

Conductors, Overhead Ground Wires, and Insulators – The presence of conductors, overhead ground wires, and insulators would probably have little to no direct effect on archaeological and historical sites. However, the long-term effects of electric or magnetic field exposure to specific data types encapsulated in archaeological deposits or artifacts (e.g., the chemical integrity of base and botanical materials and residues) has not been explored. Visual effects may impact TCPs and cultural landscapes; but these impacts would depend on the nature and proximity of the resource, and may vary from some modifiable effect to permanent and irreplaceable damage.

Access Roads – Access road repair, improvement, and construction could affect cultural resources through ground disturbance, compaction, changes in access or use, or changes in the auditory and/or visual setting. These effects are discussed above in *New Right-of-Way*.

4.10.2.2 Operation and Maintenance Activities

Ongoing operations and maintenance could have an impact on cultural resources. The nature and extent of these impacts would depend on the type and proximity of the resource and the specific activity involved, and could vary from insignificant effects to permanent, irreversible damage.

4.10.3 Site-Specific Impacts

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Because impacts from the proposed project and appropriate mitigation measures would vary (depending on the specifics of each cultural resource), site-specific impacts must be considered when evaluating alternatives.

Site-specific information will be lacking until a field survey and analysis is completed. Because of this, the following analysis is limited to anticipated potential impacts to currently recorded sites and unsurveyed areas that have a high probability for having significant cultural resources. These areas, collectively referred to as 'sensitive areas', may potentially be impacted by project activities.

Sensitive areas contain resources that are protected under federal law. Field surveys would be required in order to verify anticipated site-specific impacts. The following Table 4.10-1, *Summary of Sensitive Areas by Alternative*, summarizes the number of culturally sensitive areas per alternative. This table shows only the sensitive areas that are known through the literature search performed. The actual presence or absence of sensitive areas will be determined through field surveys.

Table 4.10-1
Summary of Sensitive Areas by Alternative

Alternative	Number of Sensitive Areas	Total Area
Preferred 2	36	7.2 mi^2
1*	36	7.4 mi^2
3	38	8.0 mi^2
1A*	38	7.8 mi^2
No Action Alternative	No new or additional areas	

*B_{SOUTH} would increase the number of known sensitive areas by 2 for Alternatives 1, and 1A. The total area would increase by 0.3 mi^2 for the same alternatives.

Sensitive areas indicate the presence of potentially affected resources that should be avoided. When unavoidable, they should be mitigated. Although some resources would inevitably be affected by the proposed project, most of the potentially affected resources would be avoidable if given due consideration. The Preferred Alternative would have the least impact to sensitive areas. The reroute in segment A would not change the number of sensitive areas for any alternative.

4.10.4 No Action Alternative

The No Action Alternative would not cause any ground-disturbing or clearing activities. While the continued operation and maintenance of the existing lines will continue to impact cultural resources, the No Action Alternative includes no new or additional impacts.

4.10.5 Recommended Mitigation

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The mitigation measures for adverse effects to cultural resources presented here are, by necessity, general in nature because field identification and assessment of resources has not yet taken place. Mitigation measures are discussed in terms of resource types.

As required for compliance with Sections 106 and 110 of the National Historic Preservation Act (NHPA), the Archaeological Resources Protection Act (ARPA), the Native American Graves Protection and Repatriation Act (NAGPRA), the National Environmental Protection Act (NEPA) and Executive Order 13007, BPA would consult with the following groups concerning recorded cultural resources, their management, and potential impacts that the proposed project could have on them:

- the Washington State Historic Preservation Officer (SHPO) through the Office of Archaeology and Historic Preservation (OAHP)
- affected Native American tribes
- the owning federal agency, if discoveries made on federal lands
- local governments
- the public

In general, the best means of mitigating effects to significant cultural resources is to protect them where they are located. Impacts to these resources can be greatly reduced by simply avoiding contact with them. Although avoidance cannot replace protection measures in cases of deteriorating conditions, avoiding impacts from project construction, operation, and maintenance activities should be standard practice whenever feasible.

If cultural resources are discovered in the course of project activities, work in the immediate area would cease and the area would be secured until appropriate actions have taken place. In such cases, the SHPO and the affected Native American tribes would be notified immediately, and a professional archaeologist who meets the Secretary of Interior’s Qualifications Standards would examine the site and make recommendations to decision-makers for a course of action.

During work in areas where there is a high probability of encountering subsurface materials, a monitor would be present during ground-disturbing activities. It is imperative that confidential information be protected. This information includes details on the location and nature of cultural resources that may be endangered by looting, vandalism, or other negative impacts by the public. It may also include specific information on the use or practices associated with traditional cultural properties and sacred sites. Protection of confidential information relating to significant cultural resources is required under the ARPA.

Before construction, the following steps would be taken:

- Conduct an intensive cultural resources survey on the selected alternative.
- Evaluate potentially significant sites.
- Complete the National Register of Historic Places Determination of Eligibility forms.

Further information on procedures to be followed in order to protect cultural and historical sites can be found in Appendix H, *Phase I, Cultural Resources Assessment.*

4.10.6 Cumulative Impacts

Operations and maintenance would contribute to cumulative damage to cultural resources currently used by Native Americans, due to changes in access, use, and auditory and visual setting.

This and other projects in the area are providing monetary resources for the discovery of important cultural resources. The negative side of this is that as resources are discovered and become part of public knowledge, the possibility of their destruction becomes greater.

4.11 Public Health and Safety

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Power lines, like electrical wiring, can cause serious electric shocks if certain precautions are not taken. These precautions include building the lines to minimize shock hazard. All BPA lines are designed and constructed in accordance with the National Electrical Safety Code (NESC). NESC specifies the minimum allowable distances between the lines and the ground or other objects. These requirements determine minimum distance to the edge of the ROW, the height of the line, and the closest point to the line that houses, other buildings, and vehicles are allowed to be located.

People must also take certain precautions when working or playing near power lines. It is extremely important that people do not place potential conductors, such as TV antennae, irrigation pipes, or streams of water from irrigation, too close to the lines. BPA provides the free booklet *Living and Working Safely Around High Voltage Power Lines*, which describes safety precautions for people who live or work near transmission lines.

4.11.1 Impact levels

Impact levels are dependent on public and occupational use of the land. The potential for public health and safety impacts increases in areas where human activities take place.

A **high** impact would occur if:

- the new line precludes the use of the ROW for pre-existing activities.
- noise levels for the new line exceed existing state standards.

A **moderate** impact would occur if:

- the new line alters pre-existing ROW activities.
- residents are present and nuisance noise levels occur, exceeding **ambient noise** levels during a portion of the time.

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A **low** impact would occur if:

- the new line would not produce a change in ROW activities.
- there would be no perceived change in noise levels.

4.11.2 Electric and Magnetic Fields

To quantify ***EMF*** levels along the alternatives, the EMFs from the new and existing lines were calculated using the BPA Corona and Field

Effects Program (USDOE, undated) for all alternatives. Minimum clearances were assumed to provide worst-case (highest) estimates for EMF levels. These worst-case conditions would seldom occur. See Appendix I, *Electrical Effects*.

The possible effects of EMF from transmission lines interacting with people on and near a ROW fall into two categories:

1. Short-term health and safety effects that can be perceived and may represent a nuisance: possible short-term effects are discussed below.

2. Possible long-term health and safety effects: The issue of whether there are long-term health effects associated with transmission line fields is controversial. In recent years, considerable research on possible biological effects of EMF has been conducted. Evidence that EMF exposures pose health risks is weak and there are no exposure standards based on long-term health effects. A review of recent studies and their implications for health-related effects is provided in a separate technical report, Appendix J, *Assessment of Research Regarding EMF and Health and Environmental Effects.*

4.11.2.1 Electric Fields – Short-Term Effects

Short-term effects from transmission line electric fields are associated with experiencing shocks from induced currents and voltages, and perceiving the electric field. Under certain conditions, induced current (spark-discharge) shocks can be experienced when a person contacts objects in an electric field. These effects occur in fields associated with transmission lines that have voltages of 230-kV or higher, and could occur under the new transmission line.

Primary shocks are those that can result in direct physiological harm. These shocks will not occur from induced currents under the existing or new lines, because clearances aboveground required by the NESC prevent large vehicles from these shocks, and grounding practices eliminate large stationary objects as sources of these shocks.

Secondary shocks are defined as those that could cause an involuntary and potentially harmful movement, but no direct physiological harm. Secondary shocks could occur under the proposed 500-kV line when making contact with ungrounded conducting objects such as vehicles or equipment. However, such occurrences are anticipated to be very infrequent. Shocks, when they occur under the 500-kV line, are most likely to be at a nuisance level.

Induced currents are always present in electric fields under transmission lines and will be present near the new line. However, during construction BPA routinely grounds metal objects located on or near the ROW. Grounding eliminates these objects as sources of induced current and voltage shocks. Induced currents are extremely unlikely to be perceived off the ROW of the new line.

Unlike fences or buildings, mobile objects such as vehicles and farm machinery cannot be grounded permanently. There are several ways to limit the possibility of induced currents from mobile objects to persons. First, required clearances for aboveground conductors tend to limit field strengths to levels that do not represent a hazard or nuisance. The NESC (IEEE, 1990) requires that sufficient conductor clearance be maintained in order to limit the induced short-circuit current in the largest anticipated vehicle under the line to 5 ***milliamperes*** (mA) or less. This can be accomplished by limiting access or increasing conductor clearances in areas where large vehicles could be present.

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The BPA and other utilities design and operate lines in compliance with NESC standards. The NESC's 5-mA criterion would be met for perpendicular road crossings of the proposed line, and the conductor clearance at each road crossing would be checked during the design stage of the line to ensure that this criterion is met. In accordance with NESC standards, line clearances would also be increased in critical areas such as over railroads and water areas suitable for sail boating.

The potential impacts of electric fields could be mitigated through implementing grounding policies, adhering to NESC standards, and increasing clearances above the minimums specified by the NESC. Worst-case levels are used for safety analyses, but in practice induced currents and voltages are considerably reduced by unintentional grounding and by shielding provided by conducting objects, such as vehicles and vegetation.

Computer models were run to calculate electric fields for the different alternatives, the results of which can be found in Appendix I, *Electrical Effects.* The maximum calculated peak electric field expected for the new transmission line would be 8.9 kilovolts-per-meter (kV/m) or less, depending on the location along each alternative. These peak values are only directly under the line near mid-span, where the conductors are at the minimum clearance.

The largest values expected at the edge of the ROW nearest the new transmission line would be 2.0 kV/m. The largest fields at the edges of the existing ROWs are 5.2 and 2.0 kV/m for the 500- and 230-kV lines, respectively.

The existing 500-kV, 230-kV and 115-kV lines in the study area have peak electric fields of 9.7, 3.3, and 1.7 kV/m respectively. These would be the electric fields present if the No Action Alternative was chosen.

4.11.2.2 Magnetic Fields – Short-Term Effects

The magnetic field generated by currents on transmission line conductors extends from the conductors through the air and into the ground. The magnitude of the field at a height of 1 meter is frequently used to describe the magnetic field under transmission lines. The most important transmission line parameters that determine the magnetic field are conductor height above ground and magnitude of the currents flowing in the conductors. As distance from the transmission line conductors increase, the magnetic field decreases.

Computer models were run to calculate magnetic fields for the different alternatives, the results of which can be found in Appendix I, *Electrical Effects.* The field values on the ROW and at the edge of the ROW are given for projected maximum currents during summer peak load, for minimum and average conductor clearances. Field levels for the new line would be comparable with those for existing lines in the study area. The actual magnetic field levels would vary as currents on the lines change daily and seasonally and as ambient temperature changes. Average currents over a year would be considerably reduced from peak values. On the new ROW with no parallel lines and with the conductors at a height of 33 feet, the maximum magnetic field at 1 meter above ground is 244 milligauss (mG). For an average conductor height of 47 feet, the maximum field would be 137 mG. The maximum fields under the new line in the configurations with parallel lines would be less than these values.

At the edge of the new ROW, the calculated magnetic field for maximum current conditions would be 55 mG for conductor height of 33 feet and 46 mG for a conductor height of 47 feet. Fields at the edge of the ROW of the new line in configurations with parallel lines would be slightly more than those stated above. The field at the edge of the ROW adjacent to a parallel line would depend on that line.

The magnetic field falls off rapidly as distance from the line increases. The calculated magnetic field for maximum current would be less than 10 mG at about 185 feet from centerline of the new transmission line. At a distance of 200 feet from centerline, the field would be 8 mG for maximum current conditions.

The peak magnetic fields on the ROWs are 302 mG and 170 mG, for the 500-kV and 230-kV lines, respectively. Fields at the edges of the existing ROWs range from 158 mG for the Schultz-Vantage 500-kV line to 7 mG for the North Bonneville-Midway 230-kV line, which has a very wide ROW. These would be the magnetic fields present if the No Action Alternative was chosen.

4.11.2.3 Health and Safety Impacts

Impacts from electric and magnetic fields are based on how the new line would potentially change activities presently occurring on the land that would become ROW. Farming activities are most commonly effected activity due to EMFs. Moving and operating irrigation systems must be done with care. The impacts shown in Table 4.11-1, *Health and Safety Impact Level*, are for each alternative by segment.

Table 4.11-1
Health and Safety Impact Level

	Seg A	Seg B	Seg C	Seg D	Seg E	Seg F	Overall Impact
Preferred (2)	Low/Mod	Low		Mod			Low/Mod
Alternative 1	Low/Mod	Low			Mod		Low/Mod
Alternative 3	Low/Mod		Low				Low
Alternative 1A	Low/Mod	Low				Low	Low

4.11.3 Noise

The Washington Administrative Code (WAC) provides noise limitations by class of property: residential, commercial, or industrial. Transmission lines are classified as industrial, and can cause the maximum permissible noise level of 60 decibels (dBA) to intrude into residential property. During nighttime hours (10 pm to 7 am), the maximum permissible limit for noise from industrial to residential areas is reduced to 50 dBA. The latter level applies to transmission lines that operate continuously. The WDOE accepts the 50 dBA level at the edge of the ROW for transmission lines, but has encouraged BPA to design lines with lower audible noise levels.

4.11.3.1 Construction Noise

Noise impacts would result from construction activities. However, this noise would be short term, occurring mostly during daylight hours. It would typically occur for a few days only at any one location, such as near a residence.

4.11.3.2 Transmission Line Noise

Corona-generated audible noise is of concern primarily for contemporary lines operating at voltages of 345-kV and higher,

Reminder

Corona *is a discharge at the surface of a conductor.*

Corona-generated noise can be characterized as a hissing, crackling sound. A technical definition is during foul (wet) weather conditions. Based on meteorological records near the proposed transmission line routes, these conditions are expected to occur less than 7 percent of the time during the year. For a few months after line construction, residual grease or oil on the conductors can cause water to bead up on the surface. This results in more corona sources and slightly higher levels of audible noise and electromagnetic interference if the line is energized. However, the new conductors "age" in a few months, and the level of corona activity decreases to the predicted equilibrium value. The proposed line has been designed with three subconductors per phase, to yield acceptable corona levels.

During foul weather, there would be an increase in the perceived noise above ambient levels for all alternatives, at the edges of new ROW. The foul weather audible noise at the edge of the ROW for the new line alone would be 50 dBA. Along the sections of the Preferred Alternative (Segment D) where new ROW parallels the existing 230-kV ROW, the increase in line-noise levels during foul weather would be perceived as doubling the noise level at the edge of the ROW adjacent to the existing lines.

During fair weather conditions, which occur about 93 percent of the time in the study area, audible noise levels would be about 20 dBA lower than foul weather (if corona were present). These lower levels could be masked by ambient noise on and off the ROW and would probably not be detectable above ambient levels.

Off the ROW, the level of audible noise from the proposed line would be well below the 55-dBA levels that can produce interference with speech outdoors. It is also highly unlikely that indoor noise levels from the line would exceed the 35-dBA level, when sleep interference can occur. Since corona is a foul weather phenomenon, people tend to be inside with windows possibly closed, which decreases their perception of corona noise when it is present. In addition, ambient noise levels can be high during foul weather periods (due to rain hitting foliage or buildings) and can mask corona noise.

Audible noise from the new transmission line would be below EPA guideline levels, and would meet the BPA design criterion that complies with the Washington state noise regulations.

4.11.3.3 Substation Noise

Alternatives 1 or 1A, ending at the Hanford Substation, would pass through the existing Vantage Substation, but no expansions would be necessary within the substation grounds. The Preferred Alternative (Alternative 2) would bypass the existing Vantage and Midway

➡ Reminder

See Map 2, Alternatives, for location of routes and substations.

Substations. As a result, the area surrounding these two substations would not experience an increase in noise.

The proposed added equipment at Schultz Substation would not result in increased noise levels. The alternatives terminating at the Hanford Substation would not result in increased noise levels at the substation. The additional substation equipment required would be similar to the equipment already in use.

The Preferred Alternative would terminate at a new Wautoma Substation, which would be a new noise source in the area. As with all substations, noise levels from the new Wautoma Substation would depend on the equipment installed and the operating modes of that equipment. However, due to the rural location of the substation and the absence of any residences in the general area, noise impacts would be minimal.

Expansion of the Schultz and Hanford Substations and the creation of a new Wautoma Substation would be designed so that the maximum noise level at the property line would not exceed the 65-dBA level required by the Washington State standard for Class C property (industrial zones that includes range and agricultural lands).

4.11.3.4 Noise Impacts

Noise impacts are based on the level of the noise produced by the new line and the people present to hear the noise. If a nuisance level of noise is produced, but people sensitive to the noise are not present, then there is a low impact. This is the impact rating given for agricultural areas where the people present are primarily working. The noise impact levels shown in Table 4.11-2, *Noise Impact Level*, are for each alternative by segment.

Table 4.11-2
Noise Impact Level

	Seg A	Seg B	Seg C	Seg D	Seg E	Seg F	Overal l Impact
Preferred (2)	Low/Mod	Low		Low			Low
Alternative 1	Low/Mod	Low			Low		Low
Alternative 3	Low/Mod		Low				Low
Alternative 1A	Low/Mod	Low				Low	Low

4.11.3.5 Radio and TV Interference

Corona on transmission line conductors can also generate electromagnetic noise in the frequency bands used for radio and television signals. This noise can cause radio and television interference (RI and TVI). Interference with electromagnetic signals by corona-generated noise is generally associated with lines operating at voltages of 345-kV or higher. This is especially true of interference with television signals. The three-conductor bundle design of the proposed 500-kV line is intended to mitigate corona generation and thus keep radio and television interference levels at acceptable levels.

Spark gaps on distribution lines and on low-voltage wood-pole transmission lines are a more common source of RI/TVI than corona from high-voltage electrical systems. This gap-type interference is primarily a fair weather phenomenon caused by loose hardware and wires. The new transmission line would be constructed with modern hardware, which would eliminate these problems and minimize gap noise. Consequently, this source of EMI is not anticipated for the proposed line.

Radio reception in the AM broadcast band (535 to 1,605 kilohertz (kHz)) is most often affected by corona-generated electromagnetic interference ***(EMI)***. FM radio reception is rarely affected. Generally, RI can affect only residences very near transmission lines. Predicted RI levels indicate that fair weather RI will be within the acceptable levels for all proposed route configurations, at distances greater than 100 feet from the outside conductor of the proposed line.

EMI *(el*
is a hig
corona
televisic

Corona-caused TVI occurs during foul weather and is generally of concern for transmission lines with voltages of 345-kV or above, and only for conventional receivers within about 600 feet of a line. As is the case for RI, gap sources on distribution and low-voltage transmission lines are the principal observed sources of TVI. The use of modern hardware and construction practices for the new transmission line would minimize these sources. Predicted TVI levels at 100 feet from the outside conductor of the new transmission line, which would be operating at 500-kV, are comparable with TVI levels from other existing BPA 500-kV lines, and lower than that from the existing Sickler-Schultz 500-kV line.

There is a potential for interference with television signals at locations very near the new transmission lines in fringe reception areas. However, interference with television reception can be corrected by several approaches: improving the receiving antenna system; installing a remote antenna; installing an antenna for TV stations less vulnerable to interference; connecting to an existing cable system; or installing a translator. It is anticipated that all instances of TVI caused by the new transmission line could be effectively mitigated.

If interference should occur, there are various methods for correcting it, and BPA has an active program to identify, investigate, and mitigate legitimate RI and TVI complaints. Therefore, the anticipated impacts of corona-generated interference on radio, television, or other reception would be minimal.

4.11.4 Toxic and Hazardous Materials

Several common construction materials (e.g., concrete, paint, etc.) and petroleum products (e.g., fuels, lubricants, and hydraulic fluids) would be used during construction. BPA would follow strict procedures for disposal of these or any hazardous materials. No impacts would occur.

Some of the new substation equipment required at the Schultz Substation may contain oil. The new equipment at the Hanford Substation may contain oil, however, the Spill Prevention Control and Countermeasure Plan currently in place would be modified to include this expansion.

The Preferred Alternative would terminate at the new Wautoma Substation. The new line termination equipment required would contain limited amounts of oil. This equipment includes such things as: breakers, switches, capacitors, buswork, substation dead ends, and a control house. Since it is expected that there would be no transformers required at this new substation, a spill containment system is not likely to be installed.

Contaminated media (soil, surface water or groundwater) if unexpectedly encountered during construction of the project may present potential risk/liability to BPA. Potential risk and liability includes workers health and safety, management of contaminated materials and/or exacerbation of contaminated media (soil, surface water, or groundwater).

Should contaminated media be unexpectedly encountered during construction of the project, work will be stopped, and an environmental specialist will be called in to characterize the nature and extent of the contamination and to determine how the work may safely be completed. Work will proceed only after measures approved by the WDOE are put in place to prevent the spread of contaminated materials and protect the health and safety of workers.

4.11.5 Fire

Construction of the new transmission line could take place at any time of the year. However, it can be expected that some construction activities will occur during summer when the weather is hot and dry. During the summer months, the potential for wildfires is high due to dry vegetation, such as sagebrush and grasses, along the new ROW. The fire risk increases even more with the increased use of vehicles and other motorized equipment used during construction. The addition of construction workers in the area also elevates the potential for fire. Vehicles would carry fire suppression equipment.

To prevent fires and other hazards, BPA maintains a safe clearance between the tops of trees and power lines. Because electricity can arc from a conductor to a treetop, trees are generally not allowed to grow over 20 feet high on the ROW. Trees that need to be cleared from the ROW, and any that could fall into the line (danger trees), are marked and removed.

4.12 Air Quality

4.12.1 Impact Levels

Impacts would be **moderate** if one or more of the following would occur

- An effect would be created that could only be partially mitigated.
- Air quality would be reduced locally.
- A possible (but unlikely) risk to human health or safety would occur due to air quality.

Impacts would be **low** if one or more of the following would occur:

- An effect would be created that could be largely mitigated.
- A reduction in air quality near the construction or clearing site would occur.
- The project would cause insignificant or very unlikely health and safety risks due to air quality.

For Your Information

***rona** is an electrical discharge at
e surface of a conductor
nsmission line. A technical
finition is included in Chapter 9,
ossary and Acronyms.*

*hen corona is present, the air
rounding a conductor is ionized
d many chemical reactions take
ace that produce small amounts
ozone and other oxidants.
zone comprises approximately 90
rcent of these oxidants, and the
maining 10 percent is mainly
mposed of nitrogen oxides. The
tional primary ambient air
ality standard for photochemical
idants, of which ozone is the
ncipal component, is 235
crograms per cubic meter, or
0 parts per billion. The
aximum incremental ozone levels
ground level produced by
rona activity on the proposed
nsmission lines during foul
eather would be much less than
e part per billion. This level is
ignificant when compared with
tural levels and fluctuations in
tural levels.*

4.12.2 Impacts Common to Construction Alternatives

Construction vehicles and windblown dust from the construction sites and clearing activities would create short-term low impacts on air quality.

Construction vehicles and heavy equipment would emit pollutants such as carbon monoxide (CO), sulfur oxides, particulate matter, nitrogen oxides, volatile and semi-volatile organic compounds, and carbon dioxide (CO_2). Emissions would be short-term and would have low or no impact on air quality.

The only potential for long-term impacts to air quality would come from the new line itself, which cause limited air emissions. The high electric field strength of a 500-kV transmission line can cause a breakdown of air at the surface of the conductors, which is called ***corona***. The proposed 500-kV line is designed to have lower corona levels than is present on the older 500-kV lines in the area and would not result in impacts to air quality.

4.12.3 No Action Alternative

No impacts are expected from this alternative.

4.12.4 Recommended Mitigation

- In order to minimize windblown dust, water trucks would be used to spray roadways and construction sites when necessary.
- Lop and scatter would be used to recycle vegetation.
- To prevent erosion, disturbed areas would be reseeded with grass or an appropriate seed mixture.

4.12.5 Cumulative Impacts

Over the long term, the proposed project would cause no cumulative effects on local or global air quality.

4.13 Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The alternatives under consideration do not pose impacts that would significantly alter the long-term productivity of the affected environment. A good example of this is the existing lines in the study area. They were built in the 1940's through the 1960's. The affected environment has recovered since then, and while there is never complete recovery the long-term productivity of the affected environment has not been significantly altered. Likewise, if the proposed project was built and then removed and the affected areas restored, little change in long-term environmental productivity would occur.

4.14 Irreversible and Irretrievable Commitment of Resources

The proposed project would include the use of aluminum, steel, wood, gravel, sand, and other non-renewable materials to construct steel structures, conductors, insulators, access roads, and other facilities. Materials may come either from on-site borrow pits or from outside sources. Petroleum-based fuels would be required for vehicles and equipment.

The proposed project would cause commitments that result in the loss of wildlife habitat for certain species and the loss of production or renewable resources, such as circle-irrigated cropland. The proposed project would irreversibly convert wildlife habitat and scrub-steppe habitat to utility and associated maintenance uses.

The proposed project would result in a loss of cropland and rangeland. These commitments are irretrievable rather than irreversible, because management direction could change and allow these uses in the future.

4.15 Adverse Effects that Cannot be Avoided

Implementation of the proposed project would result in some adverse impacts that cannot be fully avoided. These impacts and proposed mitigation are discussed under the specific resource section earlier in this chapter. Many adverse effects would be temporary, occurring during site-specific activities.

Some of the adverse effects that cannot be avoided in the proposed project include the following:

- The elimination small areas of vegetation, including wetlands and riparian vegetation, due to permanent physical developments such as transmission line structures and maintenance roads.
- Intermittent and localized decreases in air quality from dust caused by the construction, maintenance, and use of roads.
- Short-term soil compaction, erosion, vegetation degradation, and stream sedimentation from construction and maintenance.
- Short-term disturbance to wildlife during construction.
- Short-term disruption of agricultural activities during construction
- An increased level of habitat fragmentation and reduction in the amount of shrub-steppe vegetation available for wildlife habitat.

Chapter 5 — Consultation, Permit, and Review Requirements

In this Chapter:

- **Laws and procedures to follow**
- **Consultations**

Several federal laws and administrative procedures must be met by the alternatives. This chapter lists and briefly describes requirements that would apply to elements of this project, actions taken to assure compliance with these requirements, and the status of consultations or permit applications. This Draft Environmental Impact Statement (EIS) is being sent to tribes, federal agencies, and state and local governments as part of the consultation process for this project.

5.1 National Environmental Policy Act

This Draft EIS was prepared according to the National Environmental Policy Act (NEPA) (42 USC 4321 et seq.). NEPA is a national law that establishes an environmental policy. This policy requires that an interdisciplinary framework be used in environmental planning, ensures that federal agencies study the environmental effects of their actions, and provides full public disclosure and open decision-making on the part of federal agencies (Bass, Herson and Bogdan, 2001). NEPA applies to all federal projects or projects that require federal involvement. BPA would take into account potential environmental consequences and would take action to protect, restore, and enhance the environment. BPA would also provide the public opportunities to review and input into the decision-making process.

5.2 Endangered and Threatened Species

The Endangered Species Act (ESA) of 1973 (16 USC 1536) provides for conserving endangered and threatened species of fish, wildlife, and plants. Federal agencies must determine whether proposed actions would adversely affect any federally listed endangered or threatened species. When conducting an environmental impact analysis for specific projects, agencies must identify practicable alternatives to conserve or enhance such species.

BPA received a letter from the U.S. Department of the Interior, Fish and Wildlife Service (USFWS), dated March 14, 2001, that listed the endangered and threatened species that could be potentially affected by the project. Information from the National Marine Fisheries Service (NMFS) on listed endangered and threatened species was obtained through current lists published on the agency's website. ESA regulations require that a Biological Assessment be prepared to identify any threatened or endangered species that are likely to be impacted by a federal action. A Biological Assessment is being prepared separately, which will present effects determinations for each of these species. BPA will submit the Biological Assessment to the USFWS and NMFS for their review and concurrence with the effects determinations for each species. The effects determinations will also be incorporated into the FEIS.

Possible impacts of the alternatives to federal threatened or endangered species are discussed in this section and in Chapter 4, *Environmental Consequences*, (Sections 4.3, *Vegetation*; 4.4, *Wildlife*; and 4.5, *Fish Resources*). Detailed discussions of federal proposed threatened and endangered species, candidate species, and species of concern are included in *Appendix F, Fish and Wildlife Technical Report,* and *Appendix E, Vegetation.*

5.2.1 Fish

The NMFS lists Chinook salmon (Upper Columbia River Spring Run) as endangered, Upper Columbia River steelhead trout as endangered, and Middle Columbia River steelhead as threatened. USFWS lists Bull trout as threatened.

Construction impacts would be generally short-term disturbances related to construction such as sediment input, mechanical disturbance, and material spills. However, since most of the project construction will occur away from streams and include mitigation (such as construction timing restrictions for in-water work and near sensitive spawning areas, and spill prevention and erosion measures), short-term construction-related disturbances should result in low or no impacts to all fish species.

Long-term impacts resulting from ongoing operation and maintenance would result mostly from habitat alteration due to clearing of riparian vegetation, changes in runoff and infiltration patterns (from upland vegetation clearing), sedimentation from cleared areas, and maintenance access streams. With similar mitigation employed during construction, maintenance activities should result in low or no impacts to all fish species.

5.2.2 Wildlife

Bald eagles are listed by the USFWS as threatened and are known to nest within the study area. Construction near known bald eagle roost sites might disturb wintering bald eagles. However, in areas away from roost sites, the disturbance of bald eagles from construction will result in a minimal impact. With mitigation that includes identifying nesting and wintering sites and limiting construction activities in these areas during use periods, the proposed project would have no impact on bald eagles.

5.2.3 Plants

Ute ladies' tresses is listed as a threatened species by the USFWS. There are several occurrences of this species in Washington state, but this species is not known to occur in any of the four counties within the study area. Potential habitat for this species may occur along Segments A, D, E, and F. Field surveys were conducted on the Preferred Alternative in August 2001 to determine the presence of the species or its habitat. No populations were found. Further surveys will take place in 2002. If species or habitat presence are determined, avoidance measures would be employed so that no impact to Ute ladies' tresses would result from the project.

5.3 Fish and Wildlife Conservation

The Fish and Wildlife Conservation Act of 1980 (16 USC 2901 et seq.) encourages federal agencies to conserve and promote conservation of non-game fish and wildlife species and their habitats. In addition, the Fish and Wildlife Coordination Act of 1934 (16 USC 661 et seq.) requires federal agencies undertaking projects affecting water resources to consult with the USFWS and the state agency responsible for fish and wildlife resources.

Mitigation designed to conserve wildlife and their habitat is provided in Chapter 4 (See Sections 4.4.10, *Recommended Mitigation*, and 4.5.10, *Recommended Mitigation*). Standard erosion control measures would be used during construction to control sediment movement into streams, protecting water quality and fish habitat.

5.4 Heritage Conservation

Congress passed many federal laws to protect the nation's cultural resources. These include the National Historic Preservation Act, the Archaeological Resources Protection Act, the American Indian Religious Freedom Act, the National Landmarks Program, and the World Heritage List. Preserving cultural resources allows many Americans to have an understanding and appreciation of their origins and history. A cultural resource is an object, structure, building, site, or district that provides irreplaceable evidence of natural or human history of national, state, or local significance. A cultural resource can also include traditions, beliefs, practices, lifeways, arts, crafts, and social institutions of any community, often referred to as traditional cultural property. Cultural resources include **traditional cultural**

Reminder

A ***traditional cultural property*** *is defined generally as one that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs (e.g., traditions, beliefs, practices, lifeways, arts, crafts, and social institutions) of a living community that are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community.*

property, National Landmarks, archaeological sites, and properties listed (or eligible for listing) on the National Register of Historic Places (NRHP).

Construction, and operation and maintenance of the alternatives could potentially affect cultural resources. A literature review of the study area was done to determine the prehistory and history of the area and the probability of finding cultural resources that may be affected by the project. The sites identified from the literature review are described in Section 3.11, *Cultural Resources,* and Appendix H, *Phase I, Cultural Resource Assessment*. A cultural resource survey of the Preferred Alternative, including the access road system would be completed to determine if any cultural resources are present and would be impacted.

BPA would coordinate with the Washington Office of Archaeology and Historic Preservation and Tribal Historic Preservation Officers to determine the effect of any potential impacts to listed and potentially eligible sites for listing on the NRHP. BPA is working with the Confederated Tribes of the Colville Indian Reservation, the Wanapum Band, and the Yakama Nation to protect cultural resources.

If, during construction, previously unidentified cultural resources that would be affected by the proposed project are found, BPA would follow all required procedures set forth in the following regulations, laws, and guidelines: Section 106 (36 CFR Part 800) of the National Historic Preservation Act of 1969, as amended (16 USC Section 470); the National Environmental Policy Act of 1969 (42 USC Sections 4321-4327); the American Indian Religious Freedom Act of 1978 (PL 95-341); the Archaeological Resources Protection Act of 1979 (16 USC 470a-470m); and the Native American Graves Protection and Repatriation Act of 1990 (PL 101-601).

5.5 Federal, State, Area-Wide, and Local Plan and Program Consistency

5.5.1 Federal

5.5.1.1 U.S. Bureau of Land Management (BLM)

For Your Information

BLM land is crossed by Segments A, C, D, E, and F, see Map 7, Land Ownership.

Portions of all alternatives cross Bureau of Land Management (BLM) - administered lands that are managed by the Spokane District. The BLM Spokane District is divided into 13 management areas of which three are crossed by the alternatives. Table 5.5-1, *BLM-Administered Lands Crossed by Project Segments*, indicates which management areas are crossed by each alternative, and more specifically, each segment.

Table 5.5-1
BLM-Administered Lands Crossed by Project Segments

Segment	BLM Spokane District Management Area	Linear Distance Crossed on BLM-administered Land (miles)
A	Scattered Tracts	1.50
B	None	0.00
C	Rattlesnake Hills	0.21
D	Saddle Mountains and Rattlesnake Hills	2.87
E	Saddle Mountains	4.89
F	Saddle Mountains	12.77

Several BLM planning documents identify goals, objectives, and standard design features and operations procedures for activities proposed to occur on BLM-administered lands crossed by the alternatives. These plans include the Spokane Resource Management Plan Record of Decision (1987), the Proposed Spokane Resource Management Plan Amendment Final Environmental Impact Statement (1992), and the Recreation Management/Implementation Plan for the Saddle Mountains Management Area (1997). Table 5.5-2, *Spokane District General Management Objectives*, lists the general management objectives stated in the Resource Management Plan as amended (**RMP**). This table also includes the actions BPA would take to be consistent with the management objectives of the RMP.

Table 5.5-2
Spokane District General Management Objectives

General Management Objectives	Consistency
1. Protect or enhance water quality with particular attention to those watersheds with major downstream water uses including anadromous and other sport fisheries and agriculture.	▪ BPA would protect water quality by locating crossing structures as far back from river stream banks as possible and avoiding riparian areas, drainage ways, canals, and other water bodies to the extent possible. ▪ Other measures to minimize impacts to water quality and sedimentation of water bodies is identified in Section 4.1, *Water Resources, Soils, and Geology*.
2. Maintain and/or improve range productivity by providing available forage to maintain existing or target wildlife populations as estimated by the Washington Department of Fish and Wildlife. The remaining forage would be provided for livestock.	▪ BPA would minimize the amount of vegetation disturbed by construction activities to maintain range productivity. ▪ BPA would prepare a checklist for the management of the ROW vegetation. ▪ Other measures to minimize impacts to vegetation are described in Section 4.3.8, *Recommended Mitigation*.

General Management Objectives	Consistency
3. Adjust the level of sustained yield timber production by restricting production on specific forestlands, where appropriate, to accommodate other resource values. Forestlands would be withdrawn from production only when stipulations and/or mitigation would not adequately protect the other resources.	▪ No forestlands would be affected by the construction or operation and maintenance of the transmission line.
4. Keep public lands open for exploration/ development of mineral resources, rights-of-way, access, and other public purposes with consideration to mitigate designated resource concerns.	▪ Establishing a right-of-way for a new transmission line is a use for which the public lands are kept open. ▪ Mitigation for various resource concerns is discussed in Chapter 4, *Environmental Consequences*.
5. Enhance BLM land pattern and resource management efficiency through land tenure adjustments. Identify opportunities for jurisdictional transfers and develop leases or cooperative management agreements with other agencies or private individuals to improve management efficiency.	▪ No land tenure adjustments would result from the construction or operation and maintenance of the transmission line.
6. Manage upland habitat for nongame and game species to meet Washington Department of Fish and Wildlife population targets.	▪ BPA would minimize the amount of vegetation disturbed by construction activities to maintain upland habitat for nongame and game species. ▪ BPA would prepare a checklist for the management of the ROW vegetation. ▪ Other measures to minimize impacts to vegetation are described in Section 4.3.8, *Recommended Mitigation*.
7. Manage public lands and keep access routes open for a variety of recreational opportunities/experiences, including both motorized and nonmotorized recreation activities.	▪ No access routes on public land would be closed to the public as a result of the construction and operation and maintenance of a new transmission line, unless the landowner requests that access be limited or closed.
8. Consider the protection and/or enhancement of state listed threatened or endangered species habitat.	▪ BPA would consider impacts to state listed threatened and endangered wildlife, fish and plant species (See Sections 4.3, *Vegetation*, 4.4, *Wildlife,* and 4.5, *Fish Resources*). ▪ Mitigation for big game disturbance, avian collision, raptor disturbance, shrub-steppe habitat loss, and wildlife disturbance is detailed in Section 4.4.10, *Recommended Mitigation*. ▪ Mitigation for impacts to fish resources is detailed in Section 4.5.10, *Recommended Mitigation.* ▪ Mitigation for impacts to plants is detailed in Section 4.3.8, *Recommended Mitigation*.

Source: Spokane Resource Management Plan Record of Decision, 1987; Proposed Spokane Resource Management Plan Amendment Final Environmental Impact Statement, 1992.

The RMP also provides objectives for the management of specific resources. Resources that may be affected by the construction and operation and maintenance of a new transmission line are listed in

Table 5.5-3, *Spokane District Objectives for the Management of Specific Resources*, with associated management objectives. The actions that BPA would take to be consistent with these specific management objectives are also included.

Table 5.5-3
Spokane District Objectives for the Management of Specific Resources

Management Objectives for Specific Resources	Consistency
Recreation Management ▪ Recreational activities and visual resources will be evaluated as part of the specific activity plans and will be evaluated to determine their appropriateness in relation to the land use allocations made in the RMP. BLM management of cultural and historic resources emphasizes protection and preservation. ▪ The evaluation of visual resources will consider the significance of proposed projects and the visual/scenic sensitivity of the affected area. ▪ Special management areas, or Areas of Critical Environmental Concern (ACECs), have management plans that protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards. ▪ Off-Road Vehicle (ORVs) designations preclude access to public lands seasonally or year-long to all or specified types of vehicle use.	▪ BPA would evaluate impacts to recreational activities (Section 4.9, *Recreation Resources*). ▪ Impacts to recreation activities would occur during construction and be of short duration. ▪ Construction, operation and maintenance of a new transmission line would not affect the general layout and themes of recreation sites since most recreation is dispersed and would undergo temporary, minor relocation during construction. ▪ Cultural and historic resources would be protected and preserved to the extent possible. Mitigation for these resources is detailed in Section 4.10.5, *Recommended Mitigation*. ▪ No designated visual resource management areas would be affected by the construction or operation and maintenance of a new transmission line. BPA would take into account the impact of the project on visual resources, and would mitigate to minimize impacts (See Section 4.8.8, *Recommended Mitigation*). ▪ No ACEC's will be crossed by the proposed project. Sentinel Slope ACEC is the nearest one, located over three miles west of the proposed transmission line. ▪ Alternative 1A crosses approximately 9.25 miles of BLM-administered lands that have ORV designations. In this area, vehicles are permanently restricted to designated roads and trails. BPA would utilize designated roads to the extent possible. If other access was temporarily required for construction, approval from BLM would be obtained.

Management Objectives for Specific Resources	Consistency
Wildlife and Fish Habitat Management ▪ Project case-by-case evaluations will be made to consider the significance of the proposed projects and the sensitivity of fish and wildlife habitats in the affected areas. ▪ Management actions within riparian habitat areas, wetlands, and floodplains will include measures to preserve, protect, and restore natural functions. ▪ Seasonal restrictions will be applied to mitigate the impacts of human activities on important seasonal wildlife habitat. ▪ Sufficient forage and cover will be provided for terrestrial wildlife on seasonal habitat to maintain existing population levels or target population levels as established by WDFW.	▪ BPA would consider the impacts to fish and wildlife species and habitat (See Sections 4.4, *Wildlife,* and 4.5, *Fish Resources*). ▪ Mitigation for big game disturbance, avian collision, raptor disturbance, shrub-steppe habitat loss, and wildlife disturbance is detailed in Section 4.4.10, *Recommended Mitigation*. ▪ Mitigation for impacts to fish resources is detailed in Section 4.5.10, *Recommended Mitigation*. ▪ BPA would avoid impacts to riparian habitat areas, wetlands, and floodplains to the extent possible by locating structures and access roads outside resource boundaries. If impacts cannot be avoided, mitigation measures to minimize impacts are detailed in Section 4.2.8, *Recommended Mitigation*. ▪ BPA would maintain sufficient forage and cover by minimizing disturbance to vegetation. Specific mitigation is described in Section 4.3.8, *Recommended Mitigation*.
Endangered, Threatened, or BLM Sensitive Species Habitat ▪ Prior to any vegetation or ground disturbing manipulation projects, the BLM requires a survey of the project site for plants and animals listed or proposed for listing as threatened or endangered, or their critical habitats. ▪ For BLM sensitive species, or proposed or candidate T&E species, it is BLM policy to ensure that the crucial/essential habitats be considered in all management decision to minimize the need for future listing by either federal or state governments.	▪ BPA would conduct surveys of the project area that falls within BLM managed lands for plants and animals listed or proposed for listing as threatened or endangered, or their critical habitats. ▪ BPA would consider the impacts of the project on sensitive proposed, or candidate T&E species. Mitigation detailed in Sections 4.4.10, 4.5.10, and 4.3.8, *Recommended Mitigation,* would minimize the need for future listings by either the federal or state governments. ▪ BPA would comply with the Endangered Species Act and would conduct the appropriate level of consultation with the US Fish and Wildlife Service and National Marine Fisheries Service.
Range Program/Grazing Management ▪ Continue present management of public land to benefit livestock and wildlife.	▪ BPA would minimize disturbance to vegetation in order to support the present management practices on public land that benefit livestock and wildlife. ▪ Specific mitigation is detailed in Section 4.3.8, *Recommended Mitigation*.

Management Objectives for Specific Resources	Consistency
Ongoing Management Programs ▪ Noxious weed control will be proposed and subjected to site-specific environmental analyses. ▪ All public land will be available and open for utility and transportation corridor development except the Hot Lakes Resource Natural Area (RNA)/ACEC, the Brewster Bald Eagle Roost and Juniper Forest ACECs, the Chopaka Mountain Wilderness Study Area (WSA), and the Juniper Dunes Wilderness Area. New facilities will be encouraged to be located within existing corridors to the extent possible.	▪ BPA would incorporate measures to minimize the spread of noxious weeds. Mitigation to be employed is described in Section 4.3.8.4, *Minimize the Introduction and Spread of Weeds*. ▪ The new transmission line would not cross the Hot Lakes RNA/ACEC, the Brewster Bald Eagle Roost and Juniper Forest ACECs, the Chopaka Mountain WSA, or the Juniper Dunes Wilderness Area. ▪ The new transmission line would be located within or adjacent to existing corridors to the extent possible.

Source: Spokane Resource Management Plan Record of Decision, 1987; Proposed Spokane Resource Management Plan Amendment Final Environmental Impact Statement, 1992.

nt
D, E,

The Preferred Alternative and Alternatives 1 and 1A cross the Saddle Mountain Management Area of the Spokane District, for which the Saddle Mountain Recreation Management/Implementation Plan applies. This plan provides management objectives for important resources including minerals, livestock grazing, recreation, wildlife habitat, soils, and watersheds. The objectives of this plan and the actions that BPA would take to be consistent with this plan are described in Table 5.5-4, *Saddle Mountain Management Area Resource Management Objectives*.

Table 5.5-4
Saddle Mountain Management Area
Resource Management Objectives

Resource Management Objectives	Consistency
1. Manage public lands and keep access routes open for a variety of recreational opportunities/ experiences, including both motorized and non-motorized activities.	▪ No existing access routes on public land would be closed to the public as a result of the construction and operation and maintenance of a new transmission line, unless the landowner requests that access be limited or closed.
2. Keep public lands open for public purposes such as the exploration and/or development of mineral resources, rights-of-way, or access.	▪ Establishing a right-of-way for a new transmission line is a use for which the public lands are kept open. ▪ Mitigation for various resource concerns is discussed in Chapter 4, *Environmental Consequences*.
3. Enhance resource management efficiency through land tenure adjustments. Identify opportunities for jurisdictional transfers, cooperative management agreements with other agencies, or private individuals.	▪ No land tenure adjustments would result from the construction or operation and maintenance of the transmission line.

Resource Management Objectives	Consistency
4. Protect and/or enhance federally sensitive, threatened, or endangered species habitat.	▪ BPA would conduct surveys of the project site within the Saddle Mountain Management Area for plants and animals listed or proposed for listing as threatened or endangered, and for BLM Sensitive Species or their habitats. ▪ BPA would consider the impacts of the project on sensitive proposed, or candidate T&E species. Mitigation detailed in Sections 4.4.10, 4.5.10, and 4.3.8, *Recommended Mitigation*, would minimize the need for future listings by either the federal or state governments. ▪ BPA would comply with the Endangered Species Act and would conduct the appropriate level of consultation with the US Fish and Wildlife Service and National Marine Fisheries Service.
5. Provide for safe use of the Saddle Mountains.	▪ BPA would take precautions to minimize impacts to public health and safety during the construction and operation and maintenance of a new transmission line. ▪ Precautions would be taken for electric and magnetic fields, noise, toxic and hazardous materials, and fire (See Section 4.11, *Public Health and Safety*).
6. Protect and/or minimize impacts to important values such as cultural and archaeological resources, traditional and cultural properties, Native American sacred sites, or special status species.	▪ Cultural and historic resources would be protected and preserved to the extent possible. Mitigation for these resources is detailed in Section 4.10.5, *Recommended Mitigation.* ▪ BPA would comply Sections 106 and 110 of the National Historic Preservation Act (NHPA), the Archeological Resources Protection Act (ARPA), the Native American Graves Protection and Repatriation Act (NAGPRA), the National Environmental Protection Act (NEPA) and Executive Order 13007. ▪ BPA would consult with the Washington State Historic Preservation Officer (SHPO) through the Office of Archaeology and Historic Preservation (OAHP), affected Native American tribes, local governments, and the public to protect cultural resources.

Source: Recreation Management/Implementation Plan, Saddle Mountains Area—April 1997.

5.5.1.2 U.S. Department of Defense (DOD) – Yakima Training Center (YTC)

➡ Reminder

See Map 7, Land Ownership.

All of the alternatives (Segments A, B, and C) cross the Yakima Training Center (YTC) that is managed by the US Army. The number one priority of the YTC is military training, which involves developing the skills and techniques necessary to fight, survive, and prevail in a wide variety of contingencies (U.S. Army, 2001). In concert with these military training goals, protection of environmental resources is also part of the YTC management program. A Cultural and Natural Resources Management Plan (CNRMP) identifies and supports military use of the YTC while managing the existing cultural and natural resources. The overall goals of the CNRMP and the actions that BPA would take to be consistent with the plan are described in Table 5.5-5, *Yakima Training Center CNRMP Goals*.

Table 5.5-5
Yakima Training Center CNRMP Goals

Goals	Consistency
1. Ensure YTC's ability to support and preserve military training.	▪ All alternatives (Segments A, B) locates a new transmission line adjacent to an existing line. The existing transmission lines were in place prior to this land area becoming part of the YTC. As a result, the U.S. military has tailored its use of this area to accommodate existing transmission line facilities. ▪ Alternative 3 (Segment C) requires a new right-of-way and transmission line in an area where training maneuvers are not currently designed to work around such facilities. Live mortar training would need to be eliminated and ground maneuvers would also be affected. ▪ BPA would work closely with the Army to minimize conflicts and inconvenience from construction and maintenance activities.
2. Use a long-term, ecosystem management approach.	▪ BPA would consider direct, indirect and cumulative impacts of the project on the environment. Mitigation for these impacts would be employed (*See Chapter 4, Environmental Consequences*).
3. Integrate resource management goals within and among watersheds.	▪ BPA would apply the resource goals (listed below) within and among all watersheds crossed by the proposed project on the YTC.
4. Promote land management flexibility by using adaptive management strategies.	▪ Through the NEPA process, BPA would incorporate the concepts of adaptive management (land ecology, human desires and needs, and technology and economics) into the project decision-making process.
5. Develop management strategies that mitigate military training impacts.	▪ BPA proposes mitigation measures for impacts to resources, including military training, that would be caused by the construction and operation and maintenance of a new transmission line. Resource impacts and mitigation strategies are described in *Chapter 4, Environmental Consequences*.
6. Strive to meet the cultural and natural resource goals identified in each resource area (identified below).	

Goals	Consistency
Soils and Geology To maintain or improve soil resources that provide the basics for healthy, productive ecosystems.	▪ BPA would preserve existing vegetation where possible, and stabilize disturbed areas. As soon as practicable, stabilization measures would be started where construction activities have temporarily or permanently ceased. ▪ BPA would avoid riparian areas, drainage ways, canals, and other water bodies where possible. When these areas cannot be avoided, BPA would apply erosion control measures to prevent degradation of riparian or stream quality at the local and watershed level. ▪ BPA would prepare a stormwater pollution prevention plan (as required under the National Pollution Discharge Elimination System General Permit). ▪ Other mitigation to protect soils and geology are detailed in Section 4.1.4, *Recommended Mitigation*.
Water Resources Meet State of Washington surface water quality standards (WAC 173-201A-030), promote sustained survival of aquatic macro-invertebrate communities, and support water quality management efforts in the Yakima and Columbia River basins.	▪ BPA would set crossing structures as far back from stream banks and other water bodies as far as possible. BPA would avoid refueling and/or mixing hazardous materials where accidental spills could enter surface or groundwater. ▪ BPA would locate structures outside the Columbia River Shoreline area to the extent possible (consistency with the Shoreline Management Act described in Section 5.5.2.3, *Shoreline Management Act*). ▪ BPA would design the project to comply with local ordinances and state and federal water quality standards, to prevent degradation of aquifers and not jeopardize their usability as a drinking water source. ▪ BPA would prepare a stormwater pollution prevention plan (as required under the National Pollution Discharge Elimination System General Permit). ▪ Additional mitigation measures to protect water resources is described in Section 4.1.4, *Water Resources, Soils, and Geology*.
Upland Vegetation To maintain or restore upland vegetation in a diverse mosaic of plant communities in support of a range of functions.	▪ Prior to construction, BPA would survey the project area for known occurrences and potential areas of rare plant species. ▪ BPA would avoid high-quality native plant communities if possible. If not avoidable, BPA would minimize impacts to these communities. If possible, structures and roads would be placed to avoid impacting high-quality native plant communities. ▪ BPA would prepare a ROW Maintenance Plan to designate which species are appropriate for restoration in certain areas. It would include

Goals	Consistency
	specifications for planting, including the appropriate time to plant. ▪ A checklist would be prepared for the management of the ROW vegetation. BPA would reseed disturbed areas with native seed mix approved by YTC. ▪ Specific mitigation for impacts to vegetation is detailed in Section 4.3.8, *Recommended Mitigation*. ▪ BPA would survey for noxious weeds before and after construction. Weed control efforts would be conducted during and after construction to minimize the spread of noxious weeds. Specific measures to mitigate for noxious weeds in detailed in Section 4.3.8.4, *Minimize the Introduction and Spread of Weeds.*
Riparian and Wetland Resources To provide ecologically healthy and functioning riparian and wetland areas on YTC.	▪ BPA would avoid impacts to riparian habitat areas, wetlands, and floodplains to the extent possible by locating structures outside these resource boundaries. If impacts cannot be avoided, mitigation measures to minimize impacts is detailed in Section 4.2.8, *Recommended Mitigation*.
Wildlife Provide self-sustaining wildlife populations.	▪ BPA would conduct surveys of the project site for wildlife listed or proposed for listing as threatened or endangered, or their critical habitats. ▪ BPA would consider the impacts of the project on sensitive, proposed, or candidate T&E species. Mitigation detailed in Section 4.4.10, *Recommended Mitigation*, would minimize the need for future listings by either the federal or state governments. ▪ BPA would comply with the Endangered Species Act and would conduct the appropriate level of consultation with the US Fish and Wildlife Service.
Fish Resources To provide an ecologically healthy and functioning native fishery.	▪ BPA would consider the impacts of the project on sensitive, proposed, or candidate T&E species. Mitigation detailed in Section 4.5.10, *Recommended Mitigation*, would minimize the need for future listings by either the federal or state governments. ▪ BPA would comply with the Endangered Species Act and would conduct the appropriate level of consultation with the US Fish and Wildlife Service and National Marine Fisheries Service.

Goals	Consistency
Cultural Resources Identify and manage historic properties and traditional resources.	▪ Cultural and historic resources would be protected and preserved to the extent possible. Mitigation for these resources is detailed in Section 4.10.5, *Recommended Mitigation*. ▪ BPA would comply Sections 106 and 110 of the National Historic Preservation Act (NHPA), the Archeological Resources Protection Act (ARPA), the Native American Graves Protection and Repatriation Act (NAGPRA), the National Environmental Protection Act (NEPA), and Executive Order 13007. ▪ BPA would consult with the Washington State Historic Preservation Officer (SHPO) through the Office of Archaeology and Historic Preservation (OAHP), affected Native American tribes, local governments, and the public to protect cultural resources.
Recreation Provide outdoor recreational opportunities without compromising public safety, negatively impacting natural resources, or interfering with military training.	▪ BPA would evaluate impacts to recreational activities (Section 4.9, *Recreation Resources*). ▪ Impacts to recreation activities would occur during construction and be of short duration. Construction and operation and maintenance of a new transmission line would not permanently affect recreation activities or access to recreation sites since most recreation is dispersed and would undergo temporary, minor relocation during construction.

Source: Cultural and Natural Resources Management Plan, 2001.

5.5.1.3 U.S. Department of Energy (USDOE) – Hanford Reach National Monument and Hanford Site

The Preferred Alternative and Alternative 1 and 1A (Segments D, E, and F) cross areas of the Hanford Site and the Hanford Reach National Monument owned by the U.S. Department of Energy (USDOE) and managed by USDOE and the USFWS. The 586-square-mile Hanford Site was created in 1943 through the acquisition and consolidation of private lands with existing government land for the purpose of producing nuclear materials for national defense. In the late 1980's the USDOE's primary mission for the Hanford Site changed from defense materials production to environmental restoration, in particular, the cleanup of radioactive and hazardous materials stored on the site. As part of the new mission, and to fulfill existing USDOE requirements, USDOE developed a Comprehensive Land Use Plan (CLUP) for the Hanford Site. In 1999, the USDOE issued a Record of Decision (ROD) adopting a CLUP defined by the Preferred Alternative in the Final Hanford Comprehensive Land-Use Plan EIS (HCP-EIS) (USDOE, 1999).

Reminder

See Map 7, Land Ownership.

The south end of Alternatives 1 and 1A (Segments E and F) and the Hanford Substation are located on land designated in the CLUP as Conservation (areas managed for the management and protection of archaeological, cultural, ecological and natural resource- limited mining could occur as a special use). Excepting Hanford Substation, land use along the southern ends of Alternatives 1 and 1A within the Hanford Site and Hanford Reach National Monument are designated as Preservation (areas managed for the preservation of archaeological, cultural, ecological, and natural resources).

Any physical development or land use activity occurring in the Preservation designation or that is not categorically excluded in the Conservation designation is a Special Use, and subject to review and approval from USDOE before being allowed. All alternatives would cross land that would fall within the Special Use category.

The Hanford CLUP furthermore identifies five policies associated with Utility and Transportation corridors. Table 5.5-6, *Hanford CLUP Utility and Transportation Policies*, lists each policy and describes how BPA would meet the intent of each policy.

Table 5.5-6
Hanford CLUP Utility and Transportation Policies

CLUP Policy	Consistency
1. With to-be-identified exception(s), existing utility and transportation corridor rights-of-way are the preferred routes for expanded capacity and new infrastructure.	Proposed Segments are located adjacent to or near existing utility corridor rights-of-way.
2. Existing utility corridors that are in actual service, clearly delineated, and of defined width, are not considered "nonconforming" uses in any land-use designation.	The utility corridor established for this project would be in service, and would therefore not be a "nonconforming" use.
3. Utility corridors and systems without the characteristics of Number 2 (above) are considered to be nonconforming uses and shall be identified in the applicable RMP or AMP.	Not applicable.
4. Avoid the establishment of new utility corridors within the Conservation and Preservation designations unless the use of an existing corridor(s) is infeasible or impractical.	In order to maintain the required separation between transmission lines, existing corridors would need to be slightly expanded for the Preferred Alternative (2) (Segment D), or new corridors would be constructed parallel to existing corridors Alternatives 1 and 1A (Segments E and F).
5. Avoid the location of new above-ground utility corridors and systems in the immediate viewshed of an American Indian sacred site. Prioritize for removal, as funding is available, existing nonconforming utility corridors and systems in such areas.	American Indian sacred sites have not been identified. A cultural resource survey will be conducted and tower placement adjusted to the extent possible.

5.5.1.4 U.S. Fish and Wildlife Service (USFWS)

➡ Reminder

See Map 7, Land Ownership.

The U.S. Fish and Wildlife Service has several roles to fulfill in association with the proposed project. As the agency responsible for overseeing threatened and endangered species (See Section 5.2, *Endangered and Threatened Species*), they must ensure that the project does not contribute an adverse affect to such species. Also, as managers of the Columbia National Wildlife Refuge and the Hanford Reach National Monument, they must manage the area for natural resource values.

Columbia National Wildlife Refuge – The Preferred Alternative and Alternative (Segments D and E) cross an isolated parcel of the Columbia National Wildlife Refuge at the mouth of Crab Creek. This parcel is owned and managed by the USFWS. The USFWS does not presently have a Comprehensive Conservation Plan for the management of this refuge. An easement to cross USFWS lands would be required from USFWS.

Hanford Reach National Monument/Fitzner-Eberhardt Arid Lands Ecology Reserve – The USFWS has managed USDOE-owned lands under a USDOE permit in the Hanford Site area since 1971 when it took over management of the Saddle Mountain Wildlife Refuge area on the north side of the Columbia River. More recently, USFWS took over management of the Fitzner-Eberhardt Arid Lands Ecology Reserve (ALE) from the USDOE in 1997. Management of the Wahluke Slope was assigned to the USFWS and WDFW in 1971. In 1999, the USFWS and WDFW agreed that the USFWS would assume management of the Wahluke Slope.

In 2000, the entire area north of the Columbia River, the Hanford Reach of the Columbia River, the Saddle Mountain National Wildlife Refuge, and the ALE was declared the Hanford Reach National Monument, owned by USDOE but with the USFWS responsible for managing the much of the Monument area under permit from the USDOE. However, the USDOE manages the McGee/Riverlands area around Midway and the quarter-mile strip along the Columbia River on the south and west bank. The Preferred Alternative and Alternatives 1 and 1A (Segments D, E, and F) all pass through parts of the Hanford Reach National Monument managed by USFWS.

Specific management plans for the Hanford Reach National Monument have not yet been developed by the USFWS, so their applicability to the proposed project cannot be assessed. However, the Monument Proclamation includes a specific reference to upgrades to the Federal Columbia River Transmission System and states that:

> "Replacement, modification, and expansion of existing Federal Columbia River Transmission System facilities, and construction of any new facilities, within the proposed monument, as authorized by other applicable law, may be carried out in a manner consistent with the proper care and management of the objects identified in the draft proclamation, as determined in accordance with the management arrangements set out in the draft proclamation."

5.5.2 State

No conflicts with state land use plans or programs are anticipated. BPA would work with state agency representatives to minimize conflicts between proposed activities and land use plans, and would strive to meet or exceed the substantive standards and policies of the following regulations.

Reminder

See Map 7, Land Ownership.

5.5.2.1 Hydraulic Project Approval (HPA)

The goal of the Hydraulic Project Approval (Chapter 75.20 RCW, Chapter 220-110 WAC) is to protect fish in waters of the state. The WDFW must approve any form of work that uses, diverts, obstructs, or changes the natural flow or bed of any fresh water or saltwater of the state. Access roads crossing streams would be the only direct impact to fish, since BPA would try to avoid placing structures in streams, wetlands or floodplains.

BPA would obtain a hydraulic project approval. Waters of the state where fish would be impacted would be identified and mitigation for these impacts would be developed to be consistent with the hydraulic project approval requirements.

5.5.3 Counties

Alternatives would be located in Kittitas, Grant, Benton, and Yakima counties in central Washington State. There are no incorporated cities or towns crossed by the alternatives. Table 5.5-7, *Zoning Designations Crossed by the Alternatives in Each County*, identifies zoning designations by county.

Table 5.5-7
Zoning Designations Crossed by the Alternatives in Each County

	Counties			
	Kittitas	**Grant**	**Benton**	**Yakima**
Zoning Designations	Forest and Range	Rural Light Industrial	Unclassified	Agricultural
	Agricultural-20	Rural Remote	GMA Agricultural	
		Rural Residential 3		
		Open Space Conservation		
		Agricultural		
		Public Open Space		

BPA would work with county planners to minimize conflicts between proposed activities and county land use plans by striving, as much as possible, to meet or exceed the substantive standards and policies of the county zoning ordinances and comprehensive plans. More details on consistency with these plans are given in Appendix G, *Local Plan Consistency*.

5.5.3.1 Noxious Weed Control

County Noxious Weed Control Boards coordinate weed detection and control activities that emphasize the prevention of invasion by noxious weeds, eradication when possible, and containment of established species. County weed boards work locally to control weeds on state-owned and private lands. To accomplish this, counties adopt a County Weed List each year, which is divided into Classes A-C (similar to the state list) and based on the degree of threat they pose to that county. Counties also maintain Education Lists that include weeds not included in Class A-C, but for which the Weed Board will assist landowners with control efforts.

Federal law refers to weeds as "undesirable species" that may include a broader range of species than state-listed weed species (Federal Noxious Weed Act, 1986, P.L. 93-629, Section 15). On federal lands, land management agencies designate personnel to address the problems presented by weed species. In the proposed study area, personnel from county weed boards and federal land management agencies serve on joint task forces to address weed control in a concerted way, in an effort to coordinate efforts and share information.

BPA conducts weed surveys before construction to determine whether any weed mitigation needs to be conducted prior to construction and also to identify preventative measures that can be taken to minimize the risk of spreading or introducing weeds as a result of construction activities. BPA also conducts weed surveys after construction to assess whether any further weed mitigation measures are necessary.

5.6 Farmland Protection

The Farmland Protection Policy Act (PL 97-98; 7 USC 4201 et seq.) directs federal agencies to identify and quantify adverse impacts of federal programs on farmlands. The Act's purpose is to minimize the number of federal programs that contribute to the unnecessary and irreversible conversion of agricultural land to non-agricultural uses.

The location and extent of prime farmlands designated by the Natural Resource Conservation Service (NRCS) were obtained from NRCS soil survey information. Lists of unique, statewide, and locally important farmlands in Washington are in the process of being updated and certified; thus, are unavailable for consideration (Hipple, 2001).

Portions of all the alternatives would be located on soils designated by the NRCS as prime farmland. Farmland would be permanently affected if structures were located on designated soils. Farmland would not be permanently affected if the transmission facility could span the designated soils. Table 5.6-1, *Area of Affected Prime Farmland*, lists the extent to which each segment permanently affects designated prime soils.

Table 5.6-1
Area of Affected Prime Farmland (Ac)

	Prime Farmland		
Segment	Linear Distance Crossed (mi)	No. of Structures	Area Permanently Affected (Ac)
A	0.2	0	0
B North	0	0	0
B South	0	0	0
C	0	0	0
D	2.7	6	2.3
E	2.7	12	4.6
F	0	0	0

Project alternatives would have minimum impact on area farmlands since:

- No additional nonfarmland would be created due to interference with existing land patterns except for the immediate area surrounding structures.
- Agricultural operations within the corridor are currently affected by the existing line.
- No existing substantial and well maintained on-farm investments would be affected.
- The alternatives would not cause the agricultural use of adjacent farmlands to change, nor jeopardize the continued existence of area farm support services.

Any farmland that would be proposed to be converted to nonagricultural uses would require approval by the NRCS.

5.7 Floodplain/Wetland Assessment

In accordance with Department of Energy regulations on compliance with Floodplain/Wetland environmental review requirements (10 CFR 1022.12) and Executive Orders 11988 and 11990, BPA has prepared the following assessments of the impacts of the alternatives on floodplains and wetlands. BPA published a notice of floodplain/ wetland involvement for this project in the Federal Register on November 9, 2000.

5.7.1 Resource Description

The need and purpose of the project are described in Chapter 1, *Purpose and Need*. Map 4, *Water Resources*, (in Chapter 3) shows locations of floodplains with respect to the alternatives. The locations of the 100-year floodplains were determined from Flood Insurance Rate Maps published by the Federal Emergency Management Agency, U.S. Department of Housing and Urban Development.

Wetlands that would be affected by the alternatives were preliminarily identified by three methods: National Wetland Inventory Maps prepared by the USFWS for Washington, aerial photo interpretation, and reconnaissance level field inspections (See Map 4, *Water Resources*, in Chapter 3). A wetland delineation will be conducted on the Preferred Alternative to determine the actual boundaries and characteristics of wetland areas.

5.7.2 Floodplain/Wetland Effects

Floodplain impacts are discussed in Section 4.2, *Floodplains and Wetlands*. Based on preliminary engineering design of the alternatives, all floodplains and wetlands would be spanned by the new line, avoiding placement of structures in floodplains or wetlands. Soil and vegetation would be disturbed where improvements need to be made to existing access roads within floodplains or new access roads need to be constructed across floodplains or wetlands. Such improvements may include partial filling of a wetland, culvert placements, creating fords, and construction of new bridges. With mitigation to minimize erosion, sedimentation, and the spread of noxious weeds, impacts to floodplains and wetlands in these cases would be reduced or avoided.

Upgrading existing access roads in floodplains would not significantly increase the risk of flooding or flood damage. The fords and bridges that would be replaced would not be vulnerable to damage by floodwaters because they would be designed to withstand flooding. Displacement of floodwaters by bridges would be negligible; bridges are not expected to alter the floodplain storage volume or to cause a local increase in the flood stage. Fill for bridges would be limited to the amount necessary for construction.

Wetlands that would be crossed by the alternatives are discussed in Section 4.2, *Floodplains and Wetlands*. Wetlands associated with 45 creeks would be spanned. Construction, operation, and maintenance of the project is not expected to significantly affect the long-term existence, quality, or natural and beneficial values of the wetlands involved. Activities in wetlands would be coordinated with the U.S. Army Corps of Engineers (Seattle District) and Washington state and county regulatory agencies. The appropriate permits would be acquired.

5.7.3 Alternatives

Under Executive Orders 11988 and 11990, developments on floodplains and in wetlands are discouraged whenever there is a practical alternative. Table 5.7-1, *Possible Floodplain and Wetland Impact Occurrences*, estimates the number of potential floodplain and wetland impact occurrences for each alternative being considered. The magnitude of impact would be determined and site-specific mitigation would be employed to avoid or minimize impacts to floodplain and wetlands.

Table 5.7-1
Possible Floodplain and Wetland Impact Occurrences

Type of Possible Impact and Impact Level	Number of Impacts in Each Alternative			
	referre (2)	1	3	1A
Possible crossing of creek or ditch requiring a culvert and overlying fill for an access road	15	17	22	15
Structures built on fill in wetland, if unavoidable	0	1	0	0
Areas where tall trees within floodplains or wetlands may be topped or removed for line safety	4	4	3	5
Structures built in floodplain upland areas for Columbia River crossing(s)	2	2	0	2

The No Action Alternative is discussed in more detail along with the other alternatives in Chapter 2, *Alternatives*.

5.7.4 Mitigation

Mitigation for site-specific impacts is discussed in Section 4.2.8, *Recommended Mitigation*. BPA would avoid, to the extent possible, siting structures and new access roads in wetlands or floodplains and would minimize, to the extent possible, the access road construction or improvements through wetlands and floodplains. BPA would conduct wetland delineations along all access roads and existing and new ROW for wetlands to ensure full compliance with the Clean Water Act. BPA would also work with the appropriate agencies to mitigate any actions that would impact the function of wetlands.

For Your Information

*The **Executive Order on Environmental Justice** (Executive Order 12898) was enacted in February 1994 to ensure that federal agencies do not unfairly inflict environmental harm on economically disadvantaged and minority groups within the United States or any of its territories.*

5.8 Executive Order on Environmental Justice

The **Executive Order on Environmental Justice** requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects on minority and low-income populations. The U.S. Census Bureau defines minority individuals as those belonging to the following racial or ethic groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic Origin; or Hispanic. EPA Interim Guidelines on Environmental Justice (1998) define low-income as less than two times the poverty threshold/level. These parameters are partial factors in considering whether a potential environmental justice case exists. EPA Interim Guidelines recommend that environmental justice assessments use additional meaningful information and analyses to best determine if disproportionate impacts may result from a proposed action.

U.S. Census block group data for minority populations and populations with income below the poverty level were compared to the respective average county populations. Of the 11 block groups in the study area, two exceeded the county average racial minority population compositions and four exceeded the average Hispanic origin compositions for the respective counties. Two of the eleven U.S. Census block groups indicate a higher percentage of individuals with income below the poverty level. Since block group areas extend substantially beyond the study area, additional analyses using aerial photographs were used.

An examination of aerial photographs investigated if residential, commercial, or industrial buildings were present in or near the study area. The results of the examination determined that most of the study area has no buildings of any type present such as when the project alternatives are located on undeveloped, grazed shrub-steppe lands, or public lands. In other areas, such as along agricultural lands in the Preferred Alternative and Alternative 1 (Segments D and E), there are scattered farms and associated homes and outbuildings typical of rural agricultural land use.

From this assessment of demographic data and aerial photography, it is determined that places where minority or low-income populations may reside, work, or otherwise spend large parts of their days are not highly or disproportionately concentrated within the study area. Alternatives considered for the project would therefore not adversely affect any minority or economically disadvantaged groups. For these reasons, the alternatives would not violate the intent of the Executive Order on Environmental Justice.

5.9 Global Warming

The U.S. EPA defines global warming as "The progressive gradual rise of the earth's surface temperature thought to be caused by the greenhouse effect and responsible for changes in global climate patterns" (EPA, 2001). Certain manmade and natural gases absorb and reradiate infrared radiation, which prevents heat loss to space. These gases are known as **greenhouse gases**. Greenhouse gases include water vapor, carbon dioxide methane, chlorofluorocarbons, ozone, and nitrous oxides.

For Your Information

*Gases contributing to global warming are called **greenhouse gases**. Greenhouse gases include: water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ground level ozone (and the pollutants which generate ground level ozone), and stratospheric ozone depleting substances such as chlorofluorocarbons and carbon tetrafluoride. CO_2 is the most common greenhouse gas in the atmosphere. Greenhouse gases warm the atmosphere by absorbing infrared radiation given off by the earth, preventing heat loss to outer space.*

The greenhouse effect is a natural phenomenon that helps regulate the temperature of the Earth. If all of these greenhouse gases were to suddenly disappear, the Earth would be 60ºF colder and uninhabitable (EPA 2001). Although global warming occurred in the distant past as the result of natural influences, the term is most often used to refer to the warming predicted to occur as a result of increased emissions of greenhouse gases (EPA, 2001.) Human activities that contribute to global warming include burning coal, oil, and gas, and cutting down forests.

Occasional trees or woody shrubs would be cleared that would release CO_2 and would eliminate CO_2-collecting vegetation; however, this would occur on a very small scale. To dispose of any cleared vegetation, it would be lopped and scattered on the ROW. This vegetation would then gradually degrade, releasing small quantities of carbon to the atmosphere over long periods of time. BPA does not expect to conduct any outdoor burning. Exceedingly low or no impact to global warming would occur from the project as a result of clearing or recycling vegetation.

5.10 Energy Conservation at Federal Facilities

Any modifications to the Schultz, Vantage, and Hanford Substations would not require the addition of new structures, such as control houses, but would use those already in existing substations. All alternatives using these substations therefore involve the continued use of buildings that would meet federal energy conservation design standards as they apply to existing structures.

The new Wautoma Substation would include a new control house that would meet federal energy conservation design standards.

5.11 Pollution Control at Federal Facilities

Several pollution control acts apply to this project and are discussed separately in the following sections.

5.11.1 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) of 1976 (42 USC 6901 et seq.), as amended, is designed to provide a program for managing and controlling hazardous waste by imposing requirements on generators and transporters of this waste, and on owners and operators of treatment, storage, and disposal (TSD) facilities. Each TSD facility owner or operator is required to have a permit issued by EPA or the state. Typical construction and maintenance activities in BPA's experience have generated small amounts of these hazardous wastes: solvents, pesticides, paint products, motor and lubricating oils, and cleaners. Small amounts of hazardous wastes may be generated by the project. These materials would be disposed of according to state law and RCRA.

5.11.2 Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) of 1976 (15 USC 2601 et seq.) is intended to protect human health and the environment form toxic chemicals. Section 6 of TSCA regulates the use, storage, and disposal of PCBs.

BPA adopted guidelines to ensure that PCBs are not introduced into the environment equipment proposed in any of the alternatives would not contain PCBs. Any equipment removed that may have PCBs would be handled according to the disposal provisions of TSCA.

5.11.3 Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1972 (7 USC 136 et seq.) registers and regulates pesticides. BPA uses herbicides only under controlled circumstances. Herbicides are used on transmission line rights-of-way (ROW) and in substation yards to control vegetation, including noxious weeds.

When BPA uses herbicides, the date, dose, and chemical used is recorded and reported to state government officials. Herbicide containers are disposed of according to RCRA standards.

5.12 Noise Control Act

The Federal Noise Control Act of 1972 (42 USC 4903) requires that federal entities, such as BPA, comply with state and local noise requirements.

The Washington State Department of Ecology limits noise levels at property lines of neighboring properties (WAC Chapter 173-040). The maximum permissible noise levels depend on the land uses of both the source noise and receiving property (Table 5.13-1, *Maximum Permissible Environmental Noise Levels*). The environmental designation for noise abatement (EDNA) is defined by the land use of a property. In general, residential uses are Class A, commercial are Class B, and industrial and agricultural are Class C.

Table 5.13-1
Maximum Permissible Environmental Noise Levels

EDNA of Noise Source	EDNA of Receiving Property		
	Class A	Class B	Class C
Class A	55 dBA	57 dBA	60 dBA
Class B	57	60	65
Class C	60	65	70

Source: WAC 173-60-040

Several exemptions apply to the project construction, operation, and maintenance (WAC 173-60-050). Sounds created by the installation or repair of essential utility services are exempt in all EDNAs between the hours of 7 a.m. and 10 p.m. Noise from electrical substations are exempt in all EDNAs and are without time restrictions. Sounds originating from temporary construction sites are exempt from noise limits except from 10 p.m. to 7 a.m. in residential areas.

A new transmission line in Washington state would not increase the ambient audible noise level along the transmission line route or in any of the substations. Installation, construction, and maintenance of the transmission line would comply with state noise regulations.

5.13 Emission Permits under the Clean Air Act

5.13.1 Class I – Protected Areas

The Federal Clean Air Act as revised in 1990 (PL 101-542, 42 USC 7401) requires the EPA and states to carry out programs intended to assure attainment of the National Ambient Air Quality Standards. In Washington, EPA has delegated authority to the Washington Department of Ecology.

Section 160 of the Clean Air Act requires the protection, preservation, or enhancement of air quality in national parks, wilderness areas, and monuments. The 1977 Clean Air Act amendments called for a list of existing areas to be protected under Section 160. These are called Class I (one) areas (40 CFR 81 Subpart

D). No Class I areas are located in or near the study area (see Section 3.13, *Air Quality*).

5.13.2 Permits for Open Burning

The state of Washington regulates outdoor burning. The purpose of this rule (173-425 WAC) is to eliminate open burning during periods of impaired air quality and in PM-10 and carbon monoxide nonattainment areas as well as in populated regions. BPA does not expect to conduct any outdoor burning.

5.13.3 General Conformity Rule

The General Conformity Rule (40 CFR Part 51, Subpart W, 40 CFR Part 93 Subpart B, and 40 CFR Section 6.303) assures that federal actions do not interfere with state programs to improve air quality in nonattainment areas. Because none of the alternatives are within a nonattainment area, they are not subject to General Conformity Requirements.

5.14 Discharge Permits under the Clean Water Act

For Your Information

*The **Clean Water Act** is also known as the federal Water Pollution Control Act.*

The **Clean Water Act (CWA)** regulates discharges into waters of the United States. Several sections of the CWA apply to the project as further described.

5.14.1 Section 401

Section 401 of the CWA requires that states certify compliance of federal permits and licenses with sate water quality requirements. A federal permit to conduct an activity that results in discharges into waters of the United States is issued only after the affected state certifies that existing water quality standards would not be violated if the permit were issued. The Washington Department of Ecology would review permits for compliance with state water quality standards.

5.14.2 Section 402

Section 402 of the CWA authorizes stormwater discharges associated with industrial activities under the National Pollutant Discharge Elimination System (NPDES). In Washington, EPA has a general permit authorizing federal facilities to discharge stormwater from construction activities disturbing land of 5 or more acres into waters of the U.S., in accordance with various set conditions. BPA would comply with the appropriate conditions for this project, such as issuing a Notice of Intent to obtain coverage under the EPA general permit and prepare a Storm Water Pollution Prevention (SWPP) plan.

The SWPP plan helps ensure that erosion control measures would be implemented and maintained during construction. The SWPP plan would address best management practices for stabilization, stormwater management, and other controls (see Section 4.1.4, *Recommended Mitigation*).

5.14.3 Section 404

Authorization from the U.S. Army Corps of Engineers is required in accordance with the provisions of Section 404 of the CWA when there is a discharge of dredged or fill material into waters of the U.S., including wetlands. This includes excavation activities that result in the discharge of dredges material that could destroy or degrade waters of the U.S.

Wetlands within the study area are relatively few and primarily associated with creeks (see Sections 3.2 and 4.2, *Floodplains and Wetlands* and Section 5.7, *Floodplain/Wetland Assessment*). Construction, operation, and maintenance of the project is not expected to significantly affect the long-term existence, quality, or natural and beneficial values of the wetlands involved.

5.15 Underground Injection Permits under the Safe Drinking Water Act

The Safe Drinking Water Act of 1974 (42 USC sec 300f et seq.) is designed to protect the quality of public drinking water and its sources. BPA would comply with state and local public drinking water regulations. None of the alternatives would affect any sole-source aquifers or other critical aquifers or adversely affect any surface water supplies.

5.16 Permits from the Army Corps of Engineers

The U.S. Army Corps of Engineers administers several permit programs, of which Section 404 of the Clean Water Act would apply. Section 404 is described in Section 5.14.3, *Section 404*.

The Corps' authorization is also required under Section 10 of the Rivers and Harbors Act for work or placement of structures below the ordinary high-water mark of, or affecting, navigable waters of the U.S. None of the alternatives that cross the Columbia River, a navigable stream; would have structures placed below the ordinary high water mark. The Corps also authorizes the acceptable clearances for conductors crossing navigable waters. BPA would coordinate with the Corps to get conductor height approval.

5.17 Crossing State Lands

5.17.1 Department of Natural Resources (DNR)

Each alternative would cross lands administered by DNR. These lands, for which there are no specific land management plans, are considered transition lands and have been designated for agricultural purposes. They are managed for the highest and best land use, which may be as agricultural crop fields or as open rangeland (G. Sheldon).

DNR's policy is to issue upland right-of-way easements for transmission lines crossing DNR lands. The sale or granting of such easements across state lands is subject to review under SEPA. DNR may adopt an environmental analysis prepared under NEPA by following WAC 197-11-600 and WAC 197-11-630 (WAC 97-11-610) or may prepare separate documents in accordance with SEPA regulations.

5.17.2 Washington Department of Fish and Wildlife (WDFW)

Alternative 1A would cross the western edge of the Lower Crab Creek Wildlife Area, which is administered by WDFW. There are no specific management plans for this area. However, as a general rule the area is managed according to wildlife priorities, with preserving endangered species habitat and priority wildlife habitat as the first two land use management priorities. Other land use activities are permitted in those areas where such activities are deemed compatible with the preservation efforts (R. Kent, pers. comm., 2001).

WDFW's policy is to issue upland right-of-way easements for transmission lines crossing WDFW lands.

5.18 Crossing Federal Lands

5.18.1 U.S. Bureau of Land Management

Prior to construction of the new transmission line on BLM-administered lands, BPA would obtain right-of-way from the BLM. BLM must approve and issue a Right-of-Way Grant authorizing the construction and maintenance for the new transmission line. Typically, a Plan of Development is submitted with the Right-of-Way Application that thoroughly describes the project and its associated impacts. A Temporary Use Permit would also be obtained for additional area necessary for construction, material stockpiling, access, and so forth.

5.18.2 Yakima Training Center (YTC)

A permit to construct and operate a transmission line across the YTC would be required.

5.18.3 USDOE Approvals

USDOE must give approval to projects that cross the Hanford Site. A Use Request is submitted to the Real Estate Officer (REO), who determines if the project is an Allowable Use or a Special Use. If it is a Special Use, the REO submits it to the Site Planning Advisory Board (SPAB) for approval, approval with conditions or denial. If the project is an Allowable Use, or a Special Use that the SPAB recommends for approval, the REO coordinates the Use Request processing with the NEPA compliance officer. The NEPA compliance officer reviews and approves the EIS and coordinates with other permit processes, including SEPA.

5.18.4 U.S. Fish and Wildlife Service (USFWS)

USFWS must issue a right-of-way easement for the project to cross either the Columbia National Wildlife Refuge or the Hanford Reach National Monument. A determination of compatibility with the refuge legislation must also be issued.

5.18.5 U.S. Bureau of Reclamation (BOR)

The BOR and the BPA entered into a Memorandum of Understanding (MOU) in 1944 that allowed BPA to construct transmission lines across BOR lands and canals. To obtain permission for the project (the Preferred Alternative and Alternatives 1 and 1A) to cross BOR lands and canals, BPA would have to submit a map and narrative describing the location of the proposed route. BOR would then write a supplement to the 1944 MOU that would allow the construction and operation of the transmission line. Both the Yakima office and the Ephrata office would need to be contacted to conduct these MOU supplements.

5.19 Notice to the Federal Aviation Administration

As part of transmission line design, BPA seeks to comply with Federal Aviation Administration (FAA) procedures. Final locations of structures, structure types, and structure heights are submitted to FAA for the project. The information includes identifying structures taller than 200 feet above ground, and listing all structures within prescribed distances of airports listed in the FAA airport directory. BPA also assists the FAA in field review of the project by identifying structure locations. The FAA then conducts its own study of the project, and makes recommendations to BPA for airway marking and lighting. General BPA policy is to follow FAA recommendations.

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Chapter 6 — EIS Preparers

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STEVEN TROMLY, CRM Archaeologist, Confederated Tribes of the Colville Reservation History/Archaeology Department. Responsible for reporting. Education: M.A. Anthropology. Experience: Over fifteen years in federal agency, private and self-employed CRM consulting firms, also as forensic specialist.

IVY TYSON, Project Engineer, BPA. Responsible for transmission line engineering including line siting, tower spotting, tower siting, and conductor sagging. Education: B.S., Mechanical Engineering. Experience: Six years' experience in facilities engineering, four years' transmission line design engineering and project management. With BPA since 1990.

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MARIAN A. WOLCOTT, Realty Specialist, BPA. Responsible for property value analysis. Education: B.S., Forest Management. Experience: Forestry appraisal and Land Branch project coordination; with BPA as a contractor and employee since 1985.

Chapter 7 — EIS Recipients

The project mailing list contains over 4,000 potentially interested or affected landowners; tribes; local, state, and federal agencies; utilities; public officials; interest groups; businesses; special districts; libraries; and the media. They have either directly received or been given instructions on how to receive all project information that is currently available, and will have the opportunity to review the Draft and Final EIS.

Federal Agencies

- U.S. Army Corps of Engineers
- U.S. Bureau of Land Management
- U.S. Bureau of Reclamation
- U.S. Department of Energy
- U.S. Department of Natural Resources
- U.S. Department of the Army
- U.S. Environmental Protection Agency
- U.S. Fish & Wildlife Service
- U.S. General Service Administration
- U.S. National Marine Fisheries Services

Tribes or Tribal Groups

- Colville Confederated Tribes
- Umatilla Confederated Tribes:
  - Department of Natural Resources
  - Economic Development Power Plant Project
- Nez Perce Tribe
- Wanapum Band
- Yakama Nation

State Agencies, Washington

- State of Washington Department of Ecology
- State of Washington Department of Fish & Wildlife
- State of Washington Department of Natural Resources
- State of Washington Department of Social and Health Services (DSHS)
- State of Washington Department of Transportation
- Washington State Patrol

Public Officials, Washington

- Federal Congressional Representatives:
  - Maria Cantwell
  - Patty Murray
  - Doc Hastings
  - George R. Nethercutt, Jr.
- Governor Gary Locke
- State Senate:
  - Linda Evans-Parlette
  - Harold Hochstatter
  - Alex Deccio
  - Jim Honeyford
  - Patricia Hale
- State Representatives:
  - Gary Chandler
  - James Clements
  - Joyce Mulliken
  - Mary Skinner
  - Bruce Chandler
  - Barbara Lisk
  - William Grant
  - Dave Masten
  - Jerome Delvin
  - Shirley Hankins

Local Governments, Oregon

- City of Sublimity

Local Governments, Washington

- Cities of:
  - Beverly
  - Ellensburg
  - Moxee
- Counties of:
  - Benton
  - Franklin
  - Grant
  - Kittitas
  - Yakima
- Ports of:
  - Mattawa
- Fire District #8 (Mattawa, WA)
- Fire District #10 (Royal City, WA)

- Fire Protection District #4 (Yakima, WA)
- Kittitas County Hospital District 1

Businesses

- 3-B Farms
- 77 Inc.
- A&J Farms, Inc.
- AB Hop Farms
- ACL Company, LLC
- AHG Related Properties, LLC
- Alamo Orchard
- Alderman Partnership
- Altos EZ Mat Inc.
- Allstate Insurance Company
- Anchor JM LTD Partnership
- Anderson & Anderson
- Anderson Corporation
- Anderson Development Properties, LLC
- Anderson Hay & Grain Company
- Anderville Farms Inc.
- Argentea Environmental
- Auvil Fruit Company
- Avenir Corporation
- B&W Enterprises
- BT Loftus Ranches, Inc.
- Bank of America
- Bank of New York
- Bar 14 Ranch House Restaurant
- Belsaas & Smith, Inc.
- Beneficial Mortgage Company
- Bob Kelley Realty, Inc.
- Boulder River LLP
- Bowers Field Airport
- Brookwood Associates
- Brothers Ventures LLP
- Brown Boy Feed Inc.
- Brown Brothers
- Burk Wahluke Enterprises

- Burlington Northern and Santa Fe Railway
- Byrd & Barnes Partnership Columbia LLC
- C&C LLC
- Calaway Trading Inc.
- Caribou Land & Cattle Inc.
- Cascade Hop Farms LLC
- Cascade Manor Associates
- Central Washington Mental Health
- Charlton Kimball Company
- Circle B Farms
- Cliffacres Orchards Inc.
- CMA Motels Inc.
- Columbia Fruit Holdings LLC
- Columbus Properties LLC
- Coombs Ranch PTN
- Copeland Lumber Yards Inc.
- Coventry Vale Winery, Inc.
- CP Northwest LLC
- Crescent Properties Inc.
- Crosier Orchards Inc.
- D&A Properties
- D&D Orchards
- D&M Motors Inc.
- D M Construction Inc.
- David Evans & Associates
- Davidson Building Partnership
- Den Beste Farms
- Desert Rose LLC
- Desserault Ranch Inc.
- Docs A Partnership
- Dry Creek Acres LLC
- DSC Properties LLC
- Ecorehab
- Elbee Orchards LLC
- Elkhorn Ranch
- Ellensburg Lamb Company Inc.
- Ellensburg Market Poperties Inc.

- Ellensburg Poperty LLC
- Equilon Enterprises LLC
- Fairway Investments LLC
- Faltus Motor Company Inc.
- Faust & Rudolph LLC
- First Interstate Bank of Washington
- Flying X Ranch
- Frontier Tavern
- Four Feathers Fruit Company
- G&F Investments
- Gallery One
- Graf Investments Inc.
- Grebb Johnson Reed & Wachsmith
- Gunning Casteel Real Inc.
- Halverson & Applegate PS
- Hammerstad Holdings
- Harris Farms Inc.
- Hatlestad Investments Inc.
- HFSC Funeral Services of Washington Inc.
- HG White Family Enterprises
- Hill Toppers
- Household Finance Corporation III
- Huntington Court Housing Associates
- Integrated Resource Consultants
- J E M B Investment Corporation
- Jeff Gamache Farms Inc.
- Jon B. Jolly Inc.
- Jumpin Jack
- Kayser Ranch Inc.
- KB Farm Inc.
- Kelleher Motor Company
- King Fuji Ranch, Inc.
- Kittitas Company Publishing LLC
- Kittitas Valley Bank #1
- Kittitas Valley Land Developers LLC
- Krugel & Associates
- L&C Dynasty

- L&E Limited Partnership
- L&M Farms, Inc.
- Land Development Pro & Services
- Lands Associates
- Legal Properties
- Lenseigne & Lenseigne
- Lenseigne Farms
- Les Schwab Tire Center
- Libenow Properties LLC
- Main Street Square LLC
- Martinez Simon Livestock, Inc.
- Matson Fruit Company
- McDonalds Corporation
- Mc Dougall & Sons Inc.
- McDowell Properties LLC
- McNeight Express Inc.
- Medical Eye Care
- MF Williams Construction Company
- Midstate Aviation, Inc.
- Miller's Refrigeration and Appliance Service
- Moriah Valley Enterprises Inc.
- Mountain River Ranch Corporation
- MTA Holdings LLC
- Myers Partnership
- National Food Corporation
- NHD Company LLC
- N W L Ranch, Inc.
- Ocwen Federal Bank FSB
- Okan-Sea Transport Company Inc.
- Okanogan Seattle Transportation
- Pacific Exchange Company
- Pacificorp
- Palace Restaurant Inc.
- Par Five Inc.
- Paradise Investments
- Parsons Brinckerhoff, Inc.
- Pautzke Bait Company Inc.

- Peter J Young & Son
- Phoenix Group
- Pine Street Station Investment Group
- PJ Taggares Company
- Plath Orchard Company
- PM Management Inc.
- Preston Gates & Ellis
- Prudential Insurance Company
- R&A Eckenberg Farms
- Raven Orchard LLC
- RJ Wilson Steel
- RNKC LLC
- Roche Pomona Orchards
- Rockside Development Corporation
- Rocky V Orchard
- Rosewood Development DBA Greywolf Properties
- Roundup Company
- Roy Farms Inc.
- Safeway Stores Inc.
- Saint Michelle Vintners Inc.
- Samis Land Company
- Saratoga Passage Development
- Schaake Packing Company
- Seco Financial Group Inc.
- Security National Properties, LP
- Sentinel Gap Water Association
- Shaw Chiropractic Center
- Shushuskin Properties
- Signal Investments & Champion Pac & Dekk Associates
- Silver Dollar Cafe
- Simon Martinez Livestock, Inc.
- Singh Inc.
- Six B Farms LLC
- Sonrise Orchards
- South Eighty Orchards PTN
- Stalder Interests Inc.
- Sterling Savings Association

- Stockdale Inc.
- Sun Air Aviation
- Sundown M Ranch, Inc.
- Sundquist Fruit & Cold Storage Inc.
- Sunfresh, Inc.
- Sweetgrass Investments LLC
- T. Dan Bracken, Inc.
- Taco Bell of America Inc.
- Tandem Builders Inc.
- Taylor Investment Group Ltd
- Teisseire Associates
- Time Oil Company
- Tire Centers Inc.
- TNT Orchard LLC
- Tower Investments
- Town Investments LLP
- Transhumance Inc.
- Tum A Lum Lumber Company
- Twin City Foods Inc.
- United Builders of Washington Inc.
- University Place LLC
- U.S. Bancorp 2701
- V Nickel & Associates Inc.
- Van de Graaf Ranches Inc.
- Van Horn Farms Inc.
- Voshall Mini Storage and Voshall Electric
- Wahluke Hay & Supply Company
- Ward Rugh Inc.
- Washington Fruit & Produce Company
- Washington Waste Haul & Recycling Inc.
- Wells Fargo Bank
- Welsh Etter Investment Company
- Wenatchee Petroleum Company
- West Ranch Development
- Western Feed Supplements Inc.
- Windermere Real Estate
- Winding Brook Corporation No. 71

- Winegar's Drive In Dairy
- Wondrack Distributing
- Woods Hardward Inc.
- WW & Association
- Wyckoff Farms, Inc.
- Y J LLC
- Yakima Federal Savings and Loan
- Yakima Independent Medical Service
- Yakima Pomona Mobile Home Park Inc.
- Yakima Ranches LTD
- Yakima Sunny Acres Estates LLC
- Yamaha of Ellensburg Inc.
- Young Orchards
- Zirkle Fruit Company

Utilities

- Benton Rural Electric Association
- Ellensburg Telephone Company Inc.
- Franklin County PUD No. 1
- Grant County PUD No. 2
- Kittitas County PUD No. 1
- Kittitas Reclamation District
- Midstate Electric Coop Inc.
- Northwest Pipeline Corporation
- Puget Sound Energy, Inc.
- Transmission Agency of Northern California
- United Telephone Company of Northwest

Interest Groups

- Assemblies of God
- Bethel Gospel Tabernacle
- Catholic Bishop of Yakima
- Catholic Cemetery
- Children's Activity Museum of Ellensburg
- Christian and Missionary Alliance Church
- Church of God
- Church of Jesus Christ
- Church of Jesus Christ of Latter Day Saints

- Church of the Nazarene
- Clymer Foundation
- Coyote Creek Owners Association
- Eagles Lodge No. 2220
- Ecumenical Church of Ellensburg
- Ellensburg Masonic Temple Association
- First Baptist Church
- First Christian Church
- First Lutheran Church of Ellensburg
- First United Methodist Church
- Friends of Earth
- Great Roundup Cowboy Church
- I O O F Lodge 20
- Kamiakin Village Association
- Kittitas County Cattlemen's Association
- Kittitas County Historical Society
- Kittitas Valley Rifle Club
- League of Women Voters
- Lower Columbia Basin Audubon Society
- Loyal Order of Moose
- New Hope Korean Presbyterian Church
- Northwest Energy Coalition
- NRCB Hampton Court Government Management
- Pacific Northwest Association of Church of God
- Parkland Condo Owners Association
- Sierra Club
- SRE-1 Skippers of Ellensburg
- Trail's Edge Homeowners Association
- United Pentecostal Church
- Upper Columbia Corporation of Seventh Day Adventists
- Washington State Jaycees Foundation
- Wheat Grower's Association
- Wilderness Society of Washington
- Willows Condo
- Yakima Jaycees
- Yakima Ranch Owners Association
- Yakima River Alliance

- Yakima Rock and Mineral Club
- Yakima Valley Audubon Society
- Yakima Valley OIC
- Yakima Valley Sportsman Association

Libraries and Schools

- Benton City Library
- Central Washington University
- Eastern Washington University
- Ellensburg School District 401
- Kittitas Public Library
- Richland Public Library
- School District #160, Royal City, WA
- USDOE Reading Room at Washington State University, Tri-Cities
- Washington State University
- Yakima Valley Regional Library

Media

- ECTV
- Ellensburg Daily Record
- KIMA TV
- Mattawa Area News
- Tri City Herald
- Yakima Herald Republic

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http://www.wa.gov/dnr/htdocs/fr/nhp/refdesk/lists/plantrnk.html
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Data Sources for Maps

Map 1: Bonneville Power Administration Regional GIS Database. Hanford Monument Data provided by Bechtel.

Map 2: Bonneville Power Administration Regional GIS Database. Washington Department of Natural Resources Major Public Lands, June 2001.

Map 3: Bonneville Power Administration Regional GIS Database. Street Identification from DeLorme Street Atlas 6.0.

Map 4: Bonneville Power Administration Regional GIS Database. Flood Hazard data from Federal Emergency Management Agency (FEMA), Q3 flood data. Watershed boundaries from U.S. Geological Survey.

Map 5: Bonneville Power Administration Regional GIS Database. Washington Department of Natural Resources, Natural Heritage Program GIS data set May 2001. USFWS National Wetlands Inventory.

Map 6: Bonneville Power Administration Regional GIS Database. Fish Bearing Waterbodies for Parsons Brinckerhoff.

Map 7: Bonneville Power Administration Regional GIS Database. Washington Department of Natural Resources Major Public Lands, POCA data, June 2001. Hanford Site boundaries provided by Bechtel.

Map 8: Bonneville Power Administration Regional GIS Database. Hanford Site boundaries provided by Bechtel.

Map 9: Bonneville Power Administration Regional GIS Database. 30 Meter National Land Cover Data from cooperative project by U.S. Geological Survey and the U.S. Envrionmental Protection Agency. May 2000.

Map 10: Bonneville Power Administration Regional GIS Database. Visual Information provided by Parsons Brinckerhoff.

Map 11: Bonneville Power Administration Regional GIS Database. Cultural Areas provided by Confederated Tribes of the Colville Reservation History/Archaeological Department.

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Chapter 9 — Glossary and Acronyms

This chapter contains a list of acronyms, abbreviations, and technical terms used in this EIS. Words that would be defined in a desk-size dictionary (for example, the College Edition of the American Heritage Dictionary) are not included.

Acronyms and Abbreviations

Ac	acre
Army Corps	U.S. Army Corps of Engineers
ACEC	Areas of Critical Environmental Concern
ALE	Fitzner-Eberhardt Arid Lands Ecology Reserve
ARPA	Archeological Resources Protection Act
ATV	all terrain vehicle
BA	Biological Assessment
B&O	Business & Occupation Tax
BLM	U.S. Bureau of Land Management
BMP	Best Management Practices
BOR	U.S. Bureau of Reclamation
BPA	Bonneville Power Administration
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
CLUP	Comprehensive Land Use Plan
cm	centimeter
CNRMP	Cultural and Natural Resources Management Plan
CO	carbon monoxide
CO_2	carbon dioxide
CRP	Federal Conservation Reserve Program
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dBA	decibels (A-weighted)
DEIS	Draft Environmental Impact Statement
DNR	Washington State Department of Natural Resources
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOR	Washington State Department of Revenue
DPS	Distinct Population Segment
DSI	Direct Service Industries
EDNA	environmental designation for noise abatement
EIS	Environmental Impact Statement
EMF	Electric and magnetic fields
EMI	Electromagnetic interference
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FAA	Federal Aviation Administration

FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FIRM	Flood Insurance Rate Maps
FPPA	Farmland Policy Act
ft	feet
GIS	Geographic Information System
GMA	Washington State Growth Management Act
GPS	Global Positioning Systems
ha	hectares
HPA	Hydraulic Project Approval
IPM	integrated pest management
kV	kilovolt
m	meter
mA	milliampere
mG	milligauss
MOU	Memorandum of Understanding
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NESC	National Electrical Safety Code
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NHRP	National Register of Historic Places
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NWI	National Wetland Inventory
NWP	Nationwide Permit
NWR	National Wildlife Refuge
OAHP	Washington State Office of Archaeology and Historic Preservation
ORV	off-road vehicle
PCB	polychlorinated biphenyl
PHS	Priority Habitats and Species
PT	Potential Transformer
RAS	Remedial Action Scheme
RCRA	Resource Conservation and Recovery Act
REA	Rural Electric Association
REO	Real Estate Officer
RI	Radio Interference
ROD	Record of Decision
ROW	Right-of-Way
RMP	Resource Management Plan
RV	Recreational Vehicle

SEPA	Washington State Environmental Policy Act
SGCA	Western Sage Grouse Conservation Agreement
SHPO	Washington State Historic Preservation Officer
SMA	Shoreline Management Act
SPAB	Site Planning Advisory Board
SWPP	Storm Water Pollution Prevention Plan
TCP	Traditional Cultural Property
TNC	The Nature Conservancy
TSCA	Toxic Substances Control Act
TSD	Treatment, storage, and disposal
TVI	Television Interference
USDOA	U.S. Department of Army
USDOE	U.S. Department of Energy
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
WAC	Washington Administrative Code
WDOE	Washington Department of Ecology
WNHP	Washington Natural Heritage Program
WDFW	Washington Department of Fish and Wildlife
WSA	Wilderness Study Area
WQL	Water Quality Limited
YTC	Yakima Training Center

TECHNICAL TERMS

Alevin: a recently hatched juvenile fish still residing in the gravel of a stream.

Alluvium: sedimentary material deposited by flowing water as in a delta or riverbed.

Alternating current: an electric current that reverses directions at regular intervals..

Ambient noise: noise levels of the surrounding area.

Anadromous: fish that migrate up rivers from the sea to breed in fresh water.

Anticline/Anticlinal: an arching fold in layered rocks.

Aquifer: a layer of underground sand, gravel, or spongy rock in which water collects.

Aspect: when referring to vegetation, the direction a slope is facing.

Background: over five miles from the viewer

Basalt lithosols: soils with very high rock content.

Bay: an area set aside in a substation for special equipment.

Best Management Practices: a practice or combination of practices that are the most effective and practical means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

Biodiversity: different species of plants and animals in an environment.

Biological crust: groups of living organisms that coat the soil or live just below the soil surface. Some components of biological crusts include algae, blue-green algae, bacteria, lichens, mosses, liverworts, and fungi. These organisms give the soil surface a crunchy texture and a bumpy appearance, making the soil appear darker than soils without crusts. Biological crusts are beneficial because they stabilize soil, prevent wind erosion, increase soil fertility, and inhibit germination, which helps decrease invasion by non-native species.

Blackout: the disconnection of the source of electricity from all electrical loads in a certain geographical area.

Breaker: a switching device that can automatically interrupt power flow on a transmission line at the time of a fault, such as a lightning strike.

Brownout: a partial reduction of electrical voltages that causes lights to dim and motor-driven devices to lose efficiency.

Buffer area: a strip of vegetation surrounding a stream or wetland that provides habitat for wildlife, reduces or traps sediments, and slows runoff velocity.

Buswork: a generic term to describe all equipment associated with the bus tubing. Bus tubing is rigid aluminum pipes used within a substation to move electricity. The tubing is supported and vertically elevated by pedestals called bus pedestals.

Class 1 areas: Section 160 of the federal Clean Air Act requires the preservation, protection, and enhancement of the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic or historic value. The 1977 Clean Air Act amendments called for a list of existing areas to be protected under section 160.

Class A Weeds: weeds that have a limited distribution in the state, and state law requires eradication of these species.

Class B Weeds: noxious weeds that are not native to the state and are of limited distribution or are unrecorded in a region of the state and that pose a serious threat to that region.

Class C Weeds: widely established and have interest to the agricultural industry. Some of these weeds are controlled on a local basis, depending on local threats and the feasibility of control.

Clean Water Act (CWA): regulates discharges into waters of the United States. Also known as the federal Water Pollution Control Act.

Colluvium: soil and/or rock fragments moved by creep, slide, local wash and deposited at the base of steep slopes.

Columbia River Basalt Group: composed of the Grand Ronde Basalt and the overlying Wanapuma and Saddle Mountains Basalt. Comprises most of the aquifer system (USGS 1994).

Complex: a specific watershed area within the YTC. The YTC is divided into ten complexes.

Corona: the partial electrical breakdown of the insulating properties of air around the conductors of a transmission line. In a small volume near the surface of the conductors, energy and heat are dissipated. Part of this energy is in the form of small local pressure changes that result in audible noise. Corona-generated audible noise can be characterized as a hissing, crackling sound.

Cultural resources: those historic and archaeological properties, properties of traditional and cultural significance, sacred sites, Native American human remains and associated objects, and cultural landscapes which are entitled to special consideration under federal statute, regulations, and/or executive orders.

Cumulative impacts: impacts created by the incremental effect of a specific action when added to other past, present, or reasonably foreseeable future actions.

Current: the amount of electrical charge flowing through a conductor.

DDE: product of the metabolic breakdown of DDT by an organism.

Dead-end structure: transmission line towers that equalize stresses on the conductors and are made of heavier gauge steel. Normally located at angle points and large spans.

Debitage: the flaking by-products that result from working rough stone into tools.

Dedicated Recreation: recreation activities that are limited to a finite geographic location and are supported by improvements that commit the resource to a specific recreational activity.

Dedicated Recreationalist: those who participate in recreational activities within the study area and are limited to a finite geographic location.

Demographic: information relating to the dynamic balance of a population, especially with regard to density and the capacity for expansion or decline.

Direct Service Industries: This group of high-electricity use manufacturers includes 10 aluminum plants, a chlorine manufacturer and a couple of smaller metal producers. The DSI's purchase their power directly from the Bonneville Power Administration, rather than from utilities.

Dispersed Recreation: recreation activities that are not limited to a finite location. These types of activities do not require improvements that commit resources to a particular type of recreation.

Distinct Population Segment (DPS): a portion of a species or subspecies that occurs in a certain area.

Double-circuit: towers that hold conductors for two transmission lines.

Electric and magnetic fields (EMF): the two kinds of fields produced around the electric wire or conductor when an electric transmission line or any electric wiring is in operation.

Electromagnetic interference (EMI): a high-frequency noise caused by corona that can cause radio and television interference.

Emergent wetlands: wetlands dominated by herbaceous plants.

Endemic: a naturally occurring species that is limited to a particular geographic area.

Energization date: when the project has been built and is operational.

Environmental Impact Statement (EIS): a document that discloses the environmental impacts of a proposed action and alternatives.

Ephemeral wetlands: wetlands that are only filled with water for a brief time during the spring.

Evolutionarily Significant Unit (ESU): a set of populations with a distinct evolutionary history.

Excise taxes: internal taxes imposed on the production, sale, or consumption of a commodity or the use of a service.

Executive Order on Environmental Justice (Executive Order 12898): enacted in February 1994 to ensure that federal agencies do not unfairly inflict environmental harm on economically disadvantaged and minority groups within the United States or any of its territories.

Extirpated: no longer existing or living in a given geographic area.

Federal actions: can include projects that receive federal funding or require a federal permit.

Federal species of concern: species that may be rare or declining, but are not formally listed under the Endangered Species Act.

Federally listed, proposed, or candidate species: species designated or in the process of being designated under the Endangered Species Act as endangered or threatened.

Floodplain: areas that have a one-percent chance of being flooded in a given year are designated as 100-year floodplains.

Forested wetlands: wetlands with a tree canopy.

Flyway: a path of migration for many different species of birds.

Forage: food for domestic animals, i.e., cattle, sheep, etc.

Forbs: any herb other than grass.

Foreground: within 0.25 to 0.5 miles of the viewer

Forested wetlands: wetlands with a tree canopy.

Full-bench road construction: cutting into the hillside to accommodate the whole road prism.

Gauss: a unit of magnetic induction.

Greenhouse gases: gases contributing to global warming. Greenhouse gases include: water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ground level ozone (and the pollutants which generate ground level ozone), and stratospheric ozone depleting substances such as chlorofluorocarbons and carbon tetrafluoride. CO_2 is the most common greenhouse gas in the atmosphere. Greenhouse gases warm the atmosphere by absorbing infrared radiation given off by the earth, preventing heat loss to outer space.

Gully erosion: rapid erosion, usually in brief time periods, that creates a narrow channel which may exceed 100 feet in depth.

Harm: defined by the U.S. Fish and Wildlife Service as including significant habitat modification or degradation resulting in death or injury by significantly impairing behavioral patterns to the extent that normal behavior patterns (e.g., breeding, feeding, and sheltering) are disrupted.

Headwater: the source of the river.

High quality plant community: areas of native vegetation with little or no disturbance or exotic species.

High quality terrestrial ecosystem: an area must be dominated by native species, with little to no disturbance to vegetation, and have high ecological value, both in condition and viability, the ability to persist on a site.

High Visual Sensitivity: residential viewers who own property within 500' of the proposed corridors and are concerned about transmission structures and how they impact the view of the natural environment.

Incised: rivers that have carved a path through the bedrock of an area.

Intermittent stream: water flows only seasonally.

Interstitial spaces: spaces or openings in substrates that provide cover and habitat for bottom-dwelling plants and animals.

In-water work windows: times of year, determined by WDFD, when instream work is least likely to harm listed species.

Kilovolt (kV): one thousand volts.

kV/m: kilovolt per meter

Lacustrine: organisms that lived or grew in lakes.

Large woody debris recruitment potential: the potential for large trees to fall into the stream and provide fish habitat.

Lek: an open area where sage grouse gather in the spring to perform courtship dances.

Lithic: relating to stone tools.

Lithosols: rocky soils that usually develop in areas underlain by basalt.

Loess: a windblown deposit of fine-grained silt or clay.

Long-term socioeconomic impacts: the value of any agricultural crops taken out of production, interference with agricultural practices, reductions in the taxable land base, and the perceived effects on property values from new transmission and substation facilities.

Low Visual Sensitivity: most motorists who will only see the proposed transmission lines at limited locations from the roads that they are traversing.

Megawatt (MW): a unit of electrical power equal to 1 million watts.

Middleground: from the foreground to about five miles from the viewer.

Milliampere (mA): one thousandth of an ampere, a measure of electric current

Milligauss (MG): one thousandth of a gauss.

Miocene: a period in the Neogene lasting from 23 million years ago to 5 million years ago.

Mitigation: describes measures that could be taken to lessen the impacts predicted for each resource. These measures may include reducing or minimizing a specific impact, avoiding it completely, or rectifying or compensating for the impact.

Moderate Visual Sensitivity: some recreationalists, such as some bird watchers, some hikers and/or those whose recreational activity is specific to a finite geographic location, who are sensitive to man-made structures and how they impact the view of the natural environment.

Monoculture: the cultivation or growth of a single crop or organism, especially on agricultural or forest land.

Motorists: those traveling by automobile on an Interstate, State or local road within the study area.

Native American traditional cultural practices: can include gathering plants and roots for medicinal use and religious ceremonies.

Neogene: the geological period lasting from 23 million years ago to present day.

Neotropical: the biogeographic region that extends south, east, and west from the central plateau of Mexico.

Non-anadromous: fish that do not migrate to the sea and back during their life cycle.

Nonattainment area: a geographic region designated by EPA in which federal air quality standards are not or were not met by a certain date. There are six air pollutants that are monitored; particular matter (PM), carbon monoxide (CO), ozone (O3), nitrogen dioxide (NO2), sulfur dioxide (SO2), and lead (Pb).

North of Hanford: a designated area on the BPA transmission system, north of the Hanford Substation, that is used in transmission system studies.

Notice of Intent: for this project was included in the Federal Register (65 FR 77352). This publication publishes regulations and legal notices issued by federal agencies.

Noxious weeds: particularly troublesome weeds designated by Washington State law. The list of noxious weed species is divided into three classes (A, B, and C) within each county, based on the state of invasion.

Outage: a transmission line that is not in service, either planned or unplanned.

PCB: a family of industrial chemical compounds, noted as an environmental pollutant that accumulates in animal tissue.

Pacific Flyway: The path of migration for many different species of birds.

perennial stream: flows throughout the year.

Physiography: the study of the structure and phenomena of the earth's surface.

Plant communities (also known as plant associations): assemblages of species that grow together in similar habitats and are found repeated across the landscape.

PM-10: particulate matter having a nominal aerodynamic diameter less than or equal to 10 microns.

Potential transformer (PT): a type of transformer that uses low-voltage to monitor the high-voltage system. The low-voltage output of this transformer is used for relaying and metering.

Power Circuit Breaks: a breaker is a switch device that can interrupt a circuit in a power system during overload or fault conditions.

Prime Farmland: land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, livestock, timber, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and/or labor. It does not include land already in or committed to urban development or water storage. (USDA, NRCS web page)

Reconductor: take the existing conductors off of the towers and replace them with new conductors.

Regime: refers to the pattern and direction of the flow of the river.

Residents: those whose primary residence is located within the study area.

Residuum: unconsolidated weathered mineral material that accumulated as consolidated rock and disintegrated in place.

Rill erosion: mild water erosion, caused by overland flow, producing very small and numerous channels.

Riparian: vegetated areas surrounding streams, rivers, lakes, or wetlands.

Rock Hounder: recreationalist in search of rocks, including petrified wood.

Salmonid: belonging to the family Salmonidea, including salmon, trout, and whitefish.

Scree: a loose rock slope, similar to a tallus slope.

Scrub-shrub wetlands: wetlands dominated by shrubby plants.

Section 303(d): under this section of the Federal Clean Water Act, certain streams are listed that do not meet current water quality standards.

Section 404: Section 404 of the Federal Clean Water Act regulates the discharge of solid materials, including building materials, into US waters.

Section 404 Removal/Fill permit: federal permit issued by the U.S. Army Corps of Engineers that regulates wetland area.

Sedge: any number of grasslike plants of the family Cyperaceae, having solid stems and leaves in three vertical rows.

Sediment deposition: sediment deposited on a streambank or streambed.

Sediment load: the amount of sediment moved by stream

Short-term socioeconomic impacts: those created by an influx of construction workers into a local area and the additional tax monies generated.

Shrub-steppe: habitat is a shrub and grass dominated community found in arid areas.

Single-circuit: towers that hold conductors for one transmission line.

Snag: a dead tree.

Southern Intertie: a collective group of transmission lines that move power north and south between Oregon and California.

Spilling: when dam gates are opened and water flows out. The water does not go through the turbines, which would injure fish.

Spring run-off: water from the snow melting in the spring adds to the amount of water flowing in the Columbia River.

Spur road: short road segments branching off the trunk roads that go to each structure if the structure is not located on a trunk road.

Steppe: habitat is a grass-dominated community found in arid areas.

Sub soiling: plowing or turning up the layer of soil beneath the topsoil.

Substation Dead-ends: structures within the confines of the substation where incoming and outgoing transmission lines end. Dead-ends are typically the tallest structures in a substation.

Suspension structure: transmission line towers that are used to elevate wires a safe distance above the ground on relatively straight stretches of a line without sharp angles.

Switches: devices used to mechanically disconnect or isolate equipment; found on both sides of circuit breakers.

System reliability: the ability of a power system to provide uninterrupted service, even while that system is under stress.

System useage optimizing: relieving congestion on constrained transmission paths to delay transmission reinforcement.

Tailrace: the part of the millrace below the turbine through which the spent water flows.

Take: to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct.

Talus: a rock strewn area.

Traditional cultural property (TCP): one that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs (e.g., traditions, beliefs, practices, lifeways, arts, crafts, and social institutions) of a living community that are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community.

Transmission capacity: the maximum load that a transmission line or network of transmission lines can carry under existing conditions.

Transmission line dead-end: the last transmission line structure on both the incoming and outgoing sides of the substation are called dead-end structures. These structures are built with extra strength to reduce conductor tension on substation dead-ends and provide addition reliability to the substation. Dead-end structures use more insulators and heavier steel than the other kind of structure, which makes them more visible. Dead-end structures also are more expensive than suspension structures.

Turbidity: a reduction in the clarity of water from suspended materials such as clay, mud, organic material, or other materials.

Viewshed: the area that is visible within the topographic horizon from a particular location.

Vision quest: a ceremonial rite for people seeking spiritual guidance; also a rite of passage for young men.

Visual resources: the physical features that make up the visible landscape, including land, water, vegetative, and man-made elements (Guidance Material, USDOT, undated).

Waterbar: smooth, shallow ditches excavated at an angle across a road to decrease water velocity and divert water off and away from the road surface.

Water quality limited: under Section 303(d) of the Federal Clean Water Act refers to streams that do not meet current water quality standards.

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Schultz-Hanford Area Transmission Line Project

Appendices

Bonneville Power Administration
U.S. Department of Energy

Bureau of Land Management
Bureau of Reclamation
Fish and Wildlife Service
U.S. Department of Interior

Department of Army
U.S. Department of Defense

February 2002

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Appendix A – Public Involvement

Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

December 12, 2000

In reply refer to: KEC-4

To: People Interested in the Schultz - Hanford Area Transmission Line Project

Bonneville Power Administration (BPA) is proposing to build a new transmission line that could affect you. This letter briefly explains what is being proposed, outlines our process and schedule, and invites you to meetings where you can learn more.

Proposal - BPA is proposing to construct a transmission line through central Washington. The new 500-kilovolt (kV) line would relieve constraints on several transmission lines across the state. It would also provide more operational flexibility so that BPA can meet its obligations to endangered salmon and maintain transmission capacity to import and export energy.

Alternatives - Possible transmission routes are in Kittitas, Yakima, Grant, and Benton Counties. (See attached map.) The proposed line would be constructed from Schultz Substation (near Ellensburg) to either a substation on the Hanford Reach National Monument within the Hanford Nuclear Reservation or a new substation just southwest of the Hanford Nuclear Reservation. Four alternative routes are being considered. All would require the purchase of new right-of-way.

- **Alternative 1** would parallel the existing 500-kV line that runs from Schultz Substation to Vantage Substation and on to Hanford Substation (called the Schultz-Vantage-Hanford line). The new line would be 200 to 2000 feet from the existing line. An option would be to end the new line at Ashe Substation. In that case, the new line would continue parallel to the existing Hanford-Ashe 500-kV line at a distance of 200 to 2000 feet.

- **Alternative 2** would parallel the existing Schultz-Vantage 500-kV line at a distance of 200 to 2000 feet. It would then parallel next to the existing Midway-Vantage 230-kV line to a new Blackrock Substation near Benton Rural Electric Association's existing Blackrock Substation.

- **Alternative 3** would parallel (at a distance of 200-2000 feet) the existing Schultz-Vantage 500-kV line to the west side of the Columbia River. The line would then turn south on new right-of-way to the new Blackrock Substation. In the area requiring new right-of-way, we have included a broad study area.

- **Alternative 4** would parallel the existing Columbia-Ellensburg-Moxee-Midway 115-kV lines that pass through Ellensburg and Yakima before ending at the new Blackrock Substation.

We are also considering not building a new line.

Public Meetings - We will soon start to assess the environmental impacts of the proposed alternatives. But before we do, we would like to hear from you. What questions do you have? What resources should we analyze? Are there other routes we should consider? We have scheduled open house public meetings to hear your ideas.

Tuesday, January 9, 2001 **4 to 8 p.m.**	**Wednesday, January 1, 2001** **4 to 8 p.m.**	**Thursday, Jan. 11, 2001** **4 to 8 p.m.**
Sage Brush Senior Center	Yakima County Courthouse	Hal Holmes Community Center
442 Desert Aire Drive	Room 420	201 North Ruby Street
Desert Aire, Washington	Yakima, Washington	Ellensburg, Washington

We do not plan to give a formal presentation at the meetings, so come anytime between 4 and 8 p.m. Several members of the project team will be available to answer your questions and listen to your ideas.

Other Ways to Comment - If you cannot come to one of the meetings, you can still comment. If you comment by January 25, 2001, we'll be able to incorporate your ideas into our environmental studies. Call BPA's toll-free comment line at 1-800-622-4519, and leave a message (please include the name of this project); send an e-mail to: comment@bpa.gov; or mail comments to Bonneville Power Administration, Public Affairs Officer - KC-7, P.O. Box 12999, Portland, Oregon 97212. You can use the enclosed form to submit comments if you like.

Process/Schedule - The information we gather in our environmental analysis will be published in a Draft Environmental Impact Statement that will be available for review and comment late next year. If you would like to receive a copy, please return the enclosed postcard and check whether you would like to receive it by regular or electronic mail. If you do not return the postcard, you will still receive notice when the study is available.

Once we have completed the environmental review, BPA will decide whether and how to proceed with the project. If BPA decides to proceed, construction would likely begin in 2004.

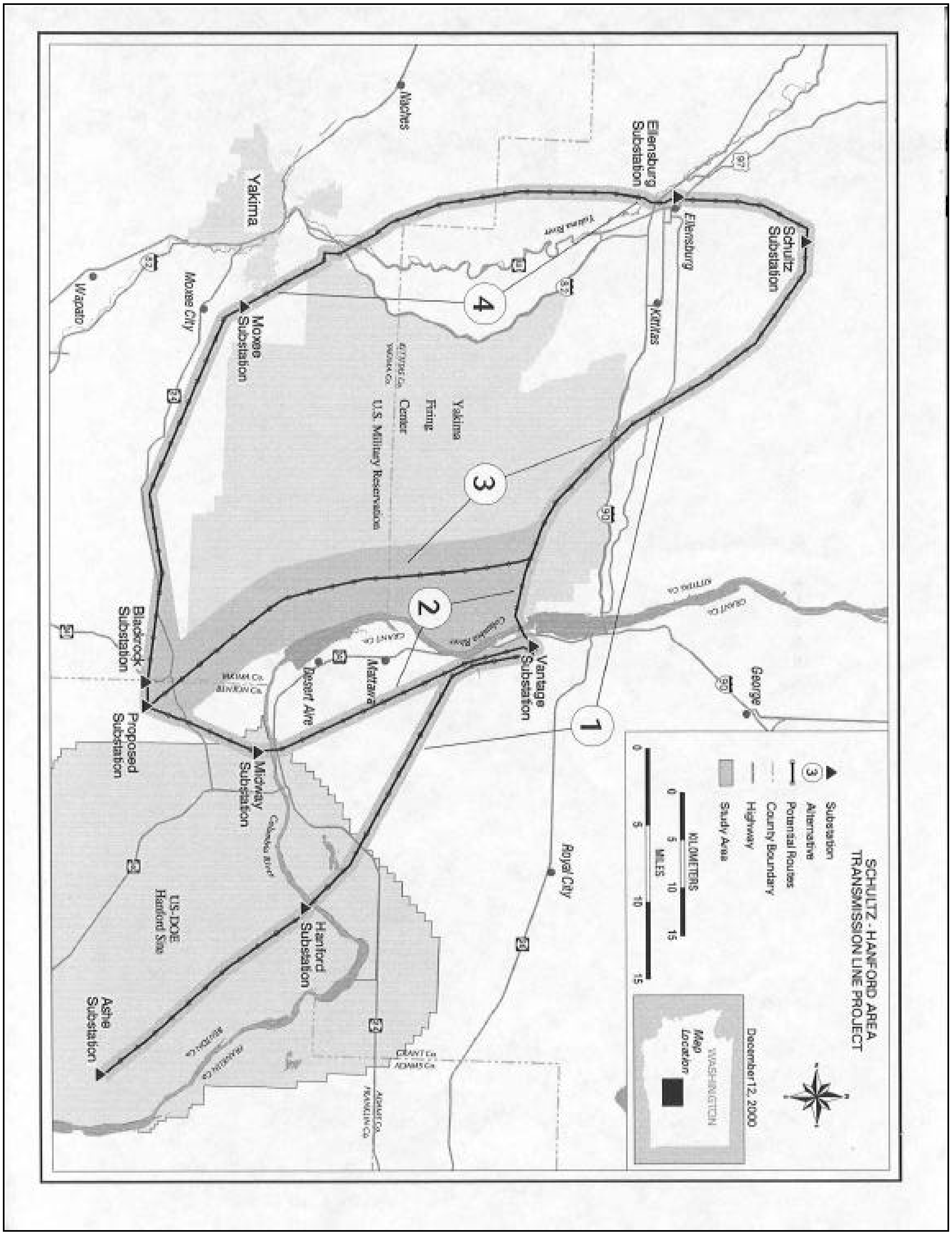
For More Information - If you have any questions about this proposal, please call me toll-free at 1-800-282-3713, at my direct number, (503) 230-5525; or send an e-mail to lcdriessen@bpa.gov.

Thank you for your interest in our work.

Sincerely,

Lou Driessen
Project Manager

3 Enclosures:
Map
Post Card
Comment Form



SCHULTZ - HANFORD AREA
TRANSMISSION LINE PROJECT
December 12, 2000
Substation
Alternative
Potential Routes
County Boundary
Highway
Study Area
KILOMETERS
MILES
0
5
10
15
WASHINGTON
Map Location
Ellensburg Substation
Schultz Substation
Ellensburg
Kittitas
Naches
Yakima
Moxee City
Moxee Substation
Wapato
Yakima Firing Center
U.S. Military Reservation
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B O N N E V I L L E   P O W E R   A D M I N I S T R A T I O N

Schultz-Hanford Transmission Line Project

"I'd Like to Tell You . . . "

1. When you develop alternative routes please consider ______

2. Please avoid areas like ______

3. Please be sure your environmental studies look at ______

4. I need more information about ______

5. I have these other comments ______

☐ Please put me on your project mailing list. (You are already on the mail list if you have received mailed notice.)

Name ______

Address ______

Please mail your comments by January 25, 2001 to:

Bonneville Power Administration
Public Affairs Office - KC
P.O. Box 12999
Portland, OR 97212

BONNEVILLE POWER ADMINISTRATION

Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

March 26, 2001

In reply refer to: KEC-4

To: People Interested in the Schultz - Hanford Area Transmission Line Project

Last December, Bonneville Power Administration (BPA) wrote to tell you about a proposed project that could affect you. We had proposed building a new transmission line in central Washington and were looking at four possible routes. We asked for your comments to help us refine the proposal. Response was great; we received over 1000 comments.

After reviewing your comments, we have made some changes to our proposal. We are no longer considering the option (formerly called Alternative 4) that went south and east from Schultz Substation, by Ellensburg, and around Yakima and Moxee. We estimated that the expenses associated with the needed right-of-way through developed land would be very high and this alternative became too expensive to be considered. We have also added an alternative to try to avoid some of the irrigated farmlands.

This letter briefly describes the alternatives we are still considering, outlines our next steps, and tells where to call if you have questions.

Proposal – BPA is still proposing to construct a transmission line through central Washington. The new 500-kilovolt (kV) line is needed to relieve constraints on several transmission paths (lines) across the state. It would add more transmission capability to move power from generation facilities in the northern Columbia River basin through central Washington. It would also provide more operational flexibility so BPA can meet its obligations to endangered salmon and maintain power transfer capabilities.

Alternatives – Possible transmission routes are in Kittitas, Yakima, Grant, and Benton Counties (See attached map). The proposed line would be constructed from Schultz Substation (near Ellensburg) to either a substation on the Hanford Reach National Monument within the Hanford Nuclear Reservation or a new substation just southwest of the Hanford Nuclear Reservation. Four alternative routes are being considered. All would require the purchase of new right-of-way.

- **Alternative 1** would parallel the existing 500-kV line that runs from Schultz Substation to Vantage Substation and on to Hanford Substation (called the Schultz-Vantage-Hanford line). The new line would be up to 1200 feet from the existing line. (BPA must separate major lines by as much as 1200 feet to meet electric reliability standards.) We have not yet decided which side of the existing right-of-way would be better, north or south.

- **Alternative 1A**, (just like Alternative 1), would parallel the existing 500-kV line from Schultz Substation to Vantage Substation. But a different route would be studied between Vantage and Hanford to avoid irrigated agricultural land. Instead, it would follow the southern edge of the Saddle Mountains and then parallel, at a distance of up to 1200 feet, the existing 500-kV Grand Coulee-Hanford line into Hanford.

- **Alternative 2** would also parallel the existing Schultz–Vantage 500-kV line at a distance of up to 1200 feet. It would turn south, parallel next to the existing 230-kV line to Midway Substation, then following another 230-kV line to a new Blackrock Substation near Benton Rural Electric Association's existing Blackrock Substation. We are looking at the possibility of tearing down the existing 230-kV line in places, and rebuilding it with a double-circuit line that would hold both the 230-kV line and the new 500-kV line.

- Alternative 3 would parallel, at a distance of up to 1200 feet, the existing Schultz–Vantage 500-kV line to the west side of the Columbia River. Before crossing the River, the line would head south on new right-of-way mainly across the Yakima Training Center to a new Blackrock Substation.

We are also considering not building a new line.

Public Comment Summary – In December and January, BPA received 1031 comments on this proposed project. Most (63 percent) were given at public meetings we had in January. We also received comments by mail, phone, and e-mail.

Most comments (71 percent) focused on the alternatives (316) or expected environmental impacts (415). Most people commented on impacts of a new transmission line to agricultural land and developed areas.

The project team reviewed all the comments and used them in refining the proposal. The comments will also be used in preparing the environmental impact statement.

Next Steps – We are starting work on the environmental analysis. The information we gather will be published in a Draft Environmental Impact Statement that will be available for review and comment late this year. To complete the environmental work, BPA needs to conduct on-the-ground environmental surveys. BPA also needs to begin preliminary mapping and design work to refine the possible routes.

To conduct the analysis we may need to access property along the proposed routes. If so, we will contact those property owners for permission.

Once we have completed the environmental review, BPA will decide whether and how to proceed with the project. If BPA decides to proceed, construction would likely begin in 2004.

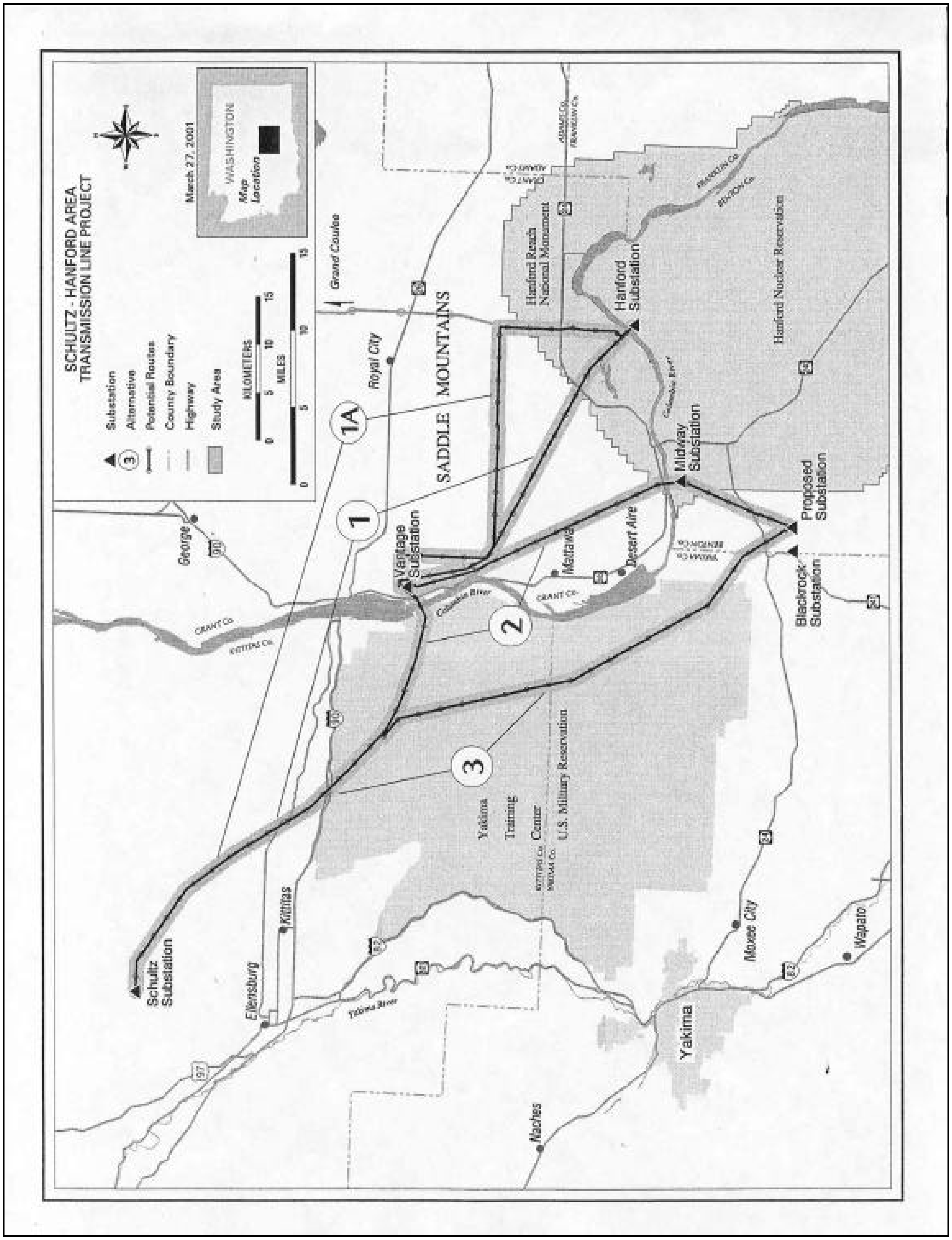
For More Information – If you have any questions about this proposal, please call me toll-free at 1-800-282-3713; at my direct number, (503) 230-5525; or send an e-mail to lcdriessen@bpa.gov. Information on the project will be posted on BPA's web site at www.efw.bpa.gov under *environmental planning/analysis.*

Thank you for your interest in our work.

Sincerely,

Lou Driessen
Project Manager

Enclosure:
Map


SCHULTZ - HANFORD AREA
TRANSMISSION LINE PROJECT
Substation
Alternative
Potential Routes
County Boundary
Highway
Study Area
KILOMETERS
MILES
March 27, 2001
WASHINGTON
Map Location
Schultz Substation
Vantage Substation
Midway Substation
Hanford Substation
Proposed Substation
Blackrock Substation
1A
1
2
3
SADDLE MOUNTAINS
Royal City
Grand Coulee
George
Mattawa
Desert Aire
Columbia River
Hanford Reach National Monument
Hanford Nuclear Reservation
Yakima Training Center
U.S. Military Reservation
Ellensburg
Kittitas
Yakima River
Yakima
Moxee City
Wapato
Naches

Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

June 6, 2001

In reply refer to: KEC-4

To: People Interested in the Schultz - Hanford Area Transmission Line Project

Bonneville Power Administration (BPA) is proposing to build a new transmission line and one of the alternatives we are studying (Alternative 1A) could affect your property. This letter briefly explains what is being proposed, outlines our process and schedule, and tells where to call for more information.

Proposal - BPA is proposing to construct a transmission line through central Washington. The new 500-kilovolt (kV) line would relieve constraints on several transmission lines across the state. It would also provide more operational flexibility so that BPA can meet its obligations to endangered salmon and maintain transmission capacity to import and export energy.

Alternatives - Possible transmission routes are in Kittitas, Yakima, Grant, and Benton counties (See attached map). The proposed line would be constructed from Schultz Substation (near Ellensburg) to either a substation on the Hanford Reach National Monument within the Hanford Nuclear Reservation or a new substation just southwest of the Hanford Nuclear Reservation. Four alternative routes are being considered. All would require the purchase of new right-of-way.

- **Alternative 1** would parallel the existing 500-kV line that runs from Schultz Substation to Vantage Substation and on to Hanford Substation (called the Schultz-Vantage-Hanford line). The new line would be up to 1200 feet from the existing line (BPA must separate major lines by as much as 1200 feet to meet electric reliability standards.

- **Alternative 1A** would parallel the existing 500-kV line from Schultz Substation to Vantage Substation (just like Alternative 1). But a different route would be studied between Vantage and Hanford to avoid irrigated agricultural land. Instead, it would go east from Vantage for about a mile on new right-of-way before turning south for about five miles. It would then turn east and follow the southern edge of the Saddle Mountains for about 15 miles before turning south and paralleling, at a distance of up to 1200 feet, the existing 500-kV Grand Coulee-Hanford line into Hanford.

- **Alternative 2** would parallel the existing Schultz-Vantage 500-kV line at a distance of up to 1200 feet. It would turn south and parallel the existing 230-kV line to Midway Substation, then follow another 230-kV line to a new Blackrock Substation near Benton Rural Electric Association's existing Blackrock Substation. We are looking at the possibility of tearing down the existing 230-kV line in places and rebuilding it with a double-circuit line that would hold both the 230-kV line and the new 500-kV line.

- **Alternative 3** would parallel, at a distance of up to1200 feet, the existing Schultz-Vantage 500-kV line, but before crossing the Columbia River, the line would head south on new right-of-way mainly across the Yakima Training Center to a new Blackrock Substation.

We are also considering not building a new line, an alternative we always consider.

Next Steps – We are working on the environmental analysis. The information we gather will be published in a Draft Environmental Impact Statement that will be available for review and comment late this year. To complete the environmental work, BPA needs to conduct on-the-ground environmental surveys. We also need to begin preliminary mapping and design work to refine the possible routes.

To do this work, we may need to access property along the proposed routes. If so, we will contact those property owners to request permission.

Once we have completed the environmental review, BPA will decide whether and how to proceed with the project. If BPA decides to proceed, construction would likely begin in 2004.

For More Information – If you have any questions about this proposal, please call me toll-free at 1-800-282-3713; at my direct number, (503) 230-5525; or send an e-mail to lcdriessen@bpa.gov. Information on the project will be posted on BPA's web site at www.efw.bpa.gov under *environmental planning/analysis.*

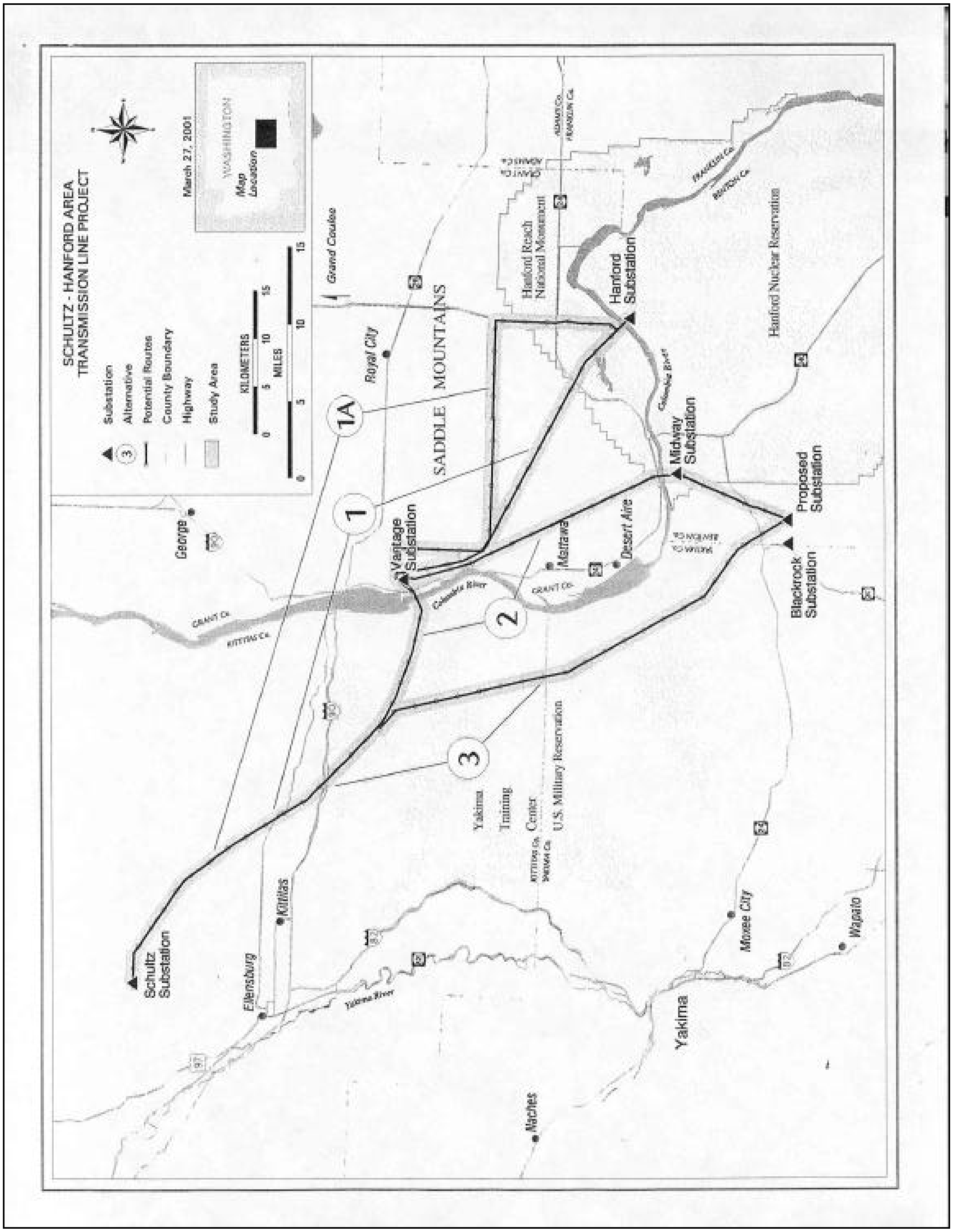
Please return the enclosed postcard to receive a copy of the Draft Environmental Impact Statement. Otherwise you will receive notice when it is available.

Thank you for your interest in our work.

Sincerely,

Lou Driessen
Project Manager

2 Enclosures:
Map
Postcard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U.S. Military Reservation
Schultz Substation
Kittitas
Ellensburg
Yakima River
Moxee City
Wapato
Yakima
Naches
1A
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Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

July 30, 2001

In reply refer to: KEC-4

To: People Interested in the Schultz - Hanford Area Transmission Line Project

Bonneville Power Administration (BPA) has selected a preferred alternative from the project alternatives being considered for this project. The preferred alternative is highlighted on the enclosed map. This letter explains that choice and tells our next steps.

Background

BPA is proposing to construct a transmission line through central Washington. The new 500-kilovolt (kV) line would relieve constraints on several transmission lines across the state. It would also provide more operational flexibility so that BPA can meet its obligations to endangered salmon and maintain transmission capacity to import and export energy.

Last winter BPA hired a team of consultants to study the impacts of the proposed project on the environment. We are using this information to write an environmental impact statement (EIS). The information collected by the consultants contributed to our selection of the preferred alternative. All project alternatives will be analyzed in the EIS. The EIS will also identify impacts of the no action alternative.

Preferred Alternative

For the draft EIS, the preferred alternative (formerly referred to as Alternative 2) has been selected because it would:

- Increase BPA transmission system capacity
- Maintain BPA transmission system reliability
- Minimize impacts to environmental resources such as irrigated agricultural lands, cultural resources, military land uses, and plants and animals
- Provide fastest energization date
- Minimize costs while meeting BPA's long-term transmission needs

The preferred alternative would parallel the existing Schultz-Vantage 500-kV line at a distance of up to 1200 feet. Closer to Vantage, the new line would head south for a short distance and then east to meet up with the Schultz-Hanford line closer to Vantage (see enclosed map). From Vantage, the new line would turn south and parallel the existing 230-kV line to Midway Substation, then follow another 230-kV line to a new substation (several names are being considered). We are looking at the possibility of tearing down the existing 230-kV line in places and rebuilding it with a double-circuit line that would hold both the 230-kV line and the new 500-kV line.

This selection of a preferred alternative is not a final agency decision. We will make a final decision on an alternative after we issue the final EIS. We welcome your comments on the preferred and other alternatives.

Current Work

We continue to conduct location surveys. The surveys will provide engineering design data and help us identify wetland boundaries, stream crossings, and other needed environmental field information. The surveys will locate property monuments and set control points for aerial photography. Between now and March 2002, the surveys will also help us stake tower locations on the ground. Tower locations need to meet the needs of landowners and BPA. If you have concerns regarding staked tower locations, contact BPA at any time.

This month, BPA will contract with appraisers to analyze market data on property values along the preferred alternative route. Landowners along this route will be contacted to request an interview regarding this process. Interviews will be done between now and January 2002.

What You May See

You may see survey crews driving on or parking alongside local roads. The survey team may use tripods and bright yellow Global Positioning System equipment. The survey crews will be locating and surveying property and section corner monuments. If you see a white plastic X about 20 feet across on the ground, it is being used for aerial photography, and the X will be removed after the photography is done. The survey crew will mark survey and tower locations with flags and survey stakes.

Next Steps

We will have a draft EIS available for public and agency review later this year. We will notify everyone on our mail list when the draft EIS is available and invite them to comment at a public meeting, by mail, phone or e-mail. More information about commenting will be available when the draft EIS is released. All comments received will be addressed in the final EIS and will help us make a decision on the project next year.

For More Information

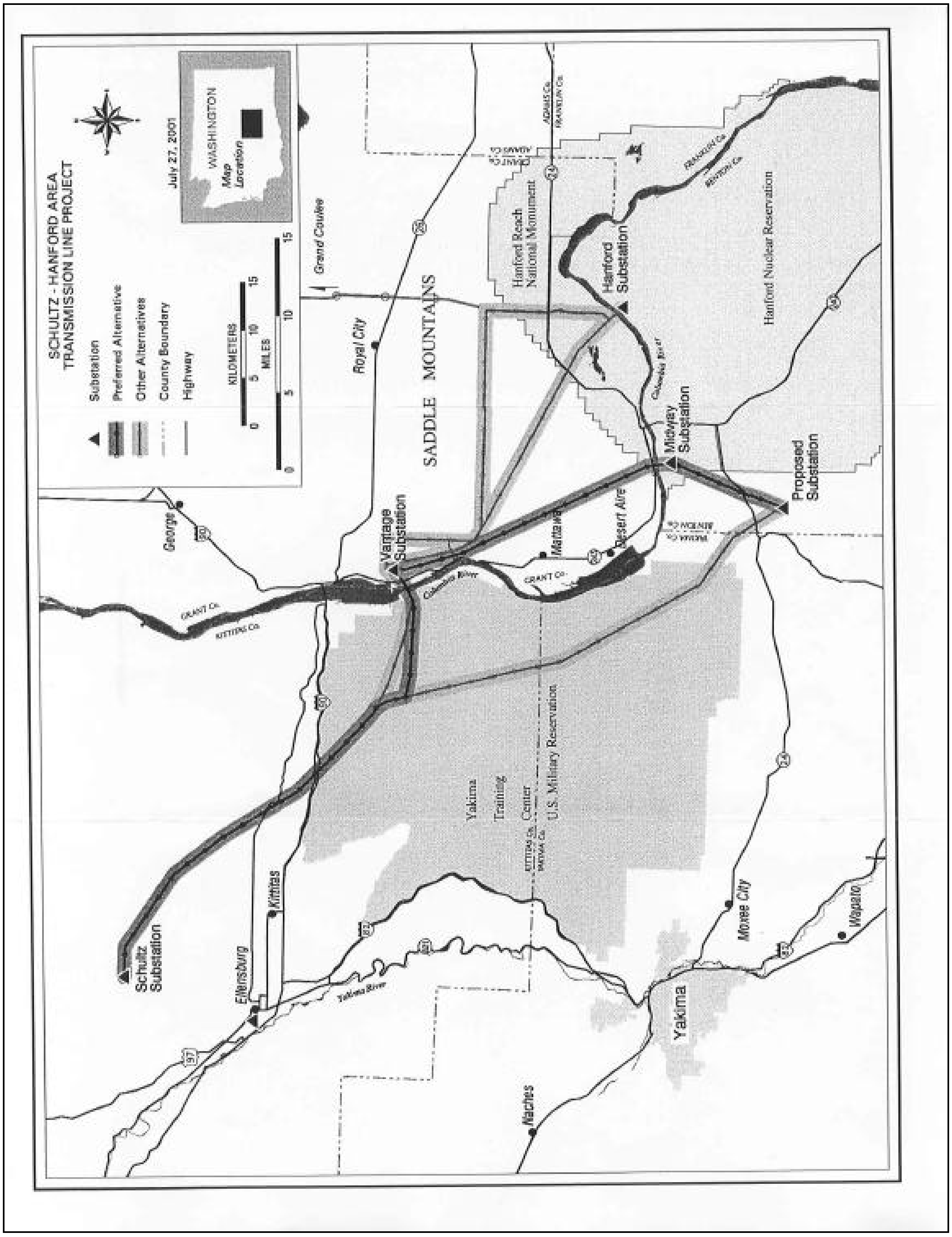
If you have any questions, please call me toll-free at 1-800-282-3713; at my direct number, (503) 230-5525; or send an e-mail to lcdriessen@bpa.gov. Information on the project will be posted on BPA's web site at www.efw.bpa.gov under *environmental planning/analysis.*

Thank you for your interest in this project.

Sincerely,

Lou Driessen,
Project Manager

Enclosure: Map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Yakima Training Center
U.S. Military Reservation
Schultz Substation
Kittitas
Ellensburg
Yakima River
Yakima
Moxee City
Wapato
Naches

Appendix B – Construction and Maintenance Activities

1.0 Construction Procedures

In order to construct the proposed project, BPA would follow existing construction practices for building the transmission line and substation. The following general steps would be followed:

- Right of Way (ROW) acquisition and preparation;
- Access road construction or improvement;
- Structure site preparation;
- Structure construction and erection;
- Insulator installation and conductor and ground wire stringing; and
- Site restoration and cleanup.

1.1. Right-of-Way Acquisition and Preparation

New ROW would be needed for the new structures and line. The new ROW would be 150 ft wide. In Segment D where BPA proposes to build a double-circuit line, the existing ROW would be expanded 25 ft on either side of the existing 100 ft wide ROW, to increase the ROW to 150 ft.

BPA would obtain easements from landowners for new ROW. These easements give the BPA the right to construct, operate, and maintain the line and access roads. Fee title to the land covered by the easement generally remains with the owner, and is subject to the provisions of the easement.

The easement prohibits large structures, tall trees, storing flammable materials and other activities that could be hazardous to people or endanger the transmission line. Activities that do not interfere with the transmission line or endanger people are usually not restricted.

Vegetation within a ROW is restricted by height. This is required for the safe and uninterrupted operation of the line. It is not anticipated that a large number of trees will need to be cleared for this project, however because of safety considerations there may be some trees at water crossings that would need to be cut.

The amount of vegetation to be removed is based on a clearing advisory (which describes safe vegetation heights along and at varying distances from the centerline) and local knowledge regarding regional conditions such as weather patterns, storm frequency and severity, general tree health, and soils. Considerations that would also influence the amount of clearing along the line are: line voltage, vegetation species, height and growth rates, ground slope, conductor elevation above ground, and the clearance distance required between the conductors and other objects.

Woody debris and other vegetation would either be left lopped and scattered, piled, or chipped, or would be taken off-site. Burning may or may not be used, due to *air shed* constraints. Contractors would be required to use brush blades instead of dirt blades on bulldozers for clearing. Other specialized brushing/mulching equipment may be required.

At the structure sites, all trees, brush, and stumps over 22 in and *snags* would be felled and removed, including root systems. The site would be graded to provide a relatively level work surface. The total amount of clearing required is unknown at this time.

An additional amount of vegetation would be cleared for access roads that are needed off the ROW and for roads in poor condition that BPA would upgrade. Roads are discussed in the next section.

1.2 Access Road System

BPA would acquire access rights to develop and maintain permanent ground access for wheeled vehicle travel to each structure. Access roads are designed for use by cranes, excavators, supply trucks, boom trucks, and line trucks for construction and maintenance of transmission lines. Truck size and carrying weight help determine road specifications.

An access road system on and off the ROW would be used to construct and maintain a new line. New roads would be within the ROW wherever possible, but where conditions require, roads would be constructed and used outside the ROW. When the new line would be 1,200 ft from the existing line, a new road system would be built. Where the new line would be built directly adjacent to an existing line, the existing access road system would be used, with spur roads to the new towers. No permanent access road construction would be constructed in cultivated or fallow fields. Any temporary access roads in cropland would be removed and the ground would be restored to its original contour when the line is completed.

A 50 ft. ROW would be acquired for new road access and 20 ft. of ROW would be acquired for any existing access roads. New access roads would be 16 ft. wide, with additional road widths of up to 25 ft. for curves. Roads would be dirt, gravel, or rock. BPA prefers to have road grades of 6 percent or less for highly erodible soils (silts) and 10 percent for soils that are more erosion resistant (earth and broken rock). For short distances, maximum acceptable road gradients are 15 percent for trunk or main roads, and 18 percent for spur roads.

BPA improves access roads by grading, improving drainage, and adding gravel to the road surface. After construction, roads are maintained for emergency access and maintenance. In some areas where access roads would not be built, helicopter construction would be used to erect structures and put up conductors.

Dips, culverts, and *waterbars* would be installed within the roadbed to provide drainage. If the road is to be temporary, any disturbed ground would be repaired and if the land use permits, the road would be reseeded with grass or other appropriate seed mixtures. After the line is built, access roads would also be used for line maintenance. If the ground is disturbed by maintenance activities, the roadbed would be repaired and reseeded if necessary. Fences, gates, cattle guards and additional rock would be added to access roads where necessary

For each segment, the following table shows the miles of estimated new access roads and existing roads that would need to be improved. Assumptions were made based on terrain and line location.

Table 2.3-1
Estimate of Access Road Development (Length)

Segment	Length (mi)	New Construction (road mi/ segment mi)	Total New Construction (mi)	Improvement (road mi/ segment mi)	Total Improvement (mi)
A	29.4	1.6	47.0	0.8	23.5
Bn	9.5	1.7	16.2	1.5	14.3
Bs	10.4	1.7	17.7	1.5	15.6
C	29.8	2.8	83.4	2.5	74.5
D	27.3	0	0	1.3	35.5
E	23.2	1.3	30.2	2	46.4
F	32.1	1.5	48.2	1	32.1

Table 2.3-2
Estimate of Access Road Disturbance (Area)

Segment	Existing Road Disturbance Width (ft)	New Road Disturbance Width (ft)	New Road (Ac)	Improved Roads (Ac)	Road Work (Ac)
A	16	25	142.4	45.6	188.0
Bn	16	25	49.1	27.7	76.8
Bs	16	25	53.6	30.3	83.9
C	16	25	252.7	144.5	397.2
D	16	25	0	68.8	68.8
E	16	25	91.5	90.0	181.5
F	16	25	146.1	62.3	208.4

1.3 Construction

1.3.1 Storage, Assembly, and Re-fueling Areas

Construction contractors would establish storage areas near the transmission line to stockpile materials for structures, spools of conductor and other construction materials until the material is needed. These areas are selected to be accessible from major roads or highways. Steel for structures is delivered in pieces on flatbed trucks and needs to be assembled on-site. A mobile crane may be needed to handle the bundles. If the terrain is too steep at the actual structure site, general assembly yards are used to erect the tower in pieces after which they are transported to the structure site by truck or helicopter. Because trucks and helicopters need to refuel often, these areas can also be used for re-fueling.

1.3.2 Structures

Transmission line structures are usually constructed using ground methods. The equipment used depends on the weight and size of the towers, and site conditions such as weather and soil characteristics. Most 500-kV lines are built using mobile cranes, but helicopter tower erection can be used as mitigation if access is unavailable or if sensitive resources must be protected. Single-circuit steel lattice towers would be used to support the transmission line conductors. The height of each structure would vary by location and surrounding landforms. Structures would average 135 ft high. The double-circuit towers would be lattice steel and approx. 170 ft high.

Most structures that would be used on the proposed line would be suspension structures. Other structures, called deadend structures, would be used where the transmission line changes direction, has an excessively long span, crosses extremely steep or rugged terrain, or crosses highways or rivers. Deadend structures equalize stresses on the conductors in these situations and are made of heavier gauge steel.

All vegetation would be removed from structure sites. Sites would be graded, if needed, to provide a level work area. An average area of about 100 ft by 100 ft would be disturbed at each structure site.

Steel towers are anchored to the ground by footings. These towers require four footings, which are placed into holes that have been excavated or blasted. Large machinery, such as backhoes or truck-mounted augurs, is used to excavate footings. The design of footings varies in response to such factors as soil properties, bedrock depth, and the soundness of the bedrock encountered. Typically, towers are attached to steel plates or grillages that are placed within the excavated area. The area is then backfilled with excavated material. If BPA finds a footing to be unstable, concrete may be used to backfill the footing. Topsoil is stockpiled during excavation and replaced during backfilling to restore the original ground surface.

Footings for suspension towers generally occupy an area of about 6 ft by 6 ft, to a depth of 12 ft. Deadend structures would have larger, deeper footings. Their footprint would be about 15 ft by 15 ft and 16 ft deep. The footings for double circuit suspension towers occupy an area of about 8 ft by 8 ft, to a depth of 12 ft. Deadend double circuit towers would have footing that are approximately 18 ft by 18 ft and 19 ft deep. These depths would be used if bedrock is not found. If bedrock is found and if the rock has properties that allow anchor borings, holes would be drilled in the rock and steel rods would be grouted within the rock. These rods are attached to either a concrete footing or welded directly to a tower member and embedded in compacted backfill. If rock properties are not suitable for anchor rods, the rock may be blasted to obtain adequate footing depth.

Steel towers are assembled in sections near the tower site. Each tower contains three components: the tower legs, the tower body, and the bridge. The bridge is the uppermost portion of the tower and serves as the attachment point for the insulators, which in turn support the conductors.

As the towers are built, heavy machinery will disturb the ground surface and/or compact soils in the tower site area and along access roads. Machinery will generate noise and dust.

1.3.3 Conductors

The wires or lines that carry the electrical current in a transmission line are called conductors. Alternating current transmission lines, like the proposed line, require three wires or sets of wires, each of which is referred to as a “phase.” Each conductor would be about 1.30 inches in diameter. There would be 3 conductors per bundle, which would be about 20 inches across. Conductors are not covered with insulating material, but rather use the air for insulation. Conductors are physically separated on the transmission structure.

After transmission structures are in place, workers first attach a smaller steel cable that is attached to the conductor to the structures, then pull the conductor under tension through the structures. Conductors are attached to the structure using glass, porcelain or fiberglass insulators. Insulators prevent the electricity in the conductors from moving to other conductors, the structure and the ground. As the lines are strung, the ground surface will be disturbed at the tensioning sites (approximately one acre per tensioning site every 2.5 miles), and noise and dust will be generated by machinery.

Transmission structures elevate conductors to provide safety within the ROW for people and structures. The National Electrical Safety Code establishes minimum conductor heights. Minimum conductor-to-ground clearance for a 500-kV line is 30 ft. Greater clearance would be provided over highway, railroad, and river crossings.

One or two smaller wires, called overhead ground wires, are attached to the top of transmission structures. Overhead ground wires protect the transmission line from lightning damage. The width of the wire varies from 0.375 to 0.625 in. Fiber optic cable may be attached to the tower as well.

1.3.3 Site Restoration and Clean-up

After the structures are in place and conductors are strung between the structures, BPA would restore disturbed areas. Soil around the tower, conductor reel, and pull site locations would be reshaped and contoured to a condition consistent with its original condition. Disturbed areas would be reseeded with grass or an appropriate seed mixture to prevent erosion. All litter and other remaining materials from construction would be disposed of, and equipment would be removed from the ROW.

1.4 Wautoma Substation Construction

A new substation would be constructed at the proposed Wautoma Substation site. The footprint of the substation would be approximately (850 ft x 500 ft). This area would include the substation yard (equipment within the fence) and grading outside of the fence.

Equipment inside the substation yard would include: breakers, switches, capacitors, buswork, substation deadends, a control house and possible transformers. No vegetation is allowed to grow within the fenced substation yard.

In order to build a new substation, construction crews would first clear and grade the substation site. Conduits, drainage pipes, and the grounding system would be trenched or dug into the ground. Footings for the equipment and foundation for the control house would be placed in appropriate positions. A chain link fence around the substation would be installed. About six inches of rock would be laid, which would extend outside of the fence. Equipment such as breakers, buswork, switches and PT's would be installed in the yard, and the control rack would be installed in the control house.

Appendix C – Line Separation Issue Paper

Line Separation

Background

While it is generally desirable to build lines on the same corridor side by side for environmental and land use reasons, the likelihood and consequences of outage of two or more lines due to a common event must be considered by transmission planners. The loss of multiple circuits into a load area will result in increased demand over the remaining circuits and can result in area blackout unless load and/or generation (sometimes a sizable amount) is tripped off to balance flow with remaining transmission capacity. Transmission planning is done on the basis of *not* interrupting customer load for the more common system transmission line outage events since high voltage grid interruptions have the potential of affecting a large number of customers and critical load such as hospitals, emergency services and other essential or sensitive loads.

The Western Systems Coordinating Council (WSCC), the reliability council for the Western US of which BPA is a member, has established performance criteria applicable to loss of multiple lines. In the case of the more likely multi-contingency events (loss of two lines or all lines in a corridor) standards exist related to allowed electrical performance as well as admissible countermeasures such as load or generator tripping. Successive loss of transmission lines and attendant load and generation, like falling dominos (called "cascading") is not allowed. In the case of even less likely events (sometimes called unplanned or extreme events) reliance is placed on containment measures such as load shedding, system islanding (separating areas of the system from one another) and other means to limit cascading.

Some pertinent parts of the reliability criteria dealing with multiple line or rights of way outages are provided in Attachment 1. Simultaneous loss of two or more lines built on the same rights of way is considered to be a likely (credible) event. Simultaneous loss of two or more lines built on separate rights of way is generally considered to be a non-credible event. Provision has been made for specific cases to classify loss of two lines on the same rights of way as a non-credible event based on line design; length; location, whether forested, agricultural, mountainous, etc; outage history; operational guidelines; and separation between circuits. A WSCC recently approved method would allow loss of two lines on the same rights of way to be classified as non-credible if the estimated frequency of occurrence (mean time between failure) is greater than 300 years. However, the latter is very difficult to demonstrate and would generally be limited to lines that are on the same rights of way for short distances. Work is continuing to also consider impact and exposure (percentage of time the system would be in an at-risk condition).

Line Spacing Requirements

There is not any single criteria or rule that establishes minimum circuit spacing requirements to qualify as very low likelihood (not credible) since the importance of various risk factors are not the same in all cases. However, cases within WSCC of minimum separation of 2000 feet have been accepted as not credible. The following list represent risks that are mitigated by line separation. To the extent that these can be mitigated by design or maintenance measures the need for separation may be reduced.

1. One tower falling into an adjacent line
2. A snagged shield wire from one line being dragged into the adjacent line (span length)
3. An aircraft flying into more than one circuit
4. Fire on the right of way or smoke (ionized particles) enveloping more than one circuit causing temporary failure
5. Lightning strokes affecting more than one line.

The risk of fire or smoke affecting two lines can be managed by rights of way maintenance practices and notification procedures. Increased spacing reduces the risk that multiple circuits will be affected and increases time for notification and corrective dispatcher action. Terrain is important in terms of the amount and volatility of combustible materials.

The risk of lightning caused events can be mitigated by the use of shield wires (a target instead of the energized conductors), and by modifying protective control circuits (relaying).

Risks 1-3 are generally mitigated by increased spacing between lines. As noted in Attachment 1 under the definition of *Three or More Circuits in a Right-of-Way* " some organizations use separation by more than the span length as adequate to designate the circuits as being in separate corridors." Span lengths for 500 kV lines are typically 1000 to 1500 feet depending on terrain.

When Is Corridor Separation Needed?

As noted, the NERC/WSCC Planning Standards make allowance for mitigating action for multi-contingency outages affecting lines on the same rights of way. However, it is BPA and general utility practice that two-line outages should *not* rely on interruption of customer load except for very unusual operating conditions such as adverse cold weather, or a weakened transmission system. Generator tripping may be used as a countermeasure in some cases for two-line outages but it also becomes objectionable if the requirements are excessive or impractical.

Summary - As a matter of practice, construction on separate rights-of-way is necessary when a multi-circuit outage on a common corridor must be considered a credible event and corrective action for this outage would require excessive or impractical countermeasures.

W Mittelstadt
10/23/01

<u>Attachment 1 Citations from WSCC Reliability Criteria Documents</u>

Western Systems Coordinating Council (WSCC) – organized in 1967 to be the regional forum for actively promoting regional electric service reliability through the development of planning and operating reliability criteria and policies; the monitoring of compliance with these criteria and policies; and the facilitation of a regional transmission planning process. It consists of 98 members, 10 affiliate members, and 7 commission members spanning the Western US and parts of Canada and Mexico.

<u>WSCC-S2</u> "The loss of three or more circuits on a common right of way shall not result in cascading".[1, page_]

<u>WSCC-S3</u> "The common mode simultaneous outage of … two circuits shall meet the performance specified for Category C of the WSCC Disturbance Performance Table…" [1, page _]

<u>Simultaneous Outage</u> "Multiple outages are considered to be simultaneous if the outages subsequent to the first event occur before manual readjustment can be made." [2]

<u>Three or More Circuits in a Right of Way</u>
"In the application of WSCC-S2, loss of three or more circuits on a common right of way is intended to cover those situations where the separation between circuits is such that a common mode failure could result in the simultaneous outage of multiple circuits. The credibility of such an outage depends on the credibility of the common mode failure. Considerations in the determination of credibility should include line design; length; location, whether forested, agricultural, mountainous, etc.; outage history; operational guidelines; and separation between circuits. For example, some organizations use separation by more than the span length as adequate to designate the circuits as being in separate corridors."[1, page_]

<u>Two Circuits</u>
"In the application of WSCC-S3, loss of two circuits is intended to cover those situations where a common mode failure could result in the simultaneous loss of two circuits. The credibility of such an outage depends upon the credibility of the common mode failure. The credible outage of two circuits could result from a lightning storm or forest fire. Loss of two circuits does not require the same tower or right of way to be credible. Consideration in the determination of credibility should include line design; length; location, whether forested, agricultural, mountainous, etc,; outage history; operational guidelines; and separation between circuits."[1, page_]

Cascading

References

[1] NERC/WSCC Planning Standards, date.

[2]WSCC Reliability Criteria, August 2000, Part IV, page 7.

Appendix D – Property Impacts

Appendix D

Property Impacts

Property Impacts

BPA construction alternatives include acquiring easements for approximately 55 to75 miles of new 500-kV transmission line right-of-way. The new right-of-way would either parallel existing transmission line corridors, being offset by 1200 feet, or be routed in a new corridor location. BPA would utilize its existing access road system where possible, however, it is anticipated that additional access road easements would need to be acquired. For the Schultz-Blackrock alternative, BPA would also need to acquire fee title to property for a substation. BPA would pay market value to nonfederal landowners for any new land rights required for this project.

The landowners would be offered market value, established through the appraisal process, for the transmission line or access road easements, or for the fee acquisition of property needed for the substation. The appraisal process takes all factors affecting value into consideration including the impact of transmission lines on property value. The appraisals may reference studies conducted on similar properties to add support to valuation considerations. The strength of any appraisal is dependent on the individual analysis of the property, utilizing neighborhood specific market data in order to determine market value.

Impacts to property for new rights-of-way for transmission lines and access roads are discussed below.

New transmission line right-of-way: The predominant land use for the new transmission line right-of-way consists of irrigated and non-irrigated agricultural land, with a small portion being comprised of rural residential properties.

BPA's transmission line easement documents encumber the right-of-way area with land use limitations. The easement specifies, "the present and future right to clear the right-of-way and to keep the same clear of all trees, whether natural or cultivated, and all structure supported crops, other structures, trees, brush, vegetation, fire and electrical hazards, except non-structure supported agricultural crops less than 10 feet in height." The landowner may grow most crops or graze livestock. Special written agreements may be entered into between BPA and the landowner to allow Christmas, ornamental or orchard trees, and structure supported crops. Heights of the trees/crops and access must be controlled to maintain safe distances.

The impact of introducing a new right-of-way for transmission towers and lines can vary dramatically depending on the placement of the right-of-way in relation to the property's size, shape, and location of existing improvements. A transmission line may diminish the utility of a portion of property if the line effectively severs this area from the remaining property (severance damage). Whether a transmission line introduces a negative visual impact is dependent on the placement of the line across a property as well as each individual landowners' perception of what is visually acceptable or unacceptable.

If the transmission line crosses a portion of the property in agricultural use such as pasture or cropland, little utility is lost between the towers, but 100% of the utility is lost within the base of the tower. Towers may also present an obstacle for operating farm equipment, and controlling weeds at tower locations. To the extent possible, new transmission lines are designed to minimize the impact to existing and proposed (if known) irrigation systems. If the introduction of a transmission line creates a need to redesign irrigation equipment or layout, BPA compensates the landowner for this additional cost.

These factors as well as any other elements unique to the property are taken into consideration to determine the loss in value within the easement area, as well as outside the easement area in cases of severance. For those portions of the project route that require the 1200 foot separation between the new and existing 500-kV transmission lines, the appraiser will analyze whether there is an impact to the property's utility in this 1200 foot wide area.

Market value would be paid for any timber to be cut on the new right-of-way, as well as for any trees off the right-of-way that need to be cut for construction purposes or that pose a danger of falling into the line or across the access roads.

New access roads: If BPA acquires an easement on an existing access road and the landowner is the only other user, market compensation is generally 50% of full fee value or something less than 50% if other landowners share the access road use. For fully improved roads, the appraiser may prepare a cost analysis to identify the value of the access road easement. If BPA acquires an easement for the right to construct a new access road and the landowner has equal benefit and need of the access road, market compensation is generally 50% of full fee value. If the landowner has little or no use for the new access road to be constructed, market compensation for the easement is generally close to full fee value.

New Substation: If the Schultz-Blackrock alternative is selected, BPA would offer market value for the fee acquisition of approximately 25 acres needed for the Blackrock Substation.

Property Value Impacts. The proposed transmission line is not expected to have long-term impacts on property values in the area. Whenever land uses change, the concern is often raised as to the effect the change may have on property values nearby. Zoning is the primary means that most local governments use to protect property values. By allowing some uses and disallowing others, or permitting them only as conditional uses, conflicting uses are avoided. Some residents consider transmission lines to be an incompatible use adjacent to residential areas; however, this feeling is not universal.

The question of whether nearby transmission lines can affect residential property values has been studied numerous times in the United States and Canada over the last twenty years or so, with mixed results. In 1995, BPA contributed to the research when it looked at the sale of 296 pairs of residential properties in the Portland, Oregon metropolitan area (including Vancouver, Washington) and in King County, Washington. The study evaluated properties adjoining 16 BPA high voltage transmission lines (subjects) and compared them with similar property sales located away from transmission lines (comps). All of the sales were in 1990 and 1991 and adjustments were made for time and other factors. The results of the study showed that the subjects in King County were worth approximately 1% less than their matched comps, while the Portland/Vancouver area subjects were worth almost 1.5% more (Cowger et al. 1996).

BPA recently updated this earlier study using 1994/95 sales data. The sales of 260 pairs of residential properties in King County and Portland/Vancouver metropolitan areas were reviewed. The information confirmed the results of the earlier study, i.e., that the presence of high voltage transmission lines does not significantly affect the sale price of residential properties. The residential sales did, however, identify a small but negative impact from 0 to 2% for those properties adjacent to the transmission lines as opposed to those where no transmission lines were present. Although this study identified a negative effect, the results are similar to the earlier study and the differences are relatively small (Cowger et al., 2000).

Studies of impacts during periods of physical change, such as new transmission line construction or structural rebuilds, generally have revealed greater short-term impacts than long-term effects. However, most studies have concluded that other factors, such as general location, size of property, improvements, condition, amenities and supply and demand factors in a specific market area are far more important criteria than the presence or absence of transmission lines in determining the value of residential real estate.

As a result of the proposed project, some short-term adverse impacts on property values (and salability) might occur on an individual basis; however, these impacts would be highly variable, individualized, and unpredictable. Constructing the transmission line is not expected to cause long-term adverse effects to property values along the right-of-way or in the general vicinity. Non-project impacts, along with other general market factors, are already reflected in the market value of properties in the area. These conditions are not expected to change appreciably. Therefore, no long-term impacts to property values are expected as a result of the proposed project.

Mitigation:

Existing transmission line right-of-way: One of the alternatives would be to tear down portions of the existing Vantage-Midway and portions of the Midway-Blackrock, 230-kV transmission lines and replacing them with a double circuit line. The new structures would generally be placed in the same locations as the existing lattice steel structures, or if possible, and desired by the affected landowner, be placed in more convenient locations. Since the existing right-of-way in this area is 100 feet in width, this alternative would require BPA to acquire easements for additional width along the existing transmission line right-of-way. Land types along the existing right-of-way include rural residential and irrigated as well as non-irrigated agricultural properties. The existing transmission line right-of-way has already imposed land use limitations on the land uses along the right-of-way by the physical presence of the lines and structures, as well as by the use limitations imposed by the original easements. Overall, the impact of acquiring additional width right-of-way along scattered portions of the transmission line corridor is expected to be minimal in respect to acreage affected as well as impact to land uses and resources since the impact is already evident with the existing transmission line.

Appendix E – Vegetation

Vegetation Information Submitted
by Kimberly St. Hilaire.

Study Area

The study area for vegetation includes an area approximately 1/4 mile on either side of each of the proposed segments, for a total of a 1/2-mile-wide strip centered on the proposed route.

Methodology

Information on project area vegetation was obtained from a variety of sources to determine which plant communities are present within the project area. Federal agencies provided information on the plant communities that occur on the lands they manage. The plant communities within the project segments that traverse the Hanford Reach National Monument have been named and mapped. The botanist from the Wenatchee Bureau of Land Management (BLM) District provided general information on plant communities that occur along BLM lands, but the BLM has not mapped plant communities within the project area. The Yakima Training Center (YTC) wildlife biologist was contacted to supplement information on plant communities within the YTC Management Plan.

Very little information is available about the plant communities on state and private lands within the project area. As a result, it is difficult to determine the species of shrubs, grasses, and forbs (flowering plants that are not grasses) within plant associations and the quality of the plant community in particular areas relative to other portions of the project area. Studies on regional plant communities within the Columbia Basin provided general descriptions of plant associations, but little site-specific information. The United States Geological Survey (USGS) National Land Cover Data Maps were used to calculate general vegetation cover types along various project segments. Aerial photographs and USGS quadrangle maps covering the project area were also used for information on landforms, water features, and elevation. The field data on sensitive wildlife occurrences mapped on Washington Department of Fish and Wildlife (WDF&W) Habitats and Species Maps sometimes have some information about plant communities in locations near the project area, although this information was usually very general in nature.

Some site-specific information is available. The Washington Natural Heritage Program (WNHP) tracks the occurrence of high quality plant associations and keeps information on the location of these communities in their database. Because it is likely that some areas within the project area have not been visited by botanists or ecologists, some high quality plant communities may occur within the project area, but are not included within the WNHP database.

During a brief field visit in January 2001, some project area plant communities were viewed from the ground in areas near major roads, and from helicopter in inaccessible areas. This visit provided limited information on plant community types within the project area due to the time of year the visit took place. A site visit was made to the area of the proposed Wautoma Substation (Segments C and D) in June 2001 to characterize site vegetation.

A rare plant survey was conducted along the Preferred Alternative during August 2001, and further rare plant surveys will occur in Spring and Fall 2002.

Plant Communities of the Study Area

The diversity of plant species and quality of vegetation in the study area can be assessed by determining the plant community, found in different locations. Table 2, lists the scientific name for each plant species discussed below.

The vegetation type found in most of the study area is referred to as shrub–steppe, with some grasslands (Franklin and Dyrness, 1973). With the exception of some riparian areas, few trees are able to survive in this arid landscape. The dominant woody vegetation on most upland sites consists of shrub species, predominantly sagebrush species. The understory of herbaceous plants in shrub-steppe was dominated by native perennial bunchgrasses prior to European settlement. Within the project area, native bunchgrass-dominated communities are no longer common due to invasion by annual grasses and weedy species after various types of disturbance (Quigley, 1999).

Shrub-steppe vegetation in the study area is characterized as a potential big sagebrush/bluebunch wheatgrass zone (Daubenmire, 1970). This is the community that is expected to occur without disturbance, alteration of habitat, or invasion by non-native species. However, most of the vegetation in the study area has been disturbed, and as a result, bluebunch wheatgrass is rarely the dominant grass species. Historic and present day causes of disturbances to vegetation in the study area include converting land to agricultural uses, grazing, fire, construction, road building, the deliberate and inadvertent introduction of non-native species, and maneuver training exercises on the YTC. Disturbance reduces native plant species cover and diversity, changes species composition and structure, and increases the likelihood of invasion by non-native species (Rickard, 1988). Native bunchgrasses and native forbs are particularly vulnerable to disturbances and have decreased dramatically in most portions of the shrub-steppe.

The dominant shrubs in upland areas commonly include several species of sagebrush, including big sagebrush, threetip sagebrush, stiff sagebrush, low sagebrush, bitterbrush, and several species of rabbitbrush (gray/rubber and green). Historically shrubs were associated with native perennial bunchgrasses such as bluebunch wheatgrass, Sandberg's bluegrass, needle-and-thread grass, and Idaho fescue (Franklin and Dyrness, 1973). In most areas today, non-native species, including cheatgrass, are now dominant. Shrubs and grasses are associated with various semi-woody or herbaceous perennials and annual or perennial forbs, which vary in species composition from area to area.

In the study area, very few riparian areas have a tree overstory, and shrub-lined riparian areas are more common. Common trees found include black cottonwood, aspen, and chokecherry; shrubs include various species of willow, wood's rose, serviceberry, black hawthorn, golden currant, wax currant, and blue elderberry. The herbaceous understory consists of grasses and forbs, with sedges, rushes, and other water-tolerant species in wetter areas. Drier riparian areas are typically vegetated with upland shrubs, including sagebrush, bitterbrush, gray rabbitbrush, wild rose, and ocean-spray, with upland grasses and forbs in the understory.

Rocky areas such as rock outcrops, rocky slopes, and canyons are common in shrub-steppe. Different kinds of rock substrates, from gravel to boulder-strewn areas, support different plant species. Large shrubs such as serviceberry and wax currant tend to occur in rocky riparian areas. Finely graveled slopes support low shrubby species and forbs, such as Oregon sunshine, purple sage, desert buckwheat, and other species, including some rare plant species.

The agricultural lands in the valley are mainly in cropland with small adjacent areas that may have some remnants of native plant communities. These areas are generally disturbed and are vegetated by non-native species, including the weed species commonly found in agricultural lands.

WNHP High Quality Plant Communities

The Washington Natural Heritage Program (WNHP) tracks the occurrence of "high quality plant communities" within "high quality terrestrial ecosystems" (WNHP Website). Two WNHP high quality plant communities occur along line segments. The Wyoming big sagebrush/bluebunch wheatgrass shrubland community occurs in one small location along Segment A. The bitterbrush/Indian ricegrass shrubland community occurs in a broad band north of the Columbia River along Segments D, E, and F.

Vegetation Cover Types

The USGS produces National Land Cover Data Maps that include some information on vegetation. These maps were used to calculate vegetation cover types along various project segments, presented in Table 1, Vegetation Cover Types. This data provides a measure of the amount of existing native vegetation along each segment. The two categories, Shrubland and Grasslands or Herbaceous, represent areas with plant communities that are likely to have some native species remaining although the condition of these areas could vary from fairly pristine to very degraded. Areas where agricultural activities occur are unlikely to recover and return to natural vegetation, even if abandoned. The information on tree cover illustrates how few trees exist in the study area and the importance of tree-lined riparian areas.

Table 1. Vegetation Cover Types

Vegetation Cover	Cover Along Each Segment (miles)						
	A	B_{NORTH}	B_{SOUTH}	C	D	E	F
Trees	0.68	0.00	0.00	0.19	0.18	0.05	0.00
Shrubland	26.22	6.17	6.96	22.07	10.09	12.87	23.01
Grasslands or Herbaceous	1.73	2.87	2.91	7.46	7.23	3.91	7.76
Agricultural	0.53	0.00	0.00	0.00	8.85	5.87	0.39

Source: USGS National Land Cover Data Maps, 2000

Segment A

The vegetation of Segment A is mainly shrubland, with very little grassland and agricultural land. Portions of Segment A support an attractive shrub-steppe plant community known as a **lithosol** community (St.Hilaire, 2001). Because big sagebrush and many grass species cannot survive in rocky soils over basalt, the lithosol zone is known for having spectacular spring wildflower displays (Taylor, 1992). Portions of Segment A have areas of lithosols that support stiff sagebrush, Sandberg's bluegrass, and a variety of wildflowers species. Flowering plant species observed growing along Segment A include desert buckwheat, dwarf goldenweed, cushion phlox, biscuitroot, and yarrow (St. Hilaire, 2001).

Other portions of Segment A have adequate soils to support the big sagebrush/bluebunch wheatgrass community that is the dominant potential plant community throughout the study area. Because of past disturbance, native grasses have declined, and the dominant grass species is generally cheatgrass. Diffuse knapweed, a weedy species, is common along roadsides within Segment A, as it is throughout the study area.

One area of Segment A covered by the big sagebrush/bluebunch wheatgrass community is sufficiently pristine to qualify as a WNHP high quality plant association, as discussed above. This is the only occurrence of this high quality plant association in the study area. It occurs along approximately 0.2 mile of Segment A. Other species found in this community include occasional stiff sagebrush, bitterbrush, and gray rabbitbrush.

Segment A has two tree-lined riparian areas. Naneum Creek, in the northern portion of Segment A, is lined by scattered black cottonwoods, bittercherry, wavy-leaved alder, and aspen with a shrub understory of willows, rose, and red osier dogwood. To the southeast, Cooke Canyon Creek has a black cottonwood-lined riparian area with areas of black hawthorn, and scattered shrubs, including willows in wetter areas and ocean-spray in dry areas. Several intermittent creeks along Segment A support channel vegetation consisting mainly of upland shrubs, including ocean-spray, rose, hawthorn, and sagebrush, with an understory of cheatgrass, yarrow, chicory, and other species.

The Segment A reroute crosses an area of shrub-steppe similar to the original alignment, but crosses Cooke Canyon Creek in an area without significant riparian vegetation below the original alignment.

Segment B (Options B_{NORTH} and B_{SOUTH})

The vegetation of B_{NORTH} and B_{SOUTH} is mainly shrubland with some grasslands and has no agricultural land. Most of Options B_{NORTH} and B_{SOUTH} are covered with shrub-steppe vegetation dominated by sagebrush.

The area immediately to the west of the Columbia River is gravelly with very little vegetative cover, including a few willows scattered at the water's edge. The slope from the river leading up to the highway is vegetated with rabbitbrush, occasional sagebrush, and various grass species. Shrub-steppe tops the bare rocky cliff above the highway, extending to the west. On the east side of the Columbia River, a dry, level, sagebrush-dominated area extends along the river. Cheatgrass and knapweed are common in the understory with some native vegetation, including yarrow and buckwheat. Between the Columbia River and the Vantage Substation, the proposed line traverses a hilly, dry expanse of shrub-steppe.

Segment C

The vegetation of Segment C is mainly shrubland with some grasslands and no agricultural land. YTC categorizes their habitats as upland, riparian, alkali, or rocky habitats (USDOE, 1996). Five potential plant communities occur within these habitat types in all of the watersheds traversed by Segment C. Plant communities on YTC are generally not pristine and cheatgrass commonly replaces bluebunch wheatgrass in many areas due to past grazing.

The five plant communities within the YTC portion of Segment C include:

- **Big sagebrush/bluebunch wheatgrass**: This community is estimated to cover half of the uplands at YTC. It is found on ridgetops, hillsides, benches, and alluvial fans on shallow and deep soils. Associated species include gray and green rabbitbrush, desert buckwheat, three-tip sagebrush, and spiny hopsage associated with various grass species. Bitterbrush is co-dominant with big sagebrush in moist sites.

- **Three-tip sagebrush/bluebunch wheatgrass**: This community is typically found on northern exposed hillslopes, canyon walls, and ridgetops, with moderately deep to deep soils. Associated species include big sagebrush, desert buckwheat, with traces of spiny hopsage, purple sage, and various grass species.

- **Stiff sagebrush/bluegrass**: This low-growing community occurs on hillsides, ridgetops, and benches in shallow soils. The climax shrub canopy is dominated by stiff sagebrush and eriogonum with traces of Wyoming big sagebrush, slenderbush eriogonum, purple sage, and bitterbrush, with a grass understory.

- **Eriogonum/ bluegrass**: This low-growing community is found on hillsides, ridgetops, and on shallow soils. The climax shrub canopy is dominated by eriogonum and either stiff sagebrush or three-tip sagebrush with a trace of Wyoming big sagebrush and purple sage. The herbaceous understory is mainly composed of grasses.

- **Alkali habitat**: This habitat type, found only in the Hanson Creek watershed, is normally found in bottomlands adjacent to intermittent streams and is occasionally associated with riparian communities bordering perennial streams. This community consists of black greasewood with traces of gray rabbitbrush.

Within the YTC, the level and type of disturbance to vegetation varies depending on the location. Most portions of the study area were grazed until 1995. Grazing reduced cover by perennial grasses and native forbs, and increased the cover by sagebrush. Grazing also damaged the vegetation in riparian areas although YTC has implemented riparian restoration projects along some creeks in the study area. Roads are present within most portions of the watershed, serving to disperse weed species. Training maneuvers occur in portions of the study area, damaging vegetation. Some of the vegetation in the study area is still in the recovery process after several fires in the 1970's and 1980's damaged vegetation. Native species were replaced with non-native species, and habitat conditions were altered due to erosion.

Although the proposed Wautoma Substation site was once a shrub-steppe community, the site is currently dominated by herbaceous species with only occasional sagebrush and rabbitbrush (St.Hilaire, 2001). This area burned sometime in the past, as evidenced by charred shrub stumps and abundant soot in the soil. Two non-native weedy species, tumble mustard and cheatgrass, are the dominant species on the site, but other common weeds include diffuse knapweed, spotted knapweed, and kochia. Native forbs scattered on the site include chaenactis, green-banded star-tulip, curve-pod milk-vetch, Grays' desert parsley, scarlet globemallow, cushion daisy, phlox, and balsamroot, all relatively common shrub-steppe species.

Segment D

The vegetation of Segment D is mainly shrubland with some grasslands, and contains the most agricultural lands of any the segments. The riparian area along the north shore of Lower Crab Creek is described as willow-dominated wetland (WDFW, April 2, 2001). Along the southern shore of Lower Crab Creek, emergent wetlands are vegetated with rushes, cat-tails, grasses, and forbs. Some Russian olive, a non-native tree, occurs in the area. To the south, the rocky, steep slopes on the north side of Saddle Mountains are described as having sparse shrub-steppe vegetation in some areas with a gentler slope. In the valley to the south, the agricultural lands are intensively farmed with small adjacent areas that may have some remnants of native plant communities, but are more likely vegetated with non-native species.

To the north of the Columbia River, a WNHP high quality native plant community occurs along approximately 0.8 mile of Segment D. This community, the bitterbrush/Indian ricegrass community, occurs in dune areas where the sand tends to shift in the winds. This creates an unstable environment in which only certain species can survive, such as Indian rice grass, white-stemmed evening primrose, sand dock, and some short-lived annuals. In one portion of this community, big sagebrush is associated with bitterbrush and Indian ricegrass (USDOE, October, 2000). Wetland plant communities do not appear to occur along the Columbia River north of the Midway Substation, except possibly for a narrow herbaceous shoreline community.

The Midway Substation is a very dry site at the base of Umtanum Ridge. The area within and immediately adjacent to the substation has been cleared of natural vegetation, with sparse shrub-steppe extending to the base of Umtanum Ridge. Several plant communities are mapped on Umtanum Ridge and to the south (USDOE, October, 2000). Rocky areas include the rocky cliffs of Umtanum ridge and a narrow strip of talus (rock strewn area) on the top of the ridge. Rocky areas support a sparse community of plants that can exist in the small pockets of soil that accumulate in rock cracks, including several rare plant species. On the crest of Umtanum Ridge and to the south, several plant communities are mapped, including big sagebrush-spiny hopsage/Sandberg's bluegrass-cheatgrass and bunchgrass-cheatgrass communities.

On the USDOE Hanford Site and the proposed Wautoma Substation, the vegetation is mainly shrub-steppe or grassland with some agricultural land. WDFW documents the presence of nearly pristine sagebrush/ bluebunch wheatgrass shrub-steppe on the summit of Yakima Ridge (WDFW, 2001a). Segment D would terminate at the proposed Wautoma Substation. The vegetation at the proposed substation site is described in the Segment C discussion.

Segment E

The vegetation of Segment E is mainly shrubland with some grasslands and agricultural lands. The large emergent wetland south of Lower Crab Creek Road is vegetated with cat-tails and bulrush. To the south, scattered willows line the northern shore of Lower Crab Creek. The south shore of Lower Crab Creek consists of an emergent wetland vegetated with rushes, cat-tails, grasses, forbs, with scattered Russian olive (WDFW, April 2, 2001). To the south, the rocky, steep slopes on the north side of Saddle Mountains are described as having sparse shrub-steppe vegetation in areas with gentler slopes. The agricultural lands in the valley are mainly in cropland with small adjacent areas that may have some remnants of native plant communities.

The Saddle Mountains Unit of the Hanford Reach National Monument is characterized as relatively undisturbed or recovering shrub-steppe habitat, with some sand dune areas dominated by grasses, and water influenced areas mapped as riparian areas (USDOE, October 2000). Hanford Site plant community maps depict three communities in the northeastern portion of the Saddle Mountains Unit, including big sagebrush/bunchgrasses-cheatgrass, big sagebrush-spiny hopsage/bunchgrasses-cheatgrass, and a small area of rabbitbrush/bunchgrass. To the south, a large area of bitterbrush/bunchgrass sand dune complex is mapped between two large wetland areas. These communities are considered "Plant Communities of Concern on the Hanford Site" (USDOE, October 2000).

The bitterbrush/Indian ricegrass shrubland north of the Columbia River is a WNHP high quality native plant community. This community extends along the river for several miles, including about 2.5 miles along Segment E.

Wetland plant communities, dominated by herbaceous species and scattered shrubs, occur in the Saddle Mountain Wasteway, north of the Columbia River. Wetland plant communities do not occur along the shoreline of the Columbia River, except possibly for a narrow herbaceous wetland along the shoreline.

Segment F

The vegetation of Segment F is mainly shrubland with some grasslands and very little agricultural land. Immediately north of Lower Crab Creek, a dune/willow complex occurs in the area of the proposed line (WDFW, April 2, 2001). This area may be somewhat degraded due to ATV use. The south shore of Lower Crab Creek consists of an emergent wetland vegetated with rushes, cat-tails, grasses, forbs, with scattered Russian olive. To the south, the rocky, steep slopes on the north side of Saddle Mountains are described as having sparse shrub-steppe vegetation in areas with gentler slopes.

Segment F traverses the Saddle Mountains from west to east, mainly along BLM land. BLM has not mapped plant communities in this area (P. Camp, Pers. Comm. 2001). This dry south-facing slope is mainly vegetated with grasses, with very few shrubs due to fires in the past. Scattered shrubs occur, mainly in the drainageways of intermittent creeks.

As described under Segment D, the area to the north of the Columbia River, in the Saddle Mountains Unit of the Hanford Reach National Monument is characterized as relatively undisturbed or recovering shrub-steppe habitat, with some sand dune areas dominated by grasses, and water-influenced areas mapped as riparian areas (USDOE, October, 2000).

The bitterbrush/Indian ricegrass shrubland that occurs north of the Columbia River along Segment F is a WNHP high quality native plant community. This community extends along Segment F for approximately 0.3 mi.

Weed Species

Some plant species are designated as weeds by federal or state law. Past land uses in the proposed study area, such as grazing and road building, have disturbed native plant communities and favored the establishment of some weed species. Present land uses, such as the use of vehicles along dirt roads or off-road and the expansion of agriculture, continue to contribute to the spread of weed species. However, some weeds do not require disturbances in order to thrive and are able to invade natural areas quickly.

Weed species have numerous detrimental effects, and their invasion of public and private lands is a matter of great concern. Weed species reduce the quality of shrub-steppe by replacing native species, and some form monocultures, which displace the more diverse native plant communities and reduce biodiversity. Weeds reduce the quality of wildlife habitat when they replace native food sources and plant cover species, and can have an economic impact on agricultural crops. Some contribute to the rapid spread of fire by providing fuel. In addition, most weeds are not as efficient as native species at binding soil, which contributes to soil erosion by water and wind.

In Washington, weed species are addressed on a county-by-county basis. Washington State law designates some particularly troublesome weeds as “noxious weed” species. The list of noxious weed species is divided into three classes (A, B, and C) within each county, based on the state of invasion. Table 2, Weeds of Concern in the Proposed Study Area, lists the Class A and Class B weeds that are of concern within each project segment.

Class B and Class C weeds are also present in the proposed study area and may be controlled as a local option, depending on the level of threat. Spiny cocklebur, a Class C weed found in Kittitas County, is present in some areas (Segments A, B, C, and G). Bull thistle and Canada thistle are Class C or Education List weed species, found throughout the entire study area. They will spread into most disturbed areas.

Some weed species are monitored by the state when they are suspected to be a potential threat or if more information is needed on the species. Common reed is monitored in the state of Washington. It is found in some wetlands on the Hanford Site (Segments E and F), where efforts are being made to eliminate known occurrences (D. Gonzales, Pers Comm, 2001). Russian thistle, a weed known to occur on the YTC (Segment C), is also a monitor species (M. Pounds, Pers Comm., 2001).

USFWS monitors several weed species including Russian olive and saltcedar. Russian olive is not designated by the State of Washington as a noxious weed, but it is spreading uncontrollably, particularly in wetland and riparian areas. Saltcedar is limited in Washington but has the potential to rapidly spread in riparian areas. It is currently found in one small wetland in the Saddle Mountains Unit of the Hanford Reach National Monument along Segment F and may occur in the Crab Creek area.

Table 2. Weeds of Concern in the Proposed Study Area

Common Name *Scientific Name* (Washington State Class*)	Kittitas County	Yakima County	Grant County	Benton County
	Segments A, B, C	Segment C	Segments D, E, F	Segments D, E, F
Dalmatian toadflax *Linaria dalmatica* ssp. *dalmatica* (Class B)	X	X	--	--
Johnsongrass *Sorghum halepense* (Class A)	-	X	--	--
Knapweed, diffuse *Centaurea diffusa* (Class B) except Benton County – no class	X YTC	X YTC	X HAN BLM	X HAN
Knapweed, spotted *Centaurea biebersteinii* (Class B)	X YTC	X YTC	X BLM	X
Knapweed, Russian *Acroptilon repens* (Class B)	YTC	X YTC	X HAN	X HAN
Kochia *Kochia scoparia* (Class B)	YTC	YTC	--	X
Musk Thistle *Carduus nutans* (Class B)	X	X	X	--
Pepperweed, perennial *Lepidium latifolium* (Class B)	YTC	YTC	--	--
Puncturevine *Tribulus terrestris* (Class B) Grant County Education list, Benton County	-	--	HAN	HAN
Purple loosestrife *Lythrum salicaria* (Class B)	X YTC	X YTC	--	HAN
Rush Skeletonweed *Chondrilla juncea* (Class B)	--	--	X BLM	X
Saltcedar *Tamarix ramosissima* (Class A)			F HAN	
Scotch thistle *Onopordum acanthoides* (Class B)	YTC	X YTC	--	--
Sowthistle, perennial *Sonchus arvensis* (Class B)	YTC	YTC	--	--

X species name provided by County Weed Board staff
BLM species name provided by BLM personnel
YTC species name found within the YTC Management Plan
HAN species name provided by Hanford Reach National Monument personnel

Rare Plants

Rare plant species vary depending on the land ownership. Table 3 identifies land ownership categories and the status of species that will be considered within each of these categories.

Table 3. Rare Species Addressed in Different Land Ownership Categories

Land Ownership/Management Category	Status of Plant Species
BLM	BLM sensitive species which includes federally listed, proposed, and candidate species and state rare species
All federally managed lands except BLM lands	Federally listed, proposed, and candidate species, federal species of concern
State owned Lands	Federally listed, proposed, candidate species, and species of concern; state endangered, threatened, and sensitive species, and a state category that includes species that are possibly extinct or extirpated in Washington
Private Lands	Federally listed, proposed, and candidate species

Information gathered on rare plant species includes the location of known occurrences and potential habitat for rare plant species. Detailed information on known occurrences, habitat preferences, and potential habitats of federally listed and candidate rare plant species are discussed below. Information on federal species of concern, BLM sensitive species, and state rare plant species includes known occurrences of these species within the study area.

Federal Listed Plants

The USFWS identified a federally listed threatened species and three federal candidate species with the potential to occur within the study area (USFWS, 2001). Table 4, Federal Status Plant Species with the Potential to Occur in the Study Area, lists the habitat and known occurrences of federal status species within the vicinity of the study area. These plants are also listed by the State of Washington (See Table 7).

Table 4. Federal Status Plant Species with the Potential to Occur in the Study Area

Common Name *Scientific Name*	Federal Status	Habitat Preference and Plant Associations	Known Occurrence(s) in the Vicinity of the Study area
Ute ladies'-tresses *Spiranthes diluvialis*	Threatened	Low elevation wetlands in valleys - associated with spikerush, sedges, grasses, and rushes	None
Northern wormwood *Artemesia campestris* var. *wormskioldii*	Candidate	Grows only within the floodplain of the Columbia River in relatively level, arid, shrub-steppe, on basalt, compacted cobble, and sand - associated with sagebrush and grasses	None within 1 mile of line segments. Several occurrences within the floodplain of the Columbia River, several miles south of the Segment B river crossing
Basalt daisy *Erigeron basalticus*	Candidate	Grows in crevices in basalt cliffs on canyon walls facing north, east, or west, from 1,250 to 1,500 feet in elevation - associated with a few grass and forb species	None within 1 mile of line segments. Occurs within Kittitas and Yakima counties along the Yakima River and Selah Creek; within the YTC, approximately 10 miles west of Segment C
Umtanum wild buckwheat *Eriogonum codium*	Candidate	Found on the exposed tops of a ridgeline that is composed of basalt, from 1,100 to 1,320 feet in elevation - associated with cheatgrass and a variety of forbs.	One known population, on Umtanum Ridge, in Benton County

Potential habitat for federal listed and candidate species occurs within the study area. Potential habitat includes any areas that meet the known habitat requirements for that species. Table 5, Habitat for Federal Listed Plant Species, lists the project segments that may contain potential habitat for federally listed and candidate species.

Because limited information is available on known occurrences of rare plant species, a preliminary rare plant field survey was conducted in August 2001 to determine where potential rare plant habitat occurs along the Preferred Alternative and to locate late blooming federally listed and candidate species. The results of this survey will be used to plan additional rare plant surveys during the spring of 2002.

Table 5. Habitat for Federal Listed Plant Species

Common Name *Scientific Name*	Segments With Potential Habitat for Federal Listed and Candidate Rare Plant Species					
	A	B	C	D	E	F
Ute ladies'-tresses *Spiranthes diluvialis*	■			■	■	■
Northern wormwood *Artemesia campestris var. wormskioldii*		■		■	■	■
Basalt daisy *Erigeron basalticus*			■	■		
Umtanum wild buckwheat *Eriogonum codium*				■		

Ute ladies'-tresses

Ute ladies'-tresses is a federally listed threatened species and a state threatened species. There are several occurrences of this species in Washington State, but this species is not known to occur in any of the four counties within the study area (WNHP, 2001). Ute ladies'-tresses is a perennial orchid that is generally found in low elevation wetlands in valleys and associated with spikerush, sedge species, grasses, and rushes (S. Moody, Pers. Comm. 2001). One of the known Washington State occurrences is within a periodically flooded alkaline, wet meadow that is adjacent to a sagebrush steppe community with big sagebrush, bitterbrush, and rabbitbrush, similar to habitat in the study area (WNHP, 2001).

Because Ute ladies'-tresses blooms in August and September, and surveys must be done when the species is in bloom, surveys were conducted in August 2001. No plants were found, however these areas would be resurveyed in 2002 because individuals of this species may not emerge above ground during some years.

Potential Ute ladies'-tresses habitat may occur in the wetland areas adjacent to Cooke Canyon Creek along Segment A, however none were found during the August 2001 surveys. There is a low probability that this species would occur in this area, based on the habitat characteristics identified during the surveys (Beck, Pers Comm, 2001).

The Lower Crab Creek drainage and valley wetlands along Segments D, E, and F were thought to be potential habitat for Ute ladies'-tresses. However, the species was not found during the August 2001 surveys and there is a low probability of it existing in this area since the area has been heavily grazed in recent years.

It is unlikely that Ute ladies'-tresses would occur along the riparian areas of other project segments because they would not provide enough water in the late spring and summer for this species to survive. The Hanford Reach National Monument EIS states that Ute ladies'-tresses "might be found" but is not known to occur on the Hanford Site (USDOE, 1999).

Northern wormwood

Northern wormwood is a federal candidate species and a state endangered species. Northern wormwood is known to occur in Grant County, but not in Kittitas, Benton, or Yakima counties. This species is only known to occur in two widely separated sites in Washington, both within the floodplain of the Columbia River (WNHP, 2001). The known population near the study area is on the east side of the Columbia River, approximately 2 miles south of the area where Segment B will span the river.

The habitat of this species is relatively level, arid, shrub-steppe, where it grows on basalt, compacted cobble, and sand. This species is found in big sagebrush/bluebunch wheatgrass or bluebunch wheatgrass/ Sandberg's bluegrass associations (Daubenmire, 1970). At both known sites, the vegetative cover is sparse and northern wormwood provides less than 1 percent of the total vegetative cover.

Potential habitat for northern wormwood within the study area is limited to the edges of the Columbia River in the areas where alternatives will span the river. Segments B, D, E, and F each have one Columbia River crossing. Surveys for northern wormwood have been conducted by The Nature Conservancy (TNC) along the northern shore of the Columbia River of the Hanford Site in the vicinity of the crossings of Segments D, E, and F, but no plants were found (M. Sachschewsky, Pers. Comm. 2001). The area along the Preferred Alternative will be surveyed for northern wormwood during spring of 2002.

Basalt daisy

Basalt daisy is a federal candidate species and a state threatened species only known to occur in Kittitas and Yakima counties. This endemic species occurs as a single population within an area approximately 10 miles long by 2 miles wide (WNHP, 2001). It grows in crevices in basalt cliffs on canyon walls along the Yakima River and Selah Creek, both of which cut through the Yakima Basalt Formation. One population is located on the YTC, approximately 10 miles west of Segment C (M. Pounds, Pers. Comm. 2001).

Basalt cliffs within segments C and D are potential habitat for basalt daisy. Although this species is not known to occur in Benton County, potential habitat for basalt daisy may occur on the cliffs of Yakima Ridge along segments C and D, just to the east of Yakima County. Potential habitat areas along the Preferred Alternative will be surveyed during spring of 2002.

Umtanum wild buckwheat

Umtanum wild buckwheat is a federal candidate species and a state endangered species. It is an endemic species that is only known to occur in one area in Benton County, on Umtanum Ridge (WNHP, 2001). This species was first discovered in 1995. An estimated 5,200 individuals compose the entire population of this species.

The only known occurrence of Umtanum wild buckwheat is located near Segment D on part of Umtanum Ridge, in the Midway area. The study area in the vicinity of Segment D was surveyed for rare plant species as part of the biodiversity inventory of the Hanford Site done by TNC in the 1990's.

The potential habitat along the Preferred Alternative was surveyed for Umtanum Wild Buckwheat in August 2001. Although this species blooms in the spring, it can be located in August because it is a perennial. Individuals were not found within the project area along Segment D (Beck, Pers Comm, 2001), although they were found nearby the proposed ROW.

Umtanum wild buckwheat is unlikely to occur along other project segments based on the limited geographic range of this species. Because very little is known about this species, surveys will be conducted on all basalt cliffs or ridgelines that may be impacted along the Preferred Alternative.

Federal Species of Concern

Six federal species of concern were identified by the USFWS (See Table 3.4-8). These species are also listed by the State of Washington.

BLM Sensitive Species

The Wenatchee Resource Area of the Spokane BLM District provided the sensitive species list for BLM lands within each of the four counties within the study area. Because detailed rare plant surveys have not been conducted on BLM lands within the study area, the BLM district botanist cautioned that it is impossible to determine with certainty which sensitive species might occur in the study area, without conducting field surveys (P. Camp, Pers. Comm. 2001).

The list of BLM sensitive species with the potential to occur along Segment F is included in Table 6, BLM Sensitive Rare Plant Species along Segment F. The other project segments cross only a few sections or smaller portions of sections of BLM land than Segment F. Information on the species that might occur along project segments other than Segment F is not available from the BLM (Camp, Pers. Comm. 2001). For the Preferred Alternative, the BLM sensitive plant list will be narrowed down based on the habitat preferences to determine which species might occur in the geographic area. This list of BLM sensitive species with potential habitat along the Preferred Alternative will form the basis for the field surveys during the appropriate season in 2002.

Table 6. BLM Sensitive Rare Plant Species

Species Common Name *Scientific Name*	Habitat Requirements
Geyer's milk-vetch *Astragalues geyeri*	Occurs in depressions in mobile or stabilized dunes, sandy flats, and valley floors within grey rabbitbrush/Indian ricegrass communities
Bristle-flowered collomia *Collomia macrocalyx*	Dry, open habitats, on talus, rock outcrops, and lithosols, in sparsely vegetated areas with a low species diversity; within sagebrush dominated communities
Gray cryptantha *Cryptantha leucophaea*	Occurs in sandy areas, on slopes associated with big sagebrush, and grasses, including Indian ricegrass, needle-and-thread grass, Sandberg's bluegrass, cheatgrass, and various forb species
Common blue-cup *Githopsis specularioides*	Open places at lower elevation, on thin soils over bedrock outcrops, talus slopes and gravelly areas
Hoover's desert-parsley *Lomatium tuberosum*	Occurs in loose talus, typically on east and north-facing slopes, within big sagebrush/bluebunch wheatgrass communities; also found in talus in drainage channels on south-facing slopes
Nuttall's sandwort *Minuartia nuttallii* var. *fragilis*	Sagebrush dominated hills to high elevation slopes, found mainly on gravelly benches or talus slopes
Cespitose evening-primrose *Oenothera cespitosa ssp. cespitosa*	Occurs in open sites on talus or on rocky slopes and may colonize road cuts; associated with big sagebrush, occurs in sagebrush dominated communities associated with gray rabbitbrush, Sandberg's bluegrass, needle and thread grass, Indian ricegrass, Junegrass, and forbs
Wanapum crazyweed *Oxytropis campestris* var. *wanapum*	Occurs on the summit of the Saddle Mountains, descending down the north slope; in deep sand in the big sagebrush/blue bunch wheatgrass community
Texosporum santi-jacobi	A pin-head lichen that occurs on soils as part of biological crust

Washington State Rare Plant Species

Known occurrences of state rare species within each segment, along lands of all ownership and management categories, are listed in Table 7, Known Occurrences of Rare Plant Species, (WNHP, 2001). Six of these species are listed as federal species of concern. All state lands along the Preferred Alternative will be surveyed for state-listed and sensitive rare plant species. The list of rare plant species for each county along the Preferred Alternative, maintained by the WNHP, will be used to determine the species that may have potential habitat along the Preferred Alternative.

Known Rare Plant Occurrences by Segment

There are no known occurrences of federally listed species along any of the project segments. A federal candidate species, Umtanum wild buckwheat, occurs in the immediate area of Segment D. Federal species of concern and state status species occur in the area of all project segments.

Table 7, Known Occurrences of Rare Plant Species, lists known occurrences of rare plant species by segment. Known occurrences within the "immediate area" of the proposed line are estimated to be within 500 feet of either or both sides of the proposed line.

Table 7. Known Occurrences of Rare Plant Species**

Common Name ***Scientific Name***	**Federal Status**	**State Status**	**Known Occurrences of Rare Plant Species Along Segments**						
			A	**B**	**C**	**D**	**E**	**F**	**G**
Umtanum wild buckwheat *Eriogonum codium*	Candidate	Endangered				■*			
Columbia milk-vetch *Astragalus columbianus*	Species of Concern	Threatened		■*	■*	■*			■
Gray cryptantha *Cryptantha leucophaea*	Species of Concern	Sensitive		■		■*	■*		
Hoover's desert-parsley *Lomatium tuberosum*	Species of Concern	Threatened				■*	■*	■*	
Persistentsepal yellowcress *Rorippa columbiae*	Species of Concern	Threatened				■*			
Hoover's tauschia *Tauschia hooveri*	Species of Concern	Threatened	■						
Dwarf evening-primrose *Camissonia pygmaea*	--	Threatened		■				■*	
Pauper milk-vetch *Astragalus misellus var. pauper*	--	Sensitive	■						
Naked-stemmed evening-primrose *Camissonia scapoidea*	--	Sensitive		■					■
Bristle-flowered collomia *Collomia macrocalyx*	--	Sensitive		■					■
Beaked cryptantha *Cryptantha rostellata*	--	Sensitive	■	■					■
Piper's daisy *Erigeron piperianus*	--	Sensitive				■*		■	
Longsepal globemallow *Iliamna longisepala*	--	Sensitive	■						
Suksdorf's monkey-flower	--	Sensitive	■*	■			■*		■

Common Name *Scientific Name*	Federal Status	State Status	Known Occurrences of Rare Plant Species Along Segments						
			A	B	C	D	E	F	G
Mimulus suksdorfii									
Nuttall's sandwort *Minuartia nutallii var. fragilis*	--	Sensitive							
Tufted evening-primrose *Oenothera cespitosa ssp. cespitosa*	--	Sensitive		■*	■	■			■

*Occurrence in the immediate vicinity (within approximately 500 feet) of segment
**Does not include federal status plants that also have state status.
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Segment A

There are no known occurrences of federally listed or candidate plants within the study area of Segment A. There are several occurrences of Hoover's tauschia (federal species of concern) within 0.4 to 1 mile of the proposed line. Suksdorf's monkey-flower (state sensitive) occurs within the immediate vicinity of the proposed line. Pauper milk-vetch, longsepal globemallow, Pauper milk-vetch, and beaked cryptantha (state sensitive species) are located approximately 0.75 to 1 mile from the segment centerline.

Option B_{NORTH}

There are no known occurrences of federally listed or candidate plants within the study area of Segment B. Columbia milk-vetch (federal species of concern and state threatened species) and tufted evening-primrose (state sensitive) occur within the immediate vicinity of the proposed line. Gray cryptantha (federal species of concern and state sensitive species) occurs within 0.25 mile of the segment centerline. Dwarf evening-primrose (state threatened) and four state sensitive species, naked-stemmed evening primrose, bristle-flowered collomia, beaked cryptantha, and Suksdorf's monkey-flower, occur approximately 0.25 to 0.5 mile from the segment centerline.

Option B_{SOUTH}

There are no known occurrences of federally listed or candidate plants within the study area of Segment B_{SOUTH}. Columbia milk-vetch (federal species of concern) occurs within 0.5 mile of the segment. Five state sensitive species occur within 1 mile of the segment: naked-stemmed evening-primrose, bristle-flowered collomia, beaked cryptantha, Suksdorf's monkey-flower, and tufted evening-primrose.

Segment C

There are no known occurrences of federally listed or candidate plants within the area of Segment C. Columbia milk-vetch (federal species of concern) occurs under and on both sides of the segment centerline. Tufted evening-primrose (state sensitive) occurs about 0.25 mile from the proposed line. The vegetation at the site of the proposed Wautoma Substation was investigated in June of 2001 and potential habitat for rare plants does not occur at this site (St. Hilaire, 2001).

Segment D

There are no federally listed plants within the area of Segment D, but there is a known occurrence of a federal candidate species, Umtanum wild buckwheat, near the segment ROW. Four federal species of concern occur in the immediate area and within 1 mile of the segment centerline: Columbia milk-vetch, persistentsepal yellowcress, gray cryptantha, and Hoover's desert parsley. Piper's daisy (state sensitive) occurs in the immediate area of the segment, while tufted evening-primrose, also a state sensitive species, occurs approximately 0.5 mile from the segment centerline. The vegetation at the site of the proposed Wautoma Substation was investigated in June of 2001, and potential habitat for rare plants does not occur at this site (St.Hilaire, 2001).

Segment E

There are no known occurrences of federally listed or candidate plants within the study area of Segment E. Hoover's desert-parsley and gray cryptantha (both federal species of concern), occur in the immediate area of the segment. Suksdorf's monkey flower (state sensitive species) also occurs in the immediate area of the segment centerline.

Segment F

There are no known occurrences of federally listed or candidate plants within the study area of Segment F. Hoover's desert parsley (federal species of concern) occurs in the immediate vicinity of the segment and within 1 mile of the study area. Dwarf evening primrose (state threatened) occurs in the immediate vicinity of the segment. Piper's daisy (state sensitive) occurs approximately 0.25 mile from the segment centerline.

Table 8. Plant Species Mentioned in EIS text by Common Name

Common Name * = non-native species	*Scientific Name*
Aspen	*Populus tremuloides*
Balsamroot	Various species of *Balsamorhiza*
Basalt daisy	*Erigeron basalticus*
Beaked cryptantha	*Cryptantha rostellata*
Big sagebrush	*Artemesia tridentata*
Biscuitroot	*Lomatium macrocarpum*
Bitterbrush	*Purshia tridentata*
Black cottonwood (=cottonwood)	*Populus trichocarpa*
Black greasewood	*Sarcobatus vermiculatus+*
Black hawthorn	*Crataegus douglasii*
Bluebunch wheatgrass	*Agropyron spicatum* or*Pseudoroegneria spicata*
Blue elderberry	*Sambucus cerulea*
Bristle-flowered collomia	Collomia macrocalyx
*Bull thistle	Circium vulgare
Bulrush	Various species of *Scirpus*
*Canada thistle	*Circium arvense*
Cattail	*Typha latifolia*
Cespitose evening-primrose	*Oenothera cespitosa ssp. cespitosa*
Chenactis	*Chaenactis douglasii*
*Cheatgrass	*Bromus tectorum*
*Chicory	*Chichorum intybus*
Chokecherry	*Prunus virginiana*
Columbia milk-vetch	Astragalus columbianus
Common blue-cup	Githopsis specularioides
Common reed	Phragmites australis
Cottonwood (=black cottonwood)	Populus trichocarpa
Curve-pod milk-vetch	Astragalus spherocarpus
Cushion daisy	Erigeron poliospermus
Cushion phlox	Phlox hoodii
* Dalmatian toadflax	*Linaria dalmatica* ssp. *dalmatica*
Desert buckwheat	Various species of *Eriogonum*
*Diffuse knapweed	*Centaurea diffusa*
Dwarf goldenweed	*Haplopapus acaulis*
Dwarf evening-primrose	*Camissonia pygmaea*
Eriogonum	Various species of *Eriogonum*
Geyer's milk-vetch	*Astragalus geyeri*
Golden currant	*Ribes aureum*
Gray cryptantha	*Cryptantha leucophaea*
Grays' desert parsley	*Lomatium grayi*
Gray rabbitbrush	*Chrysothamnus nauseosus*
Green-banded star-tulip	*Calocarpus macrocarpus*
Green rabbitbrush	*Chrysothamnus viscidiflorus*
Hoover's desert-parsley	*Lomatium tuberosum*
Hoover's tauschia	*Tauschia hooveri*
Idaho fescue	*Festuca idahoensis*
Indian ricegrass	*Oryzopsis hymenoides*
*Johnsongrass	Sorghum halepense
Junegrass	Koeleria cristata
*Kochia	*Kochia scoparia*

Common Name * = non-native species	***Scientific Name***
Low sagebrush	*Artemesia arbuscula*
Mint	*Mentha arvensis*
Mock orange	*Philadelphus lewisii*
*Musk thistle	*Carduus nutans*
Naked-stemmed evening-primrose	*Camissonia scapoidea*
Needle-and-thread grass	*Stipa comata*
Northern wormwood	*Artemesia campestris var. wormskioldii*
Nuttall's sandwort	*Minuartia nuttallii var. fragilis*
Oceanspray	*Holodiscus discolor*
Oregon sunshine	*Eriophyllum lanatum*
Pauper milk-vetch	*Astragalus misellus var. pauper*
Penstemon	*Penstemon sp.*
*Perennial pepperweed	*Lepidium latifolium*
*Perennial sowthistle	*Sonchus arvensis*
Persistentsepal yellowcress	*Rorippa columbiae*
Phlox	*Phlox sp.*
Piper's daisy	*Erigeron piperianus*
Ponderosa pine	*Pinus ponderosa*
*Puncturevine	*Tribulus terrestris*
*Purple loosestrife	*Lythrum salicaria*
Purple sage	*Salvia dorrii*
Rabbitbrush (either gray or green rabbitbrush)	Either *Chrysothamnus naseous* or C. viscidiflorus
Rabbitfoot grass	Polypogon monspeliensis
Red osier dogwood	Cornus stolonifera
Rock eriogonum (=buckwheat)	Various species of *Eriogonum*
Rose	Various species of *Rosa*
*Rush skeletonweed	*Chondrilla juncea*
Rushes	Various species of *Juncus*
*Russian Knapweed	*Acroptilon repens*
*Russian olive	*Elaeagnus angustifolia*
*Russian thistle	*Salsola iberica*
Sagebrush	Various species of *Artemesia,* see big sagebrush, threetip sagebrush, stiff sagebrush and low sagebrush
Saltgrass	*Distichlis spicata*
Sandberg's bluegrass	*Poa sandbergii* or *Poa secunda*
Sand dock	*Rumex venosus*
Scarlet globe mallow	*Spaheralcea coccinea*
* Scotch thistle	*Onopordum acanthoides*
Sedge	Various species of *Carex*
Sego lily	Various species of *Calochortus*
Serviceberry	*Amelanchier alnifolia*
Slenderbush eriogonum or buckwheat	*Eriogonum microthecum*
Spikerush	Various species of *Eleocharis*
*Spiny cocklebur	*Xanthium spinosum*
Spiny hopsage	*Grayia spinosa* or *Atriplex spinosa*
*Spotted knapweed	*Centaurea maculosa*
Stiff sagebrush	*Artemesia rigida*
Stinging nettle	*Urtica dioica*
Suksdorf's monkey-flower	*Mimulus suksdorfii*
Teasel	*Dipsacus sylvestris*
Threetip sagebrush	*Artemisia tripartita*

Common Name *** = non-native species**	***Scientific Name***
Tufted evening-primrose	*Oenothera cespitosa ssp. cespitosa*
*Tumble mustard	*Sisymbrium altissimum*
Umtanum wild buckwheat	*Eriogonum codium*
Ute ladies'-tresses	*Spiranthes diluvialis*
Wallflower	*Erysimum sp.*
Wanapum crazyweed	Oxytropis campestris *var.* wanapum
Wax currant	*Ribes cereum*
White currant	*Ribes cereum*
White-stemmed evening primrose	*Oenothera pallida*
Wild rose	Various species of *Rosa*
Willow	Various species of *Salix*
Wyoming big sagebrush	*Artemesia tridentata* ssp. *wyomingensis*
Wood's rose	*Rosa woodsii*
Yarrow	*Achillea millefolium*
Taxonomy follows Hitchcock and Cronquist, 1973.	

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Appendix F – Fish and Wildlife Technical Report

Fish and Wildlife Technical Report

Bonneville Power Administration
Schultz-Hanford Area Transmission Line Project

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1.0 INTRODUCTION

1.1 Bonneville Power Administration

The Bonneville Power Administration (BPA), a federal agency, owns and operates over 15,000 circuit miles of transmission lines throughout the Northwest. BPA markets power to direct service industries and to utilities that provide electricity for homes, businesses, and farms in the Pacific Northwest. BPA also uses the transmission system to provide power to other regions, such as Canada and California.

1.2 Transmission System

The BPA transmission system moves power from generation sites to major load areas. Generation sites are primarily the dams on the Columbia and Lower Snake Rivers, and major load areas are Seattle, Portland, Canada (during cold seasons), and California (during hot seasons). During spring and early summer months, the Northwest and Canada usually have an abundance of water from snowmelt in the mountains. The power generated from this water serves Northwest loads, and the surplus electricity is typically sent to southern markets, such as California.

1.3 Need for Capacity

The need for more capacity (i.e., a new transmission line) occurs during spring and early summer. The spring and early summer months are when juvenile salmon travel down rivers, and dams along the Lower Snake and Columbia Rivers (e.g., Lower Granite to Bonneville) spill large amounts of water to help transport juvenile salmon to the ocean. Spilling water over the dams causes less water to go through the turbines, and less power is generated. As a result, dams along the Mid- and Upper-Columbia River in Washington (e.g., Grand Coulee and Chief Joe) and dams in Canada (e.g., Mica and Revelstoke) generate most of the power needed during spring and early summer months. The large amount of power generated in the northern parts of the region and Canada moves south through central Washington to reach load centers, such as Portland and the Southern Intertie, which leads to California. This causes congestion on the transmission system in central Washington (north of Hanford) because there is not enough transmission capacity to move this large amount of power. BPA needs to increase transmission capacity in this area, to relieve existing constraints on the transmission system.

1.4 Proposed Action

To meet the need for new capacity, BPA is proposing to construct a new 500-kV transmission line between the Schultz Substation north of Ellensburg, Washington, and a substation near Hanford. Depending on the route alternative chosen, the project may terminate at the existing Hanford Substation, or at the proposed new Wautoma Substation located west of the Hanford Site, near Blackrock. Figure 1.4-1 shows the proposed routes.

1.5 Fish and Wildlife Resource Surveys

The purpose of this document is to identify fish and wildlife resources that may be affected by the proposed project. Fish species and habitats are discussed in Section 2, and wildlife species and habitats are addressed in Section 3. Each section describes the affected environment and assesses the impacts that are likely to occur to fish and wildlife species from construction and operation of the project.

Figure 1.4-1 General Project Map

INSERT PDF MAP FILE “segmntv2.pdf” or updated version showing Bsouth if available

2.0 FISH

2.1 Fish Affected Environment

This section discusses the fish habitats and species that may be affected by the proposed project. Only those streams or waterbodies with perennial flows that are affected by the project are discussed here. Some intermittent streams may have fish present at some time during the year, but usually in limited areas near a source of perennial water.

2.1.1 Study Area

The study area for the fish component of the Schultz-Hanford project includes creeks, lakes and other water bodies that may support fish along each of seven proposed line segments that make up the four possible route alternatives.

2.1.2 Methodology

The fish section was developed using field visits, literature sources, state and federal database queries, and contact with agency biologists.

2.1.2.1 Field Visits

A field visit to identify streams and ponds where suitable fish habitat might be present took place in February 2001. The proposed line segments were located in the field and the different streams and lakes that each segment passed through were identified. No fish species were observed.

2.1.2.2 Literature Sources

Journal articles, reference books, public agency management plans, agency internet sites and unpublished documents were used to determine species presence, life histories, habitat characteristics, and other information used in this section. Aerial photographs of each route, overlaid with National Wetland Inventory data were developed by the BPA and used to supplement the field visits. The WDFW catalog of Yakima basin streams and fish presence (unpublished) was used as well.

2.1.2.3 Database Queries

The US Fish and Wildlife Service (USFWS) was contacted and asked to provide a list of Threatened and Endangered fish species that might be present near the proposed project. A list of Township, Ranges and Sections within one mile of the proposed project was entered into their database. One Threatened Species (bull trout) was identified as possibly occurring near the proposed project.

The Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species Program was contacted and asked to provide a map of state Threatened and Endangered fish species that might be present near the proposed project. The same area was input into this database as for the USFWS database query. The National Marine Fish Service website (NMFS, 2001) was referenced to determine threatened or endangered anadromous salmonid presence. Two endangered stocks (Upper Columbia River Spring Chinook salmon and Upper Columbia River Steelhead trout) and one threatened stock (Middle Columbia River Steelhead trout) were identified.

2.1.2.4 Agency Contacts

Agency biologists from the WDFW were contacted regarding the presence of threatened or endangered fish species along the proposed route segments. A meeting was also held in Yakima with representatives from WDFW that identified a number of areas where fish species were known to exist.

2.1.3 Regulations and Management Plans

A number of Federal acts and management plans regulate impacts to fish from projects such as that proposed here. Section 7 of the Endangered Species Act of 1972 (as amended) requires federal agencies to ensure that any action authorized, funded or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat. In practical terms, this means that projects that have federal involvement must consult with USFWS and/or NMFS to determine if their actions will cause a "take" of a species listed (or proposed for listing) under the act. "Take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct."

A management plan has been developed for the YTC that affects fish resources. The YTC management plan states that the following measures (relevant to the proposed project) will be taken to protect fish habitat and resources on the YTC grounds:

Protection

- Protection of soils to improve percolation and reduce overland flow
  -Protection of groundwater infiltration areas
  -Erosion control structures on roads
  -Enhancement of upland vegetation
- Protection and enhancement of riparian areas
  -Bank stabilization
  -Riparian plantings
- Stream channel bed control
  -Gabion weirs
  -Boulder clusters
  -Large woody debris
  -Beavers
  -Stormwater detention facilities
  -Maintenance of hardened crossings and culverts to ensure fish passage

Maintenance

- Large woody debris placement

- Log/rock weir construction
- Boulder cluster placement
- Riparian plantings (large woody debris recruitment)
- Beaver introductions (at later date)
- Fish plantings
  -In ponds
  -In streams

Future management actions related to fish enhancement or protection on the YTC may have implications for the project, should it be constructed along the YTC alignment. Project design and construction should meet these management objectives for construction in the YTC.

2.1.4 Regional Context

The study area lies at the western edge of the Interior Columbia Basin. The area lies in the rain shadow of the Cascade Mountain, and thus receives very little precipitation (6 inches in the eastern lowest areas to 22 inches in the higher elevations in the west). Much of the precipitation occurs in the winter in the form of snow. With the exception of the Columbia River, which bisects the study area, water is scarce. Streams are generally small and intermittent. The northern part of the study area near Ellensburg drains into the Yakima River. The remainder of the project contains a number of local drainages that drain directly into the Columbia River.

2.2 Fish Habitats and Species

The proposed route from Schultz Substation to Hanford Substation (or proposed new Wautoma Substation) was broken into seven proposed alternative line segments (Segments A, B_{north}, B_{south}, C, D, E and F). In this section, a discussion of the fish habitats and species present along each line segment is given. Each perennial water feature is discussed. Intermittent streams or wetlands are not discussed. The most significant fish resources found within the project area are endangered anadromous salmonids such as salmon and steelhead. These fish are born and rear in small streams, then migrate down the Columbia River to the ocean. After several years in the ocean, they migrate upstream back to their native streams to spawn. Resident salmonids such as bull trout and rainbow trout are also important resources, as are a number of other cold and warm water fish species.

2.2.1 Unique Fish Habitats and Species of Each Line Segment

The following sections describe the habitats and fish species present along each line segment. Each perennial waterbody is addressed separately. The discussion of habitats present along each route was taken from personal observations, WDFW Priority Habitats and Species data, unpublished data from WDFW and conversations with agency biologists. Table 2.2-1 summarizes fish species presence by segment and perennial water body.

Table 2.2-1 Fish Species Presence

Perennial Water Name[1]	Segment Intercepting Waterbody							Fish Species Present In Waterbody[2]	Comments
	A	B_{north}	B_{south}	C	D	E	F		
Wilson Creek	X							**Chinook salmon (Federal Endangered, State Candidate)**, **Mountain sucker (State Candidate)**, Rainbow trout, Cutthroat trout, Brook Trout, Mountain whitefish, 3-Spine stickleback, Speckled dace, Longnose dace, Redside shiner, Torrent sculpin, Brook lamprey	Wilson Creek has high quality fish habitat in the project area. Chinook salmon are only present in the lowest mile of the creek, and not in the project area. Mountain suckers are probably found in the project area.
Naneum Creek	X							**Chinook salmon (Federal Endangered, State Candidate)**, **Mountain sucker (State Candidate)**, Rainbow trout, Cutthroat trout, Brook Trout, Mountain whitefish, 3-Spine stickleback, Speckled dace, Longnose dace, Redside shiner, Torrent sculpin, Brook lamprey	Naneum Creek has high quality fish habitat in the project area. Chinook salmon are only present in the lowest mile of the creek, and not in the project area. Mountain suckers are probably found in the project area.
Cave Canyon Creek	X							None	Fish habitat is present, but fish are not documented in this creek.
Schnebly Creek	X							Rainbow trout	Rainbow trout are present in the project area.
Coleman Creek	X							**Chinook salmon (Federal Endangered, State Candidate)**, **Bull trout (Federal Threatened, State Candidate)**, Rainbow Trout	Chinook salmon habitat is high quality, but limited to the lowest three miles of the stream. Bull trout have not been observed since 1970.
Cooke Canyon Creek	X							Rainbow trout, Cutthroat Trout, Brook trout	Cooke Canyon Creek is split into several small channels in the project area, which may limit the available fish habitat.
Caribou Creek	X							Rainbow trout	Caribou Creek has marginal fish habitat in the project area.
Parke Creek	X							Rainbow trout	Rainbow trout are likely present in the project area.
Middle Canyon Creek		X	X	X				Rainbow trout	Project crosses the intermittent headwaters of Middle Canyon Creek. It is unlikely that habitat in this area is utilized by fish.

Perennial Water Name[1]	Segment Intercepting Waterbody							Fish Species Present In Waterbody[2]	Comments
	A	B_{north}	B_{south}	C	D	E	F		
Johnson Creek		X	X	X				**Chinook salmon (Federal Endangered, State Candidate)**, **Steelhead trout (Federal Endangered/Threatened, State Candidate)**, Rainbow trout, 3-Spine stickleback, Prickly sculpin, Large scale sucker, Redside shiner	Juvenile chinook salmon only use the lowest reach of the stream for resting as they migrate down the Columbia River. Steelhead may spawn and rear in the lowest reach near the mouth. Resident fish habitat is degraded in the project area due to military operations, grazing and fires, but fish are present.
Hanson Creek				X				**Chinook salmon (Federal Endangered, State Candidate)**, Rainbow trout, Brook trout	Juvenile chinook salmon only use the lowest reach of the stream for resting as they migrate down the Columbia River. Resident fish habitat is degraded in the project area due to military operations, grazing and fires, but fish are present.
Alkali Canyon Creek				X				**Chinook salmon (Federal Endangered, State Candidate)**, Rainbow trout, Brook trout	Juvenile chinook salmon only use the lowest reach of the stream for resting as they migrate down the Columbia River. Resident fish habitat is degraded in the project area due to military operations, grazing and fires, but fish are present.
Corral Canyon Creek				X				**Chinook Salmon (Federal Endangered, State Candidate)**	Juvenile chinook salmon only use the lowest reach of the stream for resting as they migrate down the Columbia River. Resident fish habitat is degraded in the project area due to military operations, grazing and fires, and fish are not present.
Cold Creek				X	X			None	Cold Creek is intermittent in the project area, and no fish are present.
Crab Creek					X	X	X	**Chinook salmon (Federal Endangered, State Candidate), Steelhead trout (Federal Endangered/Threatened, State Candidate)**, Rainbow trout, Brown trout, Various warmwater fish species	Crab Creek supports a wide variety of fish, including many of those found in the Columbia River.

Perennial Water Name[1]	Segment Intercepting Waterbody							Fish Species Present In Waterbody[2]	Comments
	A	B_{north}	B_{south}	C	D	E	F		
No Wake Lake						X		Various warmwater species	Private waterskiing lake
Nunnaly Lake							X	Rainbow trout, various warmwater species	Nunnaly Lake is stocked with Rainbow trout for sportfishing.
Saddle Mountain Lake						X		Various warmwater species	Saddle Mountain Lake is an irrigation return flow lake.
Columbia River		X	X		X	X	X	**Chinook salmon (Federal Endangered, State Candidate)**, **Steelhead trout (Federal Endangered/Threatened, State Candidate)**, **Pacific lamprey**, Brook lamprey, Various warmwater species (40 different species all together)	The Columbia River supports 44 known species of fish, and is the major migration corridor for anadromous species.

[1] Only streams or lakes that contain water year around are listed here.

[2] Fish species that may be present in the waterbody. In some cases fish may be present somewhere in the waterbody, but not where the proposed project crosses it. Bold species are federal or state listed species.

2.2.1.1 Fish Habitat and Species of Segment A

Segment A crosses eight fish-bearing streams that drain the Wenatchee Mountains north of the project area. These streams are all part of the Wilson-Naneum Creek subbasin, a part of the Yakima basin. The major fish issue facing these streams is the lack of access between the Yakima River and the headwater areas due to obstructions from irrigation and agricultural operations in the lower sections. All streams in the Wilson-Naneum subbasin are heavily diverted on the Kittitas valley floor and have been channelized into an intricate drainage/irrigation system. There are over 200 unscreened diversions in this drainage (WDFW, unpub.). The riparian zone of the valley portions of these streams is extensively impacted by grazing and other agricultural practices. In their upper reaches these streams flow through timbered canyons with good year-round flows.

2.2.1.1.1 Wilson-Naneum Creek Crossing

The Wilson-Naneum Creek complex is one of the more productive small streams in the project area. Fish species present in the Wilson-Naneum Creek complex include steelhead, spring chinook salmon, western brook lamprey, rainbow trout, cutthroat trout, brook trout, mountain whitefish, three spine stickleback, speckled dace, longnose dace, bridgelip sucker, mountain sucker, redside shiner, and torrent sculpin (WDFW, 2001). There is currently no adult anadromous salmonid or lamprey spawning in the upper part of the creek due to migration barriers downstream, but juvenile salmonids use the lower two miles as rearing habitat. At the site of the proposed crossing, there are no anadromous fish present, however the non-anadromous species mentioned above are likely to be present.

Since the proposed crossing is at the very upper edge of the Kittitas Valley, the stream at this point is relatively unaffected by irrigation withdrawals and other agricultural activities. However, the creek is listed on the 303 (d) list for temperature and fecal coliform. The habitat conditions near the proposed crossing are good, with clean substrate, good water quality and good instream flows (personal observation, 2001). The riparian zone is in good condition with mature cottonwoods and a diverse assemblage of riparian shrubs. Large woody debris recruitment potential is higher in this area than in most of the rest of the watershed due to the presence of large cottonwoods. The high quality of this particular section of Wilson and Naneum Creeks can be attested to by the fact that the area supports a number of wintering bald eagles. The bald eagles rely on the large cottonwood trees for roosting and may use the open water areas of the stream to catch fish.

2.2.1.1.2 Schnebly Creek Crossing-

Schnebly Creek is a small stream with little suitable fish habitat near the project area. In its upper reaches, the stream supports rainbow trout (WDFW, 2001a), but it is unlikely to harbor fish where the project crosses it.

2.2.1.1.3 Coleman Creek Crossing

Fish species present in Coleman Creek are similar to those in Wilson and Naneum Creeks, and include steelhead, spring chinook salmon, western brook lamprey, rainbow trout, cutthroat trout, brook trout, mountain whitefish, three spine stickleback, speckled dace, longnose dace, bridgelip sucker, mountain sucker, redside shiner, and torrent sculpin. Bull trout were last observed in 1970 (WDFW, unpub.). Coleman Creek has been channelized and diverted into Naneum Creek and no longer has its natural mouth. There is currently no adult anadromous salmonid spawning in this creek due to obstructions, but the lower 0.5 miles of Coleman Creek has some of the best salmonid rearing habitat in the northern Kittitas Valley area (WDFW unpub.).

Higher upstream, the riparian zone of the valley portions of this stream is extensively impacted by grazing and other agricultural practices. The proposed crossing of Coleman Creek is just above the Kittitas Valley floor. The stream flows through a shallow canyon with a narrow riparian area. Stream habitat is good, with clean substrates, good water quality and good year-round flows. WDFW PHS data (WDFW, 2001a) indicates that fish are present only from the mouth upstream to a point approximately two miles below where the proposed route crosses. However, Renfrow (2001), and WDFW (unpub.) indicated that the stream near the proposed crossing probably contains many of the species present lower in the system, except anadromous fish.

2.2.1.1.4 Cooke Canyon Creek Crossing

Fish species present in Cooke Canyon Creek include rainbow trout, cutthroat trout, and brook trout. No anadromous salmonids are present due to downstream obstructions (WDFW, unpub.).

The project crosses Cooke Canyon Creek at Coleman Canyon Road. The stream is divided into multiple small channels in this area. A good riparian area with large cottonwoods and willows exists upstream of Coleman Canyon Road. Downstream of the road, the riparian vegetation consists of smaller shrubs and trees. Stream flow is good in this area, although the split channels may limit available fish habitat. Stream substrate appears clean and the riparian areas are good, although livestock are present in the area upstream of the crossing. Cooke Canyon Creek is listed on the 303 (d) list for temperature, fecal coliform and dissolved oxygen. Like Coleman Creek, the WDFW PHS data (WDFW, 2001a) indicates that fish species are probably only present downstream several miles from the proposed crossing. However, Renfrow (2001) indicated that the three trout species were probably present higher in the drainage above the project area, and may be present where the proposed ROW crosses.

2.2.1.1.5 Caribou Creek Crossing

Fish species present in Caribou Creek are probably limited to rainbow trout (WDFW, 2001a, WDFW unpub.). No anadromous salmonids are present due to downstream obstructions

The project crosses Caribou Creek adjacent to a large cultivated field. The creek here is very narrow, with a marginal riparian area and low flows. Fish habitat is marginal. It is unlikely that rainbow trout are present in large numbers in this area.

2.2.1.2 Fish Habitat and Species of Segment B_{north}

The proposed project would cross two perennial drainages and the Columbia River between the northern terminus of Segment C and the Vantage Substation. The perennial drainages drain the northeastern corner of the YTC. Extensive past grazing, military maneuvers and other disturbances have caused changes in flow regimes and a general reduction in the quality of fish habitat within the two perennial drainages.

2.2.1.2.1 Middle Canyon Creek

The only fish species known to exist in Middle Canyon Creek is rainbow trout (US Army, 1996). However, the proposed route crosses the intermittent headwaters area of Middle Canyon, where suitable trout habitat, if available would only be present during the wet season.

2.2.1.2.2 Johnson Creek

Fish species present in Johnson Creek include rainbow trout, possibly steelhead, chinook salmon, 3-spine stickleback, prickly sculpin, large scale sucker, and redside shiner (US Army,1996). Chinook salmon utilize only the lower end of the creek near the Columbia River for juvenile rearing and steelhead may be present in the lower reaches (Renfrow, 2001).

Base flows in Johnson Creek are low due to an increase in storm runoff and a reduction in infiltration caused by compacted unvegetated soils from years of cattle grazing and military land uses. A general lack of riparian vegetation coupled with low base flows causes high water temperatures during the warmer months which may limit the distribution of some species, particularly salmonids.

The proposed route crosses in the middle reach of Johnson Creek, thus anadromous salmonids are unlikely to be present, although the other species known to exist in the creek are likely to be present.

2.2.1.2.3 Columbia River Crossing

The Columbia River near the project area supports populations of approximately 44 known species of fish. Chinook salmon, sockeye salmon, steelhead and Pacific lamprey use the Columbia River near the project site as a migration corridor between the ocean and areas upstream for spawning and rearing. Fish commonly pursued for sport include whitefish, small-mouth bass, sturgeon, catfish, walleye and perch. Rough fish such as squawfish, carp, suckers and shiners are also present in large numbers (US DOE, 1999).

The Wanapum dam tailrace, located directly underneath the proposed crossing, is an important fall chinook salmon spawning area (US DOE, 1999). The Columbia River is on the 303 (d) list of pH, temperature, and dissolved gas.

2.2.1.3 Fish Habitat and Species of Segment B_{south}

Proposed Segment B_{south} crosses Middle Creek and Johnson Creek, both described in the Segment B discussion.

2.2.1.4 Fish Habitat and Species of Segment C

The proposed project crosses six major drainages, all of which drain the interior of the YTC directly to the Columbia River. Fish are present in five of the six drainages crossed (no fish are present in Cold Creek). Extensive past grazing, military maneuvers and other disturbances have caused changes in flow regimes and a general reduction in the quality of fish habitat within the two perennial drainages. In recent years, severe fires have damaged riparian vegetation and reduced the amount of vegetative cover on upland areas.

2.2.1.4.1 Middle Canyon Creek

The only fish species known to exist in Middle Canyon Creek is rainbow trout (US Army, 1996). However, like Segment B_{north} and B_{south}, the proposed route crosses the intermittent headwaters area of Middle Canyon, where suitable trout habitat, if available would only be present during the wet season.

2.2.1.4.2 Johnson Creek

Fish species present in Johnson Creek include rainbow trout, possibly steelhead, chinook salmon, 3-spine stickleback, prickly sculpin, large scale sucker, and redside shiner (US Army, 1996). Chinook salmon utilize only the lower end of the creek near the Columbia River for juvenile rearing. Steelhead may be present in the lower reaches of Johnson Creek (Renfrow, 2001). The proposed route crosses in the middle reach of Johnson Creek, thus anadromous salmonids are unlikely to be present, although the other species known to exist in the creek are likely to be present.

2.2.1.4.3 Hanson Creek

Fish species present in Hanson Creek include eastern brook trout and fall chinook (US Army, 1996). Chinook salmon utilize only the lower reach of the creek near the Columbia River for juvenile rearing, and are not present near the proposed crossing.

2.2.1.4.4 Alkali Canyon

Fish species present in Alkali Canyon Creek include rainbow trout, eastern brook trout and fall chinook (US Army, 1996) . Chinook salmon utilize only the lower reach of the creek near the Columbia River for juvenile rearing, and are not present near the proposed crossing

2.2.1.4.5 Corral Canyon

The only fish species present in Corral Canyon Creek is chinook salmon. They only utilize the extreme lower reach of the creek near the Columbia River for juvenile rearing, and are not present near the proposed crossing (US Army, 1996).

2.2.1.4.6 Cold Creek

No fish are known to be present in Cold Creek.

2.2.1.5 Fish Habitat and Species of Segment D

Segment D crosses three drainages; Crab Creek, the Columbia River and Cold Creek. A series of irrigation canals and drains are crossed on the Wahluke Slope, however these are not considered fish habitat. Depending on conditions and the availability of stable flows, fish could exist temporarily in some canals, however they would most likely be introduced into the canals by humans or carried by birds from other water bodies and would not persist.

2.2.1.5.1 Crab Creek

Fish species present in Lower Crab Creek include rainbow trout, brown trout, chinook salmon, and possibly a remnant steelhead population (WDFW, 2001a, Renfrow, 2001). The proposed project crosses the extreme lower reach of Crab Creek just upstream of its confluence with the Columbia River. Lower Crab Creek could be used by a most of the 40 Columbia River fish species on a temporary basis as well. Crab Creek is listed on the 303 (d) list for pH, temperature, PCB's, and DDE.

2.2.1.5.2 Columbia River

The Columbia River near the proposed Segment D crossing contains approximately 44 species of fish. Like the Segment B crossings, chinook salmon, sockeye salmon, steelhead and Pacific lamprey use the Columbia River near the project site as a migration corridor to upstream spawning areas and for spawning and rearing. Fish commonly pursued for sport include whitefish, small-mouth bass, sturgeon, catfish, walleye and perch. Rough fish such as squawfish, carp, suckers and shiners are also present in large numbers (US DOE, 1999).

The area directly under the proposed crossing, just upstream from the Vernita Bridge, is an important spawning area for fall chinook salmon and Upper Columbia River steelhead. This area represents the northern extent of the naturally spawning Hanford Reach population of fall chinook, which is approximately 50-60% of the total fall chinook runs in the Columbia River (US DOE, 1999). The Columbia River is on the 303 (d) list of pH, temperature, and dissolved gas.

2.2.1.5.3 Cold Creek

No fish are known to be present in Cold Creek where proposed Segment D crosses it.

2.2.1.6 Fish Habitat and Species of Segment E

Segment E crosses two major drainages; Crab Creek and the Columbia River. Like Segment D, a series of irrigation canals and drains are crossed on the Wahluke Slope, however these are not considered fish habitat.

2.2.1.6.1 Crab Creek
Proposed Segment E crosses Crab Creek several hundred meters upstream of proposed Segment D. Fish habitat and species will be similar to those discussed in the Segment D section.

2.2.1.6.2 Saddle Mountain Lake
Saddle Mountain Lake contains only warmwater fish species such as yellow perch, pumpkinseed, bluegill and crappie.

2.2.1.6.3 Columbia River
The proposed route crosses the Columbia River near the middle of the Hanford Reach. The fish species and habitats are similar to the crossing described for Segment D. Important spawning areas for fall chinook and Upper Columbia River steelhead are present downstream from the proposed crossing.

2.2.1.7 Fish Habitat and Species of Segment F

Proposed Segment F crosses only two major drainages, Crab Creek and the Columbia River, and a lake.

2.2.1.7.1 Nunnaly Lake
Nunnaly Lake is a pothole lake in the Crab Creek valley. It is a high use recreational area. Rainbow trout are stocked for sport fishing purposes. Warmwater species such as, yellow perch, pumpkinseed, bluegill, and crappie may be present.

2.2.1.7.2 Crab Creek
Proposed Segment E crosses Crab Creek several hundred meters upstream of proposed Segment D and E. Fish habitat and species will be similar to those discussed in the Segment D section.

2.2.1.7.3 Columbia River
The proposed Segment F crossing of the Columbia River uses the same alignment as proposed Segment E, and has similar fish habitat and species to that discussed in Segment D.

2.2.2 Threatened and Endangered Fish Species

The project area is within the range of three species (which includes three Evolutionarily Significant Units, or ESU's and one Distinct Populations Segment, or DPS) of threatened or endangered fish: Upper Columbia River spring-run chinook salmon, Upper Columbia River steelhead, Middle Columbia River steelhead, and bull trout.

2.2.2.1 Chinook Salmon (Upper Columbia River Spring-Run ESU)

The proposed project area is located within the ESU of the Upper Columbia River spring-run chinook salmon, a federally listed Endangered Species. Critical habitat for this ESU includes all river reaches accessible in Columbia River tributaries between Rock Island Dam and Chief Joseph Dam in Washington, excluding the Okanogan River. Also included is the Columbia River from the mouth upstream to Chief Joseph dam (and adjacent riparian zones and estuarine areas). These fish exhibit a "stream-type" life history, meaning that the juveniles spend a year or more in the freshwater streams they were born in, as opposed to "ocean-type" chinook, which migrate to the ocean or estuaries shortly after emerging from the gravel (Myers, et. al., 1998).

The Upper Columbia River spring-run chinook spawn across a geographic area that encompasses several diverse ecosystems. Fish ascend to the upper reaches of the river systems, and in some cases, access to these areas is only possible during the high spring river flows from snowmelt and spring storms. The use of smaller tributaries for spawning and extended juvenile rearing by stream-type chinook salmon increases the potential for disturbance from human activities.

Human activities have significantly influenced the distribution of the Upper Columbia River spring-run chinook salmon. When Grand Coulee Dam was constructed, a significant area of spawning and rearing habitat was permanently blocked. Fish that were originally bound for points above the dam were transferred to other rivers such as the Methow, Entiat, and Wenatchee Rivers, which had their own distinct stocks. The unique traits of the native stocks were diluted by the addition of the new stocks, and the continued hatchery supplementation of those stocks (Myers, et. al., 1998). The native stocks were adapted to local conditions within each river system and were better suited for those systems than were the transferred stocks. This may have contributed to the overall decline in the species. Hydroelectric dams and/or irrigation diversions affect virtually every river and stream containing Upper Columbia spring-run chinook salmon. Blockage or losses of spawning and rearing habitat, direct mortality by stranding or upstream and downstream passage injury, and changes in thermal regimes have resulted (Myers, et. al., 1998).

Spawning chinook require areas of clean gravel with good subsurface flow. If subsurface flow is adequate, chinook will spawn in areas with a wide variety of stream depths, flows and gravel sizes (Healey, 1998). Preferred spawning habitat is often at pool tailouts or medium riffles with one to three feet of fast-flowing water, probably since these areas often have good subsurface flows. Juvenile chinook salmon typically require structurally diverse habitat, including deep pools, undercut banks, rocks, large woody debris, and good vegetative cover on stream banks.

Within the proposed project area, Upper Columbia spring-run chinook will only be encountered in the Columbia River, which juveniles and adults use as a migration corridor between the ocean and the headwater streams where they spawn and rear.

2.2.2.2 Steelhead Trout (Upper Columbia River ESU)

The Upper Columbia River steelhead ESU is listed as Endangered. Critical habitat is designated to include all accessible river reaches in Columbia River tributaries upstream of the Yakima River, Washington, and downstream of Chief Joseph Dam. Also included is the Columbia River from the mouth upstream to Chief Joseph dam and its adjacent riparian zones and estuarine areas.

Upper Columbia River steelhead exist in an area that sees extremes in temperatures and precipitation. Most precipitation falls in the mountains as snow. Streamflow in this area is provided by melting snowpack, groundwater, and runoff from alpine glaciers and is thus very cold and generally not as productive as other warmer streams and rivers. Upper Columbia River steelhead have been documented spending up to seven years in freshwater before migrating to the ocean, probably due to the cold temperatures and the low stream productivity (Busby, et. al. 1996). Most steelhead in this ESU, like those of the Middle Columbia River ESU, spend two years in freshwater prior to migrating downstream to the ocean and one year in freshwater prior to spawning.

Upper Columbia River steelhead are limited by habitat blockages from Chief Joseph and Grand Coulee Dams, and smaller dams on tributary rivers. Irrigation diversions and hydroelectric dams, and degraded riparian and instream habitat from urbanization and livestock grazing have resulted in severe impacts to steelhead habitat. Hatchery fish that escape to naturally spawn are widespread and outnumber native fish in several major river systems. This ESU might not exist today if there were not hatchery production. However, the unique traits of the original native stocks have been diluted by the addition of stocks that originally spawned and reared above Chief Joseph and Grand Coulee dams before they were constructed, and the continued hatchery supplementation of the original native stocks (Busby, et. al., 1996). The original native stocks were adapted to local conditions within each river system and were better suited for those systems than were the transferred stocks. This dilution of the native stocks with outside stocks less suited for local conditions may have contributed to the decline in the native populations of Upper Columbia River steelhead

Steelhead typically spawn in streams with well oxygenated areas of small and medium sized gravels free of fine sediment deposition. Juvenile steelhead typically require structurally diverse habitat, including deep pools, undercut banks, large woody debris, refuges from high flows such as off channel habitat, and areas of groundwater upwelling.

The project may affect Upper Columbia River steelhead or designated critical habitat where it crosses the Columbia River on Segments B_{north}, B_{south}, D, E, and F, or small tributaries on the Yakima Training Center along Segment C. Upper Columbia River steelhead are known to spawn in the Hanford Reach of the Columbia River near where Segments D, E and F cross (USDOE, 2001).

2.2.2.3 Steelhead Trout (Middle Columbia River ESU)

The Middle Columbia River steelhead is listed as Threatened. Critical habitat is designated to include all accessible river reaches in Columbia River tributaries (except the Snake River) between Mosier Creek in Oregon and the Yakima River in Washington (including the Yakima River). Also included is the Columbia River from the mouth upstream to the Yakima River and its adjacent riparian zones and estuarine areas.

Middle Columbia River steelhead exist in some of the driest areas of the Pacific Northwest. Vegetation in this region is generally shrub-steppe. Streams and rivers in the area are often subject to low flows and high temperatures, thus minor changes in vegetation or water quality can cause habitat degradation. Since most middle Columbia River steelhead spend two years in freshwater before migrating to the ocean, and a year in freshwater after returning from the ocean but before spawning, they may be more sensitive to changes in water quality and habitat than other anadromous species that spend less time in freshwater. Middle Columbia River steelhead may be limited by high summer and low winter temperatures in many streams in this region. Low flows, extreme temperature conditions, water withdrawals and overgrazing have seriously impacted available fish habitat in this ESU (Busby, et. al., 1996). There is little or no late summer flow in sections of the lower Umatilla and Walla Walla Rivers. Riparian vegetation is heavily impacted by overgrazing and other agricultural practices, timber harvest, road building, and channelization. Instream habitat is also affected by these same factors, as well as by past gold dredging and severe sedimentation due to poor land management practices. A major present threat to genetic integrity for steelhead in this ESU comes from past and present hatchery practices. (Busby, et. al., 1996)

Steelhead typically spawn in streams with well oxygenated areas of small and medium sized gravels free of fine sediment deposition. Juvenile steelhead typically require structurally diverse habitat, including deep pools, undercut banks, large woody debris, refuges from high flows such as off channel habitat, and areas of groundwater upwelling.

The project may affect Middle Columbia River steelhead or designated critical habitat in small tributaries of the Yakima River north and east of Ellensburg, along Segment A.

2.2.2.4 Bull Trout (Columbia River Basin DPS)

The proposed project area is located within Columbia River Basin DPS for bull trout. The Columbia River Basin Bull Trout DPS includes all naturally spawning populations in the Columbia River Basin within the United States and its tributaries, excluding bull trout found in the Jarbidge River, Nevada. Bull trout in the Columbia River Basin DPS are a federal threatened species.

Bull trout were once widely distributed throughout the Pacific Northwest, but they have been reduced to approximately 44 percent of their historic range (ICBEMP 1997). Bull trout have more specific habitat requirements in comparison to other salmonids and are most often associated with clear and cold headwater streams and rivers with undisturbed habitat and diverse cover and structure.

Key factors in the decline of bull trout populations include harvest by anglers, impacts to watershed biological integrity, and the isolation and fragmentation of populations. Changes in sediment delivery (particularly to spawning areas), aggradation and scouring, shading (high water temperature), water quality and low hydrologic cycles adversely affect bull trout. Therefore, impacted watersheds are negatively associated with current populations. Additionally, the bull trout appear to be negatively affected by other non-native trout species through competition and hybridization (ICBEMP 1997).

Bull trout spawning and rearing is restricted to relatively pristine cold streams, often within the headwater reaches (Rieman and McIntyre 1993), although adults can reside in lakes or reservoirs and in coastal areas, they can migrate to saltwater (63 FR 31647). Bull trout distribution is patchy within watersheds, most likely due to the need for cold water (63 FR 31648). Juveniles are usually located in shallow backwater or side channels areas, while older individuals are often found in deeper water pools sheltered by large organic debris, vegetation, or undercut banks (63 FR 31467). Water temperature is a critical factor for bull trout, and areas where water temperature exceeds 15 degrees Celsius (59 degrees Fahrenheit) are thought to limit distribution (Rieman and McIntyre 1993).

The project may affect bull trout or designated critical habitat in small tributaries of the Yakima River north and east of Ellensburg, along Segment A.

2.3 Impacts to Fish Species

Impacts to fish species and habitat are assessed for each alternative proposed for the project. Various segments described in Section 2.2.1 are combined to form each alternative.

2.3.1 Fish Species Impact Levels

High impacts to fish would occur when an action creates a significant adverse change in fish habitat, populations or individuals. High impacts might result from actions that:

- cause the take of a federally listed or proposed threatened or endangered fish species;
- cause a significant long-term (more than two years) adverse effect on the populations, habitat or viability of a federal or state listed fish species of concern or sensitive species, which would result in trends towards endangerment or the need for federal listing; or
- harm or kill a significant number of individuals of a common fish species at the local (stream reach or small watershed) level.

Moderate impacts to fish would occur when an action creates a moderate adverse change in fish habitat, populations or individuals. Moderate impacts might result from actions that:

- without causing a take, cause a temporary (less than two months) reduction in the quantity or quality of localized (stream reach or small watershed) aquatic resources or habitats at a time when federally listed threatened, endangered or proposed fish species are **not likely** to be present (i.e., during non-spawning or rearing times);
- cause a short-term (up to two years) localized (stream reach or small watershed) reduction in population, habitat and/or viability of a federal or state listed fish species of concern or sensitive species, without causing a trend towards endangerment and the need for federal listing; or
- harm or kill a small number of individuals of a common fish species at the local (stream reach or small watershed) level.

Low impacts to fish would occur when an action creates a minor or temporary adverse change in habitat, populations or individuals. Low impacts might result from actions that:

- cause a temporary (less than two months) localized (stream reach or small watershed) reduction in the quantity or quality of aquatic resources or habitats of state listed fish species of concern or sensitive species, without causing a trend towards endangerment and the need for federal listing; or
- cause a short-term (up to two years) disturbance or displacement of common fish species at the local (stream reach or small watershed) level.

No impacts to fish would occur when an action has no effect or fewer impacts than the low impact level on fish habitat, populations or individuals.

2.3.2 Impacts to Fish Species Common to All Action Alternatives

The construction, operation and maintenance of the proposed transmission line will impact fish populations that reside in or near the study area. The extent of impact would depend on the fish species, its distribution, its habitat requirements and the availability of suitable habitat in and around the project area.

2.3.2.1 Construction Impacts

Short-term construction disturbances, depending on the time of year and the location, could impact various fish species by causing sedimentation, habitat and/or individual fish disturbance, or the release of hazardous materials into a waterway. The following would be potential short-term impacts:

- Damage to fish (e.g. gill abrasion, fin rot), from construction sediments entering streams;
- Soil from roads, cleared areas, excavations, stockpiles or other construction sources might enter streams and cause an increase in sediment load and/or sediment deposition in spawning gravels or fish habitat, or damage to food organisms;
- Concrete washing or dumping might allow concrete waste to enter streams and cause an increase in sediment load and local fish toxicity;
- Other construction materials (metal parts, insulators, wire ends, bolts, etc.) might enter streams and cause changes in flow or other unknown effects;
- Mechanical disturbance of fish habitat from equipment operating in, crossing, or passing streams;
- Streambank compaction and/or sloughing might reduce the streambank's ability to support vegetation, or cause sediment input or increased runoff;
- Heavy equipment moving across a stream (or repeated travel by light equipment) might cause substrate disturbance, including sediment release or substrate compaction;
- Riparian vegetation destruction or removal (this would be incidental only; planned vegetation removal for ROW and roads is a long-term impact) may cause a loss of fish habitat (cover), loss of stream shading, removal of large woody debris sources, and reduction in buffer capacity;
- Disturbance of individual fish from equipment operating in or near streams;
- Vibration or shock from equipment operating in or near streams would drive fish to less suitable habitat or to areas where predation is more likely. In marginal conditions such as extreme low flows and high water temperatures, stress from repeated disturbance may cause death;
- Mechanical injury or death from equipment crossing or operating in streams could result, especially to fish that live in or on the bottom of the stream (such as sculpins);
- Injury or death of fish or their prey from hazardous materials spills; or
- Petroleum fuel products, hydraulic oil, and other hazardous materials typically associated with construction activities may enter the stream, causing fish kills, aquatic invertebrate kills, and death or injury to a number of other species that fish depend on for food. Spills may also create pollution "barriers" to fish migration between stream reaches.

Depending on the location and the fish species present, short-term impacts would range from low to high. Short-term disturbances such as those listed above would constitute a high or medium impact on most species. However, since most of the project construction will occur away from streams and include mitigation (such as construction timing restrictions and spill prevention and erosion measures), short-term construction-related disturbances should result in low impacts to all fish species.

2.3.2.2 Operation and Maintenance Impacts

Long-term impacts resulting from ongoing operation and maintenance would result mostly from habitat alteration due to clearing of riparian vegetation, changes in runoff and infiltration patterns (from upland vegetation clearing), sedimentation from cleared areas, and maintenance access across streams.

Since the transmission line would span narrow riparian areas or be located upslope of stream channels, little or no riparian vegetation would be removed for line clearance. Where access roads are required to cross streams, riparian vegetation may be removed. Since riparian areas are extremely important in providing stream shading and cover for fish, and are a source of large woody debris in streams, any clearing of stream-side riparian vegetation for ROW clearance or access road construction would likely cause moderate to high impacts to fish species, should they be present.

The area cleared for tower construction and access roads in upland areas could change runoff and infiltration patterns to the extent that flow regimes in creeks would be altered, especially in smaller drainages. A decrease in groundcover from vegetation removal can cause an increase in sheet flow during storm events, with correspondingly less infiltration. This can cause higher flood flows in creeks and reduce the amount of infiltrated water that can support base flows. Higher flood flows cause more erosion and deposition of fine materials, which may affect fish habitats or cause physical damage to fish through gill abrasion. Lower base flows, in areas where base flows are already low, may cause streams to dry up in some places or result in warmer water temperatures, which can cause harm or be lethal to fish.

Clearing for roads and tower sites increases the risk of sediment input due to the erosion of soil that is normally stabilized by vegetative cover. Sedimentation of streams can cause a degradation of spawning areas, by filling the interstitial spaces in spawning gravels. This reduces the flow of oxygenated water necessary for egg and alevin survival.

Creating new vehicle access across streams can cause bank compaction, repeated sediment disturbance, disturbance or physical damage to fish (if present), a conduit for sediment input, and the possible release of automotive wastes such as fuel or hydraulic oil into a stream. Stream crossings of intermittent drainages would be accomplished by constructing fords where possible. Ford construction would involve removing a portion of the streambed below grade, then backfilling it with crushed rock or other suitable rocky material to the original streambed level. Ford approaches would be stabilized with crushed rock to reduce erosion and provide an all-weather surface. Drainages that are too incised or steep to ford may be fitted with culverts or bridges to provide water and debris passage.

Perennial streams would be crossed using existing crossings, where possible. In areas where adequate crossings or alternative routes do not currently exist, bridges or culverts would be used to maintain fish passage and stream flows, while providing vehicle access. Approaches to crossings would be stabilized with crushed rock to reduce erosion and provide an all-weather surface. Access roads would experience intense use during construction, but use should not increase much over current threshold levels once construction is complete.

Operation of the proposed project would be limited to energizing the conductors. Normal operation of the project would have no impact on fish species.

Maintenance of the project might include periodic vehicle and foot inspections, helicopter surveys, tower and line repair, ROW clearing, and other disturbances. Depending on the time of year and location, maintenance activities could impact fish species or habitat. Periodic ROW clearing will be mostly limited to riparian areas, where the impact might be high. Maintenance impacts will be similar to those impacts related to short-term construction.

2.3.3 Impacts to Fish Species Specific to Each Alternative

Impacts to fish species are assessed for each action alternative.

2.3.3.1 Alternative 1- Schultz-Hanford (Segments A, B_{north} or B_{south}, E)

2.3.3.1.1 Segment A

Segment A would cross 28 intermittent drainages and seven perennial streams, six of which are known to be fish bearing. Wilson Creek, Naneum Creek, Schnebly Creek, Coleman Creek, Cooke Canyon Creek, Caribou Creek and Parke Creek are all known to contain fish. Cave Canyon Creek does not contain fish.

Both Wilson Creek and Naneum Creek are in steep canyons. Towers would be placed high up and well away from both streams. Access would be through existing fords. Since no new construction would occur near the streams, impacts to fish are expected to be low. The increase in traffic along the existing roads would be insignificant.

Schnebly Creek has an existing crossing and Coleman Creek does not require a crossing. The towers would be constructed high up and away from the creek edges. No impacts to fish are expected.

Cooke Canyon Creek, near the proposed crossing, has several channels and lies in a wide floodplain that is mostly pasture. An existing County road provides access. Removal of riparian vegetation may be required for overhead clearance. This would create a moderate impact to rainbow trout, cutthroat trout and brook trout. With mitigation (see Section 2.4), this impact could be reduced to low.

Caribou Creek has an existing farm road ford. Towers would be located away from the creek. Impacts to fish are expected to be low.

Parke Creek has access from either side of the creek, eliminating the need for a new crossing. Towers would be located well away from both creeks. No impacts to fish are expected.

The proposed reroute of Segment A would cross Cooke Canyon Creek approximately 0.3 miles south of the original alignment in an area with very little riparian vegetation and multiple small channels. Removal of riparian vegetation in this area would not be required, minimizing the impacts to fish.

2.3.3.1.2 Segments B_{north} and B_{south}

Segments B_{north} and B_{south} would cross five intermittent drainages, two fish-bearing perennial streams (Middle Canyon Creek and Johnson Creek), and the Columbia River, which is also fish bearing.

Middle Canyon Creek and Johnson Creek would both be crossed in their headwaters, where conditions are generally unsuitable for fish survival during most times of the year. Therefore, there would be no direct impacts to fish (injury, disturbance from equipment, etc.).

Middle Canyon Creek would need to be crossed with a ford, and the streambed would be disturbed during creation of the ford, which would have the potential to cause increased sediment input, bank destabilization and riparian vegetation removal. Also, hazardous materials spills from equipment traveling across the ford could move downstream to where fish are present, should the stream be flowing. Thus, indirect impacts to fish could be high depending on the nature and quantity of a spill and the time of year it occurs. With mitigation such as construction during work windows spill control and erosion controls, (see Section 2.4), impacts to fish in Middle Canyon Creek should be low.

Johnson Creek has an existing culvert crossing, therefore impacts to fish are expected to be low.

The Columbia River would be crossed by a long span, with towers set well away from the banks. Since the towers and access roads would be far away from the edge of the river, sediment or other materials would not be able to reach the water. Therefore, there would be no impacts to any fish species in the Columbia River along Segment B_{north} or B_{south}.

2.3.3.1.3 Segment E

Segment E crosses eight intermittent streams, four canals or drains, two lakes, one perennial stream and the Columbia River. Both lakes, the stream, and the Columbia River contain fish. Segment E would parallel Segment D from the Vantage Substation to the top of the Saddle Mountains, then head southeast into the Hanford Site.

The Crab Creek crossing would have towers placed over 200 feet from the stream bank. Access would be from either side, so no new crossings of Crab Creek are proposed. Some riparian vegetation may need to be cleared. No new construction will occur near Crab Creek, therefore impacts to fish (Chinook salmon, steelhead, rainbow trout, brown trout and warm water fish) are expected to be low.

Saddle Mountain Lake would be crossed at its eastern end, near where the overflow channel (Saddle Mountain Wasteway) exits. An existing access road crosses the wasteway and could be used for access. Towers would be placed over 200 feet from either side of the edge of the lake. Riparian vegetation is relatively low, although some trees may need to be removed for overhead access. The lake supports warm water fish only. Since no new access roads would be built, towers would be located away from the lake. No sensitive fish species are present, so impacts would be low.

The Columbia River crossing into the Hanford Site would be accessed from either side of the river. Towers would be placed well back from the edge of the river. There is very little riparian vegetation in this area and none of it would need to be cleared. There would be no impacts to fish species in the Columbia River at this location.

2.3.3.2 Alternative 1A Schultz-Hanford (Segments A, B_{north} or B_{south}, F)

Impacts to fish resources along Segments A, B_{north} and B_{south} would be the same as described for Alternative 1 (see Section 2.3.3.1.1 and 2.3.3.1.2)

Segment F would cross 30 intermittent drainages, one canal, two lakes, one perennial stream and the Columbia River. Nunnaly Lake, Crab Creek, Saddle Mountain Lake and the Columbia River all contain fish.

Segment F would use the same crossing of the Columbia River as described in Segment E, so impacts to fish would be similar to those described in that section.

Nunnally Lake is a closed depression north of Crab Creek that has been filled with water and contains rainbow trout and various warmwater fish species. It is managed as a recreational fishery. Access roads would be routed around the lake, and towers would be located on either side, over 200 feet from the edge of the lake. Since no new access roads would be constructed near the lake, towers would be placed far away from the edge. No riparian vegetation would be removed, so the impact to fish in Nunnally Lake would be low to none.

2.3.3.3 Alternative 2 Schultz-New Wautoma Substation (Segments A, B_{north} or B_{south}, D)

Impacts to fish resources along Segments A, B_{north} and B_{south} would be the same as described for Alternative 1 (see Sections 2.3.3.1.1 and 2.3.3.1.2).

Segment D crosses 11 intermittent drainages, nine canals or drains, one lake, one perennial stream and the Columbia River. No Wake Lake, Crab Creek and the Columbia River all contain fish.

No Wake Lake is a private constructed lake used for water skiing. It contains warm water species of fish. Towers may be placed close to the water, but access would be from either side. The land surrounding the lake is relatively flat, which would limit the erosion potential from tower and access road construction and limit the potential for spills to enter the lake. No impacts to fish are expected at this location.

Since Segment D would cross Crab Creek near the location where Segment E crosses, impacts would be similar to those described for Segment E (Section 2.3.3.1.3).

The proposed crossing of the Columbia River would parallel existing transmission lines. The towers would be set over 200 feet from the edge of the river, and access would be from existing roads on either side of the river. Since no new access roads near the river would be built and there is sufficient distance from the towers to the river, no sediments spills or other materials would be able to easily enter the river. Impacts are expected to be low.

2.3.3.4 Alternative 3 Schultz-New Wautoma Substation YTC Route (Segments A, C)

Impacts to fish resources along Segment A would be the same as described for Alternative 1 (see Section 2.3.3.1.1).

Segment C construction would cross 40 intermittent drainages and six perennial steams, five of which are fish bearing. Middle Canyon Creek, Johnson Creek, Hanson Creek, Alkali Canyon Creek and Corral Canyon are all known to contain fish. No fish are present in Cold Creek.

Middle Canyon Creek and Johnson Creek would be crossed with fords in their headwater sections. Impacts to fish in these two creeks would be similar to those described for Segment B (Section 2.3.3.1.2).

Hanson Creek and Alkali Canyon Creek both contain rainbow trout and brook trout throughout their lower and middle reaches. Both of these creeks and Corral Canyon Creek support chinook salmon in their very lowest reaches near the Columbia River. These creeks are in steep canyons, so the towers would be placed on either side of the canyons well above the creek. No impacts are expected from tower construction and placement. However, all three of these streams would need to have bridges or culverts placed in them to allow vehicular access. Impacts to fish, especially chinook salmon, from construction of these access roads and structures could be high, depending on when the construction occurs, if sediments or spills enter the creek, and if fish are present. With mitigation such as doing in-water work during work windows, erosion and spill control measures, and construction of structures that allow fish passage (see Section 3.4), impacts to rainbow trout, brook trout and chinook salmon would be low.

2.3.3.5 No Action Alternative

No impacts to fish resources are expected under the No Action Alternative.

2.3.4 Impacts to Threatened and Endangered Fish Species

Table 3.3-2 lists federally listed fish species that are present within the study area. A Biological Assessment is being prepared separately, which will present effects determinations for each of these species.

Table 3.3-2 Impacts to Threatened and Endangered Fish Species

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Documented Occurrence Type	Potential Impact	Mitigated Impact
Chinook Salmon (Upper Columbia River Spring Run ESU)	FE	SC	B_{north}, B_{south}, C, D, E, F	P	Moderate	Low
Steelhead Trout (Middle Columbia River ESU)`	FT	SC	A	P	Moderate	Low

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Documented Occurrence Type	Potential Impact	Mitigated Impact
Steelhead Trout (Upper Columbia River ESU)	FE	SC	B_{north}, B_{south}, C, D, E, F	P	Moderate	Low
Bull Trout	FT	SC	A	H	Moderate	Low
FE = Endangered SC = Candidate P = Present (general presence) FT = Threatened H = Historically Present, Not Currently Present						

2.3.4.1 Chinook Salmon (Upper Columbia River Spring Run ESU)

Upper Columbia River chinook salmon (a federally listed endangered species) are present in the study area only in the Columbia River, where line Segments B_{north}, B_{south}, D, E and F cross it and possibly in some of the lower reaches of streams crossed by Segment C. The construction and operation of Segment A would have no impact on Upper Columbia River chinook salmon, since they are not present in the Yakima River basin and the streams that these segments cross.

Construction of any of the three Columbia River crossings associated with Segments B_{north}, B_{south} D, E and F would also have no impact on Upper Columbia River chinook salmon. This is because towers would be built far enough away from the river bank and riparian areas to eliminate the potential for sediments, spills or other materials to enter the river. New towers at river crossings would parallel existing towers, which range from 200 to1,000 feet from the edge of the river. Access to the towers would be limited to the landside of the towers and would not enter the riparian zone. Riparian vegetation removal would not be required at any of the Columbia River crossings. The streams crossed by Segment C are in steep, narrow canyons and would need stream crossings constructed across them. Chinook may be present at certain times of year in the lowest reaches and could be affected by sediment and pollutants moving downstream from construction areas. Therefore, the impacts to Upper Columbia River chinook salmon could be moderate.

2.3.4.2 Steelhead Trout (Upper Columbia River ESU)

Upper Columbia River ESU steelhead (a federally listed endangered species) are present in the lower reaches of streams crossed by Segments B_{north}, B_{south} and C. They also exist in the Columbia River where Segments B_{north}, B_{south}, D, E, and F cross it.

The Columbia River crossings (described in the chinook salmon sections above) would have no impact on Upper Columbia River steelhead. Crossings of Middle Creek and Johnson Creek on Segments B_{north}, B_{south} and C would not directly impact Upper Columbia River steelhead, since this creek does not support steelhead where these proposed segments cross it. However, the lower reach of Middle and Johnson Creeks may support steelhead, and moderate to high indirect impacts could occur from sediments, spills or other materials entering the creek, or removal of upland and riparian vegetation that might change flow regimes and increase stream temperatures. The area of Crab Creek where Segments D, E and F cross it may support steelhead, however the construction of towers and access roads would not occur within 200 feet of Crab Creek, and no riparian vegetation would be removed. With mitigation (see Section 3.4), impacts to Upper Columbia River steelhead are expected to be low.

2.3.4.3 Steelhead Trout (Middle Columbia River ESU)

Middle Columbia River ESU steelhead (a federally listed threatened species) are present in the Yakima River basin, but are not known to exist in the upper reaches of streams where Segment A crosses. However, these streams are federal designated critical habitat.

Construction near streams along Segment A could cause sediments or other materials to enter the streams and have minor impacts to water quality. This would cause moderate impacts to Middle Columbia River steelhead. However, with mitigation (see Section 3.4), impacts to Middle Columbia River Steelhead are expected to be low.

2.3.4.4 Bull Trout Columbia River DPS

Bull trout (a federally listed threatened species) are not known to currently exist within any of the streams, lakes or rivers crossed by the project, although all streams and rivers are designated as critical habitat. Coleman Creek, near Ellensburg, is known to have historically contained bull trout, but none have been observed since 1970 and it is unknown whether any are still present. No historical records of bull trout are documented in any of the other proposed stream crossings. No new access roads would be constructed across Coleman Creek and the towers would be placed well away from the creek. Since construction would occur far from the creek, and no sediments, spills or other materials would be likely to enter the creek, the project would have no impact on bull trout.

2.3.5 Impacts to Special Status Wildlife Species

Table 3.3-2 lists state and federal special status species that USFWS and WDFW have identified as possibly occurring within the project area and indicates the possible impact the project may have on them.

Table 3.3-3 Impacts to Special Status Fish Species

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Documented Occurrence Type	Potential Impact	Mitigated Impact
Coastal Cutthroat Trout	FP		None	N	None	None
Westslope Cutthroat Trout	FSC		A	P	Moderate	Low
Interior Redband Trout (Rainbow)	FSC		All Segments	P	High	Low
Margined Sculpin	FSC	SS	None	N	None	None
Pacific Lamprey	FSC		B_{north}, B_{south}, D, E, F	P	Low	None
River Lamprey	FSC	SC	A	P	Low	None

Federal Status
FP = Proposed for Listing
FSC = Species of Concern

State Status
SC = Candidate
SS = Sensitive

Presence
P = Present (general presence)
N = Not Present

2.3.6 Cumulative Impacts to Fish Species

The proposed action may contribute to localized, short-term and long-term disturbance to fish resources, because of increased sediment input and possible hazardous materials spills. Erosion and sedimentation of streams within the study area has increased over the past 100 years due to land use practices such as grazing, agriculture, road building, land clearing, military operations and other disturbances. This has contributed to a reduction in the quality and availability of fish habitat in many streams. Increased access and human activity around streams during this time period has also increased the frequency of hazardous material spills entering streams. While spill events are relatively rare and generally confined to a single stream or stream reach, their effects can be devastating to fish resources.

Riparian vegetation has been significantly reduced from historic levels in Washington and much of the remaining habitat is heavily disturbed by grazing, fire, and other land uses. Small areas of riparian habitat would be lost because of the proposed project, adding cumulatively to the existing degradation of habitat.

Overall, with mitigation, the project is unlikely to cause significant long-term impacts to fish. However, even small impacts may contribute cumulatively to further degradation of fish habitat and species health.

2.4 Recommended Fish Species Mitigation Measures

The following mitigation measures would be implemented in order to reduce or eliminate impacts to fish species from the construction, operation and maintenance of the proposed project.

2.4.1 Tower Construction Mitigation

To minimize short- and long-term impacts to fish from tower construction:

- To reduce the possibility of sediments or spills entering streams or lakes, towers would be placed over 200 feet (where possible) from the edge of streams or lakes that are known to contain fish.
- Sediment and stormwater controls including silt fence, waterbars, temporary seeding, soil pile covering, and dust control would be implemented on construction sites located near fish bearing water bodies.
- To prevent spills from entering streams and/or groundwater, a spill prevention and spill response plan would be developed and implemented prior to construction. Spill kits would be carried in all construction equipment and vehicles.
- To prevent erosion and sediment movement, vegetation removal would be limited to the amount required for safe working conditions and tower placement. Where possible, vegetation (even if temporarily disturbed but not destroyed) would be left in place.
- To reduce the amount of exposed soils that could be eroded, site restoration would occur as soon as possible following construction. Disturbed areas would be graded to their original contours and planted with native vegetation suitable for the local area. Vegetation would be planted only during appropriate spring or fall growing seasons.

2.4.2 Access Road Mitigation

To minimize short- and long-term impacts to fish from access road construction and use during maintenance activities:

- To protect certain life-stages of fish species, in-water work would only occur during WDFW in-water work windows, or as otherwise authorized or directed by WDFW.
- To prevent damage to stream banks and reduce the potential for sediment or hazardous material input to streams, access roads would be placed as far away from creeks as terrain and ROW will allow.
- Where fish-bearing streams must be crossed, existing access roads would be used where available. New crossings would be constructed using culverts or bridges that allow for uninterrupted fish passage. Fords would be limited to intermittent non-fish-bearing streams and the intermittent headwaters of fish-bearing streams.
- Approaches to stream crossings would be rocked with crushed gravel or other material suitable to prevent erosion and minimize road damage from vehicles and equipment during wet conditions.
- Temporary sediment controls such as silt fence would be installed prior to construction, and monitored for proper function until completion of construction and site restoration. Permanent stormwater and sediment controls like ditches and waterbars would be installed on slopes and maintained periodically.
- Vegetation removal would be limited to only the amount required to safely construct new access roads. Riparian vegetation would be removed only where absolutely necessary.
- Site restoration of cutbanks, fill banks, and other areas of disturbed soils other than the traveled way would be restored as soon as possible after completion of construction. Native vegetation suitable for the area would be planted during the next appropriate growing season following construction.
- Access control structures such as gates, large waterbars and eco blocks would be placed at access road entrances, to limit the amount of vehicular traffic that might create erosion problems or other disturbance to streams containing fish. Signs would be placed on new and existing roads to prevent human encroachment.

3.0 WILDLIFE

3.1 Wildlife Affected Environment

This section discusses the wildlife habitats and species that may be affected by the proposed project.

3.1.1 Study Area

The study area for the wildlife component of this project includes an area approximately two miles on either side of each of the seven proposed line segments that make up the four possible routes. The study area encompasses the northern edge of the Kittitas Valley, the eastern edge of the Yakima Training Center, portions of the middle Columbia River, Lower Crab Creek, the central Saddle Mountains, the Wahluke Slope and the northern edge of the Hanford Reach National Monument.

3.1.2 Methodology

The wildlife section was developed using field visits, literature sources, state and federal database queries, and contact with agency biologists.

3.1.2.1 Field Visits

A field visit to characterize major habitat areas took place in February 2001. The proposed line segments were located in the field and the different habitat types each segment passed through were identified. Few species were observed due to the time of year, however those observations that were made are included in this section. More detailed wildlife surveys will take place during the appropriate time of year once a final route has been selected.

3.1.2.2 Literature Sources

Journal articles, reference books, public agency management plans, agency internet sites and unpublished documents were used to determine species presence, life histories, habitat characteristics, and other information used in this section. Aerial photographs of each route, overlaid with National Wetland Inventory data and plant and wildlife species occurrence data were developed by the BPA and used to supplement the field visits to determine habitat types.

3.1.2.3 Database Queries

The US Fish and Wildlife Service (USFWS) was contacted and asked to provide a list of Threatened and Endangered Wildlife Species that might be present near the proposed project. USFWS provided a list of species that were known to occur in Benton, Grant, Kittitas and Yakima Counties. One Threatened Species (Bald Eagle) and three Candidate Species (Western Sage Grouse, Washington Ground Squirrel and Mardon Skipper) were identified as possibly occurring near the proposed project.

The Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species Program was contacted and asked to provide a map of state Threatened and Endangered species that might be present near the proposed project. WDFW provided quad maps showing rare species and habitat occurrences near the project area. The discussion of species unique to each area within a line segment is drawn mostly from this information.

3.1.2.4 Agency Contacts

Agency biologists from the USFWS, BLM, and WDFW were contacted regarding the presence of threatened or endangered species or other species along the proposed route segments. A meeting was held in Yakima with representatives from the above agencies as well as DNR and BOR that identified a number of areas where such species were known to exist.

3.1.3 Regulations and Management Plans

A number of Federal acts regulate impacts to wildlife from projects such as that proposed here. First, Section 7 of the Endangered Species Act of 1972 (as amended) requires federal agencies to insure that any action authorized, funded or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat. In practical terms, this means that projects that have federal involvement must consult with USFWS and/or NMFS to determine if their actions will cause a "take" of a species listed (or proposed for listing) under the act. "Take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct."

Second, the Migratory Bird Treaty Act of 1918 (as amended) prohibits the killing, capture, or "take," of migratory birds, which includes most bird species, including waterfowl, songbirds and hawks. In some cases (such as hunting), permits may be issued for the killing or collection of certain bird species.

Third, the Bald Eagle Protection Act of 1940 (as amended) prohibits, except under certain specified conditions, the taking, possession and commerce of Bald Eagles.

Management Plans have been developed for a number of areas along the proposed project, most notably for the YTC and Hanford Reach National Monument areas.

The YTC management plan states that the following actions (relevant to the proposed project) will be taken to protect wildlife habitat and resources on the YTC grounds:

- Protect male and female western sage grouse habitat;
- Protect and restore bald eagle wintering habitat;
- Protect ferruginous hawk sites;
- Establish and implement cooperative agreements with state and local agencies, including Western Sage Grouse Conservation Agreement (SGCA);
- Work with WDFW to coordinate and control hunting;
- Protect riparian habitat for wildlife use;
- Avoid and protect habitats used by threatened and endangered species;
- Restrict all activities in a 1-kilometer radius around SGCA-specified leks from March 1 to May 15 between 2400 and 0900;

The Hanford Management Plan indicates that the area over which the power line crosses (with the exception of a small part leading up to the Hanford Substation on the south side of the Columbia River), is designated as a "preservation" land use zone. According to the plan, "preservation" areas are managed

> "…for the preservation of archeological, cultural, ecological, and natural resources. No new consumptive uses (i.e., mining or extraction of non-renewable resources) would be allowed within this area. Limited public access would be consistent with resource preservation. Includes activities related to Preservation uses."

Despite this plan designation, the Hanford National Monument Proclamation and Background Paper of June 9, 2000, specifically mentions that a new BPA transmission line in the approximate alignment proposed in this EIS would not be prohibited.

3.1.4 Regional Context

The study area lies at the western edge of the Interior Columbia Basin. This area is dominated by low shrub-steppe vegetation typical of the region. With the exception of a few riparian and agricultural areas, trees are nonexistent. Elevation ranges from approximately 400 feet asl at the Columbia River, to 3000 feet asl at the Saddle Mountain crest in the YTC and the area north of Ellensburg. In the higher elevations, dwarf shrub-steppe and grassland vegetation exists. Most of the proposed line segments lie within undeveloped areas, although the area between Vantage Substation and Midway and Hanford Substations is heavily agricultural. Transmission line towers are the most dominant human element in much of the study area.

3.2 Wildlife Habitats and Species

The proposed route from Schultz Substation to Hanford Substation (or proposed new Wautoma Substation) was broken into seven proposed line segments. In this section, a general discussion of the habitats and wildlife species common to all line segments is presented, followed by a more detailed discussion of each segment. Each line segment is described based on the discrete geographic areas that exist along the line. The major wildlife habitats that exist within each discrete geographic area are described, and any unique or unusual populations of wildlife (such as the presence of Threatened or Endangered species) are discussed.

3.2.1 Wildlife Habitat Common to All Line Segments

The majority of the study area lies within the dry shrub-steppe ecoregion of eastern Washington. Shrub communities dominated by sagebrush represent the majority of the habitat available in the study area, although the density and species composition of the shrub layer varies considerably. To a lesser extent, grassland habitats are also present. Most of the shrub-steppe vegetation within the study area has been heavily disturbed by cattle grazing, fires, off-road vehicles, clearing, colonization by invasive species and other human-caused disturbance, and thus may provide only marginal habitat for shrub-steppe dependant species. All segments cross areas of riparian vegetation, which are mostly limited to narrow areas on either side of small streams or the Columbia River. Like the shrub-steppe vegetation, these riparian areas have been subjected to heavy disturbance, and have been largely destroyed in some areas. Large trees such as cottonwoods are generally sparse in the riparian areas, with the majority of the vegetation composed of small trees and shrubs in the early seral stages. Agricultural areas exist within some line segments. Wetland areas are limited to river and stream crossings, as well as the lower Crab Creek and the Saddle Mountain Lake area.

3.2.2 Wildlife Species Common to All Line Segments

Approximately 150 wildlife species (birds, mammals, reptiles and amphibians) are known to use the shrub-steppe habitat type for a some part of their life cycle (Johnson and O'Neil, 2001). The shrub-steppe and shrub-steppe grassland habitat type represents the majority of the available wildlife habitat within the project area. Of these 150 wildlife species, only approximately 50 are closely associated with shrub-steppe habitat, the remaining species use shrub-steppe habitat occasionally for some stage of their life cycle. These 150 species, however, do not represent the total number of species that may be encountered within the proposed project area. For example, a study of the Hanford Site documented 195 bird species in the general area where the project is proposed (Nature Conservancy, 1999). Many of these species were associated with the open water habitats along the Columbia River or were using the area temporarily as they migrated along the Pacific Flyway.

3.2.2.1 Mammal Species

Common large mammal species occupying the shrub steppe communities include mule deer and elk. These species are often present only in the winter in this habitat, with the exception of the Hanford elk herd and a mule deer herd located on the northern section of the Hanford Reach National Monument. Mountain lions may be present in the northern section of the project, closer to mountainous terrain. Rock outcrops, cliffs and talus slope habitats in some areas of the shrub-steppe may be used by bobcats and occasionally by California bighorn sheep.

Smaller mammals inhabiting the shrub-steppe habitat include the coyote, raccoon, badger, striped skunk, black-tailed and white-tailed jackrabbits, mountain cottontail rabbit, least chipmunk, several species of ground squirrels, Great Basin pocket mouse, deer mouse, grasshopper mouse, northern pocket gopher, sagebrush vole, and Merriam's shrew. Yellow-bellied marmots and bushy-tailed wood rats may occur in rocky areas. Approximately fifteen bat species including the western small-footed bat, little brown bat, big brown bat, pallid bat, and several myotis bat species roost in cliffs and talus slopes and feed along riparian drainages

Issues facing shrub-steppe mammal species include conversion of shrub-steppe to agriculture and habitat fragmentation from road building, clearing and other development. Agricultural development in the shrub-steppe region has occurred primarily in areas of deep soils. Species that require deep soils for burrowing such as badgers, ground squirrels, and rabbits have been disproportionately affected and in the case of the Washington ground squirrel and the pygmy rabbit, severely impacted (Johnson and O'Neil, 2001). Fragmentation of habitat may have profound effects on small mammal populations since dispersal patterns are disrupted and areas of suitable habitat are opened up to predators, parasites, and invasion of exotic plant and animals species (Johnson and O'Neil, 2001).

3.2.2.2 Bird Species

Birds commonly associated with the shrub-steppe habitat within the study area include the sage sparrow, western meadowlark, Brewer's sparrows, sage thrasher, horned lark, common raven, magpie, rock wren, burrowing owl and northern and loggerhead shrike. Sage grouse and sharp-tailed grouse, once common throughout the shrub-steppe habitat, are now limited to small isolated ranges. Raptor species include red-tailed hawk, ferruginous hawk, Swainson's hawk, rough-legged hawk, Northern harrier, golden eagle, bald eagle, and prairie falcon. Rare migrants such as the common loon, and black tern as well as a wide variety of waterfowl and shorebirds may occur along the Columbia River, Crab Creek, or near other open water areas (Johnson and O'Neil, 2001).

Most species of birds that breed in the shrub-steppe habitat are neotropical migrants such as loggerhead shrike, sage and Brewer's sparrows and sage thrasher. Year-round residents include sage and sharp-tailed grouse, ravens, and magpies. Winter residents include birds that breed in northern sites but do not migrate as far south as the neotropical migrants, such as rough-legged hawks and northern shrikes. Bald eagles also winter near the Columbia River and other streams.

Issues facing shrub-steppe bird species are similar to those facing mammals, such as habitat fragmentation and shrub-steppe conversion to agriculture. Some bird species, such as the sage sparrow and the sage thrasher are extremely dependant on intact sagebrush communities with a dense shrub component; therefore disturbances such as clearing and fire may reduce the availability of this habitat. Large, intact patches of sagebrush may also be important to shrub-steppe bird species, especially sage and Brewer's sparrows (Johnson and O'Neil, 2001).

3.2.2.3 Reptile and Amphibian Species

The shrub-steppe area of central Washington supports approximately 20 native reptile species but only about 10 amphibian species. About half of the reptile species are lizards and the other half snakes. Lizard species include western fence lizard, short horned lizard, sagebrush lizard and side-blotched lizard. Gopher snake, western rattlesnake, garter snake, racer and rubber boa are some of the more common snake species, while striped whipsnake and nightsnake are relatively rare. Painted turtles may be present in slow moving water or ponds. Amphibians are generally found only around water, the exception being the Great Basin spadefoot toad, which may be found several kilometers from open water. Western toads and Pacific tree frogs are relatively common near water while tiger salamanders and long-toed salamanders may be found in some wetland areas. Woodhouse's toad is a rare species, but can be found near wetlands in the northern Hanford Reach National Monument (Johnson and O'Neil, 2001).

Reptiles face many of the same threats from habitat fragmentation and conversion to agriculture that shrub-steppe birds and mammals do. Some amphibian species may have benefited from some of the open water and marsh habitats created by irrigation projects. However, the introduction of exotic warmwater species such as bass and bullfrogs has impacted other amphibian species.

3.2.3 Unique Wildlife Habitats and Species Of Each Line Segment

The following sections describe the habitats and species present along each line segment. Each line segment was broken into several distinct areas, generally based on geography. The general types of wildlife habitats and any unusual habitats within each of the areas are described, followed by a discussion of any unique wildlife species or congregations of common species that may be present. The discussion of habitats present along each route was taken from personal observations, WDFW Priority Habitats and Species data, and several management plans and other studies.

3.2.3.1 Wildlife Habitat and Species of Segment A

The proposed Segment A ROW includes two separate segments. An approximately two mile line segment will be constructed running northeast of the Schultz Substation and paralleling the existing Rocky Reach-Maple Valley 345kV line to connect to the existing Sickler-Schultz line. This will eliminate a crossing approximately five miles east of the Schultz Substation. The remainder of Segment A will parallel the Schultz-Vantage 500kV line on the north side for approximately 24.3 miles southeast to a point near Boylston where proposed segments B_{north}, B_{south} and C begin. The total Segment A length is 29.4 miles.

3.2.3.1.1 Wenatchee Mountains Foothills
The Sickler-Schultz connection line would be located in the foothills of the Wenatchee Mountains north of Ellensburg and the Kittitas Valley. The route would cross Wilson and Naneum Creeks, which are both located in steep canyons. The new Schultz-Hanford line would cross the lowest edge of the slope leading up to the Wenatchee Mountains, crossing Schnebly Creek, Colockum Creek, Cooke Canyon Creek and Caribou Creek on its way. Several outlying agricultural areas, such as irrigated hay fields and pastures are crossed.

3.2.3.1.1.1 Habitat
The upland areas between the Wilson and Naneum Creek canyons is characterized by mostly shrub-steppe vegetation, although some ponderosa pine and Douglas Fir are present in the northern part of the line segment. The riparian areas of these streams, although limited in width and disturbed by grazing are important wildlife habitats, since the larger trees and shrubs provide structural diversity needed by nesting birds, small mammals and other species. A mix of shrub-steppe and grass/forb communities exists along the remainder of the proposed segment.

3.2.3.1.1.2 Unique Wildlife Populations
Wildlife populations in this area are generally typical of shrub-steppe habitats. The area is used as wintering grounds by large herds of mule deer (WDFW, 2001a). The riparian areas of Wilson and Naneum Creeks provide winter roosting and foraging habitat for bald eagles (Personal Observation, 2001). A sagebrush vole was sighted near Schnebly Canyon (WDFW, 2001a). Colockum Creek Canyon is a migration corridor for the Quilomene elk herd. East of Cooke Canyon, a sharp tailed grouse sighting within one mile of the proposed line was recorded in 1981 (WDFW, 2001a). The area east of Cooke Canyon is also known to harbor nesting long-billed curlews (WDFW, 2001a).

3.2.3.1.2 Vantage Highway/I90
South of Caribou Creek, the proposed Segment A route crosses through the rolling terrain around the Vantage Highway and Interstate 90, north of the Boylston Mountains. Segment A ends near Cheviot (an old railroad place name) approximately eight miles south of Interstate 90.

3.2.3.1.2.1 Habitat
The majority of the vegetation in this area is shrub-steppe habitat with typical shrub-steppe species. Sagebrush density varies, with areas in low spots, washes and north slopes tending to be denser, and the upland areas more open with grass and forbs between widely spaced shrubs. The terrain is rolling to flat, with few areas of rocky outcroppings or cliffs.

3.2.3.1.2.2 Unique Wildlife Populations

This area serves as winter habitat for the Quilomene deer and elk herds (WDFW, 2001a). Sage grouse have been repeatedly observed in the area surrounding the proposed line (Clausing, 2001). A sage grouse lek was observed in 1983 less than one mile southwest of the southern end of the line segment (WDFW, 2001a). White-tailed jackrabbits have been observed near the southern end of the proposed segment (WDFW, 2001a).

3.2.3.2 Wildlife Habitat and Species of Segment B_{north}

The proposed ROW would parallel the existing 500 kV line from the northern terminus of the YTC proposed route east 9.5 miles to the Vantage Substation. The proposed ROW crosses three distinct areas. The majority of the proposed line crosses through the shrub-steppe of the YTC. At the eastern end of the segment, the line crosses the steep cliffs and narrow riparian area of the Columbia River. The Vantage Substation lies on a plateau at the top of the east bank of the Columbia River.

3.2.3.2.1 Northern Yakima Training Center

The Yakima Training Center area of Segment B_{north} runs from the end of Segment A to the edge of the Columbia River canyon through mostly rolling terrain with some steeper canyons of Johnson Creek and Middle Canyon.

3.2.3.2.1.1 Habitat

The majority of the vegetation along this segment is shrub-steppe habitat with typical shrub-steppe species. The proposed route passes through the upper Badger Creek complex and the Johnson Creek and Middle Canyon drainages that contain some limited riparian areas. These canyons also provide rocky outcrops, ridge tops and steep slopes representing a small but significant component of the available habitat (US Army, 1996).

3.2.3.2.1.2 Unique Wildlife Populations

The WDFW (Clausing, 2001) has indicated that sage grouse may be present in the area surrounding the proposed ROW. Also, loggerhead shrike, sage thrashers, sage sparrows, and Swainson's hawks are known to occur in the general vicinity of the proposed ROW (Stepniewski, 1998, US Army, 1996).

3.2.3.2.2 Columbia River

Segment B_{north} crosses the Columbia River just below the Wanapum Dam. The Columbia River sits in a canyon approximately 300 feet deep, with steep cliffs on the west side. The east side of the river, below the Vantage Substation features a flat depositional bar elevated from the main channel approximately 40 feet, leading to a moderate slope that climbs approximately 400 feet to a plateau where the Vantage Substation sits.

3.2.3.2.2.1 Habitat

The area on west side of the Columbia is characterized by steep rocky cliffs, some with talus slopes along the bottom edge. A narrow riparian area composed mostly of grasses exists next to the Columbia River. The east side includes a narrow grassy riparian area with scattered trees, a flat depositional bar covered in sagebrush and grasses, followed by a moderately steep area of alternating cliffs and steep slopes with scattered shrubs and grasses. The riparian areas are subject to frequent changes in water level due to the operations of Wanupum dam several hundred meters upstream. The area surrounding the river receives a high amount of recreational use, especially during the summer months, and existing habitats are subjected to frequent human disturbance.

3.2.3.2.2.2 Unique Wildlife Populations

Numerous species more often associated with wetlands and riparian habitats are found in this area. Ring- billed and California gulls, Caspian and Forster's terns, and Canadian geese are present. This section of the Columbia River is located within the Pacific flyway and, during the spring and fall months, the area serves as a resting point for neotropical migrants, migratory waterfowl, and shorebirds. During the fall and winter months, large numbers of migratory ducks (>100,000) and geese (>10,000) find refuge in the Wanapum reservoir (WDFW, 2001a). Other species present during winter months include American white pelicans, double-crested cormorants, and common loons. Bald eagles winter along the Columbia River (Personal Observation, 2001). An historical sighting of a desert nightsnake within one mile of the proposed project was made on the west shore of the Columbia River (WDFW, 2001a).

3.2.3.2.3 Vantage Substation Area

The Vantage Substation sits on a plateau above the east rim of the Columbia River canyon. Transmission lines enter the substation from the north and south. A small depression north of the substation contains a wetland complex.

3.2.3.2.3.1 Habitat

The area surrounding the Vantage Substation contains a unique complex of basalt cliffs, sand dunes, shrub-steppe and small wetlands. High quality riparian vegetation exists within the wetland areas.

3.2.3.2.3.2 Unique Wildlife Populations

Species of special note recorded as using the area surrounding the Vantage Substation include the striped whipsnake and the desert nightsnake (WDFW, 2001a). Bird species often found along the Columbia River (see Columbia River Section 3.2.3.2.2.) also utilize the wetland areas.

3.2.3.3 Wildlife Habitat and Species of Segment B_{south}

Segment B_{south} generally parallels Segment B_{north}, therefore the wildlife habitat and species are similar to those discussed under Segment B_{north} (Section 3.2.3.2.). The total distance of Segment B_{south} is 10.4 miles.

3.2.3.4 Wildlife Habitat and Species of Segment C

The proposed ROW cuts south from the existing 500 kV Vantage-Raver line at an area approximately eight miles south of Interstate 90 and travels 29.8 miles to the proposed Wautoma substation near Blackrock. Seven distinct areas characterize this route: the northern YTC area, the Saddle Mountains, the central YTC area (including four drainage complexes), Umtanum Ridge, Cold Creek, Yakima Ridge, and the Dry Creek Valley

3.2.3.4.1 Northern Yakima Training Center

The Yakima Training Center area of Segment C runs from the end of Segment A to the bottom of the Saddle Mountains. The proposed ROW crosses Johnson Creek through mostly rolling terrain. Wildlife habitat and species in this area is similar to that discussed in the Segment B_{north} discussion (Section 3.2.3.2.) of the Northern Yakima Training Center area.

3.2.3.4.2 Saddle Mountains (West of Columbia River)
The Saddle Mountains are one of three anticlines in the YTC running east west (Saddle Mountains, Umtanum Ridge and Yakima Ridge). The proposed Segment C ROW crosses the Saddle Mountains at approximately the 3100-foot elevation. The Saddle Mountains rise abruptly 1500 feet above the surrounding landscape. The mountains are high enough to catch and retain snowfall, which may accumulate to three feet or more during some winters.

3.2.3.4.2.1 Habitat
The slopes of the Saddle Mountains are mostly vegetated, but very steep with rocky outcrops and talus slopes interspersed throughout. The rocky areas provide habitat for raptor species, marmots, bobcats and lizards.

3.2.3.4.2.2 Unique Wildlife Populations
Loggerhead shrike, golden eagle, ferruginous hawk, Swainson's hawk, prairie falcon, and sage thrasher are all known to use the northern slope of the Saddle Mountains (Stepniewski, 1998).

3.2.3.4.3 Central Yakima Training Center
From the bottom of the south side of the Saddle Mountains, the proposed ROW cuts across three drainage complexes (Hanson Creek, Alkali Canyon, and Corral Canyon) to the bottom of Umtanum Ridge. The terrain is hilly, with steep canyons and ridges trending east west.

3.2.3.4.3.1 Habitat
Wildlife habitat in the Central Yakima Training Center area includes riparian areas, steep rocky cliff areas, and upland areas of shrub-steppe vegetation. The riparian vegetation of Hanson Creek, Alkali Canyon and Corral Canyon are important wildlife habitats, since large trees, shrub species (other than sagebrush), and grasses and forbs are present that provide nesting and perching habitat. The open water areas of the creeks provide an important water source for birds and mammals, especially larger mammals such as deer and coyote.

3.2.3.4.3.2 Unique Wildlife Populations
The area between the Saddle Mountains and Umtanum Ridge is home to approximately 70 percent of the YTC mule deer population (300-400 deer) (US Army, 1996). The upland areas near Hanson Creek supports over 75% of the breeding populations of loggerhead shrike on the YTC, and supports Swainson's hawks (US Army, 1996). The Hanson Creek riparian area on either side of the proposed ROW has documented bald eagle winter roost sites (WDFW, 2001a, US Army, 1996). Lewis's woodpeckers are also known to exist in the Hanson Creek Riparian area (US Army, 1996). Alkali Canyon complex supports an historic sage grouse lek and known populations of nesting prairie falcons (US Army, 1996). Cliffs in Corral Canyon downstream of the proposed ROW also have documented prairie falcon nests (US Army, 1996, WDFW, 2001a). Breeding burrowing owls were sighted approximately 1.5 miles southwest of the proposed ROW between Corral Canyon and Sourdough Canyon in 1993 and 1994, but the nest was unoccupied in 1995-1997 (WDFW, 2001a). Sage sparrows have been observed in the Corral Canyon area as well (US Army, 1996). Long billed curlews have been observed in the Corral Canyon complex near the proposed ROW (Stepniewski, 1998).

3.2.3.4.4 Umtanum Ridge
The second anticline in the YTC, Umtanum Ridge, runs east west like the Saddle Mountains. The proposed ROW crosses Umtanum Ridge approximately three miles west of the Priest Rapids Dam. The ROW climbs approximately 1300 feet up the steep rocky north face where it

crests the ridge at approximately the 3000-foot elevation. The south side is a gentler slope that drops approximately 900 feet to Cold Creek. This side of the ridge is intersected with small drainages running south to Cold Creek. Umtanum Ridge, like the Saddle Mountains, collects significant snowfall in most winters.

3.2.3.4.4.1 Habitat
Umtanum Ridge, like the Saddle Mountains, has a steep northern slope covered mostly with shrub-steppe vegetation. Some rocky outcroppings on the north side provide habitat for raptors. The gentler south side has flat areas along the ridgelines between the small canyons draining south to Cold Creek that have relatively undisturbed shrub-steppe vegetation. These areas provide good habitat for sage grouse.

3.2.3.4.4.2 Unique Wildlife Populations
Breeding sage grouse have been observed on the flatter areas of the south side of Umtanum Ridge. Several leks are located less than one mile west of the proposed ROW. WDFW (Clausing, 2001) and Schroeder et. al. (2000), indicate that this area is considered the core area of one of the two remaining sage grouse populations in Washington. Merriam's shrews were caught in research traps at the top of Umtanum Ridge, near the proposed ROW (Wunder et. al., 1994).

3.2.3.4.5 Cold Creek
Between Umtanum Ridge and Yakima Ridge lies the Cold Creek canyon. The canyon is approximately 900 feet deep and parallels the ridges running east-west. Both sides of the canyon are relatively gentle slopes, although the south side (north side of Yakima Ridge) has some steeper outcroppings, particularly near Cairn Hope Peak, just west of the proposed ROW.

3.2.3.4.5.1 Habitat
The riparian area of Cold Creek provides more structurally diverse habitat than the surrounding shrub-steppe in the form of shrubs, trees, wetland areas and open water. The Cold Creek canyon contains an important mixture of native shrub-steppe vegetation and riparian areas between the Hanford Reach National Monument area and the YTC that acts as a corridor for wildlife moving to and from these locations. In addition, the Cold Creek canyon is one of the most important flyways in Washington for migrating birds (Stepniewski, 1998, Visser, 2001).

3.2.3.4.5.2 Unique Wildlife Populations
Elk, deer, sage grouse, loggerhead shrike and jackrabbits all use the Cold Creek canyon as a local migration corridor between the Hanford Reach National Monument and the YTC. Neotropical migrants, waterfowl, raptors and many other bird species use the canyon as a migration corridor as part of their longer journeys between regions north and south of Central Washington (Stepniewski, 1998). Many of these migrants may stop and temporarily use the riparian or upland habitats. Breeding Swainson's hawks and loggerhead shrikes have been documented within one mile of the proposed ROW (WDFW, 2001a, US Army, 1996).

3.2.3.4.6 Yakima Ridge
The third anticline in the YTC, Yakima Ridge, runs east west like the Saddle Mountains and Umtanum Ridge. The proposed ROW crosses Yakima Ridge diagonally to the southeast. The ROW climbs approximately 800 feet up the north face where it crests the ridge at approximately the 2800-foot elevation. The ROW crosses several drainages running to the east, then drops down the south side approximately 1800 feet to Dry Creek. Like Umtanum Ridge, Yakima Ridge has drainages down either side that form steep canyons running perpendicular to the ridge.

Snowfall in the area of the proposed ROW can be significant, but is somewhat less than the Saddle Mountains or Umtanum Ridge since the area is further south and east, and is on the downslope side of Yakima Ridge.

3.2.3.4.6.1 Habitat

Yakima Ridge, like the Saddle Mountains and Umtanum Ridge, has slopes covered mostly with shrub-steppe vegetation. Some rocky outcroppings on both sides of the ridge in small canyons provide habitat for raptors and species such as marmots and wood rats that prefer rocky habitats and scree slopes. The gentler south side has flat areas along the ridgelines between the small canyons draining south to Cold Creek that have deeper soils and relatively undisturbed shrub-steppe vegetation.

3.2.3.4.6.2 Unique Wildlife Populations

The entire eastern end of Yakima Ridge is considered a part of the Cold Creek migration corridor (see discussion above). On the south side of the ridge breeding prairie falcons were observed in 1988 within one mile of the proposed ROW (WDFW, 2001a). Multiple sightings of breeding burrowing owls have been made in an area adjacent to Highway 24 where the proposed ROW crosses (WDFW, 2001a).

3.2.3.4.7 New Wautoma Substation

The proposed new substation sits at the southern base of Yakima Ridge, in the shallow, broad valley of Dry Creek.

3.2.3.4.7.1 Habitat

The vegetation surrounding the new substation is heavily disturbed shrub-steppe vegetation. The area is open and relatively flat. Dry Creek, true to its name, is intermittent. Due to the presence of some water during parts of the year, the creek bottom has a higher density of shrubs than the surrounding areas but does not contain a true riparian community. Some surrounding areas have some of the highest quality shrub-steppe vegetation in the state of Washington, including the top of the Yakima Ridge .75 miles north of the site and a large area of shrub-steppe vegetation 2.5 miles east of the site in the Fitzner-Eberhardt Arid Lands Ecology (ALE) Reserve portion of the Hanford Reach National Monument. However, the area within and immediately surrounding the site is highly degraded from fires, livestock grazing and past agricultural practices.

3.2.3.4.7.2 Unique Wildlife Populations

A small colony of burrowing owls was observed 0.5 miles east of the new substation site (Personal Observation, 2001). Prime elk wintering habitat for the Hanford elk herd is located several miles east of the site along Dry Creek in the ALE Reserve. The Hanford elk herd, unique among elk herds because it exists exclusively in shrub-steppe habitat, travels at least as far upstream as the proposed substation, as evidenced by elk dropping on the site (Personal Observation, 2001). These elk probably travel much further, since the numbers of elk has dramatically increased over the past several years and numerous reports of straying animals are documented (WDFW, 2000).

3.2.3.5 Wildlife Habitat and Species of Segment D

The proposed ROW for Segment D would parallel and double circuit the existing Vantage-Midway 230-kV line then parallel the existing Big Eddy-Midway line southwest to the proposed new substation, a total of 27.3 miles. This proposed route segment crosses ten distinct areas which are, from north to south: the Vantage Substation area, the Beverly area, Lower Crab Creek, the Saddle Mountains, the Wahluke Slope, the Columbia River, Umtanum Ridge, the Cold Creek drainage, Yakima Ridge, and Dry Creek.

3.2.3.5.1 Vantage Substation Area
The proposed line exits the Vantage Substation to the south. This area is discussed in the section describing Segment B_{north} (Section 3.2.3.2.).

3.2.3.5.2 Beverly Area
The proposed ROW of Segment D cuts south diagonally across the gentle east edge of the Columbia River canyon then east of the town of Beverly on the flats where Crab Creek Coulee enters the Columbia River. The area is primarily shrub-steppe vegetation, although several agricultural areas lie on either side of the proposed line.

3.2.3.5.2.1 Habitat
The habitat along this section of Segment D is mostly shrub-steppe vegetation. Several roads and a railroad intersect the proposed ROW, and agricultural operations are located within 0.5 miles of each side of the ROW. A high degree of disturbance exists in this area, which limits the quality of the available habitat. The proposed ROW is next to the Columbia River, which is an important winter habitat for waterfowl and a bird migration corridor (described in more detail in Segment B discussion).

3.2.3.5.2.2 Unique Wildlife Populations
Nightsnakes and striped whipsnakes have been documented adjacent to and under the proposed ROW (WDFW, 2001a). Bird species associated with the Columbia River may be incidental visitors to this area (see Segment B_{north} Section 3.2.3.2.discussion).

3.2.3.5.3 Crab Creek
The proposed ROW crosses Crab Creek just east of its confluence with the Columbia River and approximately four miles south of the Vantage Substation.

3.2.3.5.3.1 Habitat
Crab Creek and its associated wetlands and riparian areas offer high quality habitat for many species of wildlife. Open water areas such as Nunnally Lake, Crab Creek and other smaller wetlands are present, and provide excellent waterfowl habitat. Willows, shrubs and large areas of sedges, reeds and grass provide greater structural diversity than the surrounding shrub-steppe vegetation.

3.2.3.5.3.2 Unique Wildlife Populations
The lower Crab Creek area is one of the most important waterfowl breeding grounds in Washington, and an important wintering ground (Clausing, 2001, WDFW, 2001a). Many bird species also use the open water and wetlands for resting and feeding on their annual migrations along the Pacific Flyway. Beaver are found in some open water areas. A small isolated population of Ord's kanagaroo rat may occupy sandy habitats on either side of Crab Creek.

3.2.3.5.4 Saddle Mountains
Immediately after crossing Crab Creek, the proposed ROW climbs approximately 1500 feet up the steep northern side of the Saddle Mountains and crests at approximately the 2100-foot elevation. The line continues to the southeast over the crest of the Saddle Mountains and down the gentler southern side towards the Wahluke Slope.

3.2.3.5.4.1 Habitat

The Saddle Mountain area provides a variety of wildlife habitats, including cliffs, talus slopes, benches, open grassy slopes and shrub-steppe habitats. The steep north side has many steep rocky outcroppings, mostly located on the top third of the slope. Habitat for bats, and raptors is abundant here. The crest of the Saddle Mountains has a unique dwarf shrub-steppe vegetation community with a number of rare plant species (Fisher, 2001). The south side contains some high quality shrub-steppe vegetation that is relatively undisturbed. A designated sage grouse movement corridor exists along the south slope of the Saddle Mountains, although no sage grouse have been observed recently in the area (Schurger, 2001, Visser, 2001)

3.2.3.5.4.2 Unique Wildlife Species

Large populations of Brewer's vesper, and sage sparrows, sage thrasher and other passerine bird species can be found in the spring and summer on the south side of the Saddle Mountains. The cliffs on the north and west side of the Saddle Mountains are home to many raptor species, including red-tailed, Swainson's, ferruginous and rough-legged hawks; prairie falcons; American kestrels; bald and golden eagles, and ravens (WDFW, 2001a). A golden eagle nest site is located less than one mile west of the proposed line in the Sentinel Bluffs, which lie above and just east of the Columbia River. A prairie falcon nest site is located on the north slope of the Saddle Mountains just below the crest within 0.25 miles of the proposed line (WDFW, 2001a). A striped whipsnake was sighted at the crest of the Saddle Mountains near the proposed line in 1979 (WDFW, 2001a).

3.2.3.5.5 Wahluke Slope

The proposed ROW crosses the Wahluke Slope just east of the town of Mattawa. The Wahluke Slope, as its name implies, is a broad, gentle slope that stretches from the base of the Saddle Mountains south to the Columbia River. The landscape is generally flat, with few terrain features.

3.2.3.5.5.1 Habitat

This area of the Wahluke Slope is heavily farmed, with very little remaining native shrub-steppe habitat. Circle-irrigated crops, cherry, peach and apple orchards, and vineyards provide the majority of the available wildlife habitat. Irrigation provides some small wetland areas associated with canals, irrigation return flows or wells, but these areas are very limited in size.

3.2.3.5.5.2 Unique Wildlife Species

Mammal species present are limited to those species that can tolerate high levels of disturbance, such as coyotes, raccoons, and a variety of rodent species. Structures such as barns and sheds provide roosting habitat for a number of bat species. Bird species present on the Wahluke Slope are also limited to those species that can tolerate high levels of human disturbance. Red-tailed hawks, American kestrels, crows and ravens are present, as well as a number of songbirds. Pheasant and quail utilize croplands. Red-winged and yellow-headed blackbirds may use the limited wetland areas associated with irrigation practices. Near the southern end of the area a breeding loggerhead shrike was observed within a mile of the proposed ROW in 1993 (WDFW, 2001a).

3.2.3.5.6 Columbia River

The proposed ROW crosses the Columbia River just west of the Vernita Bridge on Highway 24. Three existing transmission lines cross the Columbia River at this location, and Highway 243 parallels the north side of the river. The Columbia River in this area is in a wide, shallow canyon.

The north edge of the canyon is an old gravel bar with an area of sand dunes. The south side is also an old gravel bar (China Bar). The Midway Substation is located on the China Bar below the steep cliffs of Umtanum Ridge. This area is the upstream end of the Hanford Reach, the last free-flowing, non-tidal section of the Columbia River in the United States.

3.2.3.5.6.1 Habitat

A unique area of sand dunes and Indian rice grass exists north of the Columbia River crossing (WDFW, 2001a). This area receives moderate recreational use and the sand dunes and the surrounding native shrub-steppe vegetation has been disturbed by ORV use. The China Bar area on the south side is mostly shrub-steppe vegetation that has also been disturbed by recreational use. The riparian areas on either side of the open water of the Columbia River are narrow and composed mostly of grasses and forbs, with some trees. These riparian areas are subject to regular inundation as water levels fluctuate due to operations at Priest Rapids Dam several miles upstream. The section of the Columbia River where the proposed ROW crosses is at the upstream end of the Hanford Reach, an important spawning area for chinook salmon. These salmon provide a high quality food source that attracts various species of wildlife including bald eagles.

3.2.3.5.6.2 Unique Wildlife Species

Like the Columbia River crossings described in Segment B, this section of the Columbia River supports large numbers of wintering waterfowl. This section of the Columbia River (like the Segment B crossings), is located within the Pacific flyway and, during the spring and fall months, the area serves as a resting point for neotropical migrants, migratory waterfowl, and shorebirds. Bald eagles are present throughout the Hanford Reach during the winter, feeding on waterfowl and salmon carcasses WDFW, 2001a). Several Swainson's hawk nests have been documented on the China Bar south of the Columbia River approximately one mile east of the proposed ROW (WDFW, 2001a).

3.2.3.5.7 Umtanum Ridge

Directly south of the Midway Substation, the proposed ROW climbs approximately 950 feet up the steep north facing slope of Umtanum Ridge to approximately the 1380 foot elevation, then travels down the much gentler south slope of the ridge into the Cold Creek drainage.

3.2.3.5.7.1 Habitat

The steep northern side of Umtanum Ridge is a mixture of rocky outcroppings, talus slopes and cliffs interspersed with areas of shrub-steppe vegetation. The top of Umtanum Ridge and the south side is gently rolling shrub-steppe habitat.

3.2.3.5.7.2 Unique Wildlife Species

The cliffs of the north side of Umtanum Ridge harbor a large number of raptor species. The proposed ROW passes close to a known prairie falcon nest (WDFW, 2001a). Other known prairie falcon nests are located within one or two miles on both sides of the proposed ROW (WDFW, 2001a). A loggerhead shrike was sighted at the crest of Umtanum Ridge in 1994 (WDFW, 2001a). On the south slope of Umtanum Ridge, a Swainson's hawk nest was observed in 1990 within the proposed ROW (WDFW, 2001a). Three other Swainson's hawk nests are located within one mile of the proposed ROW (WDFW, 2001a).

3.2.3.5.8 Cold Creek

The proposed ROW crosses Cold Creek between Umtanum Ridge and Yakima Ridge. Cold Creek is in a broad, almost flat valley here, unlike the steeper canyon upstream where proposed Segment C crosses. Highway 24 roughly parallels Cold Creek.

3.2.3.5.8.1 Habitat

The broad valley of Cold Creek in this area contains a mixture of grassy shrub-steppe and agriculture. Cold Creek itself contains little riparian habitat in this area, but does have areas of relatively undisturbed shrub-steppe vegetation. As discussed in Segment C, Cold Creek acts as an important migration corridor of relatively undisturbed shrub-steppe habitat between the YTC and the Hanford Site exists along Cold Creek. The Cold Creek Valley is also a major bird migration corridor.

3.2.3.5.8.2 Unique Wildlife Species

The Cold Creek migration corridor is used by elk, mule deer, sage grouse, jackrabbits, songbirds and other animals traveling between the YTC and the Hanford Site (WDFW, 2001a, Clausing, 2001, Stepniewski, 1998). Neotropical migrants, waterfowl, raptors and many other bird species use the canyon as a migration corridor as part of their longer journeys between regions north and south of Central Washington (Stepniewski, 1998). Many of these migrants may stop and temporarily use the upland habitats. Nesting burrowing owls have been observed next to the proposed ROW near Highway 24 (WDFW, 2001a). Prairie falcons, golden eagles, Swainson’s hawks and Lewis’ woodpeckers have all been observed using the Cold Creek valley for nesting or foraging near where the ROW crosses (Stepniewski, 1998).

3.2.3.5.9 Yakima Ridge

From Cold Creek, the proposed ROW climbs gently up the north slope of Yakima Ridge approximately 550 feet to the 1550 foot elevation, then drops steeply approximately 500 feet into the proposed new Substation. The hills are smooth, with few rocky outcroppings.

3.2.3.5.9.1 Habitat

Both sides of Yakima Ridge under the proposed ROW are relatively undisturbed shrub-steppe, although some agricultural activity has taken place on the north side west of the proposed ROW. The top of Yakima Ridge is a nearly pristine bluebunch wheatgrass community that is partially covered with sage.

3.2.3.5.9.2 Unique Wildlife Species

WDFW PHS database documented no occurrences of unique wildlife populations in the area immediately surrounding the proposed ROW crossing of Yakima Ridge. However, Stepniewski (1998), indicates that grasshopper sparrows, sage sparrows, sage thrashers, golden eagles and ferruginous hawks have been observed close to the proposed ROW.

3.2.3.5.10 New Wautoma Substation

The proposed ROW enters the proposed new substation from the north. This area is previously discussed under Segment C (Section 3.2.3.4.).

3.2.3.6 Wildlife Habitat and Species of Segment E

Segment E parallels Segment D to the east from Vantage to the top of the Saddle Mountains, then turns southeast, crosses the Wahluke Slope, enters the Hanford Reach National Monument and ends at the Hanford Substation. This segment is 23.2 miles long and crosses six distinct areas: the Vantage area, Crab Creek, the Saddle Mountains, the Wahluke Slope, the Hanford Reach National Monument, and the Columbia River.

3.2.3.6.1 Vantage Area

The proposed Segment E ROW parallels proposed Segment D approximately 0.5 miles to the east. The habitats and species present in the Vantage area have been previously discussed in Segment D.

3.2.3.6.2 Crab Creek

The proposed Segment E ROW crosses Crab Creek approximately 0.5 miles east of where proposed Segment D crosses. The habitats and species present in Crab Creek have been previously discussed in Segment D.

3.2.3.6.3 Saddle Mountains

The proposed ROW continues to parallel Segment D as it climbs the steep northern side of the Saddle Mountains immediately after crossing Crab Creek. From the crest of the Saddle Mountains, however, the proposed ROW turns southeast at the crest of the Saddle Mountains and heads across a part of the Wahluke Slope towards Hanford further to the east than Segment D. Habitat and species in the Saddle Mountains for this segment are similar to those existing along Segment D.

3.2.3.6.4 Wahluke Slope

The proposed ROW crosses the central part of the Wahluke Slope. The Wahluke Slope in this area is very gently sloping to the south. Like proposed Segment D, the proposed ROW crosses through an area of the Wahluke Slope that is heavily farmed, with very little remaining native shrub-steppe habitat. Habitats and species are similar to those discussed under Segment D. No unique species are documented in the Wahluke Slope area along proposed Segment E

3.2.3.6.5 Hanford Reach National Monument

Southeast of Highway 24, the proposed ROW crosses into the Hanford Reach National Monument. The area is generally flat, although the line drops into a shallow depression that contains Saddle Mountain Lake. The terrain is slightly rolling and hummocky. Sand dunes and blowouts are scattered throughout the area.

3.2.3.6.5.1 Habitat

The proposed ROW passes through a variety of habitats in the Hanford Reach National Monument. The northwestern end of the line where it crosses Highway 24 generally has a sagebrush-dominated community interspersed with grassy sand dune areas. As the line drops into the shallow basin that contains Saddle Mountain Lake, the vegetation turns to more of a grass dominated habitat, with only sparse shrub areas. A well-developed riparian area surrounds Saddle Mountain Lake and the channel leading east from it. Closer to the Columbia River, the terrain is flat or gently sloped south and covered by a patchwork of shrubby and grassy areas. The USFWS indicates that this area is considered very high quality shrub-steppe habitat (Haas, 2001)

3.2.3.6.5.2 Unique Wildlife Species

Where the proposed line crosses Highway 24 and enters the Hanford Reach National Monument, burrowing owls have been observed, although no nest sites are documented in this area (WDFW, 2001a). Near Saddle Mountain Lake, many observations of Woodhouse's Toads have been made (WDFW, 2001a). A herd of approximately 70 mule deer exists in the area east and south of Saddle Mountain Lake (WDFW, 2001a, Haas, 2001, Personal Observation, 2001). Closer to the Columbia River, near the Saddle Mountain Wasteway, nesting Swainson's hawks and great blue herons have been observed (WDFW, 2001a). Sagebrush lizards and nightsnakes have been documented near the proposed ROW (Nature Conservancy, 2001). Sagebrush voles and pygmy rabbits are also documented in the area surrounding the proposed segment (Brunkal, 2001)

3.2.3.6.6 Columbia River

The proposed ROW crosses the Columbia River in the middle of the Hanford Reach and stops just south of the river at the existing Hanford Substation. The north bank of the Columbia River in this area is not well defined, but slopes gently up from the river. The south bank is steep, but no more than approximately 50 feet high.

3.2.3.6.6.1 Habitat

The riparian area of the Columbia is very narrow and composed mostly of grasses, with a few widely spaced trees. There is little variation in the landscape on the north side, although the steep south bank may provide some suitable denning areas for burrowing mammals. The entire Hanford Reach provides important open water habitat for waterfowl.

3.2.3.6.6.2 Unique Species Present

As with the rest of the Columbia River in central Washington, hundreds of thousands of waterfowl use the open water habitats and wetlands as breeding areas, overwintering areas, or stopovers on spring and fall migrations. These species, as well as neotropical migrants may be present in or near the river. Communal bald eagle roosts are located within three miles of each side of the proposed ROW crossing (WDFW, 2001a).

3.2.3.7 Wildlife Habitat and Species of Segment F

Proposed Segment F heads east for several miles from the Vantage Substation, then turns south, crosses Crab Creek and heads up the steep northern slope to the top of the Saddle Mountains, just east of the where Segments D and E cross the Saddle Mountain crest. From here, the line heads east just south of the crest of the Saddle Mountains for approximately 15 miles. Where the segment intersects the Grand Coulee-Hanford 500kV line, it turns south and parallels it into the Hanford Substation. The segment length is 32.1 miles. The proposed line crosses 6 distinct areas: the Vantage area, Crab Creek, the Saddle Mountains, the Wahluke Slope, the Hanford Reach National Monument and the Columbia River.

3.2.3.7.1 Vantage Area

The proposed ROW heads east out of the Vantage Substation for approximately two miles, then turns south down a gentle slope to Crab Creek, approximately four miles. The area immediately surrounding the substation has been discussed in Segment B and D. However, the area to the east of the substation is flatter and has more agricultural activity associated with it than the other segments.

3.2.3.7.1.1 Habitat

Proposed Segment F crosses through areas composed mostly of shrub communities, although circle irrigation, orchards and vineyards are immediately adjacent to each side of the proposed line.

3.2.3.7.1.2 Unique Species Present

An observation of an Ord's kangaroo rat caught in a trap was made in 1987 (WDFW, 2001a), within the proposed ROW (see the Crab Creek discussion below for more information on Ord's kangaroo rat). A ferruginous hawk nest was observed in 1995 approximately one mile east of the proposed line (WDFW, 2001a).

3.2.3.7.2 Crab Creek

The proposed ROW crosses Crab Creek approximately one mile east of where proposed Segments D and E would cross. More extensive wetlands are present in this area than exist near Segments D and E.

3.2.3.7.2.1 Habitat

As discussed in the Segment D section, Crab Creek and its associated wetlands and riparian areas is one of the most important waterfowl breeding grounds in Washington. Nunnally Lake is important habitat for waterfowl. An area of sand dunes and willows exists just north of Crab Creek.

3.2.3.7.2.2 Unique Wildlife Species

Nunnally Lake supports a large population (3-4000) of wintering ducks (WDFW, 2001a). Quail have been observed using varied habitats along the valley bottom. In addition, within 0.5 miles of the proposed line, a number of Ord's kangaroo rats were caught in 1996 and 1997 (Gitzen, et. al., 2001). This sighting, and the observation made in 1987 two miles north of Crab Creek are significant in that they represent new sightings in areas where this species previously was not recorded.

3.2.3.7.3 Saddle Mountains

The proposed ROW climbs the steep northern side of the Saddle Mountains immediately after crossing Crab Creek. The line parallels proposed Segment E for approximately 0.75 miles, then turns due east for approximately 14 miles along the lower half of the slope to the existing Grand Coulee-Hanford 500kV line.

3.2.3.7.3.1 Habitat

The habitats and species of the western end of the Saddle Mountains has been described in Segments D and E. Segment F is not located far enough from these segments to warrant a separate discussion. However, where Segment F turns east and follows the lower slope of the Saddle Mountains, different habitat conditions are encountered. On the south slope, the vegetation community changes from a sagebrush-dominated community on the west end to a grass-dominated community on the east end. A number of canyons intersect the south slope, providing some rocky outcrop and talus slope habitats.

3.2.3.7.3.2 Unique Wildlife Species

No observations of unique wildlife species have been made in this area, however this may be due to the extremely limited access in the area. WDFW and BLM report that sage grouse were historically present along the Saddle Mountains, and that the relatively intact shrub-steppe vegetation is still considered a migration corridor between the YTC and areas east of the Saddle Mountains (Clausing, 2001, Fisher, 2001). In addition, species such as prairie falcons, ferruginous hawks and loggerhead shrikes have been observed on the crest and the north slope of the Saddle Mountains, within several miles of the proposed line (WDFW, 2001a). The area surrounding the proposed ROW supports one of the largest contiguous areas of occupied habitat for sage sparrows known in Washington (Nature Conservancy, 1999).

3.2.3.7.4 Wahluke Slope

The proposed ROW parallels the Grand Coulee-Hanford 500kV line that crosses the eastern part of the Wahluke Slope. This area of the Wahluke Slope is part of the Hanford Reach National Monument area and is located just east of the heavily farmed area. With the exception of the Wahluke Branch Canal, which runs west to east, the area north of Highway 24 is relatively undisturbed and retains much of its pre-development condition. The area slopes gently to the south.

3.2.3.7.4.1 Habitat

Areas of dense sagebrush dominate the habitat. There are no outstanding terrain features.

3.2.3.7.4.2 Unique Wildlife Species

The dense sagebrush provides nesting habitat for a number of Swainson's hawks. Three nests have been observed within one mile east of the proposed ROW (WDFW, 2001a).

3.2.3.7.5 Hanford Reach National Monument

South of Highway 24, the proposed ROW drops over a steep slope approximately 200 feet into a large depression that to the west contains Saddle Mountain Lake. At the south end of the depression, the line intersects with proposed Segment E, and heads south to cross the Columbia River in the same alignment.

3.2.3.7.5.1 Habitat

The depression south of Highway 24 contains a mixture of sand dunes, blowouts and intermittent wetlands. A mixture of sagebrush and grasslands is present. The steep slope on the northern edge of the depression is composed of soft substrate materials.

3.2.3.7.5.2 Unique Wildlife Species

A Swainson's hawk nest was observed on the top of the slope directly in the path of the proposed ROW (WDFW, 2001a). A herd of approximately 40 mule deer was observed in the central part of the depression (personal observation, 2001). Near the southern end of the proposed segment, immature sage sparrows were observed within one mile of the proposed line in 1987 (WDFW, 2001a). Sagebrush lizards and nightsnakes have been documented near the proposed ROW (Nature Conservancy, 2001).

3.2.3.7.6 Columbia River

The proposed Segment F ROW crossing of the Columbia River follows the same alignment that Segment E does. Wildlife habitats and species will be the same as discussed in Segment E.

3.2.4 Threatened and Endangered Species

This section discusses federally listed Threatened, Endangered and Proposed species and other species that are likely to be listed in the near future that may occur in the project area. These species include the bald eagle, the sage grouse, the Washington ground squirrel, and the Mardon skipper.

3.2.4.1 Bald Eagle

The bald eagle is a federally listed threatened species, but is proposed for de-listing. The Washington Department of Fish and Wildlife is reviewing their status as a state threatened species. There are approximately 650 nesting pairs of bald eagles in Washington and as many as 3,000-4,000 wintering bald eagles.

Bald eagles in Washington are generally migratory. Eagles that nest in Washington usually move north after nesting to feed on early salmon runs in western British Columbia and southeast Alaska. Many of the eagles that winter along rivers in Washington are birds that nest in Alaska, British Columbia or Montana (Stinson et. al., 2001).

Bald eagle nesting parameters in the Pacific Northwest include proximity to water with an adequate food source, large trees with sturdy branching at sufficient height for nesting, and stand heterogeneity both vertically and horizontally (Grubb, 1976). Nest tree structure is more important than tree species, and nest trees are typically among the largest in the stand providing an unobstructed view of an associated water body. Critical nesting activities generally fall between January 1, and August 31.

Wintering bald eagles concentrate in areas where food is abundant and disturbance is minimal (Rodrick and Milner, 1991). Because eagles often depend on dead or weakened prey, spawned salmon are often an important food source for wintering eagles. Rivers, streams and large lakes with spawning salmon and/or waterfowl concentrations are primary feeding areas for wintering bald eagles. Eagles typically perch near their food source during the day and prefer the tallest trees, which afford the best views. Deciduous and dead coniferous trees near the feeding area are preferred for diurnal bald eagle perching (Stalmaster and Newman, 1979). Evening roosts are generally established near the feeding area but may occur inland as well (Peterson, 1986). Wintering activities generally occur between mid-November and mid-March. .

Bald eagles are not known to nest within ten miles of the proposed project area. Bald eagles have attempted to nest along the Hanford Reach of the Columbia River approximately ten miles east of the proposed project area (USDOE, 2001). Wintering bald eagles are present along all segments, including the area north of Ellensburg near Wilson and Naneum creeks, in the YTC near Hanson and Alkali Canyon Creeks, and near the Columbia River crossings at the Vantage, Midway and Hanford Substations. No primary winter roost sites are known to exist within three miles of the proposed project area, although secondary roosts and ground perches have been identified around the area where Segments E and F cross the Columbia River into the Hanford Substation (USDOE, 2001). Surveys of potential winter roost sites will occur along the preferred alternative in winter 2002.

3.2.4.2 Sage Grouse

The sage grouse is a candidate for federal listing. The WDFW lists the sage grouse as Threatened. In Washington, sage grouse historically ranged from the Columbia River, north to Oroville, west to the foothills of the Cascades, and east to the Spokane River (Schroeder, et. al., 2000). The current Washington population of breeding sage grouse is estimated at approximately 1,000 birds roughly divided between two populations. One population of approximately 600 birds is located on mostly private lands in Douglas and Grant Counties, while the other approximately 400 birds exists in Kittitas and Yakima Counties on the YTC (Schroeder, et. al, 2000).

Sage grouse gather in the spring at specific locations, called leks, to perform courtship displays and mating. Leks are most commonly found in a barren area surrounded by sagebrush, but they have been found in a wide variety of open areas such as gravel pits, roads, buttes, dry lake beds and meadows (Hays, et. al., 1998). Nesting occurs in areas of medium to high shrub cover, often with dry grasses. Sage grouse consume sagebrush, grasses, forbs and some insects. Preferred winter habitats are tall dense stands of sagebrush, which provide shelter and forage (Hays, et. al., 1998). Winter sites often face south or west, since less snow generally accumulates in these orientations.

Within the proposed project area, sage grouse are known to exist within the YTC, including sections of Segments A, B_{north}, B_{south} and C. Sage grouse have been observed within each of the six drainages in the YTC the route passes through, and are known to nest in the Alkali Canyon and Corral Canyon drainages. A historic lek in the Johnson Creek drainage has not been used since 1987. Most of the core sage grouse habitat in the YTC is west of the proposed route. Historic sage grouse migration corridors exist along the top of the Saddle Mountains and along Cold Creek, although sage grouse have not been sighted in these areas recently.

3.2.4.3 Washington Ground Squirrel

The Washington ground squirrel was originally common in Washington and Oregon east and south of the Columbia River. Habitat loss and fragmentation has severely reduced its range, and it is listed as both a state and federal Species of Concern. The distribution of the squirrel in Washington has been reduced and become more fragmented in the last 10 years (Betts, 1999).

The Washington ground squirrel prefers a grass and forb dominated habitat with deep, weak soils (Betts, 1990). They feed mostly on grass and forbs, but may also eat bulbs, seed pods and insects. The preference for areas of grasses and forbs rather than brushy areas probably reflects habitat selection based on the total abundance of food sources (Betts, 1990) Washington ground squirrels generally live in colonies of up to 250 individuals.

Much of the proposed project is located west of the Columbia River, outside of the Washington ground squirrels known historic range. Washington ground squirrels most likely do not currently exist within the project area on the east side of the Columbia River, One historical occurrence (pre-1978) was noted near line segment F in the Saddle Mountains (Betts, 1990). An existing population was found on the Hanford Reach National Monument north of the crest of the Saddle Mountains approximately five miles east of Segment F (Nature Conservancy, 1999). This is the nearest known existing population of Washington ground squirrel to the project. Suitable Washington ground squirrel habitat exists within the project area east of the Columbia River especially near Crab Creek (Hill, 2001) and the Wahluke Slope (Nature Conservancy, 1999), but it is not known if these habitats are currently occupied.

3.2.4.4 Mardon Skipper

The Mardon skipper is a small species of butterfly that is a candidate for federal listing. The WDFW has listed it as Endangered. There are two generalized areas where the Mardon skipper occurs: the Puget Prairie area in Thurston and Pierce Counties, and the South Cascades area in Yakima and Klickitat Counties. Only nine of 18 historic sites are currently occupied with a total population of approximately 300 adults estimated in 1998 (Potter, et. al., 1999).

The habitat requirements of the South Cascades populations are generally open fescue grasslands within Ponderosa pine woodlands. Site conditions can range from dry open ridgetops to wetland and riparian areas. Females lay eggs on tufts of bunchgrass (including Idaho fescue), and the larvae feed on the bunchgrass for three or four months. Adults feed on the nectar of a variety of plants, including penstemon, sego lily, and wallflower (Potter, et. al., 1999).

The closest known location of historic and present Mardon skipper populations is approximately 50 miles southwest of the proposed project (Potter, et. al., 1999). The Ponderosa pine/fescue habitat type does not occur within the project area boundaries, although the habitat type may exist near the northern end of the project area. It is unlikely that the Mardon skipper exists within the project area.

3.2.5 Federal Species of Concern and State Listed Species

A list of state and federal listed wildlife species that are known to exist within the four counties crossed by the proposed project is presented in Table 3.2-1. The table indicates which of these species could possibly occur along each line segment.

Table 3.2-1 Possible Presence of State and Federal Listed Species Within Project Area.

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Document Occurrence Type
Birds				
Aleutian Canada goose	FT[1]	ST	B, D, E, F, G	M
Bald eagle	FT	ST	All segments	W
Golden eagle		SC	B, C, D, E, F, G	B
Ferruginous hawk	FSC	ST	All segments	B
Swainson's hawk		SM	All segments	B
Northern goshawk	FSC	SC	All segments	M
Peregrine falcon	FSC	SE	C, D, E, F	B
Swainson's hawk		SM	All segments	B
Osprey		SM	B, D, E, F, G	B
Prairie falcon		SM	All segments	B
Turkey vulture		SM	B, D, E, F, G	B
Prairie falcon		SM	C, D, E, F	B
Burrowing owl	FSC	SC	C, D, E, F	B
Northern Spotted Owl	FT	SE	None	N
Lewis' woodpecker		SC	A, C, D, E, F	B
Sage sparrow		SC	All segments	B
Sage thrasher		SC	All segments	B
Loggerhead shrike	FSC	SC	All segments	B
Long-billed curlew	FSC	SM	A, C, E, F	B
Western bluebird	FSC	SM	All segments	B
Ash-throated flycatcher	FSC	SM	None	N
Olive sided flycatcher	FSC		All segments	P
Little Willow flycatcher	FSC		All segments	P
Grasshopper sparrow	FSC	SM	C	B
Western sage grouse	FSC	ST	A, C, F	B
Sharp tailed grouse	FSC	ST	None	H
American white pelican		SE	B, D, E, F, G	M
Harlequin duck	FSC		B, D, E, F, G	P
Common loon		SS	B, D, E, F, G	M

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Document Occurrence Type
Marbled murrelet	FT	ST	None	N
Black tern	FSC	SM	B, D, E, F, G	M
Caspian tern		SM	B, D, E, F, G	M
Forster's tern		SM	B, D, E, F, G	M
Great blue heron		SM	B, D, E, F, G	B
Black-crowned night heron		SM	B, D, E, F, G	B
Mammals				
Gray wolf	FE	SE	None	N
Canada lynx	FT	ST	None	N
Grizzly bear	FT	SE	None	N
California bighorn sheep	FSC		B, D, E, F, G	P
Pacific fisher	FSC	SE	None	N
Wolverine	FSC	SC	None	N
Western gray squirrel	FSC	ST	None	N
Washington ground squirrel	FC	SC	D, E, F	H
Pygmy rabbit	FSC	SE	None	H
Ord's kangaroo rat		SM	B, D, E, F, G	P
Northern grasshopper mouse		SM	All segments	P
Sagebrush vole		SM	All segments	P
White-tailed jackrabbit		SC	All segments	B
Merriam’s shrew		SC	All segments	B
Ord's kangaroo rat		SM	All segments	B
Potholes meadow vole	FSC		None	N
Sagebrush vole		SM	All segments	B
Pacific western big-eared bat	FSC	SC	All segments	P
Long-eared myotis	FSC	SM	All segments	P
Long-legged myotis	FSC	SM	All segments	P
Fringed myotis	FSC	SM	All segments	P
Western small-footed myotis	FSC	SM	All segments	P
Yuma myotis	FSC		All segments	P
Pallid bat		SM	All segments	P
Insects				
Mardon skipper	FC	SE	None	N
Persius' duskywing		SM	E	P
Reptiles & Amphibians				
Cascades frog	FSC		None	N
Larch Mountain salamander	FSC	SS	None	N
Northern leopard frog	FSC	SE	D, E, F	P
Red-legged frog	FSC		None	N
Tailed frog	FSC	SM	None	N
Columbia Spotted Frog	FSC	SE	All segments	P
Night snake		SM	B, D, E, F, G	P
Woodhouse's Toad		SM	E, F	B
Sagebrush lizard	FSC		All segments	B
Night snake		SM	All segments	B
Striped whipsnake		SC	All segments	B

Federal Status	State Status	Presence
FE = Endangered	SE = Endangered	P = Present (general presence)
FT = Threatened	ST = Threatened	B = Breeding
FC = Candidate	SS = Sensitive	M = Migrant
FSC = Species of Concern	SC = Candidate	W = Winter Resident
	SM = Monitor	N = Not Present
		H = Historically Present, Not Present Now

Note 1: To be delisted in 2001

3.3 Impacts to Wildlife Species and Habitat

Impacts to wildlife species and habitat are assessed for each alternative proposed for the project. Various segments described in Section 2.2.3 are combined to form each alternative.

3.3.1 Wildlife Species Impact Levels

Environmental impact levels to wildlife are defined in four categories:

High impacts would occur when an action creates a significant adverse change in wildlife habitat, populations, or individuals. High impacts may result from actions that:

- cause the take of a federally listed or proposed threatened or endangered wildlife species;
- cause a significant reduction in the population, habitat or viability of a federal or state listed wildlife species of concern or sensitive wildlife species, which would result in trends towards endangerment or the need for federal listing;
- cause a significant long-term (more than two years) reduction in the quantity or quality of habitat critical to the survival of local populations of common wildlife species; or
- harm or kill a significant number of individuals of a common wildlife species.

Moderate impacts would occur when an action creates a moderate adverse change in wildlife habitat, populations or individuals. Moderate impacts may result from actions that:

- create an effect on federally listed or proposed threatened or endangered wildlife species that could be partially mitigated;
- cause a reduction in the population, habitat or viability of a federal or state listed wildlife species of concern or sensitive wildlife species, without resulting in trends towards endangerment or the need for federal listing; or
- harm or kill a small number of individuals of a common wildlife species.

Low impacts would occur when an action creates a minor adverse change in wildlife habitat, populations or individuals. Low impacts may result from actions that:

- create an effect on federally listed or proposed threatened or endangered wildlife species that could be largely or completely mitigated (i.e., seasonal restrictions on construction activities) or are temporary and benign (i.e., temporary disturbance by construction noise);
- cause a minor short-term (less than two years) reduction in the quantity or quality of the habitat of a federal or state listed wildlife species of concern or sensitive wildlife species, without resulting in trends towards endangerment or the need for federal listing; or
- cause a significant short-term (less than two years) reduction in the quantity or quality of habitat critical to the survival of local populations of common wildlife species.

Minimal impacts would occur when an action creates a temporary or minor adverse change in wildlife habitat or individuals. Minimal impacts may result from actions that:

- cause a temporary (less than two weeks) disturbance or displacement of a federal or state listed wildlife species of concern or sensitive wildlife species; or
- cause a short-term (less than one year) disturbance or displacement of a common wildlife species.

No impacts would occur when an action has no effect or fewer impacts than the minimal impact level on wildlife habitat, populations or individuals.

3.3.2 Impacts to Wildlife Species Common to All Action Alternatives

The construction, operation and maintenance of the proposed transmission line would impact wildlife populations residing in or near the proposed study area. The extent of impact would depend on the species, habitat requirements, and availability of suitable habitat in and around the construction and ROW area.

3.3.2.1 Construction Impacts

Construction impacts can be generally categorized as short-term disturbances related to construction noise, dust, human intrusion, or long-term physical habitat changes or harm to individual animals.

Short-term construction disturbances, depending on the time of year and location, could impact a wide variety of species including mule deer, elk, wintering bald eagles, passerine bird species, waterfowl, raptors, small rodents and amphibian species. Nesting raptors are easily disturbed by construction noise and human presence, and may abandon their nests if the disturbance is severe. Short-term disturbance of a federally listed species may constitute a take, which is considered a high impact. However, with mitigation (e.g., construction timing restrictions), short-term construction-related disturbances would result in only low or minimal impacts to wildlife species.

Long-term construction impacts would mostly stem from habitat loss, due to clearing for ROW or roads. Clearing would mostly impact species that use shrub-steppe habitats, although some limited areas of riparian vegetation may need to be removed. Clearing would be required for tower sites, new substations, expanded substations and access roads. Most ROW areas not associated with towers, roads or substations would not need to be cleared, since the shrub-steppe vegetation generally does not grow high enough to exceed line clearance thresholds.

Areas cleared of shrub-steppe vegetation would most likely be invaded by non-native pioneer species, which would preclude the regrowth of native vegetation. In areas of relatively undisturbed, native shrub-steppe habitat, clearing would constitute a high impact, because high-value habitat for state or federally listed shrub-steppe-dependant species (e.g., sage grouse, sage sparrows, sage thrashers and loggerhead shrikes) would be reduced. In areas of degraded shrub-steppe vegetation (e.g., vegetation infested with weed species), clearing would constitute a moderate impact, since the habitat is already degraded. Clearing in areas previously cleared or severely disturbed (such as agricultural lands) would result in minimal impacts to wildlife species.

Clearing areas of native shrub-steppe vegetation, especially linear corridors such as roads can increase the risk of predation for shrub-steppe dependant small mammal, reptile and bird species. With less cover available and an easy corridor for predators to travel into previously unbroken habitat, these species can be at increased risk of predation from coyotes, raptors and other predators (Brunkal, 2001). Species most susceptible to increased predation include jackrabbits, sagebrush voles, sagebrush lizards, striped whipsnakes, nightsnakes, and sage grouse.

Riparian areas are generally located in narrow strips along small streams and often in canyons. Since the proposed transmission line would either span these narrow areas or would be located upslope of stream channels, little or no riparian vegetation would need to be removed for transmission line clearance and tower construction. However, since riparian areas are extremely important wildlife habitat, clearing riparian vegetation for ROW or access road construction would cause moderate to high impacts to wildlife species by disrupting movement corridors, removing nesting or foraging habitat, and compacting stream banks.

3.3.2.2 Operation and Maintenance Impacts

Impacts to wildlife from the operation and maintenance of the proposed project are generally related to the temporary disturbance of wildlife (caused by maintenance equipment and human presence), or the physical presence of the structures.

3.3.2.2.1 Maintenance Impacts

Maintenance of the proposed project may include periodic vehicle and foot inspections, helicopter surveys, tower and line repair, clearing of ROW, and other disturbances. Depending on the time of year and the location, maintenance activities could impact a wide variety of species, including mule deer, elk, wintering bald eagles, passerine bird species, waterfowl, raptors, small rodents and amphibian species. Raptors frequently use transmission line towers for nesting and perch sites, and because the towers are the tallest part of the landscape, they may be the preferred hunting site for some species. Nesting raptors are easily disturbed by equipment noise and human presence and may abandon their nests if the disturbance is severe. Periodic ROW clearing would be limited to riparian areas, where the impact would be high.

3.3.2.2.2 Operation and Avian Collision Impacts

Operation of the proposed project would have the greatest impact on bird species, due to the collision threat posed by towers, transmission lines and grounding wires. Other wildlife species would not be significantly impacted, since the presence of the transmission lines, towers and access roads do not present barriers to migration, create excessive noise, or otherwise cause major behavior changes.

Some bird species, usually waterfowl, are prone to collisions with transmission lines, especially the grounding wires located at the top of the towers (Meyer, 1978, James and Haak, 1979, Beaulaurier, 1981, Beaulaurier et al., 1982, Faanes, 1987). Collisions usually occur near water or migration corridors and more often during inclement weather. Raptor species are less likely to collide with power lines, perhaps due to their excellent eyesight and tendency to not fly at dusk or in low visibility weather conditions (Olendorff and Lehman, 1986). Smaller migratory birds are at risk, but generally not as prone to collision because of their small size, their ability to quickly maneuver away from obstacles, and the fact that they often migrate high enough above the ground to avoid transmission lines. Permanent-resident birds that fly in tight flocks, particularly those in wetland areas, may be at higher risk than other species.

The following four factors influence avian transmission line collisions: the current level of risk, power line configuration, amount of bird use in a particular area, and the tendency of certain bird species to collide with wires.

The existing transmission lines that would be paralleled have a current level of risk for avian collisions. The risk would be less where a new transmission line parallels an existing transmission line. Although risks and mortality would increase in these areas, they wouldn't double since there would already be existing risk. Avian collision risk would be higher for a new transmission line corridor (Segments C and F).

The type and configuration of transmission lines is a factor that influences avian collisions. Generally, ground wires located above the transmission wires and towers cause the majority of the avian collision mortalities (Beaulaurier, 1981, Beaulaurier et al, 1982, James and Haak, 1979). Ground wires would be required on all the segments, due to the risk of lightning strikes, so the proposed line would contribute more to avian collisions than one without ground wires. Line markers have been shown to reduce the incidence of avian collisions (Beaulaurier, 1981, Avian Power Line Interaction Committee, 1994).

The amount of bird use is heaviest at the Columbia River crossings where large numbers of waterfowl congregate, and at Crab Creek where a series of wetlands and open water habitats occur. Segments C and D cross Cold Creek, which is one of the most important migration corridors in Washington for passerines, raptors and other upland bird species (Stepniewski, 1998). The remaining areas of each alternative are generally located in upland areas without large concentrations of birds and outside of major migration corridors.

The types of birds most likely to collide with transmission lines are waterfowl, such as ducks and geese, great blue herons, and birds that form tight flocks such as blackbirds. Raptor species generally do not collide with transmission lines, because they rarely fly in poor weather conditions, and have excellent vision. Migrating passerine species generally fly high enough to avoid transmission lines, however during periods of poor visibility such as storms or fog, they tend to fly lower and may be at risk of collision with transmission lines or towers. Towers with warning lights (e.g., those that may be placed near airports, river crossings or other areas where visual enhancement is necessary) tend to attract birds to them at night during periods of low visibility, and therefore may increase the risk of avian collisions during inclement weather.

Waterfowl and other large species associated with wetland or open water would be placed at a higher risk of collision with the proposed transmission lines at the Columbia River crossings of Segments B_{north}, B_{south}, D, E, and F, and the Crab Creek crossing of Segments D, E and F. Impact levels are expected to be moderate for waterfowl at these locations. Passerine species and other upland migrants would be placed at a higher risk of collision with the proposed transmission line on Segments C and D where they cross the Cold Creek corridor, particularly during poor weather conditions. Impact levels are expected to be moderate for upland bird species at these locations.

Transmission lines and towers provide a beneficial effect to some bird species, especially raptors. Transmission towers are the tallest structures in many areas of the shrub-steppe habitat of eastern Washington and as such, may provide the only suitable perching, roosting and nesting spots for some species. Red-tailed hawks, ferruginous hawks, and Swainson's hawks all utilize tower structures for hunting perches and may build nests in suitable locations. Existing towers have probably contributed to an increase in these species (Johnson and O'Neil, 2001).

Although raptor species may benefit from an increase in habitat from additional towers, the effect to small shrub-steppe dependant species such as jackrabbits, sagebrush voles, sagebrush lizards, striped whipsnakes, nightsnakes, and sage grouse could be detrimental. Increased numbers of predatory raptors coupled with an increase in cleared areas may cause additional predation on these species (Brunkal, 2001).

3.3.3 Impacts to Wildlife Species Specific to Each Action Alternative

Impacts to wildlife species are discussed below for each alternative route. Table 2.3-1 shows the amount of different land area types disturbed by the project for each segment, which gives an indication of overall impact to wildlife species.

Table 2.3-1 Disturbed Area Data

LANDUSE COVER TYPE	COVER TYPE (ACRES)						
	A	B_{north}	B_{south}	C	D	E	F
Commercial, Industrial or Transportation	1.94	0.09	0.09	0.43	1.76	0.26	0.68
Urban, or Recreational Grasses				0.29			
Low Intensity Residential					0.32	0.17	
Deciduous Forest	1.49			2.72	0.29		
Evergreen Forest	3.43				0.14	0.44	
Mixed Forest	0.15				0.22		
Grasslands or Herbaceous Vegetation	12.89	26.17	26.66	106.98	25.92	34.14	58.33
Shrubland	195.36	56.26	63.76	316.50	36.18	112.38	172.97
Pasture/Hay	1.19				17.14	29.95	2.63
Fallow	2.46				0.29	0.17	
Orchard, Crops or Grains	0.30				1.25		
Row Crops					13.05	21.13	0.30
Woody Wetlands				0.29			
Bare Rock, Sand, or Clay				0.29		1.14	1.65
Unknown					0.07	0.44	
Total Acres	**219.21**	**82.52**	**90.51**	**427.50**	**96.63**	**200.22**	**236.56**

3.3.3.1 Alternative 1- Schultz-Hanford (Segments A, B_{north} or B_{south}, E)

3.3.3.1.1 Segment A

Segment A would require approximately 208 acres of shrub-steppe and grassland vegetation to be cleared for tower sites and access road construction and approximately 5 acres of forests. Nesting habitat for sagebrush obligate species such as the sage sparrow and sage thrasher would be removed, as would known nesting habitat for long-billed curlew (moderate impact). Sharp-tailed grouse have been documented in the past near the west end of Segment A, and if they still exist, would be moderately impacted by vegetation removal. Sage grouse are known to exist in the southern end of this segment, although no occurrences have been documented closer than one mile from the proposed ROW. Disturbance to sage grouse from vegetation removal and construction noise may result from this project (moderate to high impact). The increase in risk to raptors, waterfowl and passerine bird species from collision with transmission lines and towers would be low, since no major migration corridors or bodies of water are located along this segment (minimal impact). However, the increase in potential habitat for perching raptors may cause an increase in predation risk for shrub-steppe dependant animals, a moderate risk. If the project were constructed during the winter, the potential for disturbing roosting bald eagles (threatened species) would be high near the Wilson and Naneum Creek crossings (high impact). Also, wintering deer and elk might be temporarily disturbed by construction noise and activity (minimal impact).

3.3.3.1.2 Segments B_{north} and B_{south}

Segment B_{north} would require approximately 82 acres of shrub-steppe and grassland vegetation to be cleared for tower sites and access road construction, while Segment B_{south} would require approximately 90 acres of clearing. If the project were constructed during the winter, the potential for disturbing roosting bald eagles would be high near the Columbia River crossing (high impact). In the upland areas, wintering deer and elk might be disturbed by construction activity (minimal impact). Sage grouse are known to exist near the western end of these segments and might be impacted (moderate to high impact). Night snakes have been observed near the proposed ROW and might be impacted (minimal impact). Near the Columbia River, waterfowl, pelicans and other birds using the area as a migration corridor might be at increased risk of collision with the transmission line spanning the river (moderate impact).

3.3.3.1.3 Segment E

Segment E would require that approximately 146 acres of shrub-steppe and grassland habitat would need to be cleared for tower sites and access roads. Segment E crosses Crab Creek and the Columbia River, which are both migration corridors for birds and areas of high waterfowl concentrations. The risk of avian collisions would be increased in these areas, although the proposed line would be located adjacent to an existing line (moderate impact).

The habitat in the area between the Vantage Substation Crab Creek is mostly shrub-steppe vegetation. Disturbance of this area would cause moderate impacts to shrub-steppe habitat and shrub-steppe dependant species. Nightsnakes and striped whipsnakes have been documented near the ROW and could be disturbed or harmed (a moderate impact).

The Saddle Mountains have documented occurrences of nesting prairie falcons and golden eagles that could be disturbed by construction activities (low to moderate impact). Other species in the Saddle Mountains include the striped whipsnake, chukar, passerine bird species, and a variety of small mammals. Impacts to these species would be moderate, due to the removal of shrub-steppe and dwarf shrub-steppe plant communities.

The area immediately south of the Saddle Mountain crest has not been converted to agriculture. Shrub-steppe-dependant species in this area would be moderately impacted. The line crosses the remainder of the Wahluke Slope over mostly agricultural lands that have little native shrub-steppe habitat present. Construction and operation of the project in this section of the proposed segment would have no impact on species that depend on shrub-steppe habitat, and minimal to no impact on other wildlife species. The project may have a low positive impact for raptor species due to an increase in nesting, perching and roosting habitat. However, the additional habitat available for perching raptors could increase the predation risk for small shrub-steppe dependant species such as sage sparrows, sage thrashers, mice and voles, a moderate impact.

The shrub-steppe habitat in the Hanford Site is relatively undisturbed, although invasive species are present due to past grazing practices. A herd of mule deer, uncommon in the central shrub-steppe region, is present in this area and may be disturbed by construction activity (low impact). Shrub-steppe-dependant species such as the sage sparrow would be disturbed by construction and habitat removal during clearing (moderate impact). Burrowing owls have been documented near the proposed line and may be impacted by clearing and construction (moderate impact). Raptors (including Swainson's hawks) are present. The project might have a low positive impact for raptors, since the towers are the tallest structures within many miles and make excellent perching, roosting and nesting habitat.

A large wetland complex called Saddle Mountain Wasteway, just west of Segment E, is home to a large numbers of waterfowl, great blue herons and other wetland species. The project would cross a channel and the associated wetland complex leading east from the lake. Woodhouse's toads have been documented in great numbers within this area and might be impacted (low impact). The proposed line would avoid the riparian area (minimal impact to riparian species), but add an additional line that would increase the collision hazard for waterfowl and other bird species (moderate impact). The crossing over the Columbia River into the Hanford Substation would also increase the collision hazard for waterfowl and other bird species using the migration corridor (moderate impact).

3.3.3.2 Alternative 1A Schultz-Hanford (Segments A, B_{north} or B_{south}, F)

Impacts to wildlife and wildlife habitat along Segments A and B_{north} or B_{south} would be the same as described for Alternative 1, (see Sections 3.3.3.1.1 and 3.3.3.1.2.)

3.3.3.2.1 Segment F

Segment F would require clearing of 231 acres of shrub-steppe and grassland vegetation. Impact levels in the area between the Vantage Substation and the crest of the Saddle Mountains would be similar to those described for Segment E. South of the crest of the Saddle Mountains, the area is relatively undisturbed, with the exception of historic grazing and some motorized recreation activities. An historic sage grouse sighting was made near the study area, and a possible historic (pre-1978) Washington ground squirrel colony was located in the general vicinity of the proposed project. The top of the Saddle Mountains is an historic sage grouse corridor. If either of these species are still present, construction and clearing of the project would cause a high impact to them.

From the Saddle Mountains, Segment F cuts south across the Wahluke Slope. This section of the Wahluke Slope is not used for agriculture and is relatively undisturbed shrub-steppe habitat. Swainson's hawks are known to nest along this section and might be positively impacted by construction and operation of the project (low positive impact). Other shrub-steppe-dependant wildlife species would be moderately impacted by removal of shrub-steppe vegetation during tower placement and road clearing.

After crossing Highway 24, Segment F enters the Hanford Site. The impacts to wildlife in this area would be similar to those impacts associated with Segment E.

3.3.3.3 Alternative 2 Schultz-New Wautoma Substation (Segments A, B_{north} or B_{south}, D)

Impacts to wildlife and wildlife habitat along Segments A and B_{north} or B_{south} would be the same as described for Alternative 1 (see Sections 3.3.3.1.1 and 3.3.3.1.2).

Segment D has the most varied terrain, and thus the most diverse group of habitats of all the proposed segments. Approximately 62 acres of shrub-steppe and grassland habitat would need to be cleared for tower sites and access roads. Segment D crosses Crab Creek and the Columbia River, which are both migration corridors for birds and areas of high waterfowl concentrations. The risk of avian collisions would be increased in these areas, although the proposed line would be located adjacent to an existing line (moderate impact). The Saddle Mountains have documented occurrences of nesting prairie falcons and golden eagles that could be disturbed by construction activities (low to moderate impact). Other species in the Saddle Mountains include the striped whipsnake, chukar, passerine bird species, and a variety of small mammals. Impacts to these species would be moderate, due to the removal of shrub-steppe and dwarf shrub-steppe plant communities.

Segment D crosses the Wahluke Slope over mostly agricultural lands, with no native shrub-steppe habitat present. Construction and operation of the project in this section of the proposed segment would have no impact on species that depend on shrub-steppe habitat and would have minimal to no impact on other wildlife species.

The southern third of Segment D crosses the Columbia River and climbs over Umtanum Ridge. On the steep north face of Umtanum Ridge, nesting prairie falcons and other raptor species have been documented. Construction in this area would cause low to moderate impacts. Swainson's hawks, loggerhead shrikes, and burrowing owls have all been documented nesting near or on the proposed ROW south of Umtanum Ridge. Clearing in this area would cause moderate to high impacts to burrowing owls (depending on tower and road placement) and moderate impacts to other shrub-steppe-dependant species. In addition, the southern end of the proposed line crosses the Cold Creek wildlife migration corridor, which is one of the most important bird migration corridors in Washington and an important corridor for wildlife migrating between the YTC and the Hanford Site. Disturbance to this area could disrupt the migration patterns of these species and increase the hazard of avian collisions with transmission lines and towers (moderate impact).

3.3.3.4 Alternative 3 Schultz-New Wautoma Substation YTC Route (Segments A, C)

Impacts to wildlife and wildlife habitat along Segment A would be the same as described for Alternative 1, see Section 3.3.3.1.1.

Segment C would require approximately 423 acres of shrub-steppe and grassland vegetation and 3 acres of forested land to be cleared for tower sites and access roads. Sage grouse, burrowing owls, wintering bald eagles, and loggerhead shrike are all known to be present near the proposed ROW, and would be impacted by habitat removal and disturbance (high impact). The southern end of the segment crosses Cold Creek, which one of the most important bird migration corridors in Washington. The southern portion is also an important area for deer, elk, coyote, jackrabbit and other species migrating between the YTC and the Hanford Site. Disturbance to this area could disrupt the migration patterns of these species, and increase the hazard of avian collisions with transmission lines and towers (moderate impact).

3.3.3.5 No Action Alternative

The no action alternative would not change any existing conditions, and therefore would have no impact on wildlife species.

3.3.4 Impacts to Threatened and Endangered Wildlife Species

This section describes the impacts that the proposed project would have on the four wildlife species that are either federally listed or proposed for listing: the bald eagle, sage grouse, Washington ground squirrel and the Mardon skipper. A Biological Assessment is being prepared separately, and a determination of the effects for each of these species will be presented in that document.

3.3.4.1 Bald Eagle

Bald eagles are not known to nest within the study area. Wintering bald eagles are present along all segments, including the area north of Ellensburg near Wilson and Naneum creeks, in the YTC near Hanson and Alkali Canyon Creeks, and near the Columbia River crossings at the Vantage, Midway and Hanford Substations. Construction near known bald eagle roost sites might disturb wintering bald eagles (high impact). In areas away from roost sites, the disturbance of bald eagles from construction will result in a minimal impact. It is unlikely that eagle habitat would be removed. With mitigation, the proposed project would have no impact on bald eagles.

3.3.4.2 Sage Grouse

The sage grouse is a candidate for federal listing. The Washington Department of Fish and Wildlife (WDFW) lists the sage grouse as threatened. In Washington, sage grouse have historically ranged from the Columbia River, north to Oroville, west to the foothills of the Cascades, and east to the Spokane River. Within the proposed study area, they are known to exist within each of the six drainages in the YTC that are crossed by sections of Segments A, B_{north}, B_{south} and C. Sage grouse are known to nest in the Alkali Canyon and Corral Canyon drainages. A historic lek in the Johnson Creek drainage has not been used since 1987. Most of the core sage grouse habitat in the YTC is west of the proposed route. Historic sage grouse migration corridors exist along the top of the Saddle Mountains and along Cold Creek, although they have not been sighted in the Saddle Mountain area recently. Construction of Segments A, B_{north}, B_{south} and C and would cause a high impact to sage grouse. Construction of Segments D, E, and F would cause a low impact. With mitigation, construction of Segments A, B_{north}, B_{south} or C would cause a moderate impact to sage grouse. With mitigation, construction of all other segments would cause a low impact.

3.3.4.3 Mardon Skipper

The closest known location of historic and current Mardon skipper populations is approximately 50 miles southwest of the proposed project. The Ponderosa pine/fescue habitat type does not occur within the study area boundaries, although this habitat type may exist near the northern end of the study area. The project would have no impact on the Mardon Skipper.

3.3.4.4 Washington Ground Squirrel

The Washington ground squirrel is listed as both a state and federal species of concern. Much of the proposed project is located west of the Columbia River, outside of the Washington ground squirrels' known historic range. Washington ground squirrels probably do not currently exist within the study area on the east side of the Columbia River. One historical occurrence (pre-1978) was noted near line Segment F in the Saddle Mountains (Betts, 1990). The nearest known existing population is approximately 15 miles east of line Segment F. Suitable Washington ground squirrel habitat may exist within the proposed study area east of the Columbia River, especially near Crab Creek (Hill, 2001). If Washington ground squirrel colonies exist within or adjacent to the proposed study area, construction of the project would cause a high impact. If no colonies exist, the project would have no impact. With mitigation, the proposed project would have a moderate or low impact on any Washington ground squirrel colonies that might exist within the proposed study area.

3.3.5 Impacts to Special Status Wildlife Species

Table 2.3-2 lists state and federal special status species that may be present within each segment of the proposed study area and indicates the possible impact the project may have on them.

Table 2.3-2 Impacts to Special Status Species

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Documented Occurrence Type	Potential Impact	Mitigated Impact
Birds						
Aleutian Canada goose	FT[1]	ST	B_{north}, B_{south}, D, E, F	M	M	M
Bald eagle	FT	ST	All Segments	W	H	L
Golden eagle		SC	B_{north}, B_{south}, C, D, E, F	B	M	L
Ferruginous hawk	FSC	ST	All Segments	B	M	L
Swainson's hawk		SM	All Segments	B	M	L
Northern goshawk	FSC	SC	All Segments	M	N	N
Peregrine falcon	FSC	SE	C, D, E, F	B	L	L
Swainson's hawk		SM	All Segments	B	M	Mn
Osprey		SM	B_{north}, B_{south}, D, E, F	B	L	Mn
Prairie falcon		SM	All Segments	B	M	Mn
Turkey vulture		SM	B_{north}, B_{south}, D, E, F	B	L	Mn
Burrowing owl	FSC	SC	C, D, E, F	B	H	M
Northern Spotted Owl	FT	SE	None	N	N	N
Lewis' woodpecker		SC	A, C, D, E, F	B	M	L
Sage sparrow		SC	All Segments	B	H	M
Sage thrasher		SC	All Segments	B	H	M
Loggerhead shrike	FSC	SC	All Segments	B	M	M
Long-billed curlew	FSC	SM	A, C, E, F	B	H	M
Western bluebird	FSC	SM	All Segments	B	M	M
Ash-throated flycatcher	FSC	SM	None	N	N	N
Olive sided flycatcher	FSC		All Segments	P	M	L
Little Willow flycatcher	FSC		All Segments	P	M	L
Grasshopper sparrow	FSC	SM	C	B	M	M
Western sage grouse	FSC	ST	A, C, F	B	H	M
Sharp tailed grouse	FSC	ST	None	H	N	N
American white pelican		SE	B_{north}, B_{south}, D, E, F	M	M	M
Harlequin duck	FSC		B_{north}, B_{south}, D, E, F	P	M	M
Common loon		SS	B_{north}, B_{south}, D, E, F	M	M	M
Marbled murrelet	FT	ST	None	N	N	N
Black tern	FSC	SM	B_{north}, B_{south}, D, E, F	M	M	M
Caspian tern		SM	B_{north}, B_{south}, D, E, F	M	M	M
Forster's tern		SM	B_{north}, B_{south}, D, E, F	M	M	M
Great blue heron		SM	B_{north}, B_{south}, D, E, F	B	M	M
Black-crowned night heron		SM	B_{north}, B_{south}, D, E, F	B	M	M
Mammals						
Gray wolf	FE	SE	None	N	N	N
Canada lynx	FT	ST	None	N	N	N
Grizzly bear	FT	SE	None	N	N	N
California bighorn sheep	FSC		B_{north}, B_{south}, D, E, F	P	L	L
Pacific fisher	FSC	SE	None	N	N	N
Wolverine	FSC	SC	None	N	N	N
Western gray squirrel	FSC	ST	None	N	N	N
Washington ground squirrel	FC	SC	D, E, F	H	H	M-N
Pygmy rabbit	FSC	SE	D, E, F	H	H	M-N
Ord's kangaroo rat		SM	B_{north}, B_{south}, D, E, F	P	M	L

Species Name	Federal Status	State Status	Possible Presence by Line Segment	Documented Occurrence Type	Potentia l Impact	Mitigated Impact
Northern grasshopper mouse		SM	All Segments	P	H	M
Sagebrush vole		SM	All Segments	P	H	M
White-tailed jackrabbit		SC	All Segments	B	H	M
Merriam's shrew		SC	All Segments	B	H	M
Potholes meadow vole	FSC		None	N	N	N
Pacific western big-eared bat	FSC	SC	All Segments	P	M	M
Long-eared myotis	FSC	SM	All Segments	P	M	M
Long-legged myotis	FSC	SM	All Segments	P	M	M
Fringed myotis	FSC	SM	All Segments	P	M	M
Western small-footed myotis	FSC	SM	All Segments	P	M	M
Yuma myotis	FSC		All Segments	P	M	M
Pallid bat		SM	All Segments	P	M	M
Insects						
Mardon skipper	FC	SE	None	N	N	N
Persius' duskywing		SM	E	P	Mn	Mn
Reptiles & Amphibians						
Cascades frog	FSC		None	N	N	N
Larch Mountain salamander	FSC	SS	None	N	N	N
Northern leopard frog	FSC	SE	D, E, F	P	Mn	Mn
Red-legged frog	FSC		None	N	N	N
Tailed frog	FSC	SM	None	N	N	N
Spotted Frog	FC	SE	All Segments	P	Mn	Mn
Woodhouse's Toad		SM	E, F	B	Mn	Mn
Sagebrush lizard	FSC		All Segments	B	H	M
Night snake		SM	B_{north}, B_{south}, D, E, F	P	H	M
Striped whipsnake		SC	All Segments	B	H	M

Federal Status
FE = Endangered
FT = Threatened
FC = Candidate
FSC = Species of Concern

State Status
SE = Endangered
ST = Threatened
SS = Sensitive
SC = Candidate
SM = Monitor

Presence
P = Present
B = Breeding
M = Migrant
W = Winter Resident
N = Not Present
H = Historically Present, Not Currently Present

Impact
H = High
M = Moderate
L = Low
Mn = Minimal
N = None

3.3.6 Cumulative Impacts to Wildlife Species

The following discussion of cumulative impacts takes into account the linear nature of the proposed route, and any impacts that the proposed project would have on wildlife resources. The proposed project could potentially impact existing environmental conditions of current concern in eastern Washington, especially from the loss and fragmentation of native shrub-steppe plant and dependant wildlife communities.

The shrub-steppe habitat type has been significantly reduced from historic levels in Washington, and much of the remaining habitat is heavily disturbed by grazing, fire, or other land uses. It is generally recognized that preserving large, unbroken tracts of high-quality shrub-steppe vegetation is important for maintaining populations of shrub-steppe dependant species such as sage grouse, sage sparrow, Washington ground squirrel and others (Johnson and O'Neil, 2001).

Construction of towers and access roads through shrub-steppe vegetation would increase the existing levels of habitat fragmentation and reduce the amount of shrub-steppe vegetation available for wildlife habitat. Over time, native shrub-steppe vegetation may recolonize the disturbed areas. However, construction of the proposed project would increase the potential for the linear spread of noxious weeds into previously undisturbed areas. The presence of noxious weeds makes the recolonization of disturbed areas with native vegetation extremely difficult, and generally leads to a long-term reduction in quality wildlife habitat.

Overall, the loss and fragmentation of additional shrub-steppe, grassland and riparian habitat from the proposed project, when added to the existing severe decline of these habitats from industry, road building, agriculture, grazing, military maneuvers, fires and other human-caused disturbance, will contribute cumulatively to a decrease in the amount and productivity of native wildlife habitat. Future transmission lines, road building, agricultural conversion of shrub-steppe and other foreseeable projects will compound this problem.

3.4 Recommended Wildlife Species Mitigation Measures

To reduce the impacts to wildlife associated with the construction, operation and maintenance of the proposed project, a number of mitigation measures would be implemented.

3.4.1 Big Game Disturbance

- Avoid construction on designated portions of Segments A, E, and F during extreme winter weather or unusually heavy snow accumulations, when big-game species are less mobile and more vulnerable to disturbance.
- Coordinate with WDFW to ensure that construction does not significantly interfere with big game wintering or migration.
- Gate and sign new or existing roads to prevent human encroachment into big game wintering areas or significant migration corridors.

3.4.2 Avian Collision Mitigation

- Where possible, line up new structures with existing structures to minimize vertical separation between sets of transmission lines.
- Install appropriate line markers in high risk areas, such as crossings of the Columbia River, Crab Creek, the Cold Creek migration corridor and high ridge crossings such as Saddle Mountains, Umtanum Ridge and Yakima Ridge.
- Monitor potential problem areas after construction to ensure that line markers are functioning properly, and identify any new areas that might require line markers.
- If possible, reduce or eliminate warning lights on towers.

3.4.3 Raptor Disturbance Mitigation

- Prior to initiating ground disturbing activities identify active raptor nest sites by consulting with WDFW and USFWS and conducting raptor nesting surveys if required.

- Time project construction to avoid the critical nesting periods, as determined by USFWS and WDFW.

- Time project construction to avoid disturbing wintering bald eagles. Perennial stream and river crossings and the areas one mile on either side of these crossings should be avoided from early November through mid-March. Known eagle wintering locations include Wilson and Naneum Creeks, which are all Columbia River crossings and perennial creeks in the YTC.

3.4.4 Shrub-Steppe Habitat Loss Mitigation

- Minimize the construction area to the extent possible at tower sites. Install construction "envelopes": silt fencing or other barrier materials surrounding the construction site to prevent vehicle turnaround, materials storage, or other disturbance outside the designated construction area.

- Do not clear vegetation for temporary vehicle travel or equipment storage. Crushing vegetation is preferable to removing it.

- When possible, avoid the use of access roads in steep terrain during unusually wet or muddy conditions or extremely dry conditions.

- Prevent the spread of noxious weeds by revegetating disturbed areas using native seed mix as soon as conditions permit.

- Carry fire fighting equipment in all vehicles and observe seasonal fire restrictions on construction. Park vehicles in areas free from dry grass or other vegetation.

3.4.5 Wildlife Disturbance Mitigation

- Prior to initiating ground-disturbing activities, identify areas of important wildlife populations or colonies such as burrowing owls, sage grouse leks, ground squirrels and other small animal species by consulting with WDFW and USFWS and conducting surveys if required.

- If possible, avoid locating towers, roads, construction staging areas, substations, or other disturbances in known colonies of small animal species.

- Gate and sign new or existing roads to prevent human encroachment into areas containing significant wildlife populations or relatively undisturbed wildlife habitat.

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SCHULTZ - HANFORD AREA TRANSMISSION-LINE PROJECT

ADDENDUM TO APPENDIX F:

IMPACTS OF EMF ON AQUATIC ECOSYSTEMS AND SPECIES OF SPECIAL CONCERN

January 8, 2002

Prepared by

Exponent

for

Parsons Brinckerhoff

1.0 Impacts of EMF on aquatic ecosystems and species of special concern

The proposed 500-kV Schultz-Hanford transmission line will cross the Columbia River in parallel to several other transmission lines. As a result, certain ecological concerns are evaluated regarding the potential impact of EMF associated with the proposed transmission line on the aquatic ecosystems and the aquatic species in the creeks. Species of special concern are Pacific salmon (*Oncorhynchus spp.*), particularly the chinook salmon (*O. tschawytscha*) and the steelhead (*O. mykiss*). (Personal Communication; Doug Corkran, Parsons Brinckerhoff, December 31, 2001). These species spend their adult lives in estuarine or oceanic environments and are well known for their annual spawning runs into freshwater, returning to the home streams and rivers where they were spawned and spent the first few months of their lives (Groot and Margolis, 1998). Pacific salmon are an important part of the history, ecology, and economy of the Pacific Northwest region.

1.1 Potential Exposure to EMF

The proposed 500-kV transmission line crossing over the Columbia River will be a source of magnetic field, but not electric field exposure, for fish in close vicinity to the line. (The water shields the fish from electric fields.) Since the level of EMF decreases with distance from the source, maximum magnetic-field exposures of fish will occur when they are directly under the lines , when spawning on Vernita Bar or when traveling down or up the river during their life cycle. This exposure scenario is evaluated for EMF levels based on the proposed transmission line configuration for current and future use (Bracken, 2001). The minimum clearance over the river will be greater than the minimum clearance over land, leading to exposures in the river well below the maximum of 244 mG for the proposed line at 1 m height above the earth.

2.0 Likely Biological Effects of EMF

2.1 Biological Organisms

More than one hundred studies of the effects of EMF on wildlife and domestic animals have been conducted during the past thirty years. These studies have examined basic life history aspects including survival, growth and reproduction. To date, there is little or no evidence that mammals, birds or fish exhibit any harmful effects when exposed to EMF of frequencies close to or at power frequencies (50-60 Hz), even for a prolonged period of time (NRC, 1997a). Additionally, prolonged exposure is not a critical issue for the species of concern, the salmon, because they are migratory by nature and will only be exposed to EMF associated with the proposed transmission line during the relatively short time they take to swim past or spawn under the line.

The scientific literature does not provide evidence of adverse effects of EMF exposure to living organisms at the levels associated with this project. An additional question is whether EMF exposure can affect salmon's ability to navigate during their spawning run. The Pacific salmon have been thought to navigate by several mechanisms: detecting and orienting to the earth's magnetic field, using a celestial compass (i.e., based on the position of the sun in the sky), and using their innate ability to imprint on their home stream by odor (Groot and Margolis, 1998, Quinn et al, 1981).

Generally, scientific studies have reported that, along with other cues or biological mechanisms, certain species of birds, bees, and fish may have magnetite in certain organs in their bodies, and use magnetite crystals as an aid in navigation (Bullock, 1977; Wiltschko and Wiltschko 1991, Kirschvink, 1993, Walker et al. 1988). Crystals of magnetite have been found in Pacific salmon (Mann et al, 1998; Walker et al, 1998). These magnetite crystals are believed to serve as a compass that orients to the earth's magnetic field. However, other studies have not found magnetite in sockeye salmon (*Oncorhynchus nerka*) fry (Quinn et al, 1981). While salmon can apparently detect the geomagnetic field, their behavior is governed by multiple stimuli as demonstrated by the ineffectiveness of magnetic field stimuli in the daytime (Quinn et al, 1982) and the inability of strong magnetic fields from permanent magnets attached to sockeye salmon to alter their migration behavior (Ueda et al, 1998).

It should be noted that the earth's magnetic field is static (0 Hz), in contrast to the oscillating magnetic field created by the AC (alternating current) transmission lines crossing the Columbia River. Static magnetic fields have fixed polarity, i.e. the earth's magnetic north and south poles. The electrical current that generates the magnetic field in transmission lines constantly alternates its direction, thus, the term "alternating current" (AC). AC transmission lines produce magnetic fields that do not have fixed polarity.

No studies have been conducted to date that specifically examine the effects of AC magnetic fields on the salmon's ability to orient to the earth's magnetic field. Studies on the response of other organisms that also use magnetite crystals as one means of navigation can, however, provide useful insight regarding salmon. Kirschvink, 1993 reports studies of the effects of AC magnetic fields on honeybees, which use magnetite crystals to navigate. In this study, the honeybees only oriented to an AC magnetic field when it was one million times greater in intensity than the DC field needed to elicit the same orientation response. This difference in intensity indicates that the AC magnetic field is less influential than the DC magnetic field in the navigation of honeybees and potentially other organisms that orient to the earth's magnetic field using magnetite crystals (Kirschvink, 1993). The level of AC magnetic fields estimated for the proposed transmission line are well below the levels reported in that study.

2.2 Ecological Systems

Recently, scientists have published the results of long-term monitoring studies designed to determine ecological impacts of extremely-low-frequency (ELF) electric and magnetic fields produced by a United States Navy communication system. Power line fields are also in the ELF range. Specifically, over a period of 13 years, academic researchers in Wisconsin conducted 11 separate experiments examining the impact of ELF EMFs on ecosystems (e.g., wetlands, streams, aquatic ecosystems) and specific organisms (e.g., slime mold, birds, small vertebrates, litter decomposers and microflora, upland flora, pollinating insects, soil arthropods, earthworms, and soil amebas). The fish community examined in this study showed no significant differences in species diversity, biomass or condition when compared to the control site. The results of the other studies also demonstrated no convincing evidence for effects of EMF on any of the organisms or ecosystems they examined (NRC, 1997b).

3.0 Conclusion

The scientific literature does not support the conclusion that the EMF associated with the proposed transmission line will have an adverse impact on the survival, growth, and reproduction of organisms in the ecosystem. There are no data on the effects of AC EMF on salmon navigation, but based on a study with honeybees, it appears that organisms that use magnetite crystals to orient to the earth's magnetic field would be affected only when the field levels are very much greater than the levels expected from the transmission line. Given this evidence and the salmon's ability to navigate using multiple sensory cues, the proposed transmission line crossing the Columbia River is unlikely to have an adverse impact on these species of concern and the aquatic ecosystems of these creeks. No effects on water quality and no ecological impacts of magnetic fields are expected.

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Fish and Wildlife Technical Report Addendum
List of Common and Scientific Species Names

Bonneville Power Administration
Schultz-Hanford Area Transmission Line Project

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January 9, 2002

Common Name	Scientific Name
Birds	
Aleutian Canada goose	*Branta canadensis leucopareia*
American kestrel	*Falco sparverius*
American white pelican	*Pelecanus erythrorhynchos*
Ash-throated flycatcher	*Myiarchus cinerascens*
Bald eagle	*Haliaeetus leucocephalus*
Black tern	*Chlidonias niger*
Black-crowned night heron	*Nycticorax nycticorax*
Brewer's sparrow	*Spizella breweri*
Burrowing owl	*Athene cunicularia*
California gull	*Larus californicus*
Canada goose	*Branta canadensis*
Caspian tern	*Sterna caspia*
Common loon	*Gavia immer*
Common raven	*Corvus corax*
Double-crested cormorant	*Phalacrocorax auritus*
Ferruginous hawk	*Buteo regalis*
Forster's tern	*Sterna forsteri*
Golden eagle	*Aquila chrysaetos*
Grasshopper sparrow	*Ammodramus savannarum*
Great blue heron	*Ardea herodias*
Harlequin duck	*Histrionicus histrionicus*
Horned lark	*Eremophila alpestris*
Lewis' woodpecker	*Melanerpes lewis*
Loggerhead shrike	*Lanius ludovicianus*
Long-billed curlew	*Numenius americanus*
Magpie	*Pica pica*
Marbled murrelet	*Brachyramphus marmoratus*
Mountain Quail	*Oreortyx pictus*
Northern goshawk	*Accipiter gentilis*
Northern harrier	*Circus cyaneus*
Northern shrike	*Lanius excubitor*
Northern Spotted Owl	*Strix occidentalis*
Olive sided flycatcher	*Contopus borealis*
Osprey	*Pandion halietus*
Peregrine falcon	*Falco peregrinus*
Prairie falcon	*Falco mexicanus*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-billed gull	*Larus delawarensis*
Ring-necked pheasant	*Phasianus colchicus*
Rock wren	*Salpinctes obsoletus*
Rough-legged hawk	*Buteo lagopus*
Sage sparrow	*Amphispiza belli*
Sage thrasher	*Oreoscoptes montanus*
Sharp tailed grouse	*Tympanuchus phasianellus*
Swainson's hawk	*Buteo swainsoni*
Turkey vulture	*Cathartes aura*
Western bluebird	*Sialia mexicana*
Western meadowlark	*Sturnella neglecta*
Western sage grouse	*Centrocercus urophasianus*
Willow flycatcher	*Empidonax traillii*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*

Common Name	Scientific Name
Mammals	
Badger	*Taxidea taxus*
Black-tailed jackrabbit	*Lepus californicus*
Bobcat	*Lynx rufus*
Bushy-tailed woodrat	*Neotoma cinerea*
California bighorn sheep	*Ovis canadensis californiana*
Canada lynx	*Lynx canadensis*
Coyote	*Canis latrans*
Deer mouse	*Peromyscus maniculatus*
Elk	*Cervus elaphus*
Fringed myotis	*Myotis thysanodes*
Gray wolf	*Canis lupus*
Great Basin pocket mouse	*Perognathus parvus*
Grizzly bear	*Ursus arctos*
Least chipmunk	*Tamias minimus*
Long-eared myotis	*Myotis evotis*
Long-legged myotis	*Myotis volans*
Merriam's shrew	*Sorex merriami*
Mountain lion	*Felis concolor*
Mule deer	*Odocoileus hemionus hemionus*
Northern grasshopper mouse	*Onychomys leucogaster*
Northern pocket gopher	*Thomomys talpoides*
Ord's kangaroo rat	*Dipodomys ordii*
Pacific fisher	*Martes pennanti*
Pacific western big-eared bat	*Corynorhinus townsendii*
Pallid bat	*Antrozous pallidus*
Potholes meadow vole	*Microtus pennsylvanicus*
Pygmy rabbit	*Brachylagus idahoensis*
Raccon	*Procyon lotor*
Sagebrush vole	*Lagarus curtatus*
Striped skunk	*Mephitis mephitis*
Washington ground squirrel	*Spermophilus washingtoni*
Western gray squirrel	*Sciurus griseus*
Western small-footed bat	*Myotis ciliolabrum*
White-tailed jackrabbit	*Lepus tonwnsendii*
Wolverine	*Gulo gulo*
Yellow-bellied marmot	*Marmota flaviventris*
Yuma myotis	*Myotis yumanensis*
Insects	
Mardon skipper	*Polites mardon*
Persius' duskywing	*Erynnis persius*
Reptiles & Amphibians	
Cascades frog	*Rana cascadae*
Garter snake	*Thamnophis sirtalis*
Gopher snake	*Pituophis catenifer*
Great Basin spadefoot toad	*Scaphiophus intermontanus*
Larch Mountain salamander	*Plethodon larselli*
Long-toed salamander	*Ambystoma macrodactylum*
Night snake	*Hypsiglena torquata*
Northern leopard frog	*Rana pipiens*
Pacific tree frog	*Hyla regilla*
Painted turtle	*Chrisemys picta*

Common Name	Scientific Name
Reptiles & Amphibians (continued)	
Racer	*Coluber constrictor*
Red-legged frog	*Rana aurora*
Rubber boa	*Charina bottae*
Sagebrush lizard	*Sceleporus graciosus*
Short-horned lizard	*Phrynosoma douglassi*
Side-blotched lizard	*Uta stansburiana*
Spotted Frog	*Rana pretiosa*
Striped whipsnake	*Masticophis taeniatus*
Tailed frog	*Ascaphus truei*
Tiger salamander	*Ambystoma tigrinum*
Western fence lizard	*Sceloporus occidentalis*
Western rattlesnake	*Crotalus viridis*
Western toad	*Bufo boreas*
Woodhouse's Toad	*Bufo woodhousei*
Insects	
Columbia River tiger beetle	*Cicindela columbica*
Juniper hairstreak	*Mitoura siva*
Mardon skipper	*Polites mardon*
Silver-bordered bog fritillary	*Boloria selene atrocastalis*
Fish	
Three-spined stickleback	*Gasterosteus aculeatus*
Bridgelip sucker	*Catostomus columbianus*
Brook lamprey	*Lampetra richardsoni*
Brook trout	*Salvelinus fontinalis*
Brown trout	*Salmo trutta*
Bull trout	*Salvelinus confluentus*
Chinook salmon	*Oncorhynchus tsawytscha*
Cutthroat trout	*Oncorhynchus clarki*
Large-scale sucker	*Catostomus macrocheilus*
Longnose dace	*Rhinichthys cataractae*
Mountain sucker	*Catostomus platyrhynchus*
Mountain whitefish	*Prosopium williamsoni*
Pacific lamprey	*Entosphenus tridentatus*
Prickly sculpin	*Cottus asper*
Rainbow trout	*Oncorhynchus mykiss*
Redside shiner	*Richardsonius balteatus*
Sand roller	*Percopsis transmontana*
Speckled dace	*Rhinichthys osculus*
Steelhead trout	*Oncorhynchus mykiss*
Torrent sculpin	*Cottus rhotheus*

Appendix G – Consistency With Local Government Regulations Appendix

Consistency With Local Government Regulations Appendix

Bonneville Power Administration
Schultz-Hanford Area Transmission Line Project

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Consistency with Local Government Regulations

The Schultz-Hanford Area Transmission Line Project crosses Kittitas, Yakima, Grant, and Benton Counties in central Washington. The facilities could be located in a number of zoning districts within these jurisdictions.

1.1 State

No conflicts with state land use plans or programs are anticipated. BPA would work with state agency representatives to minimize conflicts between proposed activities and land use plans, and would strive to meet or exceed the substantive standards and policies of the following regulations.

1.1.1 Growth Management Act (GMA)

The Growth Management Act of 1990 (GMA, RCW 36.70A) requires all cities and counties to plan for future growth while protecting natural resources (Washington Department of Ecology, 1994). All jurisdictions must classify and designate natural resource lands (e.g., agricultural and forest land) and critical areas (e.g., wetlands, fish and wildlife habitat, aquifer recharge areas). These jurisdictions must also adopt development regulations such as zoning ordinances to protect these critical areas.

In addition to the requirements, Washington's fastest growing cities and counties must adopt development regulations to conserve natural resource lands. These jurisdictions must establish Urban Growth Areas that can accommodate the increase in population expected to occur over the next 20 years. Comprehensive plans and development regulations consistent with these plans must also be adopted.

As a federal agency, BPA is exempt from obtaining permits to impact critical areas. Designated critical areas, however, would be identified and mitigation for these impacts would be developed to be consistent with the applicable county's critical area ordinance.

1.1.2 Shoreline Management Act (SMA)

The goal of Washington's Shoreline Management Act of 1971 (SMA, 173-16 WAC) is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines" (Washington Department of Ecology, 2001). Cities and counties are the primary regulators but the state has authority to review local programs and permit decisions. The State's authority is housed in the Department of Ecology. Under the SMA, each city and county adopts a shoreline master program that is based on state guidelines but tailored to the specific geographic, economic, and environmental needs of the community. Master programs provide policies and regulations addressing shoreline use and protection as well as a permit system for administering the program.

The project would cross one river, two creeks, and one lake that are designated as shorelines of the state: the Columbia River in Kittitas, Grant, and Benton Counties; Naneum Creek in Kittitas County; and Nunnally Lake and Lower Crab Creek in Grant County.

Final structure locations will not be determined until the detailed design stage of project development. During design, designated shorelines would be identified and mitigation for these crossings would be developed. Where possible, BPA would locate structures outside of the shoreline jurisdictional area. BPA would take the following measures, when practicable, to assure consistency with each counties' Shoreline Master Programs.

- Location of structures within the identified shoreline would be avoided if possible. If locations within the shoreline area could not be avoided, BPA would consult with the appropriate state and local agencies to determine the best placement of the transmission structure.
- Transmission line structures would be located in water bodies only if there were no reasonable alternative. (Placing structures in water bodies is not anticipated).
- Disturbed land would be restored as closely as possible to pre-project contours and replanted with an appropriate native seed mix. However, there may be locations where site topography would require near-bank disruption. A restoration and monitoring plan would be prepared before disturbing shoreline areas.
- Appropriate erosion control measures would be implemented.

1.1.3 Noxious Weed Control

County Noxious Weed Control Boards coordinate weed detection and control activities that emphasize the prevention of invasion by noxious weeds, eradication when possible, and containment of established species. County weed boards work locally to control weeds on state-owned and private lands. To accomplish this, counties adopt a County Weed List each year, which is divided into Classes A-C (similar to the state list) and based on the degree of threat they pose to that county. Counties also maintain Education Lists that include weeds not included in Class A-C, but for which the Weed Board will assist landowners with control efforts.

Federal law refers to weeds as "undesirable species" that may include a broader range of species than state-listed weed species (Federal Noxious Weed Act, 1986, P.L. 93-629, Section 15). On federal lands, land management agencies designate personnel to address the problems presented by weed species. In the proposed study area, personnel from county weed boards and federal land management agencies serve on joint task forces to address weed control in a concerted way, in an effort to coordinate efforts and share information.

BPA conducts weed surveys before construction to determine whether any weed mitigation needs to be conducted prior to construction and also to identify preventative measures that can be taken to minimize the risk of spreading or introducing weeds as a result of construction activities. BPA also conducts weed surveys after construction to assess whether any further weed mitigation measures are necessary.

1.2 Counties

Alternatives would be located in Kittitas, Grant, Benton, and Yakima counties in central Washington State. There are no incorporated cities or towns crossed by the alternatives. Table 5.5-7, *Zoning Designations Crossed by the Alternatives in Each County*, identifies zoning designations by county.

Table 5.5-7
Zoning Designations Crossed by the Alternatives in Each County

	Counties			
	Kittitas	**Grant**	**Benton**	**Yakima**
Zoning Designations	Forest and Range	Rural Light Industrial	Unclassified	Agricultural
	Agricultural-20	Rural Remote	GMA Agricultural	
		Rural Residential 3		
		Open Space Conservation		
		Agricultural		
		Public Open Space		

BPA would work with county planners to minimize conflicts between proposed activities and county land use plans by striving, as much as possible, to meet or exceed the substantive standards and policies of the county zoning ordinances and comprehensive plans.

1.2.1 Kittitas County

Zoning Ordinance

According to the Kittitas County Zoning Ordinance, an electrical transmission line is considered a "special utility" if it exceeds 115 kV. The proposal is a 500-kV transmission line and would, therefore, be considered a special utility. Special utilities are allowed as conditional uses in all zoning districts and typically require the approval of a Zoning Conditional Use Permit by the Kittitas County Board of Adjustment. Section 17.61.030 of the zoning ordinance identifies seven (A-G) approval criteria that must be addressed by an applicant for a Conditional Use Permit application. A proposed 500-kV transmission line, or special utility, would be consistent with the zoning ordinance as long as an applicant could show that the proposal meets the applicable review criteria.

Comprehensive Plan

None of the review criteria identified in Section 17.61.030 of the zoning ordinance specifically require an applicant to address how the proposal is consistent with the Kittitas County Comprehensive Plan. However, since the Kittitas County Comprehensive Plan responds to and implements the planning goals of the Washington State GMA, and guides land-use decisions throughout the county, it would be expected that a Zoning Conditional Use Permit would not be approved if it were determined that the proposed use was inconsistent with this plan.

All of the alternatives (Segments A, B, and C) in Kittitas County are located on lands identified in the comprehensive plan as rural multiple use and the Yakima Training Center. Lands mapped as rural multiple use are combined with a number of other lands (rural residential, non-designated agricultural, forest multiple use, and public recreation lands) and identified as Rural Lands in Chapter 8 of the comprehensive plan. In addition, Chapter 6 of the plan relates to utilities in general without distinguishing between utilities and special utilities. Each chapter outlines a number of goals, policies, and objectives relevant to rural lands and utilities. Project consistency with the applicable goals, policies and objectives is addressed below. There are no goals, policies, or objectives related to the management or development of the YTC in the Kittitas County Comprehensive Plan.

The applicable goals, policies, and objectives identified in Chapter 6, Utilities, and Chapter 8, Rural Lands, are as follows:

GPO 6.7 Decisions made by Kittitas County regarding utility facilities will be made in a manner consistent with and complementary to regional demands and resources.

GPO 6.18 Decisions made regarding utility facilities should be consistent with and complementary to regional demand and resources and should reinforce an interconnected regional distribution network.

GPO 6.21 Avoid, where possible, routing major electric transmission lines above 55 kV through urban areas.

GPO 6.32 Electric and natural gas transmission and distribution facilities may be sited within and through areas of Kittitas County both inside and outside of municipal boundaries, UGAs, UGNs, Master Planned Resorts, and Fully Contained Communities, including to and through rural areas of Kittitas County.

GPO 8.2B (This GPO is a repeat of GPO 6.32 from Chapter 6.)

All of the alternatives would be consistent with the Kittitas County Comprehensive Plan. The new transmission line would become part of BPA's regional power grid serving the entire Northwest region. It would not cross through urban areas of Kittitas County. Although the alternatives would convert some rural lands to a utility facility, according to the comprehensive plan GPO 6.32 and 8.2B electrical transmission facilities may be sited through the rural areas of Kittitas County. In addition, implementation of **Best Management Practices (BMPs)** and mitigation measures to protect the natural and built environment, adjacent land uses, and any cultural resources identified would help ensure consistency with the County comprehensive plan.

1.2.2 Grant County

Zoning Ordinance

According to the Grant County Zoning Ordinance, an electrical transmission line is considered a "minor utility" if it is less than 115 kV and it is considered a "major utility" if it exceeds 115 kV. According to the ordinance, major utility developments are designed to serve a broader community or regional area. The new 500-kV transmission line would become part of the Pacific Northwest power grid, thus meeting the intent of major utility developments in Grant County.

According to Tables 4 and 5 in Chapter 24.03 of the Grant County Zoning Ordinance, a major utility is allowed as a conditional use in two of the six identified zoning designations through which Alternatives 1, 2, and 1A pass, Rural Light Industrial and Agricultural. As a result, approval of a Type III Conditional Use Permit from the Grant County Board of Adjustment would typically be necessary in order to establish the use. Section 25.08.060 of the zoning ordinance identifies ten approval criteria that must be addressed in a Conditional Use Permit application. A proposed 500-kV transmission line, or special utility, would be consistent with the zoning ordinance as long as an applicant could show that the proposal meets the applicable review criteria.

The same tables indicate that a major utility is a prohibited use in the remaining four zones, Rural Residential 3, Rural Remote, Open Space Conservation, and Public Open Space. Minor utilities are, however, allowed in these zones as discretionary uses. The existing transmission lines, which a portion of three alternatives parallel, were constructed prior to the most recent adoption of the Grant County Zoning Ordinance in October 2000. The prior zoning ordinance did not distinguish between major and minor transmission lines. As a result, any new transmission lines in excess of 115 kV through these zones would be considered an "illegal use" as defined by the zoning ordinance (E. Harrell, pers. comm., 2001).

Comprehensive Plan

The Grant County Zoning Ordinance implements the goals and policies of the Grant County Comprehensive Plan by transferring into regulations and ordinances all or any part of the general objectives and intent of the comprehensive plan. Thus, if a proposed use were inconsistent with the intent of the zoning ordinance it would also be inconsistent with the comprehensive plan. As discussed above, the proposed 500-kV transmission line would be inconsistent with the zoning ordinance if located in four of the six zoning designations through which the alternatives would cross. As a result, the transmission line would also be inconsistent with the comprehensive plan in those locations.

In the remaining two zones a Type III Conditional Use Permit would typically be required to build a new transmission line. The two zones, Rural Light Industrial and Agricultural, are part of the land use categories Rural Lands, more specifically rural activity centers, and Resource Lands, respectively. One of the criteria for approval of a Conditional Use Permit states that the proposed use must be consistent with the purposes and regulations of the Grant County Comprehensive Plan. Typically, to satisfy this criterion, and ultimately gain approval of the conditional use permit, consistency with the goals and policies of the Land Use Element, including the Rural Lands sub-element and the Resource Lands sub-element, (Chapter 5) as well as the Utilities Element (Chapter 10) would need to be shown.

The applicable goals and policies identified in Chapter 5, Land Use Element, and Chapter 10, Utilities Element, are as follows:

> *Goal RU-3: Promote the continuation and enhancement of the existing rural activity centers in order to preserve their multi-use function to the rural community of Grant County.*
>
> *Goal RE-2: Mitigate conflicts between agricultural and non-agricultural land uses in designated agricultural resource lands.*
>
> *Goal U-1: Necessary energy and communication facilities and services should be available to support current and future developments.*
>
> *Goal U-2: Negative impacts associated with the siting, development, and operation of utility services and facilities on adjacent properties, significant cultural resources, and the natural environment should be minimized.*

BPA has determined that the proposed 500-kV transmission line is a necessary addition to the Northwest power grid to ensure enough power is available to support existing and future developments in the region. The project, including structures and possible access roads, would convert some rural and resource lands to a utility facility. However, the facility would not preclude or severely inhibit agricultural or other land uses from occurring on the lands adjacent to the towers or the right-of-way. In addition, negative impacts associated with siting the transmission line will be minimized through the use of BMPs and mitigation measures (See Chapter 4, *Environmental Consequences*) to protect the natural and developed environment, adjacent land uses, and any cultural resources identified. Thus, the project would be consistent with the Grant County Comprehensive Plan in those areas were the proposed use would typically require a Type III Conditional Use permit.

1.2.3 Benton County

Zoning Ordinance

The all of the alternatives would cross one of two different zoning districts in Benton County, Unclassified and GMA Agricultural. The Benton County Zoning Ordinance, Title 11, does not specifically address utility transmission lines but historically they are considered permitted uses in all zoning designations regardless of the voltage. This is not expected to change for the proposed new transmission line (T. Marden, pers. comm. 2001).

The new Wautoma Substation would be constructed on land zoned GMA Agricultural. According to the Benton County Zoning Ordinance Section 11.18.050 states that *"Public or quasi-public buildings and yards and utility buildings, such as: pumping stations, fire stations, substations and…"* are allowable uses in this zoning district; no land use reviews would be required to locate the new substation.

Comprehensive Plan

All alternatives in Benton County are located on lands identified in the Benton County Comprehensive Plan as either the Hanford Reservation or GMA Agricultural and zoned according to the Benton County Zoning Ordinance as Unclassified and GMA Agricultural.

Although the project would convert some agricultural land to a utility use, transmission lines and a utility substation are allowable uses in the GMA Agricultural and the Unclassified zoning districts. As allowable uses, they do not require the approval of a Benton County land use review and, therefore, would be consistent with the intent of the zoning ordinance.

Since the zoning ordinance implements and must be consistent with the Benton County Comprehensive Plan, a proposed use that is consistent with the zoning ordinance would also be consistent with the comprehensive plan. Thus, the proposed transmission line and substation facilities would be consistent with the Benton County Comprehensive Plan. To further ensure consistency with the comprehensive plan, BMPs and mitigation measures to protect the natural and developed environment, adjacent land uses, and any cultural resources identified would be implemented. (See Chapter 4, *Environmental Consequences.*)

1.2.4 Yakima County

Zoning Ordinance

After exiting the Yakima Training Center, Alternative 3 (Segment C), the only alternative located in Yakima County, would cross a portion of land that has a County zoning district designation of Agricultural. According to Section 15.08.630 of the Yakima County Zoning Ordinance, Title 15, a 500-kV transmission line would be considered a "utility service" since it is not a local transmission or collection line.

In the Agricultural zone, a utility service would typically require a Type II Administrative Review if the SEPA threshold for transmission lines is exceeded. According WAC 197-11-800 Section 24.c, a transmission line with an associated voltage of more than 55-kV is not exempt from the Washington State SEPA regulations. As a result, in the Agricultural zone of Yakima County a proposed 500-kV line would typically require the approval of a Type II Administrative Review from the Yakima County Planning Director in order for the use to be established. Section 15.12.040 of the zoning ordinance identifies the conditions of approval for Type II applications. A proposed 500-kV transmission line, or utility service, would be consistent with the zoning ordinance as long as an applicant could show that the proposal meets the applicable review criteria.

Comprehensive Plan

One of the criteria for approval of a Type II Administrative Review in Yakima County states that the proposed use must *"achieve and further the intent, goals, objectives, and policies of the comprehensive plan and this title" (Yakima County, 2000, Zoning Ord.)*. Thus, to establish a transmission line in the Agricultural zoning district, an application would need to show how the proposal is consistent with the Yakima County Comprehensive Plan; Plan 2015.

Alternative 3 (Segment C) in Yakima County is located on lands identified in the comprehensive plan as Agricultural Resource Areas, which is a sub-element of the Economic Resource Lands. The intent of the Agricultural Resource Areas is to *"…preserve, stabilize, and enhance the primary agricultural land base which is being used for, or offers the greatest potential for, continued production of agricultural products and harvesting" (Yakima County, 1998, Plan 2015)*. To do this a number of goals and policies have been identified in the comprehensive plan relating to the Agricultural Resource Areas. The comprehensive plan also includes a number of goals and policies related to utilities. While the plan does identify several goals and policies only a few are applicable to the proposed transmission line. The applicable goals and policies of the Land Use and Utilities sections of Plan 2015, Volume 1 are as follows:

> *Goal LU-ER-AG 1: Maintain and enhance productive agricultural lands and discourage uses that are incompatible with farming activities.*
>
> *Goal UT 17: Promote the delivery of electrical services, on demand, within the County consistent with utility's public service obligations.*
>
> *Policy UT 17.2: When new, expanded or upgraded transmission is required, use of existing corridors should be evaluated first. Yakima County should facilitate appropriate corridor sharing among different utility types and owners.*

There are no existing transmission line corridors for the new line to parallel. As a result, a new corridor would be required through the Agricultural Resource Area. A new transmission corridor, including structures and access roads, would convert some agricultural lands to a utility facility. However, the facility would not preclude or severely inhibit agricultural practices from occurring on the lands adjacent to the structures or the right-of-way. In addition, BMPs and mitigation measures to protect the natural and developed environment, adjacent land uses, and any cultural resources identified would be implemented. Thus, the project would be consistent with the Yakima County comprehensive plan. (See Chapter 4, *Environmental Consequences*.)

Appendix H – Phase I, Cultural Resource Assessment

Phase I Cultural Resources Assessment for the Schultz-Hanford Area Transmission Line Draft Environmental Impact Statement Revision 3

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Chapter 1 Introduction

The Department of Energy's Bonneville Power Administration (BPA) is proposing to build a new 500-kV transmission line between BPA's Schultz Substation, north of Ellensburg, Washington and a substation in the vicinity of the US Department of Energy Hanford Reservation, also in Washington. At present four different alternative routes are being considered for the new transmission line; three of the alternatives may utilize a route option (Segment B south) for a short portion of the proposed line. All four alternatives are addressed within the scope of this work. A new transmission line would allow BPA to increase transmission capacity in central Washington to relieve present and future congestion in its 500-kV transmission system.

The present study assesses the effects of the proposed alternatives on previously recorded cultural resources based only on the available literature; no new field assessments were conducted for the Cultural Resources section of this Draft Environmental Impact Statement. Cultural resources are those historic and archaeological properties, properties of traditional and cultural significance, sacred sites, Native American human remains and associated objects, and cultural landscapes which are entitled to special consideration under federal statute, regulations, and/or executive orders. Cultural resources located in the general area of the proposed project include, but are not limited to, prehistoric camps, lithic scatters, prehistoric stone tool quarries, historic homesteads, historic railroad sites, and traditional root gathering areas. There are no sacred sites recorded at this time in the proposed project area.

This assessment of potential impacts on cultural resources was limited to a literature search, compilation and assessment of records and reports of sites potentially impacted by the five alternatives, delineation of areas of high site probability which have not been surveyed, and a comparison of potential impacts to these sensitive areas for each proposed project alternative. Discussion of both generalized and site-specific impacts is included herein and general recommendations for mitigation of potential impacts are presented.

Chapter 2 Proposed Action and Alternatives

The Department of Energy's Bonneville Power Administration (BPA) is proposing to build a new 500-kV transmission line between BPA's Schultz Substation, north of Ellensburg, Washington and a substation in the vicinity of the US Department of Energy Hanford Reservation, also in Washington. A new line would allow BPA to increase transmission capacity in central Washington to relieve present and future congestion in its 500-kV transmission system.

2.1 Segment A - Schultz to Segment B

All four of the alternatives include the line location from the BPA Schultz Substation following the Schultz-Vantage 500-kV transmission line to a point ca. 8 km south of Interstate 90 at the intersection with proposed Segments B and C (Segment A; green line on map). For all but ten miles of its length, the centerline of this segment of the new line would be 1,200 feet to the north of the existing Schultz-Vantage line, with an additional 75 feet of right-of-way off of the new centerline; for a 10-mile segment in the vicinity of its crossing of Interstate 5, the offset will be 1,400 feet north of the existing line. A small revision of the initially proposed alignment of Segment A involves moving a ca. 3-mile segment to the west a short distance in the vicinity of Coleman Creek and Colockum Roads. Segment A data is included within the descriptions and assessments of the alternatives throughout the balance of this report.

2.2 Route Option for Segment B – Schultz to Vantage via PP&L (PacifiCorp) Line

This constitutes a modification of the originally proposed Segment B only and is not an alternative by itself. *Segment B north* is the originally proposed Segment B route from the end of Segment A south of Interstate 5 east, parallel to and 1,200 feet south of the Schultz-Vantage line, to the Vantage Substation. *Segment B south* initially runs further to the south following the Segment C route, and then heads east on the south side of the John Wayne Trail following an existing PP&L line. Just before the Columbia River, B south turns slightly to the north and crosses the Columbia River at the same location proposed for B north (pink line on the map).

2.3 Alternative 1 -- Schultz to Hanford parallel 500-kV

Alternative 1 includes Segments A, B, and E; both Segment B (B north which is the original Segment B, and B south which is the original Segment G) route options are available to this alternative. The Segment E route follows the Vantage-Hanford 500-kV transmission line from the Vantage Substation into the Hanford Substation (green line on map). The centerline of the new line would be 1200 feet to the north of the existing Vantage-Hanford line, with an additional 75 feet of right-of-way to the north of the new centerline.

2.4 Alternative 1A – Schultz to Hanford via Crab Creek route

Alternative 1A includes Segments A, B, and F; both Segment B route options are available to this alternative. Segment F would run east from the Vantage substation creating a new right-of-way that would be 150 feet wide (thin orange line on map). The new line would then run south, turning and following the Vantage-Hanford line for a short length before turning east to intersect with the Grand Coulee-Hanford 500-kV transmission line. The centerline of the new line would run south to Hanford, 1200 feet to the east (with an additional 75 feet of right-of-way to the east) of the Grand Coulee-Hanford line.

2.5 Alternative 2 – Schultz to Blackrock via Midway Parallel 230-kV

Alternative 2 includes Segments A, B, and D; both Segment B route options are available to this alternative. The Segment D route would parallel or replace the existing Vantage-Midway 230-kV line (plum line on map). At this time it is undetermined whether the new line would parallel the Vantage-Midway line on the east or west side, so both sides will be assessed herein. An additional 150 feet of right-of-way would be needed. (If the 230-kV line were to be removed and the new line built in its place, the existing right-of-way would need to be increased from the current 100 feet to 150 feet.) South of the Midway Substation, the new line would parallel the existing Big Eddy - Midway line into a new substation to the south (blue line on map). The existing line has a right-of-way of 125 feet. The new line would be located on an additional right-of-way that would be 150 feet wide, either west or east of the existing line. Note: at this time, project planners are assuming a parallel build for this alternative with the centerline of the new transmission line 125 feet from the existing 230-kV line.

2.6 Alternative 3 -- Yakima Training Center route to Blackrock

Alternative 3 includes Segments A and C. This route alternative would start out like the others following the Schultz-Vantage line, but would not cross the Columbia River into Vantage. Instead the new line would turn south at the end of Segment A and create a new right-of-way on the west side of the Columbia River crossing south through the Yakima Training Center (orange line on map) and terminating at the new substation near Blackrock.

2.7 No Action Alternative

The no action alternative would continue operations with the existing transmission lines, with no increase in transmission capacity.

2.8 Agency Preferred Alternative

Bonneville Power Administration has selected Alternative 2 with the B south route option as the agency preferred alternative.

Chapter 3 Affected Environment

The project takes place in the Columbia Basin of Central Washington. Discussion of the affected environment includes the environmental setting, cultural setting, cultural resources types found in the project area, and previous work as it applies to analysis of the affected environment.

3.1 Environmental Setting

The Columbia Basin is characterized as an arid-to-semiarid steppe zone (Franklin and Dyrness 1973). This area is within the rain shadow of the Cascade Range, and receives an average of only 18 cm of precipitation each year, most falling as snow (Campbell 1984), making it the driest part of Washington State (Smith and Chatters 1986). The area's topography is dominated by numerous smaller drainages flowing through deeply entrenched, dissecting canyons, trending towards the Columbia River. These small drainages are fed to some extent by snowmelt and runoff, but springs and seeps provide most of their flow (Smith and Chatters 1986). The area becomes dryer over the summer months, and few streams provide year-round water. Temperatures typically range from -18 to greater than 32 degrees C (Campbell 1984; Franklin and Dyrness 1973). These extreme physical conditions present special challenges to vegetation, animals, and humans occupying the area.

An *Artemesia tridentata-Agropyron spicatum* (sagebrush/bluebunch wheatgrass) vegetation community characterizes the area (Daubenmire 1970) featuring xeriphytic fauna such as pronghorn, jackrabbits, and ground squirrels. A variety of edible plants in the project area include multiple species of camas, onion, bitterroot, mariposa and brodiea lilies, balsamroot, chokecherry, hawthorn, elderberry, and serviceberry, all important Native American food resources; as well as willow, wild rose, grasses and sedges for non-food materials. Trees are for the most part limited to riparian areas.

While at first glance the area may seem barren and monotonous, microclimates present greater diversity. Xerophytic uplands contrast with riparian vegetation along streamsides. Smith and Chatters (1986:23-32) identify twelve modern steppe and aquatic habitats there. Gough (1998:3.1) notes that differences in elevation and aspect result in temperature differences of 2 to 4 degrees C within a single drainage, causing vegetation maturation (and hence harvest) to occur over a period of weeks within relatively close proximity.

Global climate change has resulted in a fluctuation of more arid and moist periods in this area (Table 3.1). More recently, changes in vegetation community have been increased by human activity. Because of historic overgrazing, vegetation densities have decreased, and the disturbance regime, surface erosion and stream channel incision have increased. Although the extent and nature of this change is poorly understood, palynological data suggest that local habitats may have changed significantly over the past 150 years (Mehringer 1985). A contributing factor to this could be a lower ground water table at present than observed in the past (Gough 1998:3.2).

The Columbia Plateau is a plain constructed from the Columbia River Basalt Group. The Yakima fold belt within the Columbia Plateau is "comprised of basalt flows and sediments that have been folded under north-south compression forming east-west trending anticlinal ridges and synclinal valleys" (Gough 1998:3.3). This geological activity has resulted in greater relief here than much

Table 3.1
Sequence of Environmental Change in the Columbia Basin
(from King and Putnam 1994:7)

Period	Climate	Typical Flora and Fauna
12,000 BP	Cold, dry	Sagebrush, grasses, Pleistocene fauna
10,000 BP	Warming, but great seasonal extremes	Grasses, abundant large ungulates
8,000 BP	Warming, drying	Sparse sagebrush, grasses, small mammals
4,500 BP	Moister, perhaps cooler	Grasslands, forests expand, large mammals become abundant
2,300 BP	Warming, drying, approaching modern conditions	Grasslands retreating, xeric-adapted mammals at low elevations
Present	Hot, arid	Sage, bunchgrass, xeric mammals predominate

of the Columbia Plateau. Anticline folding has increased the exposure of silicate lithic raw materials in this area; the Vantage region in particular is known for the abundance of petrified wood and other silicate rocks (collectively referred to herein as cryptocrystalline silicates), and includes several prehistoric, historic and modern quarry sites. For a more detailed discussion of the geological and geomorphic setting, the reader is referred to Gough (1998).

Hillslope soils are typically shallow and rocky, and those of the valley bottoms are deep, silty, and often gravelly (Gough 1998:3.3). The presence of a full complement of volcanic ash, including at least five identifiable episodes, has been a significant asset to archaeological dating, and provides the opportunity for more detailed development of our knowledge of the area's prehistory.

3.2 Cultural Setting

A brief discussion of traditional culture groups and culture history of this area is presented. For a more extensive overview of the area's cultural history, the reader is referred to King and Putnam (1994), Galm, Hartmann, Masten and Stephenson (1981) and Lince (1984). Holstine (1994) presents a well-organized and detailed historic overview, and Hollenbeck and Carter (1986) developed a prehistoric and ethnographic overview, both of the general area.

The following summary of this area's prehistoric cultural history follows the chronological sequence presented by Galm et al. (1981) and summarized by King and Putnam (1994:15-17):

> **Clovis Phase (11,500-10,500 BP):** In eastern Washington, the Clovis Phase is characterized by small, highly mobile bands of hunter/gatherers that exploited a wide range of subsistence resources, including bison and elk (Rice and Stilson 1987). Clovis Phase sites are usually small, exhibit low artifact densities, and are associated with early landforms, especially upland plateaus. The Clovis artifact assemblage consists of lithic debitage, large scraping tools, cobble tools, and large lanceolate, Plano-type projectile points (Clovis points). Bone and antler artifacts are rare, perhaps due to differential preservation.

Windust Phase (10,500-8,000 BP): The Windust Phase is characterized by small, mobile bands of foragers/collectors that exploited plant and animal resources during a seasonal round (Chatters 1986). The few cultural deposits known from this phase are generally small and exhibit low artifact densities. Large shouldered and large basal-notched lanceolate projectile points are diagnostic of this phase.

Vantage Phase (8,000-4,500 BP): Vantage Phase peoples were highly mobile, opportunistic foragers adapted primarily to riverine environments (Chatters 1986; Galm et al. 1985). Archaeological data from this phase suggests that fish had become an important subsistence resource. Archaeological sites of the Vantage Phase are generally discovered along river and stream margins. Projectile points diagnostic of this phase include large, shouldered lanceolates and unstemmed lanceolate forms.

Frenchman Springs Phase (4,500-2,500 BP): The Frenchman Springs Phase is characterized by the introduction of semi-subterranean houses and the presence of specialized camps for hunting, root collecting, and plant processing. Archeologists have suggested that the ethnographic Plateau pattern emerged by the end of this phase (e.g., Nelson 1969). Several styles of smaller, contracting stemmed projectile points are diagnostic of this period.

Cayuse Phase (2,500-200 BP): During the Cayuse Phase, inhabitants of the Columbia Plateau wintered in large, nucleated villages of 50 pithouses or more (Chatters 1986). In the spring, people dispersed to gather roots, and in the fall and winter small parties established hunting camps in the uplands. This seasonal round became increasingly diverse and better organized over time, and trade with coastal groups was common. By about 200 years ago, the introduction of diseases reduced Native American populations and led to significant changes in the settlement and subsistence patterns of native Columbia Plateau groups (Campbell 1989). Projectile points diagnostic of the Cayuse Phase are generally much smaller than those of previous phases, and are either side-notched or corner-notched. These smaller points probably represent the appearance of bow and arrow technology.

The Historic Period began here with the visitation of Lewis and Clark to the confluence of the Snake and Columbia Rivers in 1805 en route to the Pacific (Thwaites 1959 vol. III:122-130). The Columbia, Kittitas, Wanapam, Wenatchee, and Yakama peoples lived in the vicinity of the project area at contact (Ray 1936) (Figure 3.1). These people were Sahaptan and Salish speakers, part of what would later be described as the Plateau culture. Their life was focused on an annual round anchored by specific times for gathering, hunting, fishing, and trading (Figure 3.2), but also for religious activities, visiting, courting, storytelling, dancing, and other such activities. Better ethnographic descriptions of Plateau groups are available in Mooney (1896), Ray (1936, 1939), Relander (1956) and Spier (1935).

A period of exploration and trapping followed, with early travelers such as Wilson P. Hunt of the Astor Company, David Thompson of the Northwest Company, Alexander Ross, Ross Cox, and many others arriving in this area between 1805 and 1815. The Hudson's Bay Company opened Fort Nez Perces in the 1820's, later called Old Fort Walla Walla in the 1830's. Many interesting

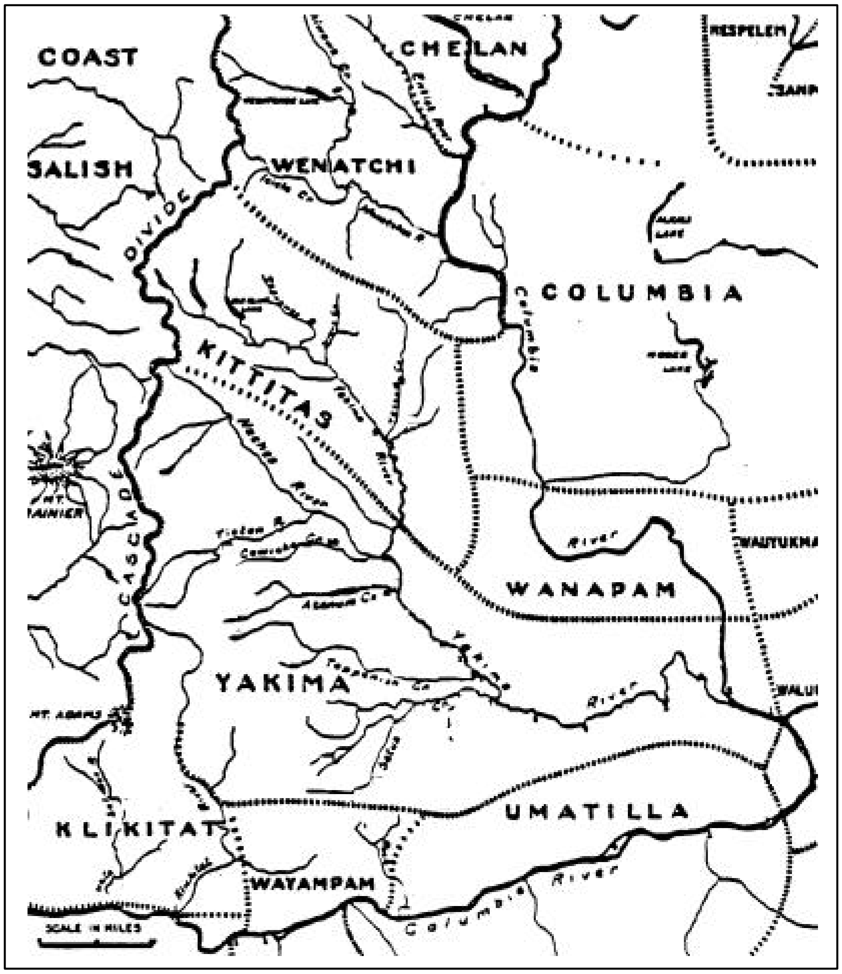

Figure 3.1 Tribes of the project area. After Ray (1936).

and informative historical accounts of this period are available, such as Franchere (1969), Glover (1962), Thwaites (1959), and Symons (1882).

Gold mining brought many Europeans, Euroamericans, and Chinese through the project area beginning around 1850, but it was ranching that kept them there. The area's grass provided sustenance for cattle and their owners alike (Splawn 1917). Transportation -- particularly river crossings -- provided the means for expansion. The Columbia River, the Caribou Trail, wagon roads, and later the railroads, all served to bring travelers and supplies to this area, providing residents with the opportunity to serve as merchants. Camels were even used for several years to bring gold mining supplies from this area to Idaho and Montana (Lewis 1928).

Horse ranching and fruit farming increased in the latter half of the last century, but it was not until more efficient irrigation systems were organized about the turn of the century that fruit farming really became a major activity in this region.

The world's first dual purpose nuclear reactor was built on the Hanford Reservation in 1963-1969 (Rice 1983). Some of the Hanford Reservation structures are now old enough to be considered historic sites.

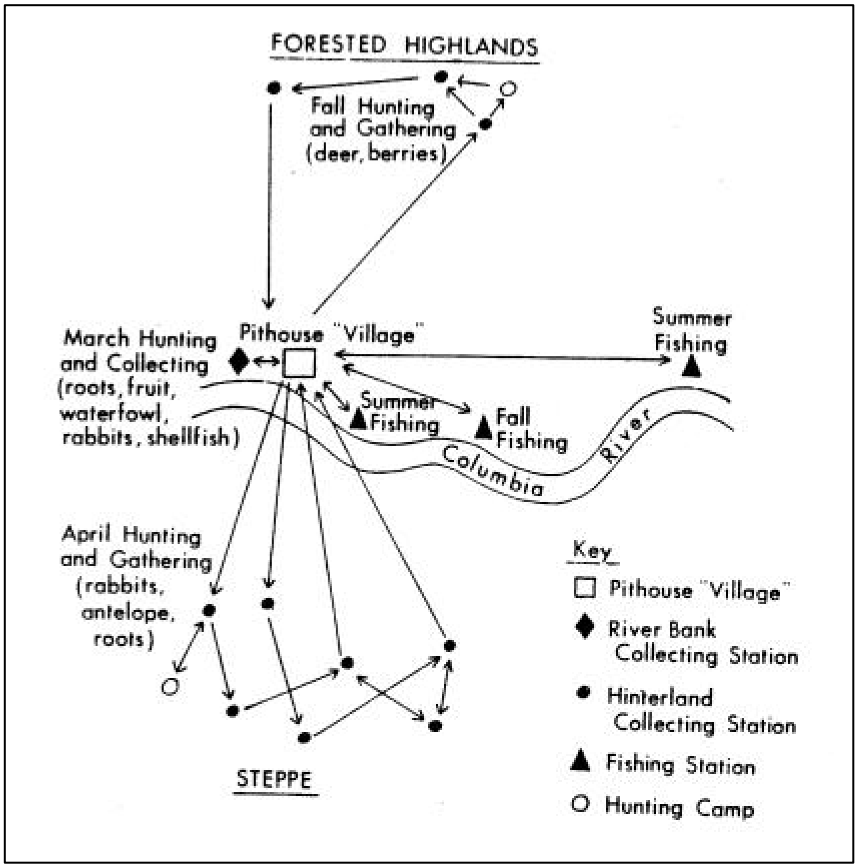

Figure 3.2 The annual round. After Dancey 1973.

3.3 Cultural Resource Types

Significant cultural resources are categorized as historic and archaeological properties, properties of traditional and cultural significance, sacred sites, and cultural landscapes, which are all recognized and protected under federal mandates.

Archaeological lithic scatters produced during stone tool manufacture or modification are the most common archaeological site type in the project area. Flaked tools and debitage are the overwhelmingly the most common cultural material present at these sites, although ground, pecked and battered stone tools also are found. Much of the flaked material is from local cryptocrystalline sources. Campsites, which include a number of material types and features and which represent longer-term use and multiple activities, make up the second most common site type. Other common archaeological site types include resource procurement and processing activities, such as quarries, butchering sites and root gathering areas. Field assessment in Phase II of the EIS process is likely to locate additional prehistoric sites of these kinds. The dominant tool form found in these archaeological sites are lithic flakes, although ground, pecked and battered stone tools as well as bone tools also are present.

Historic sites recorded in this area include historic homesteads, dumps, trails, railroad-related features and earthen structures. These sites include both historic structures and artifact scatters.

Other kinds of historic sites may be recorded with further survey, or as sites become old enough to be considered 'historic' (greater than fifty years old under NHPA).

Traditional cultural properties and sacred sites have not been surveyed in the project area. TCPs in the project area probably include traditional gathering areas. Sacred sites, which may also be traditional cultural properties, may include vision quest sites and other locations for traditional religious activities. Likewise, cultural landscapes have not been identified within the project area, but probably include both prehistoric and historic components, and both man-made and natural features.

3.4 Previous Work

Cultural resource investigations in the general area began with the work of Smith (1905) along the Yakima River valley in 1903. Krieger (1927) followed with a 1926 survey along the Columbia River. In the 1950's the Smithsonian Institution and Lee conducted surveys along the Columbia (e.g., Campbell 1950, Shiner 1951). Results of these surveys provided important contributions to our knowledge of prehistoric site locations but lacked the present day emphasis on interpreting past lifeways.

The following excerpt from King and Putnam (1994) presents a summary of more recent archaeological and historic investigations. Although focusing on the Yakima Training Center (YTC), it provides a clear focus on the trends and accomplishments pertinent to this study, particularly what areas have received the most scientific attention, and how the study of site prediction has developed in this area. A more exhaustive inventory of previous investigations throughout the project area is available in HRA (1999), King and Putnam (1994), Rice (1983), and Schalk (1986).

> The first intensive archaeological investigation in the region began in the 1950s and 1960s with the large-scale excavation of deeply stratified sites along the Columbia River floodplain (e.g., [Campbell 1950; Kidd 1964;] Nelson 1969; Swanson 1962; Warren 1968). These early studies focused on resolving chronological issues and concentrated on explaining the emergence of the Plateau pattern using riverine data sets. Early interpretations of archaeological patterns characterize Columbia Plateau cultural development in terms of change from dependence on game resources to an increased reliance on fish and shellfish. In turn, this intensification of fishing techniques is said to have increased the size and number of pithouse villages. Nelson (1969) has argued that this increased dependence on fish resulted from the spread of a more efficient fishing technology from groups in the north.
>
> More recent archaeological studies have focused on upland contexts, in part to provide a less biased, more complete database with which to address the emergence of the Plateau pattern (Benson et al. 1989; Chatters and Benson 1986; Dancey 1973; Hartmann and Lindeman 1979). These studies, which began with Dancey’s work in the early 1970’s, have resulted in informal predictive statements about the distribution of functional site types in the [Yakima Training Center] YTC.

Dancey's research addressed the development of the Plateau pattern by characterizing functional and geomorphological variability in upland settings in the Hanson, Cottonwood, and No Name Creek drainages. To describe this variability, Dancey implemented a use-wear-based functional analysis of 18 upland surface assemblages and 8 assemblages from Columbia River contexts. The results of his study suggest that functional differences in assemblage content correlate with microenvironments (Dancey 1973:94-111).

Dancey's study identified several site types that he correlates with site categories known from the ethnographic period. Winter village settlement are located on, or directly adjacent to, the Columbia River floodplain. Specialized camps occur at the heads of coulees in proximity to a variety of subsistence resources. Resource acquisition locations occur within coulee bottoms, on upland flats, and along the floodplain. Dancey concluded that this pattern persisted with little or no change during the last 3,000 years (1973:126).

As a result of the inventory of Hanson, Cottonwood, and No Name Creek drainages, Hartmann and Lindeman (1979) proposed an alternative site typology based on the work of Binford and Binford (1966) that distinguishes among base camps, transient camps, and work sites. Their results suggest that base camps occur at the heads of tributary drainages and transient camps occur along major drainages. In contrast, they found that work sites occur in a wide range of environmental settings.

Along similar lines, Chatters and Benson (1986) defined five functional site types as a result of test excavations at 10 sites along Hanson, Cottonwood, and No-Name Creeks: base camps; field or residence camps; locations or stations; lithic reduction stations; and quarries. Several years later, Benson et al. (1989) modified the Chatters and Benson (1986) typology to describe the distribution of functional variability within the proposed YTC expansion area, a 63,000-acre parcel between the Saddle Mountains and Interstate 90. Their modified typology includes five aboriginal site types: camps, quarries, lithic reduction sites, locations, and rock features (Benson et al. 1989:5:2-3).

The results of the Benson et al. (1989) survey suggest that primary winter residence camps occur on the Columbia River floodplain and field camps (centers of food gathering and domestic activity) occur along upland drainages. Their work found that camps tend to be located at relatively low elevations in flat areas or on gentle slopes. Locations, on the other hand, tend to occur in close proximity to specific resources, usually on gentle slopes at slightly higher elevations than camps. In contrast, they found that quarries and lithic reduction sites, which have no direct analogue in Dancey's work, generally occur in steep upland areas away from water sources.

The various typologies used to describe YTC archaeological deposits have played an important role in efforts to model the distribution of cultural resources at the facility. To date, modeling efforts have focused to one degree or another on describing the antiquity and development of settlement and subsistence patterns observed by ethnographers at the time of sustained Euroamerican contact (c.f. Chatters 1986). Dancey's (1973) suggestion that the Plateau pattern has an antiquity of roughly 3,000 years has driven much of this research. As a

> consequence, archaeologists continue to compress functional variability into typologies derived largely from ethnographic settlement pattern data.

The majority of cultural resource work in the project area has been conducted on the Yakima Training Center. More recent work includes survey and testing of archaeological sites in the Selah Creek drainage during 1992-1993 (King and Putnam 1994), archaeological and historic inventory in 1996 (Boreson 1998), and excavation and evaluation of sites in the Johnson Creek Drainage the next year (Gough 1998). These works resulted in evaluation of more than five sites eligible for inclusion in the National Register of Historic Places, and provided much needed detail and more refined dating that is possible with contemporary archaeological methods. An overview of this work was completed last year (HRA 1999).

Outside of the YTC area, other important areal surveys have been completed for the Hanford area (1968, 1969, 1983), Chatters (1980) in Grant County north of the Hanford area, and Schalk (1982) along the Columbia. Other important works include Bicchieri (1993), Chatters (1986), Galm, Hartmann, Masten and Stephenson (1981), Hartmann (1980), Hartmann, Landis and Morgan (1982), Jackson and Hartmann (1977), Rice and Chavez (1980), Rice (1983), and Stratton and Lindeman (1978).

Much of the rest of the archaeological work has been project specific. One such project that encompassed an unusually large area was Eastern Washington University's Archaeological and Historical Services survey along Puget Sound Power and Light's Wanapum-Hyak electrical transmission line in 1990 (DePuydt 1990) covering a large portion of Johnson Canyon. Most have been smaller projects with reports confined to gray literature (e.g., Cook and Moura (1996), Hartmann (1977), Hartmann and Galm (1976), Hunter (1992), Jackson (1996), Masten and Galm (1985), Randolph (1980), Rice (1973, 1976, 1980), and Smith, Uebelacker, Eckert and Nickel (1976)), but when considered together comprise a large body of data.

In summary, archaeological and historical investigations and management in the project area has included archaeological and historical survey, testing and evaluation, largely focused within the YTC, the Hanford Reservation area, and along the Columbia River corridor. Outside of these areas, little work has been done toward systematic survey and/or evaluation of archaeological and historic sites. Throughout the project area, including the YTC and Hanford area, there has been virtually no survey or identification of traditional cultural properties or cultural landscapes.

Chapter 4 Environmental Consequences

Significant cultural resources are protected under a number of state and Federal mandates, and consideration of project effects on significant cultural resources is required. Pertinent Federal mandates are listed in Table 4.1.

Table 4.1
Federal Cultural Resource Mandates[1]

Federal Statutes
Abandoned Shipwreck Act of 1987 43 USC 2101-2106
American Indian Religious Freedom Act of 1978, as amended 42 USC 1996-1996a
Antiquities Act of 1906 16 USC 431-433; 34 Stat. 225
Archeological and Historic Preservation Act of 1974 16 USC 469-469c
Archeological Resources Protection Act of 1979 16 USC 470aa-470ll
Historic Sites Act of 1935 16 USC 461-467
National Environmental Policy Act 42 USC 4321-4370c
National Historic Preservation Act of 1966, as amended 16 USC 470-470w
Native American Graves Protection and Repatriation Act of 1990 25 USC 3001-3013

Federal Regulations
Advisory Council on Historic Preservation, Protection of Historic and Cultural Properties, 36 CFR 800
Council on Environmental Quality, Regulations Implementing the National Environmental Policy Act, 40 CFR 1500-1508
Department of Defense, Protection of Archeological Resources, 32 CFR 229
Department of the Interior, Protection of Archeological Resources, 43 CFR 7
Department of the Interior, Native American Graves Protection and Repatriation Act, 43 CFR 10
Department of the Interior, Curation of Federally-owned and Administered Archeological Collections, 36 CFR 79
Department of the Interior, Determinations of Eligibility for Inclusion in the National Register of Historic Places, 36 CFR 63
Department of the Interior, National Historic Landmark Program, 36 CFR 65
Department of the Interior, National Register of Historic Places, 36 CFR 60
Department of the Interior, Preservation of American Antiquities, 43 CFR 3
Department of the Interior, Supplemental Regulations [per ARPA], 43 CFR 7.2

Executive Orders and Presidential Memoranda
EO 13007 Indian Sacred Sites
EO 11593 Protection and Enhancement of the Cultural Environment
White House Memorandum for the Heads of Executive Departments and Agencies, dated April 29, 1994: Government-to-Government Relations with Native American Tribal Governments

[1] Historic preservation law also includes a considerable body of case law, which is not discussed in this report.

4.1 General Impacts of Action Alternatives

Generally, any ground disturbing activity within the boundaries of any significant cultural resource is destructive, resulting in permanent, irreversible and irretrievable loss of scientific information and/or cultural value.

Non-ground disturbing activities, such as cutting vegetation and road easements, may or may not have negative impacts on cultural resources depending on the type of resource involved and the proximity of the activity to the resource.

4.1.1 Easements for Right-of-Way

Easements for right-of-way potentially affect cultural resources by changing access and use. In general, grants of easement for the project may increase access and use by the public of area that previously were restricted or difficult to access. Increased access and use may have negative impacts on traditional cultural properties and sacred sites by interfering with the natural auditory and view sheds. Increased access may contribute to an increase in the rate of vandalism and disturbance to archaeological and historic sites.

4.1.2 Clearing of Vegetation

Clearing of vegetation may include ground disturbing and/or non-ground disturbing activities. As stated before, ground disturbing activity within the boundaries of significant cultural resources is destructive, resulting in permanent, irreversible damage. Non-ground disturbing vegetation clearing may result in damage to cultural resources through compaction of cultural deposits within archaeological sites and historic sites.

Clearing vegetation, with or without ground disturbance, affects most types of traditional cultural properties (TCP). Natural vegetation is an integral part of many TCPs, such as traditional gathering areas, and may be relevant to some sacred sites as well. Clearing vegetation in a traditional gathering area or within the viewshed of a vision quest site is likely to have a negative effect on these resources.

Natural and modified vegetation often are a critical component of cultural landscapes as well. Clearing or cutting vegetation in these areas will have some impact on these resources, although the nature and extent of the effect is dependent on the specific resource.

4.1.3 Grading and Backfilling

Grading and backfilling, including but not limited to preparation of construction sites and staging areas, materials delivery, road and structure construction, site restoration and clean-up, and on-going project maintenance, is a ground disturbing activity resulting in permanent, irreversible damage to archaeological and historic sites. Traditional cultural properties and cultural landscapes also may be negatively affected, although the nature and extent of such effects are dependent on the specific resource, and may vary from some restorable or replaceable negative effect to permanent damage. The source locations of materials used in backfilling and road construction would need field assessments as well as the proposed transmission line locations.

4.1.4 Use of Heavy Equipment

In addition to the impact caused by ground disturbing activities, compaction caused by heavy machinery can cause destruction of archaeological and historic sites and traditional cultural properties. Damage caused by compaction to archaeological sites and historic sites, TCP's, and cultural landscapes is likely to be irreversible.

Use of heavy equipment will also cause auditory and visual disturbance to some TCP's and sacred sites. Permanent disturbance to auditory and visual factors may represent permanent, irreversible damage to some TCPs. In addition, continued use of heavy equipment near a sacred site such as a vision quest site would make the site unusable for contemporary Native American practitioners.

4.1.5. Reseeding

Reseeding will in most cases have little affect on archaeological and historic sites depending on the methods used. Reseeding may impact TCPs and cultural landscape by changing the existing vegetation stands or communities. (See comments under Section 4.1.2.)

4.1.6 Construction of Structures

Construction of structures is a ground disturbing activity that may result in permanent, irreversible damage to archaeological and historic sites, and also may threaten burials. Construction of structures at the location of TCPs and cultural landscapes may have negative effects on these resources.

Construction within the viewshed of TCPs and cultural landscapes also may have negative effects. Such effects would include a temporary negative effect by increased auditory and visual disturbance during construction activities, but also may include permanent auditory and visual disturbances. This could include a disruption of the natural view and artificial noise caused by transmission towers and lines. The nature and extent of these effects are dependent on the specific resource as well as the nature and proximity of the structure, and may vary from some restorable or replaceable negative effects to permanent damage.

4.1.7 Conductors, Overhead Ground Wires and Insulators

The presence of conductors, overhead ground wires, and insulators probably would have little to no direct effect on archaeological and historical sites, although long-term effects of such exposure to specific data types encapsulated in archaeological deposits or artifacts (e.g., base and botanical materials' and residues' chemical integrity) has not been explored. Visual effects may impact TCP's and cultural landscapes; such effects are dependent on the nature and proximity of the resource, and may vary from some modifiable effect to permanent and irreplaceable damage.

4.1.8 Access Roads

Access road repair, improvement, and construction may affect cultural resources through ground disturbance, compaction, changes in access or use, or changes in auditory and/or visual setting. These effects are discussed in Sections 4.1.1 and 4.1.6.

4.1.9. On-going Operations, Maintenance and Other Project Activities

On-going operations, maintenance and other project activities may impact cultural resources. The nature and extent of such impacts are dependent on the type and proximity of the resource and the specific activity involved, and may vary from insignificant effects to permanent, irreversible damage. Discussion of potential impacts in the previous sections, however, illustrates the nature and extent of potential impacts that would occur during ongoing activities. In addition, ongoing activities will have greater cumulative damage to those cultural resources that have contemporary use by Native Americans, by changes in access, use, and auditory and visual setting for these resources.

4.2 Site-Specific Impacts

Impacts and appropriate mitigation measures vary with the specifics of individual resources, therefore consideration of alternatives must include consideration of site-specific impacts. Because much needed site-specific information is lacking until completion of the field assessment and analysis, the following analysis is necessarily limited to anticipated potential impacts to currently recorded sites and unsurveyed areas with a high probability for occurrence of significant cultural resources. These areas, collectively referred to as 'sensitive areas', *potentially* may be impacted by project activities. They have been prioritized as high (with known significant and sensitive materials), moderate (with potentially significant and sensitive materials), and low priority (with potentially significant but less sensitive materials). Note that even low priority sensitive areas contain materials protected under Federal law, they are just lower priority relative to the moderate and high priority areas. Field investigation will be required in order to verify these anticipated site-specific impacts. The following presents a summary of anticipated site-specific impacts based on best available knowledge.

Table A1 in the appendix presents a listing of the sites in or near to the alternatives described in Chapter 2. Segment A sites (n=22) would be impacted by all four alternatives. The proposed realignment of a portion of Segment A in the vicinity of Coleman Creek Road will not affect any recorded cultural resources not already accounted for in Table A1. Because of the proximity of portions of the two Segment B route options, seven sites that potentially would be impacted by the use of the Segment B north route also may be impacted by the B south route option. Segment B north may impact 52 recorded sites that would not be impacted by the use of Segment B south. Conversely, just six sites may be impacted by the use of the B south route option that would not be impacted if the B north route were used; however, the B south option route has not had the same degree of field assessment as the B north route.

4.2.1 Alternative 1

The recorded sites and specific sensitive area segments in or near to the route of Alternative 1 are detailed in Tables A1 and A2, respectively, in the appendix. Ninety-three previously recorded sites are within or near to the Alternative 1 route. The location of sensitive areas, including the recorded sites as well as unsurveyed areas with a high potential for occurrence of significant cultural resources, in or adjacent to the Alternative 1 corridors are shown in Figure 4.1. Under Alternative 1 (B north), 36 sensitive areas are potentially affected. Based on a 0.4 km (~1300') wide corridor, Alternative 1 (B north) would potentially impact 19.2 km^2 of sensitive areas, including 3.5 km^2 high priority areas, 7.5 km^2 moderate priority areas, and 8.2 km^2 of lower priority areas. Under Alternative 1 (B south), 38 sensitive areas are potentially affected. Based on a 0.4 km (~1300') wide corridor, Alternative 1 (B south) would potentially impact 19.9 km^2 of sensitive areas, including 3.1 km^2 high priority areas, 8.3 km^2 moderate priority areas, and 8.5 km^2 of lower priority areas.

4.2.2 Alternative 1A

Alternative 1A represents a variation on Alternative 1 in reaching the Hanford Substation. Ninety-three previously recorded sites could be affected by the Alternative 1A route, most are the same as could be impacted under Alternative 1. Under Alternative 1A (B north), 38 sensitive areas are potentially affected. Based on a 0.4 km (~1300') wide corridor, Alternative 1A (B north) would potentially impact 20.2 km^2 of sensitive areas, including 2.5 km^2 high priority areas, 7.5 km^2 moderate priority areas, and 10.2 km^2 of lower priority areas. Under Alternative 1A (B south), 40 sensitive areas are potentially affected. Based on a 0.4 km (~1300') wide corridor, Alternative 1A (B south) would potentially impact 20.9 km^2 of sensitive areas, including 2.1 km^2 high priority areas, 8.3 km^2 moderate priority areas, and 10.5 km^2 of lower priority areas. The location of sensitive areas for this alternative are shown in Figure 4.1.

4.2.3 Alternative 2

Ninety-one cultural resources sites have been recorded in or adjacent to the Alternative 2 route. Under Alternative 2 (B north), 34 sensitive areas are potentially affected. Based on a 0.4 km (~1300') wide corridor, Alternative 2 (B north) would potentially impact 17.8 km^2 of sensitive areas, including 2.5 km^2 high priority areas, 6.1 km^2 moderate priority areas, and 9.2 km^2 of lower priority areas. Under Alternative 2 (B south), 36 sensitive areas are potentially affected amounting to an total area of 18.5 km^2. This includes 2.1 km^2 high priority areas, 6.9 km^2 moderate priority areas, and 9.5 km^2 of lower priority areas. The location of sensitive areas for this alternative are shown in Figure 4.1.

4.2.4 Alternative 3

Fifty-five previously recorded sites occur within or near to the Alternative 3 route which has only a single route option. Thirty-eight sensitive areas are potentially affected by this alternative; the location of these sensitive areas, which include the previously recorded sites as well as unsurveyed areas with a high potential for occurrence of significant cultural resources, are shown in Figure 4.1. Based on a 0.4 km (~1300') wide corridor, Alternative 3 would potentially impact 20.7 km^2 of sensitive areas, including no high priority areas, 7.5 km^2 of moderate priority areas, and 13.2 km^2 of low priority areas.

4.2.5 No Action Alternative

The No Action Alternative includes no ground-disturbing or clearing activities in addition to continued operations, maintenance and other project activities addressed in Section 4.1.9. While these project activities for the existing lines have and continue to impact cultural resources, the No Action Alternative, versus other alternatives, includes no new or additional impacts, and hence represents the alternative with the least specific impacts to cultural resources.

4.2.6 Comparison of Alternatives

For the purposes of comparison, a summary of sensitive areas affected by each alternative is presented in Table 4.2.

Table 4.2
Summary of Sensitive Areas by Alternative

Alternative	# Areas	Total Area	High Priority	Mid Priority	Lower Priority
Alternative 1-Bn	36	19.2 km^2	3.5 km^2	7.5 km^2	8.2 km^2
Alternative 1-Bs	38	19.9 km^2	3.1 km^2	8.3 km^2	8.5 km^2
Alternative 1A-Bn	38	20.2 km^2	2.5 km^2	7.5 km^2	10.2 km^2
Alternative 1A-Bs	40	20.9 km^2	2.1 km^2	8.3 km^2	10.5 km^2
Alternative 2-Bn	34	17.8 km^2	2.5 km^2	6.1 km^2	9.2 km^2
Alternative 2-Bs	36	18.5 km^2	2.1 km^2	6.9 km^2	9.5 km^2
Alternative 3	38	20.7 km^2	0 km^2	7.5 km^2	13.2 km^2
No Action Alternative	No new or additional areas				

When considered as an entire route, the route alternatives with *least* impact to sensitive areas are:

1) Alternative 2-B north option route (Schultz-Vantage-Midway-Blackrock)
2) Alternative 2-B south option route (Schultz-PP&L line-Vantage-Midway-Blackrock).

The alternative routes with highest potential for impact to sensitive areas are:

For total area affected:

1) Alternative 1A-B south option route (Schultz-PP&L line-Vantage-Grand Coulee line-Hanford)
2) Alternative 3 (Schultz-YTC-Blackrock)

For high priority areas affected:

1) Alternative 1-B north option route (Schultz-Vantage-direct to Hanford)
2) Alternative 1-B south option route (Schultz-PP&L line-Vantage-direct to Hanford)

For total number of sensitive areas affected:

Alternative 1A-B south option route (Schultz-PP&L line-Vantage-Grand Coulee line-Hanford)

Of these three factors, total area and high priority areas are critical considerations; total number of sensitive areas is less important.

While this comparison allows some discussion of the relative magnitude of potential effects of each of the proposed alternatives, the reader should bear in mind that sensitive areas indicate the presence of potentially affected resources that should be avoided, or when unavoidable, mitigated. Although some resources inevitably will be affected by the chosen alternative, most of the potentially affected resources will be avoidable with due consideration. This summary allows general comparison of relative level of effort to avoid and/or otherwise mitigate significant resources. This summary does *not* replace the need for field investigation to verify the number and extent of cultural properties, to assess the impact of the chosen alternative or to develop specific mitigation measures.

4.3 Mitigation Measures

The mitigation measures for adverse effects to cultural resources presented here are, by necessity, general in nature as field identification and assessment of resources has not yet taken place. Mitigation measures are discussed in terms of resource types.

4.3.1 General

Mitigation planning begins with consultation with the Washington State Historic Preservation Officer (SHPO) through the Office of Archaeology and Historic Preservation (OAHP), affected Native American tribes, local governments, and the public concerning recorded cultural resources, and impacts to and management of these resources. Consultation is required for compliance with Sections 106 and 110 of the National Historic Preservation Act (NHPA), the Archeological Resources Protection Act (ARPA), the Native American Graves Protection and Repatriation Act (NAGPRA), the National Environmental Protection Act (NEPA) and Executive Order 13007. Agency officials must consider comments received during consultation. Information gained during consultation should be incorporated in mitigation planning and actions.

In general, the best means of mitigating effects to significant cultural resources is protection in place. Impacts to significant cultural resources can be greatly reduced simply by avoiding contact with the resource. Avoidance is, of course, not a replacement for protection measures in cases of deteriorating conditions, but avoidance of impact by project construction, operation and maintenance activities should be standard practice whenever feasible.

A plan of action for cases of inadvertent discovery of cultural resources, particularly subsurface resources, should be prepared during planning. If cultural resources are discovered in the course of project activities, work in the immediate area should cease and the area be secured until appropriate actions have taken place. In such cases, the SHPO and affected tribes should be notified immediately and a professional archaeologist that meets the Secretary of Interior's Qualifications Standards examine the site and make recommendations to decision-makers for a course of action. During work in areas of higher probability of encountering subsurface materials, a professional may monitor ground disturbing activities. In any case, the plan of action should outline the process of avoiding irreversible damage to undiscovered resources and the process for dealing with such discoveries. This is especially critical in cases affecting Native American burials. The procedure for Native American burial inadvertent discovery is addressed by NAGPRA and State Regulations (see Section 4.3.3 below). Project field personnel should be trained in their role in the process before field work begins.

Finally, it is imperative that confidential information be protected. Confidential information includes information about the location and nature of cultural resources that may be endangered by looting, vandalism, or other negative impacts by the public. Confidential information may also include specific information about the use or practices associated with traditional cultural properties and sacred sites. Protection of confidential information for the protection of significant cultural resources is required under ARPA.

4.3.2 Archaeological and Historic Sites

Identification and evaluation of archaeological and historic sites is required for compliance with Sections 106 and 110 of NHPA. When a preferred alternative has been selected, the project proponent should conduct an intensive cultural resources survey of potential impact areas, evaluate potentially significant sites, and complete National Register of Historic Places Determination of Eligibility forms. Recommendations should then be made on impact avoidance and/or site treatment where appropriate.

When avoidance of significant archaeological and historic resources is not possible, data recovery excavation, or some other appropriate method of mitigating the negative effects determined through consultation with affected parties, should be conducted. Data recovery efforts require ARPA or State excavation permits, depending on land ownership, and must precede project activities in those areas. Data recovery excavations are always permanent and destructive, so avoidance is the preferred alternative. Archaeological sites are tested and/or excavated by professional archaeologists who, when in a supervisory capacity, must meet the Secretary of Interior's Qualifications Standards. Historic structures and landscapes should be recorded by professionals that also meet the Secretary of Interior's Qualifications Standards. Moving structures removes them from their historic context and should be avoided, but may be used in cases of unavoidable destruction of their original site.

4.3.3 Native American Graves

Native American graves are protected under NAGPRA as well as Washington State law (which provides protection for all burials and grave sites, not just those of Native Americans). Native American graves and associated materials should be protected in place whenever possible. Destruction of Native American graves is not an alternative.

In addition to previously recorded burial sites in the project area, additional burial sites may be identified during the field assessment and site treatment phases of work for this EIS. It is strongly recommended that agencies consult with affected tribes and the Washington SHPO to develop an agreement that would establish a plan of action in the event of an inadvertent discovery of Native American graves *before* beginning any ground-disturbing activities.

4.3.4 Traditional Cultural Properties and Sacred Sites

Traditional cultural properties (TCP) vary widely in type and use; hence potential effects and appropriate mitigation may vary widely. Because there has been no inventory of traditional cultural properties in the project area, it is impossible to address specific mitigation needs. However, TCP's in the project area probably include traditional gathering areas. Other types of TCP's, such as traditional meeting places or trails, may be identified during consultation or the Phase II field assessment. Mitigation of effects to such properties must be determined through consultation with the affected tribe(s) and can vary based on the resource's materials, setting, impacts, and traditional uses. As examples of types of mitigation, vision quest sites and traditional gathering areas are discussed on a general level.

Sacred sites, such as vision quest sites, may be affected by any non-traditional human activity in the auditory and view shed of the site. If project activities take place within such areas, attempts should be made to limit the amount of time spent in this area, and visual and auditory impacts should be limited and masked as much as possible. For example, appropriate native vegetation may be planted between an access road and a vision quest site to mask visual and auditory disturbances.

Traditional gathering areas may be affected by construction, or by the introduction of non-native vegetation. A camas gathering area, for example, may be ruined by the introduction of invasive non-native plants. Construction effects to gathering areas may in part be offset by reduction of non-native plants, and protection, enhancement or expansion of other gathering areas.

The first step in mitigating effects to TCPs is to identify the nature and extent of TCPs, identify impacts, and recommend appropriate mitigation. Much of this needs to be determined through consultation with the affected tribe(s) that may interview tribal elders or traditional practitioners likely to use or have used resources within the project area.

Vision quest sites and other sacred sites associated with elevated landforms will probably receive relatively greater impact than other site types; it is therefore important that mitigation for impacts to these resources receive prompt attention. Any mitigation of effects to traditional cultural properties must be planned in consultation with the appropriate Native American tribes.

4.3.5 Cultural Landscapes

Like traditional cultural properties, cultural landscapes have received little attention in this area. When a preferred alternative has been identified, inventory of cultural landscapes potentially affected by the project should be completed by a landscape architect or other appropriate professional. Appropriate mitigation actions will depend on the nature and proximity of such resources but may include avoidance, revegetation with similar plant types, or data recovery.

Chapter 5 Study Methods

This Phase I assessment of potential impacts on cultural resources began with a literature and archival search at the Washington State Office of Archaeology and Historic Preservation. This intensive search included a review of maps, site records, and pertinent reports stored there. A search of library and archival materials at the University of Washington, especially in the Special Collections of the Pacific Northwest department, located a significant amount of material related to this report. Finally, pertinent national databases, such as the National Park Service's National Archeological Database (Maps and Reports), the National Register of Historic Places, and the National NAGPRA Consultation Database also were searched. While this search was intensive, it was not exhaustive and the limited scope and timeline for this assessment did not allow in-depth review of the materials located.

A list of recorded sites in or near each alternative's corridor was created. The distribution of recorded sites is heavily biased by the amount of archaeological survey that has taken place; some portions of the project area have received much more coverage, and hence have many more sites recorded than others. Those areas that have been the subject of Federal projects, such as along the Columbia River and within the Yakima Training Center, have received the lion's share of work; their high site densities reflect more the level of scrutiny than a real difference in cultural resource distribution. In addition, some resource types -- particularly traditional cultural properties, sacred sites, and cultural landscapes -- have received little or no attention throughout the project area.

This study attempted to correct these biases by inclusion of areas which have not been surveyed but which hold a high potential for cultural resources based on landform association with recorded sites. This method is obviously not perfect, but better correction requires both field sampling and a more in-depth settlement pattern analysis than can be covered in the scope of the current study. Archaeological site density is highest in proximity to springs, stream heads and confluences (Gough 1998; King and Putnam 1984; Smith and Chatters 1986). Vision quest sites, root gathering areas, and quarries are more likely to take place at higher elevations, especially ridgelines and other bedrock exposures. Those portions of the project area that have not been subject to intense survey which fell in proximity to springs, stream heads and confluences, as well as prominent ridgelines, were identified as sensitive areas.

The location of sensitive areas was then plotted and included in the assessment of impacts. In order to protect resources from looting or other negative impacts, exact locations are masked. Areas containing several resources in close proximity were grouped together, and smaller sites were randomly offset. All sensitive areas were made into circles, as site shapes often indicate their landform location. These sensitive areas indicate the location of *potential* negative impacts by project activities to cultural resources.

Priority was assigned based on site significance and sensitivity of materials. Higher priority sites contain highly significant or potentially highly significant materials such as, but not limited to, archaeological sites with multiple components and/or material types, and/or highly sensitive materials such as sacred sites, and TCP’s. Moderate priority sites have potentially significant materials, but of a less sensitive or unknown but likely less sensitive nature, as compared to higher priority sites. Examples of moderate priority areas would be an historic railroad site or some quarry sites. Sites with potentially significant but less sensitive materials such as a small lithic scatter, small historic dump, or a single cairn, were given lower priority. Note that low priority areas, especially when considered as a whole, contain important materials protected under

Federal law; they are just lower priority relative to the moderate and higher priority areas. Where a number of low priority sites were tightly clustered and potentially would qualify for nomination to the National Register of Historic Places as an archaeological district, their area was assigned a higher priority than if they had been considered separately. Field investigation will be required in order to assess more site-specific impacts more accurately.

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Glossary/Acronyms

Advisory Council on Historic Preservation (ACHP) - The Council was established by Title II of the National Historic Preservation Act to advise the President and Congress, to encourage private and public interest in historic preservation, and to comment on Federal Agency actions under Section 106 of the National Historic Preservation Act.

Antiquities Act of 1906 - Provides for the protection of historic and prehistoric ruins and objects of antiquity on Federal lands, and authorizes scientific investigation of antiquities on Federal lands, subject to permits and other regulatory requirements.

American Indian Religious Freedom Act (AIRFA) - States that the policy of the United States is to protect and preserve for American Indians their inherent rights of freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians. These rights include, but are not limited to, access to sites, use and possession of sacred objects, and the freedom to worship through ceremony and traditional rites.

Archaeological Resources Protection Act (ARPA) of 1979 - Prohibits the removal, sale, receipt, and interstate transportation of archeological resources obtained illegally (without permits) from public or Indian lands and authorizes Federal agency permit procedures for investigations of archeological resources on public lands under the Federal agency's control.

Archaeological Site - Any material of human life or activities that are at least 100 years of age, and which is of archaeological interest (32 CFR 229.3(a)).

Confidential Information - Confidential information is information which, if released, would potentially endanger significant cultural properties, or their significant qualities. Generally, specific site locations are considered confidential, and will not be released except if such a disclosure is determined to be in the best interest of cultural resource preservation and protection, under an approved Cultural Resource Permit. Confidential information concerning Native American resources will not be divulged without the explicit permission of the affected tribe. Security of confidential information is mandated by the National Historic Preservation Act, and the Archaeological Resources Protection Act.

Consultation - Consultation is "the process of seeking, discussing, and considering the views of other participants, and, where feasible, seeking agreement with them. Consultation is built upon the exchange of ideas, not simply the provision of information. In order to fulfill consultation requirements, the Federal agency should: (1) Make its interests and constraints clear from the beginning; (2) Make clear any rules, processes, or schedules applicable to consultation; (3) Acknowledge others' interests as legitimate, and seek to understand them; (4) Develop and consider a full range of options; and (5) Try to identify solutions that will leave all parties satisfied. On-going relationships always make consultation a more successful and satisfying endeavor. Consultation with Tribes must be performed on a government-to-government basis.

Cultural Items - As defined by NAGPRA, human remains and associated funerary objects, unassociated funerary objects (at one time associated with human remains as part of a death rite or ceremony, but no longer in possession or control of the federal Agency or museum), sacred objects (ceremonial objects needed by traditional Native American religious leaders for practicing traditional Native American religions), or objects of cultural patrimony (having ongoing historical, traditional, or cultural importance central to a Native American group, rather than property owned by an individual Native American, and which, therefore, cannot be alienated, appropriated, or conveyed by any individual of the group).

Cultural Patrimony - The Native American Graves Protection and Repatriation Act (NAGPRA) defines objects of cultural patrimony as "an object having ongoing historical, traditional, or cultural importance central to the Native American group or culture itself, rather than property owned by an individual Native American, and which, therefore, cannot be alienated, appropriated, or conveyed by any individual . . . and such object shall have been considered inalienable by such Native American group at the time the object was separated from such group."

Cultural Resource - This term refers to those historic and archaeological properties, properties of traditional and cultural significance, sacred sites, Native American human remains and associated objects, and cultural landscapes which are entitled to special consideration under federal statute.

Executive Order (EO) 11593 - Directs Federal agencies to provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the Nation; to ensure the preservation of historic properties; to locate, inventory, and nominate to the National Register all properties under their control that meet the criteria for nomination; and to ensure that historic properties are not inadvertently damaged, destroyed, or transferred before the completion of inventories and evaluation for the National Register. The intent of EO 11593 have been integrated into the NHPA Section 110 through the 1980 amendments to that statute.

Executive Order 13007 on Indian Sacred Sites - Directs Federal agencies to consider Indian sacred sites in planning Agency activities.

Historic Contexts - A historic context is an organizational format that groups information about related historic properties, based on a theme, geographic limits and chronological period. A single historic context describes one or more aspects of the historic development of an area, for example, Coal Mining in Northeastern Pennsylvania between 1860 and 1930. A set of historic context is a comprehensive summary of all aspects of the history of the area.

Historic Property or Historic Resource - As defined by the NHPA, is any prehistoric or historic Tribe, site, building, structure, or object included in, or eligible for inclusion in, the National Register. The term includes artifacts, records, and remains that are related to and located in such properties. The term includes properties of traditional religious and cultural importance (traditional cultural properties) which are eligible for the National Register because of their association with the cultural practices or beliefs of an Indian Tribe or Native Hawaiian organization. The term "eligible for inclusion in the National Register" includes both properties formally determined as such by the Secretary of the Interior and all other properties that meet National Register listing criteria.

Memorandum of 29 April 1994 on Government to Government Relations with American Indian Tribal Governments - Directs Federal agencies to conduct their relationship with Federally recognized Indian Tribes on a government to government basis.

Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 - (P.L. 101-601), requires Federal agencies to establish procedures for identifying Native American groups associated with cultural items on Federal lands, to inventory human remains and associated funerary objects in Federal possession, and to return such items upon request to the affiliated groups. The law also requires that any discoveries of cultural items covered by the Act shall be reported to the head of the Federal entity who shall notify the appropriate Native American Tribe or organization and cease activity in the area of the discovery for 30 days.

National Environmental Policy Act of 1969 (NEPA) - (Public Law 91-190; 42 USC 4321-4347) states that the policy of the Federal government is to preserve important historic, cultural, and natural aspects of our national heritage and requires consideration of environmental concerns during project planning and execution. This act requires Federal agencies to prepare an Environmental Impact Statement (EIS) for every major Federal action that affects the quality of the human environment, including both natural and historic properties. It is implemented by regulation issued by the Council on Environmental Quality (40 CFR Parts 1500-08) that are incorporated into AR 200-2, Environmental Effects of Agency Actions.

National Historic Landmark (NHL) - This is a special category of historic property designated by the Secretary of the Interior because of its national importance in American history, architecture, archeology, engineering, or culture. Section 800.10 of the Council's regulations (36 CFR 800) and Section 110(f) of the NHPA specify some special protections for NHL's.

National Historic Preservation Act (NHPA) of 1966 - [as amended (Public Law 89-665; 16 USC 470-470w-6)] establishes historic preservation as a national policy and defines it as the protection, rehabilitation, restoration, and reconstruction of Tribes, sites, buildings, structures, and objects significant in American history, architecture, archeology, or engineering.

National Register of Historic Places (National Register) - A nationwide listing of sites, buildings, structures, and objects of national, state, or local significance in American history, architecture, archeology, or culture that is maintained by the Secretary of the Interior, NPS.

Sacred Objects - Sacred objects are defined in the Native American Graves Protection and Repatriation Act (NAGPRA) as "specific ceremonial objects which are needed by traditional Native American religious leaders for the practice of traditional Native American religions by their present day adherent." The CCT of Indians includes sacred objects as a subgroup of Objects of Cultural Patrimony.

Section 106 - Under the National Historic Preservation Act, Section 106 requires Federal agencies to take into account the affects of undertakings on historic properties listed, or those eligible for listing on the National Register and afford the ACHP an opportunity to comment on such undertakings. Section 106 requirements are implemented by regulations (36 CFR 800) issued by the ACHP.

Section 110 - Under the National Historic Preservation Act, Section 110 outlines overall Agency responsibilities with respect to historic properties.

Section 111 - Under the National Historic Preservation Act, Section 111 addresses leases and exchanges of historic properties. It allows the proceeds of any lease to be retained by the Federal agency for use in defraying the costs of administration, maintenance, repair, and related expenses of historic properties.

Section 402 - Under the National Historic Preservation Act, Section 402 describes Federal Agency responsibilities for historic properties in other nations and requires the head of the Federal Agency to take into account the effect of an undertaking on property which is on the

World Heritage List or on the applicable country's equivalent of the National Register to avoid or mitigate any adverse effect.

State Historic Preservation Office (SHPO) - Under the NHPA, the SHPO has been designated in each state to administer the state historic preservation program, including but not limited to review of Section 106 activities and National Register nominations.

Tribal Historic Preservation Office (THPO) - Under the NHPA, federally-recognized Native American Tribes may assume SHPO responsibilities for lands within the external boundaries of their Reservation and dependent Indian communities. The THPO may assume some or all of the SHPO responsibilities.

Undertaking - As defined by NHPA is a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal Agency, including those carried out or on behalf of the Federal agency; those carried out with Federal financial assistance; those requiring a Federal permit, license, or approval; and those subject to State or local regulation administered pursuant to a delegation or approval by a Federal Agency. If a proposed activity or action is determined to be an undertaking, Section 106 compliance and the procedures in 36 CFR 800 must be followed.

World Heritage List - A list developed by the World Heritage Committee containing properties forming part of the cultural heritage and natural heritage which the committee considers as having outstanding universal value based on different criteria. The list shall be updated every two years.

Appendix

Data Tables

Table A1. Recorded Site References
Table A2. Areas of Cultural Resources Sensitivity

Table A1. Recorded Site References

ALTERN.	SEGM.*	NUMBER	SITE TYPE	REFERENCES
1, 1A, 2, 3	A	45KT0095	camp	Highways 1966
1, 1A, 2, 3	A	45KT0096	camp	Highways 1966
1, 1A, 2, 3	A	45KT0301	camp, burials, historic	Bittinger and Benson 1982
1, 1A, 2, 3	A	45KT0600	lithic	Yakima Tng Ctr 1986
1, 1A, 2, 3	A	45KT0601	homestead, lithic	Yakima Tng Ctr 1986
1, 1A, 2, 3	A	45KT0602	homestead, lithic	Yakima Tng Ctr 1986
1, 1A, 2, 3	A	45KT0603	historic	Yakima Tng Ctr 1986
1, 1A, 2, 3	A	45KT0626	lithic	Yakima Tng Ctr 1986
1, 1A, 2, 3	A	45KT0664	lithic	Yakima Tng Ctr 1986
1, 1A, 2, 3	A	45KT0665	lithic	Yakima Tng Ctr 1986
1, 1A, 2, 3	A	45KT0974	?	?
1, 1A, 2, 3	A	45KT0984	lithic	Holstine et al. 1994
1, 1A, 2, 3	A	45KT1290	lithic	Boreson 1994; LAAS 1996
1, 1A, 2, 3	A	45KT1294	lithic	Boreson 1994; LAAS 1996
1, 1A, 2, 3	A	45KT1301	lithic	Boreson 1994; LAAS 1996
1, 1A, 2, 3	A	45KT1314	lithic	Boreson 1994; LAAS 1996
1, 1A, 2, 3	A	45KT1382	lithic, historic	HRA/D&M 1996
1, 1A, 2, 3	A	45KT1496	cairns, lithic	Bicchieri 1993
1, 1A, 2, 3	A	45KT1506	isolate (lithic)	Bicchieri 1993
1, 1A, 2, 3	A	45KT1507	lithic	Bicchieri 1993
1, 1A, 2, 3	A	45KT1508	isolate (lithic)	Bicchieri 1993
1, 1A, 2, 3	A	45KT1509	isolate (lithic)	Bicchieri 1993
1, 1A, 2	B	45GR0418H	mining, lithic	Schalk 1982
1, 1A, 2	B	45GR0435H	historic homestead and lithic	Schalk 1982
1, 1A, 2	B	45GR0672	cairns, lithic, historic	HRA/D&M 1996
1, 1A, 2	B	45KT0007	camp	Campbell 1950
1, 1A, 2	B	45KT0036	quarry	Greengo 1962
1, 1A, 2	B	45KT0211	lithics	Galm and Hartmann 1975
1, 1A, 2	B	45KT0212	lithics	Galm and Hartmann 1975
1, 1A, 2	B	45KT0315	?	Cochran 1978
1, 1A, 2	B	45KT0629	lithic, quarry	Boreson 1998; Luttrell and Stolp 1989; Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0630	lithic, quarry	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0631	lithic, quarry	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0632	lithic, quarry	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0633	lithic, quarry	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0649	lithic, quarry	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0659	lithic	Yakima Tng Ctr 1986

ALTERN.	SEGM.*	NUMBER	SITE TYPE	REFERENCES
1, 1A, 2	B	45KT0660	lithic	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0662	lithic	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0663	lithic	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0701	historic	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0703	historic; lithic; pit	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0712	historic	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0713	lithic	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0721	lithic	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0722	lithic, faunal	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0726	lithic	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0727	lithic, quarry	Yakima Tng Ctr 1986
1, 1A, 2	B	45KT0825	historic pit	DePuydt 1990
1, 1A, 2	B	45KT0848	lithic, cairn	DePuydt 1990
1, 1A, 2	B	45KT0849	?	DePuydt 1990
1, 1A, 2	B	45KT0850	lithic	DePuydt 1990
1, 1A, 2	B	45KT0853	cairns	DePuydt 1990
1, 1A, 2	B	45KT0856	historic	DePuydt 1990
1, 1A, 2	B	45KT0992	lithic	Holstine et al. 1994
1, 1A, 2	B	45KT1296	lithic	LAAS 1996
1, 1A, 2	B	45KT1297	lithic	LAAS 1996
1, 1A, 2	B	45KT1298	quarry	Boreson 1994; LAAS 1996
1, 1A, 2	B	45KT1303	lithic	Boreson 1994; LAAS 1996
1, 1A, 2	B	45KT1304	lithic	Boreson 1994; LAAS 1996
1, 1A, 2	B	45KT1305	lithic	LAAS 1996
1, 1A, 2	B	45KT1306	lithic	Boreson 1994; LAAS 1996
1, 1A, 2	B	45KT1307	lithic	Boreson 1994; LAAS 1996
1, 1A, 2	B	45KT1308	lithic	LAAS 1996
1, 1A, 2	B	45KT1309	lithic, quarry	Boreson 1994; LAAS 1996; NWAA n.d.
1, 1A, 2	B	45KT1317	lithic	LAAS 1996
1, 1A, 2	B	45KT1318	lithic	LAAS 1996
1, 1A, 2	B	45KT1319	lithic, cairn, poss. trail, tcp?	LAAS 1996
1, 1A, 2	B	45KT1320	lithic	Boreson 1994; LAAS 1996; Lohse 1985
1, 1A, 2	B	45KT1321	lithic	LAAS 1996
1, 1A, 2	B	45KT1334	lithic	LAAS 1996
1, 1A, 2	B	45KT1341	lithic	Boreson 1994; LAAS 1996
1, 1A, 2	B	45KT1728	lithic	DePuydt 1990
1, 1A, 2	B	45KT1730	lithic	Jackson 1996, 2000
1, 1A, 2	B, G	45GR0058	burial	Campbell 1950
1, 1A, 2	B, G	45KT0037	cave	Greengo 1962
1, 1A, 2	B, G	45KT0213	possible religious marker	Galm and Hartmann 1975
1, 1A, 2	B, G	45KT0214	camp	Galm and Hartmann 1975
1, 1A, 2	B, G	45KT0577	cairn	Davis 1984

ALTERN.	SEGM.*	NUMBER	SITE TYPE	REFERENCES
1, 1A, 2	B, G	45KT0854	lithic	DePuydt 1990
1, 1A, 2	B, G	45KT1727	lithic; historic forge	DePuydt 1990; Nelson 1969
3	C	45BN0243	cairn, lithic	Hartmann 1972
3	C	45KT0328	?	?
3	C	45KT0332	?	?
3	C	45KT0391	lithic	Dancey 1973; Moura and Cook 1996
3	C	45KT0392	lithic	Dancey 1973; Moura and Cook 1996
3	C	45KT0890	workshop	Cook and Moura 1996; Rice et al. 1991
3	C	45KT0894	quarry	Chatters and Zweifel 1987; Cook and Moura 1996; Rice et al. 1991
3	C	45KT0899	quarry	Rice et al. 1991; Cook and Moura 1996
3	C	45KT0907	lithic	Rice et al. 1991; Cook and Moura 1996
3	C	45KT0922	quarry	King and Putnam 1994; Stone and Shong 1996
3	C	45KT0923	quarry	King and Putnam 1994; Stone and Shong 1996
3	C	45KT0924	lithic	King and Putnam 1994; NWAA n.d.; Stone and Shong 1996
3	C	45KT0925	quarry	King and Putnam 1994; Stone and Shong 1996
3	C	45KT0927	lithic	King and Putnam 1994; Stone and Shong 1996
3	C	45KT0938	lithic	King and Putnam 1994; Stone and Shong 1996
3	C	45KT1329	lithic	LAAS 1996
3	C	45KT1342	lithic	1985
3	C	45KT1343	lithic	LAAS 1996
3	C	45KT1344	lithic	LAAS 1996
3	C	45KT1345	lithic, possible tcp	LAAS 1996
3	C	45KT1346	lithic	Boreson 1994; LAAS 1996
3	C	45KT1353	lithic	Jackson 1997; NWAA n.d.
3	C	45YA0187	lithic	Cook and Moura 1996; Hartmann and Lindeman 1979
3	C	45YA0328	lithic	Cook and Moura 1996; Hartmann 1980; Sender 1981
3	C	45YA0332	lithic	Cook and Moura 1996; Sender 1981
3	C	45YA0630	lithic	LAAS 1996; Sender 1981
3	C	45YA0655	lithic	HRA 1999
3	C	45YA0656	lithic	HRA 1999
1, 1A, 2, 3	C, G	45KT0225	camp	Galm and Hartman 1976

ALTERN.	SEGM.*	NUMBER	SITE TYPE	REFERENCES
1, 1A, 2, 3	C, G	45KT0705	lithic	Regan/Stolp (AHS) 1990; Yakima Tng Ctr 1986
1, 1A, 2, 3	C, G	45KT0723	cairn	Yakima Tng Ctr 1986
1, 1A, 2, 3	C, G	45KT0724	lithic	Yakima Tng Ctr 1986
1, 1A, 2, 3	C, G	45KT0824	historic, RR, lithic	DePuydt 1990
2	D	45BN0544	?	?
	D	45BN0546	?	?
2	D	45GR0151	?	?
2	D	45GR0152	?	?
2	D	45GR0427	lithic	Schalk 1982
1	E	45GR0051	camp	Campbell 1950
1	E	45GR0155	lithic	Galm and Hartmann 1975; Schalk 1982
1	E	45GR0353H	historic homestead	Chatters 1979
1	E	45GR0365	lithic	Chatters 1979
1	E	45GR0428	lithic, faunal	Schalk 1982
1, 1A	E,F	45GR0451	quarry, lithic	Masten and Galm 1985
1A	F	45GR0436	lithic	Schalk 1982
1A	F	45GR0457	lithic, quarry, camp	Masten and Galm 1985
1A	F	45GR0469	lithic	Masten and Galm 1985
1A	F	45GR0633	cairns, lithic	Thompson 1989
1A	F	45GR0645	cairn	Hunter 1992
1, 1A, 2	G	45KT0988	lithic, quarry	Walker 1993

*These are the handwritten segment designations on the 11 x 14 map. They indicate:
Segment A = Schultz to SE corner of Boylston quad.
Segment B=SE corner of Boylston quad to Vantage (now B north option route)
Segment C= SE corner of Boylston quad to Blackrock
Segment D=Vantage thru Midway to Blackrock
Segment E=Vantage direct to Hanford.
Segment F=Vantage through Wahatis Peak, then south to Hanford
Segment G=SE corner of Boylston south to PP&L line then east joining Segment B over river (now B south option route)

Table A2. Areas of Cultural Resources Sensitivity

NAME	SEGMENT*	ALTERN.	ZONE	UTME	UTMN	RADIUS(km)	PRIORITY	AREA (km^2)
AN	A	1, 1A, 2, 3	10	715016	5199444	0.3	3	0.282743339
AM	A	1, 1A, 2, 3	10	712300	5201300	0.5	2	0.785398163
AL	A	1, 1A, 2, 3	10	710900	5202750	0.3	2	0.282743339
AK	A	1, 1A, 2, 3	10	711400	5202900	0.4	2	0.502654825
AJ	A	1, 1A, 2, 3	10	711040	5203570	0.3	3	0.282743339
AI	A	1, 1A, 2, 3	10	705500	5210500	0.3	3	0.282743339
AH	A	1, 1A, 2, 3	10	704300	5211700	0.5	3	0.785398163
AG	A	1, 1A, 2, 3	10	703500	5212600	0.3	3	0.282743339
AF	A	1, 1A, 2, 3	10	702000	5214000	0.5	3	0.785398163
AE	A	1, 1A, 2, 3	10	701100	5215300	0.5	3	0.785398163
AD	A	1, 1A, 2, 3	10	699400	5216750	0.5	3	0.785398163
AC	A	1, 1A, 2, 3	10	698100	5218000	1.0	3	3.141592654
AB	A	1, 1A, 2, 3	10	694800	5220000	0.3	3	0.282743339
AA	A	1, 1A, 2, 3	10	693200	5221000	0.3	3	0.282743339
A1	A	1, 1A, 2, 3	10	691000	5222350	1.0	2	3.141592654
AW	B	1, 1A, 2	10	727120	5194540	1.0	3	3.141592654
BK	B	1, 1A, 2	11	272500	5195000	0.5	1	0.785398163
AT	B	1, 1A, 2	10	724800	5195210	0.5	2	0.785398163
AV	B	1, 1A, 2	10	724000	5194600	0.4	3	0.502654825
AS	B,C,G	1, 1A, 2, 3	10	720220	5195950	0.5	2	0.785398163
AR	B,C,G	1, 1A, 2, 3	10	722100	5196000	0.4	3	0.502654825
AQ	B,C,G	1, 1A, 2, 3	10	719000	5196500	0.5	2	0.785398163
AP	B,C,G	1, 1A, 2, 3	10	718100	5196900	0.8	3	2.010619298
AO	B,C,G	1, 1A, 2, 3	10	717060	5197800	1.0	3	3.141592654
BM	B,G	1, 1A, 2	11	272090	5193800	0.3	2	0.282743339
BL	B,G	1, 1A, 2	11	274000	5194000	1.3	1	5.309291585
BJ	B,G	1, 1A, 2	11	275200	5195200	0.3	1	0.282743339
CK	C	3	11	279800	5158800	0.3	3	0.282743339
CJ	C	3	11	278000	5160750	1.0	3	3.141592654
CI	C	3	11	275950	5162250	1.0	3	3.141592654
BI	C	3	11	273401	5163842	0.4	3	0.502654825
CG	C	3	11	273700	5167000	1.0	3	3.141592654
CE	C	3	11	271300	5169150	0.7	2	1.5393804
BH	C	3	10	726050	5176000	1.0	3	3.141592654
BG	C	3	10	725400	5178600	0.5	3	0.785398163
BF	C	3	10	724200	5178900	1.0	3	3.141592654
BE	C	3	10	724200	5180800	1.0	3	3.141592654
BD	C	3	10	723600	5182500	0.5	3	0.785398163
BC	C	3	10	723000	5184600	0.3	2	0.282743339
BB	C	3	10	722155	5185350	0.6	2	1.130973355
BA	C	3	10	721744	5187844	0.3	3	0.282743339

NAME	SEGMENT*	ALTERN.	ZONE	UTME	UTMN	RADIUS(km)	PRIORITY	AREA (km^2)
AZ	C	3	10	721700	5189000	1.0	3	3.141592654
AY	C	3	10	721220	5189500	0.4	2	0.502654825
AX	C,G	1, 1A, 2, 3	10	719860	5194500	0.5	2	0.785398163
AU	C,G	1, 1A, 2, 3	10	720500	5194800	0.5	3	0.785398163
CM	D	2	11	281600	5156700	0.7	3	1.5393804
CL	D	2	11	282900	5157700	0.4	3	0.502654825
CH	D	2	11	286700	5165700	0.7	3	1.5393804
CF	D	2	11	287200	5167200	1.0	1	3.141592654
BY	D	2	11	279900	5183500	0.5	3	0.785398163
BW	D	2	11	279900	5185500	0.5	3	0.785398163
BQ	D	2	11	278300	5186750	0.3	3	0.282743339
CB	E	1	11	300750	5175600	0.5	3	0.785398163
CA	E	1	11	299900	5176500	0.5	3	0.785398163
BZ	E	1	11	285500	5183500	0.5	3	0.785398163
BO	E	1	11	278000	5189500	1.3	1	5.309291585
BN	E	1	11	277200	5192800	0.3	2	0.282743339
CD	E,F	1, 1A	11	303000	5173000	1.0	1	3.141592654
CC	E,F	1, 1A	11	302500	5174600	1.0	2	3.141592654
BX	E,F	1, 1A	11	282100	5185300	0.4	3	0.502654825
BR	E,F	1, 1A	11	280200	5186500	0.4	2	0.502654825
CN	F	1A	11	292800	5185500	1.0	3	3.141592654
CO	F	1A	11	299600	5185500	0.7	3	1.5393804
BV	F	1A	11	293700	5185800	0.5	3	0.785398163
BU	F	1A	11	296650	5185950	0.3	3	0.282743339
BS	F	1A	11	286500	5186000	1.0	3	3.141592654
BT	F	1A	11	289200	5186000	0.5	3	0.785398163
BP	F	1A	11	279330	5187640	0.3	2	0.282743339
CS	G	1, 1A, 2	10	728250	5193300	0.3	3	0.282743339
CR	G	1, 1A, 2	10	726700	5193400	1.0	2	3.141592654
CQ	G	1, 1A, 2	10	724650	5193500	0.5	3	0.785398163
CP	G	1, 1A, 2	10	722000	5194200	0.5	3	0.785398163

* These are the handwritten segment designations on the 11 x 14 map. They indicate:
Segment A = Schultz to SE corner of Boylston quad.
Segment B=SE corner of Boylston quad to Vantage
Segment C= SE corner of Boylston quad to Blackrock
Segment D=Vantage thru Midway to Blackrock
Segment E=Vantage direct to Hanford.
Segment F=Vantage through Wahatis Peak, then south to Hanford
Segment G=SE corner of Boylston south to PP&L line, and then east following PP&L line to Vantage

Appendix I– Electrical Effects

SCHULTZ - HANFORD AREA
TRANSMISSION LINE PROJECT

APPENDIX I

ELECTRICAL EFFECTS

August 6, 2001

Prepared by

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for

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ELECTRICAL EFFECTS FROM THE PROPOSED SCHULTZ – HANFORD AREA TRANSMISSION PROJECT

1.0 Introduction

The Bonneville Power Administration (BPA) is proposing to build a 500-kilovolt (kV) transmission line from the Schultz Substation near Ellensburg, Washington, to either the existing BPA 500-kV Hanford Substation located on the Hanford Site or to a new 500-kV Wautoma Substation located west of the Hanford Site. The proposed line and the associated remodeled and new substations are known as the Schultz – Hanford Area Transmission Project. Alternative routes include construction on new right-of-way on a new corridor, on existing right-of-way parallel to several existing lines, and on new right-of-way parallel to existing 230-kV and/or 115-kV lines. In addition, the existing Sickler-Schultz 500-kV line would be realigned on new right-of-way north of the Schultz substation. The purpose of this report is to describe and quantify the electrical effects of the proposed Schultz – Hanford/Wautoma line. These include the following:

- the levels of 60-hertz (Hz; cycles per second) electric and magnetic fields (EMF) at 3.28 feet (ft.) or 1 meter (m) above the ground,
- the effects associated with those fields,
- the levels of audible noise produced by the line, and
- electromagnetic interference associated with the line.

Electrical effects occur near all transmission lines, including those already present along segments of the proposed route for the Schultz - Hanford/Wautoma line. Therefore, the levels of these quantities for the proposed line are computed and compared with those from the existing lines.

The voltage on the conductors of transmission lines generates an electric field in the space between the conductors and the ground. The electric field is calculated or measured in units of volts-per-meter (V/m) or kilovolts-per-meter (kV/m) at a height of 3.28 feet (ft.) (1 meter [m]) above the ground. The current flowing in the conductors of the transmission line generates a magnetic field in the air and earth near the transmission line; current is expressed in units of amperes (A). The magnetic field is expressed in milligauss (mG), and is usually measured or calculated at a height of 3.28 ft. (1 m) above the ground. The electric field at the surface of the conductors causes the phenomenon of corona. Corona is the electrical breakdown or ionization of air in very strong electric fields, and is the source of audible noise, electromagnetic radiation, and visible light.

To quantify EMF levels along the route, the electric and magnetic fields from the proposed and existing lines were calculated using the BPA Corona and Field Effects Program (USDOE, undated). In this program, the calculation of 60-Hz fields uses standard superposition techniques for vector fields from several line sources: in this case, the line sources are transmission-line conductors. (Vector fields have both magnitude and direction: these must be taken into account when combining fields from different sources.) Important input parameters to the computer program are voltage, current, and geometric configuration of the line. The transmission-line conductors are assumed to be straight, parallel to each other, and located above and parallel to an infinite flat ground plane. Although such conditions do not occur under real lines because of conductor sag and variable terrain, the validity and limitations of calculations using these assumptions have been well verified by comparisons with measurements. This approach was used to estimate fields for the proposed Schultz - Hanford/Wautoma line, where minimum clearances were assumed to provide worst-case (highest) estimates for the fields.

Electric fields are calculated using an imaging method. Fields from the conductors and their images in the ground plane are superimposed with the proper magnitude and phase to produce the total field at a selected location.

The total magnetic field is calculated from the vector summation of the fields from currents in all the transmission-line conductors. Balanced currents are assumed; the contribution of image currents in the conductive earth is not included. Peak currents and power flow directions for the proposed and existing lines were provided by BPA and are based on the projected summer peak power loads in 2006. In the case of corridors with more than one line, calculations were performed for similar (maximum) current conditions on both lines.

Electric and magnetic fields for the proposed line were calculated at the standard height (3.28 ft. or 1 m) above the ground (IEEE, 1987). Calculations were performed out to 300 ft. (91 m) from the centerline of the proposed line and out to 200 ft. (61 m) from the centerline of existing lines. The validity and limitations of such calculations have been well verified by measurements. Because maximum voltage, maximum current, and minimum conductor height above-ground are used, ***the calculated values given here represent worst-case conditions:*** i.e., the calculated fields are higher than they would be in practice. Such worst-case conditions would seldom occur.

The corona performance of the proposed line was also predicted using the BPA Corona and Field Effects Program (USDOE, undated). Corona performance is calculated using empirical equations that have been developed over several years from the results of measurements on numerous high-voltage lines (Chartier and Stearns, 1981; Chartier, 1983). The validity of this approach for corona-generated audible noise has been demonstrated through comparisons with measurements on other lines all over the United States (IEEE Committee Report, 1982). The accuracy of this method for predicting corona-generated radio and television interference from transmission lines has also been established (Olsen et al., 1992). Of the methods available for predicting radio interference levels, the BPA empirical equivalent method agrees most closely with long-term data. Important input parameters to the computer program are voltage, current, conductor size, and geometric configuration of the line.

Corona is a highly variable phenomenon that depends on conditions along a length of line. Predictions of the levels of corona effects are reported in statistical terms to account for this variability. Calculations of audible noise and electromagnetic interference levels were made under conditions of an estimated average operating voltage (540 kV for the proposed line) and with the average line height (47 ft. or 14 m for 500-kV lines). Levels of audible noise, radio interference, and television interference are predicted for both fair and foul weather; however, corona is basically a foul-weather phenomenon. Wet conductors can occur during periods of rain, fog, snow, or icing. Along the alternative routes of the proposed Schultz – Hanford/Wautoma transmission line, such conditions are expected to occur about 7 percent of the time during a year, based on hourly records at the Yakima Air Terminal from 1996 to 1999. Corona activity also increases with altitude. For purposes of evaluating corona effects from the proposed line, an altitude of 2000 ft. (610 m) was assumed for Configurations A-1 to A-4 and 1200 ft. (366 m) for Configurations D-1 to D-4.

2.0 Physical Description

2.1 Proposed Line

The Schultz – Hanford/Wautoma line would be a three-phase, single-circuit design with a maximum phase-to-phase voltage of 550 kV. The average voltage of the line would be 540 kV. The maximum electrical current on the line would be 1436 A. The estimated currents in each phase are based on the projected summer peak load in 2006, as determined in case studies prepared by BPA. BPA provided the physical and operating characteristics of the proposed and existing lines.

The physical dimensions and electrical characteristics for the configuration of the proposed line are shown in Figure 1, and summarized in Table 1. The three 1.302-inch (in.) (3.31-centimeter (cm)) diameter conductors for each phase (ACSR: steel reinforced aluminum conductors) would be arranged in an inverted triangle bundle configuration with 17-in. (43.3-cm) spacing between conductors. Voltage and current waves are displaced by 120° in time (one-third of a cycle) on each electrical phase. The conductor bundles would be arranged in a delta or triangular configuration on steel towers, as shown in Figure 1. The horizontal phase spacing between the lower conductor bundles would be 40 ft. (12.2 m). The vertical spacing between the upper and lower conductor bundles would be 28.7 ft. (8.8 m). Minimum conductor-to-ground clearance would be 33 ft. (10.1 m) at a conductor temperature of 122°F (50°C), which represents maximum operating conditions and high ambient air temperatures; clearances above ground would be greater under normal operating temperatures. The average clearance above ground will be approximately 47 ft. (14.3 m); this value was used for corona calculations. At road crossings, the ground clearance would be at least 54 ft. (116.5 m) at 122°F (50°C). The 33-ft. (10.1-m) minimum clearance provided by BPA is greater than the minimum distance of the conductors above ground required to meet the National Electric Safety Code (NESC) (IEEE, 1990). The final design of the proposed line could entail larger clearances. The right-of-way width for the proposed line would be 150 ft. (45.7 m).

2.2 Existing Lines

The proposed Schultz – Hanford/Wautoma 500-kV line could parallel existing BPA 500-kV, 230-kV, and 115-kV lines along different segments of the alternative routes. In addition, the realigned Sickler-Schultz 500-kV line could parallel and existing 345-kV line. Eight possible configurations were identified, including the new right-of-way with no parallel line (Table 2). The physical and electrical characteristics of the corridor configurations that were analyzed are given in Table 1; cross-sections of the corridors are shown in Figure 1.

3.0 Electric Field

3.1 Basic Concepts

An electric field is said to exist in a region of space if an electrical charge, at rest in that space, experiences a force of electrical origin (i.e., electric fields cause free charges to move). Electric field is a vector quantity: that is, it has both magnitude and direction. The direction corresponds to the direction that a positive charge would move in the field. Sources of electric fields are unbalanced electrical charges (positive or negative) and time-varying magnetic fields. Transmission lines, distribution lines, house wiring, and appliances generate electric fields in their vicinity because of unbalanced electrical charge on energized conductors. The unbalanced charge is associated with the voltage on the energized system. On the power system in North America, the voltage and charge on the energized conductors are cyclic (plus to minus to plus) at a rate of 60 times per second. This changing voltage results in electric fields near sources that are also time-varying at a frequency of 60 Hz (a frequency unit equivalent to cycles per second).

As noted earlier, electric fields are expressed in units of volts per meter (V/m) or kilovolts (thousands of volts) per meter (kV/m). Electric- and magnetic-field magnitudes in this report are expressed in root-mean-square (rms) units. For sinusoidal waves, the rms amplitude is given as the peak amplitude divided by the square root of two.

The spatial uniformity of an electric field depends on the source of the field and the distance from that source. On the ground, under a transmission line, the electric field is nearly constant in magnitude and direction over distances of several feet (1 meter). However, close to transmission- or distribution-line conductors, the field decreases rapidly with distance from the conductors. Similarly, near small sources such as appliances, the field is not uniform and falls off even more rapidly with distance from the device. If an energized conductor (source) is inside a grounded conducting enclosure, then the electric field outside the enclosure is zero, and the source is said to be shielded.

Electric fields interact with the charges in all matter, including living systems. When a conducting object, such as a vehicle or person, is located in a time-varying electric field near a transmission line, the external electric fields exert forces on the charges in the object, and electric fields and currents are induced in the object. If the object is grounded, then the total current induced in the body (the "short-circuit current") flows to earth. The distribution of the currents within, say, the human body, depends on the electrical conductivities of various parts of the body: for example, muscle and blood have higher conductivity than bone and would therefore experience higher currents.

At the boundary surface between air and the conducting object, the field in the air and perpendicular to the conductor surface is much, much larger than the field in the conductor itself. For example, the average surface field on a human standing in a 10 kV/m field is 27 kV/m; the internal fields in the body are much smaller: approximately 0.008 V/m in the torso and 0.45 V/m in the ankles.

3.2 Transmission-line Electric Fields

The electric field created by a high-voltage transmission line extends from the energized conductors to other conducting objects such as the ground, towers, vegetation, buildings, vehicles, and people. The calculated strength of the electric field at a height of 3.28 ft. (1 m) above an unvegetated, flat earth is frequently used to describe the electric field under straight parallel transmission lines. The most important transmission-line parameters that determine the electric field at a 1-m height are conductor height above ground and line voltage.

Calculations of electric fields from transmission lines are performed with computer programs based on well-known physical principles (cf., Deno and Zaffanella, 1982). The calculated values under these conditions represent an ideal situation. When practical conditions approach this ideal model, measurements and calculations agree. Often, however, conditions are far from ideal because of variable terrain and vegetation. In these cases, fields are calculated for ideal conditions, with the lowest conductor clearances to provide upper bounds on the electric field under the transmission lines. With the use of more complex models or empirical results, it is also possible to account accurately for variations in conductor height, topography, and changes in line direction. Because the fields from different sources add vectorially, it is possible to compute the fields from several different lines if the electrical and geometrical properties of the lines are known. However, in general, electric fields near transmission lines with vegetation below are highly complex and cannot be calculated. Measured fields in such situations are highly variable.

For evaluation of EMF from transmission lines, the fields must be calculated for a specific line condition. The NESC states the condition for evaluating electric-field-induced short-circuit current for lines with voltage above 98 kV, line-to-ground, as follows: conductors are at a minimum clearance from ground corresponding to a conductor temperature of 120°F (49°C), and at a maximum voltage (IEEE, 1990). BPA has supplied the needed information for calculating electric and magnetic fields from the proposed transmission lines: the maximum operating voltage, the estimated peak current in 2006, and the minimum conductor clearances.

There are standard techniques for measuring transmission-line electric fields (IEEE, 1987). Provided that the conditions at a measurement site closely approximate those of the ideal situation assumed for calculations, measurements of electric fields agree well with the calculated values. If the ideal conditions are not approximated, the measured field can differ substantially from calculated values. Usually the actual electric field at ground level is reduced from the calculated values by various common objects that act as shields.

Maximum or peak field values occur over a small area at midspan, where conductors are closest to the ground. As the location of an electric-field profile approaches a tower, the conductor clearance increases, and the peak field decreases. A grounded tower will reduce the electric field considerably by shielding. For the parallel line configurations considered here, minimum conductor clearances were assumed to occur along the same lateral profile for both lines. This condition will not necessarily occur in practice, because the towers for the parallel lines may be offset or located at different elevations. The assumption of simultaneous minimum clearance results in peak fields that may be larger than what occurs in practice.

For traditional transmission lines, such as the proposed line, where the right-of-way extends laterally well beyond the conductors, electric fields at the edge of the right-of-way are not as sensitive as the peak field to conductor height. Computed values at the edge of the right-of-way for any line height are fairly representative of what can be expected all along the transmission-line corridor. However, the presence of vegetation on and at the edge of the right-of-way will reduce actual electric-field levels below calculated values.

3.3 Calculated Values of Electric Fields

Table 3 shows the calculated values of electric field at 3.28 ft. (1 m) above ground for the proposed Schultz - Hanford/Wautoma 500-kV transmission-line configurations. The peak value on the right-of-way and the value at the edge of the right-of-way are given for the eight proposed corridor configurations and for minimum and average conductor clearances. Figure 2a shows lateral profiles for the electric field from the proposed line for the minimum and average line heights. Figures 2b–c show calculated fields for both existing and proposed Configurations D-1 and D-3 with parallel lines.

The calculated peak electric field expected on the right-of-way of the proposed line on new right-of-way (Configuration A-1) is 8.9 kV/m. When the proposed line parallels other lines the peak field under the proposed line is 8.9 kV/m or less.

As shown in Figure 2a, the peak values would be present only at locations directly under the line, near mid-span, where the conductors are at the minimum clearance. The conditions of minimum conductor clearance at maximum current and maximum voltage occur very infrequently. The calculated peak levels are rarely reached under real-life conditions, because the actual line height is generally above the minimum value used in the computer model, because the actual voltage is below the maximum value used in the model, and because vegetation within and near the edge of the right-of-way tends to shield the field at ground level. Maximum electric fields under the existing parallel 500-kV, 230-kV, and 115-kV lines are 9.7, 3.3, and 1.7 kV/m, respectively.

The largest values expected at the edge of the right-of-way nearest the proposed line would be 2.0 kV/m. On the edge of the right-of-way away from the proposed line, the field would vary with the line configuration present. The largest fields at the edges of the existing rights-of-way are 5.2 and 2.0 kV/m for the 500- and 230-kV lines, respectively.

3.4 Environmental Electric Fields

The electric fields associated with the Schultz - Hanford/Wautoma line can be compared with those found in other environments. Sources of 60-Hz electric (and magnetic) fields exist everywhere electricity is used; levels of these fields in the modern environment vary over a wide range. Electric-field levels associated with the use of electrical energy are orders of magnitude greater than the naturally occurring 60-Hz fields of about 0.0001 V/m, which stem from atmospheric and extraterrestrial sources.

Electric fields in outdoor, publicly accessible places range from less than 1 V/m to 12 kV/m; the large fields exist close to high-voltage transmission lines of 500 kV or higher. In remote areas without electrical service, 60-Hz field levels can be much lower than 1 V/m. Electric fields in home and work environments generally are not spatially uniform like those of transmission lines; therefore, care must be taken when making comparisons between fields from different sources such as appliances and electric lines. In addition, fields from all sources can be strongly modified by the presence of conducting objects. However, it is helpful to know the levels of electric fields generated in domestic and office environments in order to compare commonly experienced field levels with those near transmission lines.

Numerous measurements of residential electric fields have been reported for various parts of the United States, Canada, and Europe. Although there have been no large studies of residential electric fields, sufficient data are available to indicate field levels and characteristics. Measurements of domestic 60-Hz electric fields indicate that levels are highly variable and source-dependent. Electric-field levels are not easily predicted because walls and other objects act as shields, because conducting objects perturb the field, and because homes contain numerous localized sources. Internal sources (wiring, fixtures, and appliances) seem to predominate in producing electric fields inside houses. Average measured electric fields in residences are generally in the range of 5 to 20 V/m. In a large occupational exposure monitoring project that included electric-field measurements at homes, average exposures for all groups away from work were generally less than 10 V/m (Bracken, 1990).

Electric fields from household appliances are localized and decrease rapidly with distance from the source. Local electric fields measured at 1 ft. (0.3 m) from small household appliances are typically in the range of 30 to 60 V/m. Stopps and Janischewskyj (1979) reported electric-field measurements near 20 different appliances; at a 1-ft. (0.3-m) distance, fields ranged from 1 to 150 V/m, with a mean of 33 V/m. In another survey, reported by Deno and Zaffanella (1982), field measurements at a 1-ft. (0.3-m) distance from common domestic and workshop sources were found to range from 3 to 70 V/m.

The localized fields from appliances are not uniform, and care should be taken in comparing them with transmission-line fields.

Electric blankets can generate higher localized electric fields. Sheppard and Eisenbud (1977) reported fields of 250 V/m at a distance of approximately 1 ft. (0.3 m). Florig et al. (1987) carried out extensive empirical and theoretical analysis of electric-field exposure from electric blankets and presented results in terms of uniform equivalent fields such as those near transmission lines. Depending on what parameter was chosen to represent intensity of exposure and the grounding status of the subject, the equivalent vertical 60-Hz electric-field exposure ranged from 20 to over 3500 V/m. The largest equivalent field corresponds to the measured field on the chest, with the blanket-user grounded. The average field on the chest of an ungrounded blanket-user yields an equivalent vertical field of 960 V/m. As manufacturers have become aware of the controversy surrounding EMF exposures, electric blankets have been redesigned to reduce magnetic fields. However, electric fields from these “low field” blankets are still comparable with those from older designs (Bassen et al., 1991).

Generally, people in occupations not directly related to high-voltage equipment are exposed to electric fields comparable with those of residential exposures. For example, the average electric field measured in 14 commercial and retail locations in rural Wisconsin and Michigan was 4.8 V/m (ITT Research Institute, 1984). Median electric field was about 3.4 V/m. These values are about one-third the values in residences reported in the same study. Power-frequency electric fields near video display terminals (VTDs) are about 10 V/m, similar to those of other appliances (Harvey, 1983). Electric-field levels in public buildings such as shops, offices, and malls appear to be comparable with levels in residences.

Using a small 60-Hz dosimeter, Deadman et al. (1988) measured occupational exposures over a one-week period for 20 utility workers and 16 office workers. The geometric mean of the weekly electric-field exposures during work for the 20 utility workers was 48.3 V/m, compared to 4.9 V/m for the office workers. The transmission linemen (n=2, 420 V/m) had the highest geometric mean exposures. These results are consistent with previous studies that used less sophisticated instrumentation.

In a survey of 1,882 volunteers from utilities, electric-field exposures were measured for 2,082 workdays and 657 non-work days (Bracken, 1990). Electric-field exposures for occupations other than those directly related to high-voltage equipment were equivalent to those for non-work exposure.

Thus, except for the relatively few occupations where high-voltage sources are prevalent, electric fields encountered in the workplace are probably similar to those of residential exposures. Even in electric utility occupations where high field sources are present, exposures to high fields are limited on average to minutes per day.

Electric fields found in publicly accessible areas near high-voltage transmission lines can typically range up to 3 kV/m for 230-kV lines, to 10 kV/m for 500-kV lines, and to 12 kV/m for 765-kV lines. Although these peak levels are considerably higher than the levels found in other public areas, they are present only in limited areas on rights-of-way.

The calculated electric fields for the proposed Schultz - Hanford/Wautoma 500-kV transmission line are consistent with the levels reported for other 500-kV transmission lines in Washington and elsewhere. The calculated electric fields on the right-of-way of the proposed transmission line would be much higher than levels normally encountered in residences and offices.

4.0 Magnetic Field

4.1 Basic Concepts

Magnetic fields can be characterized by the force they exert on a moving charge or on an electrical current. As with the electric field, the magnetic field is a vector quantity characterized by both magnitude and direction. Electrical currents generate magnetic fields. In the case of transmission lines, distribution lines, house wiring, and appliances, the 60-Hz electric current flowing in the conductors generates a time-varying, 60-Hz magnetic field in the vicinity of these sources. The strength of a magnetic field is measured in terms of magnetic lines of force per unit area, or magnetic flux density. The term “magnetic field,” as used here, is synonymous with magnetic flux density and is expressed in units of Gauss (G) or milligauss (mG).

The uniformity of a magnetic field depends on the nature and proximity of the source, just as the uniformity of an electric field does. Transmission-line-generated magnetic fields are quite uniform over horizontal and vertical distances of several feet near the ground. However, for small sources such as appliances, the magnetic field decreases rapidly over distances comparable with the size of the device.

The interaction of a time-varying magnetic field with conducting objects results in induced electric field and currents in the object. A changing magnetic field through an area generates a voltage around any conducting loop enclosing the area (Faraday's law). This is the physical basis for the operation of an electrical transformer. For a time-varying sinusoidal magnetic field, the magnitude of the induced voltage around the loop is proportional to the area of the loop, the frequency of the field, and the magnitude of the field. The induced voltage around the loop results in an induced electric field and current flow in the loop material. The induced current that flows in the loop depends on the conductivity of the loop.

4.2 Transmission-line Magnetic Fields

The magnetic field generated by currents on transmission-line conductors extends from the conductors through the air and into the ground. The magnitude of the field at a height of 3.28 ft. (1 m) is frequently used to describe the magnetic field under transmission lines. Because the magnetic field is not affected by non-ferrous materials, the field is not influenced by normal objects on the ground under the line. The direction of the maximum field varies with location. (The electric field, by contrast, is essentially vertical near the ground.) The most important transmission-line parameters that determine the magnetic field at 3.28 ft. (1 m) height are conductor height above ground and magnitude of the currents flowing in the conductors. As distance from the transmission-line conductors increases, the magnetic field decreases.

Calculations of magnetic fields from transmission lines are performed using well-known physical principles (cf., Deno and Zaffanella, 1982). The calculated values usually represent the ideal straight parallel-conductor configuration. For simplicity, a flat earth is usually assumed. Balanced currents (currents of the same magnitude for each phase) are also assumed. This is usually valid for transmission lines, where loads on all three phases are maintained in balance during operation. Induced image currents in the earth are usually ignored for calculations of magnetic field under or near the right-of-way. The resulting error is negligible. Only at distances greater than 300 ft. (91 m) from a line do such contributions become significant (Deno and Zaffanella, 1982). The clearance for magnetic-field calculations for the proposed line was the same as that used for electric-field evaluations.

Standard techniques for measuring magnetic fields near transmission lines are described in ANSI IEEE Standard No. 644-1987 (1987). Measured magnetic fields agree well with calculated values, provided the currents and line heights that go into the calculation correspond to the actual values for the line. To realize such agreement, it is necessary to get accurate current readings during field measurements (because currents on transmission lines can vary considerably over short periods of time) and also to account for all field sources in the vicinity of the measurements.

As with electric fields, the maximum or peak magnetic fields occur in areas near the centerline and at midspan where the conductors are the lowest. If more than one line is present, the peak field will depend on the relative electrical phasing of the conductors. The magnetic field at the edge of the right-of-way is not very dependent on line height. If more than one line is present, the peak field can depend on the relative electrical phasing of the conductors and the direction of power flow. Phasing information was available for the parallel 500-kV line, but not for the parallel 115-kV line. Assumption of a phasing scheme for the 115-kV line does not affect the calculated field levels on the existing or proposed corridor.

4.3 Calculated Values for Magnetic Fields

Table 4 gives the calculated values of the magnetic field at 3.28 ft. (1 m) height for the proposed 500-kV transmission-line configurations. Field values on the right-of-way and at the edge of the right-of-way are given for projected maximum currents during summer peak load in 2006, for minimum and average conductor clearances. The actual magnetic-field levels would vary, as currents on the lines change daily and seasonally and as ambient temperature changes. Average currents over the year would be about 45 percent of the maximum values. Average fields over a year would be considerably reduced from the peak values, as a result of increased clearances above the minimum height and reduced currents from the maximum summer load value.

Figure 3 shows lateral profiles of the magnetic field under maximum current and minimum clearance conditions for selected configurations of the proposed 500-kV transmission line. A field profile for average height under Configuration A-1 is included in Figure 3a. Maximum field levels for the proposed and existing configurations of Configurations D-1 and D-3 are shown in Figures 3b and 3c.

For the proposed 500-kV line on new right-of-way with no parallel lines (Configuration A-1), the maximum calculated 60-Hz magnetic field expected at 3.28 ft. (1 m) above ground is 244 mG. This field is calculated for the maximum current of 1436 A, with the conductors at a height of 33 ft. (9.1 m). The maximum field would decrease for increased conductor clearance. For an average conductor height over a span of 47 ft. (14.3 m), the maximum field would be 137 mG. (See Figure 3a.) Maximum fields under the proposed line in the configurations with parallel lines would be less than these values.

At the edge of the right-of-way of the proposed line, the calculated magnetic field for maximum current conditions is 55 mG for minimum conductor height and 46 mG for average conductor height. Fields at the edge of the right-of-way of the proposed line in the configurations with parallel lines would be less than those for Configuration A-1. The field at the edge of the right-of-way adjacent to a parallel line would depend on that line.

The magnetic field falls off rapidly as distance from the line increases. The calculated magnetic field for maximum current would be less than 10 mG at about 185 ft. (72 m) from the centerline. At a distance of 200 ft. (61 m) from the centerline of the proposed line, the field would be 8 mG for maximum current conditions.

The calculated fields for the seven other configurations that were analyzed are given in Table 4. For the existing lines, the peak magnetic fields on the rights-of-way are 302 mG and 170 mG, for the 500-kV and 230-kV lines, respectively. Fields at the edges of the existing rights-of-way range from 158 mG for the Vantage-Schultz 500-kV line to 7 mG for the North Bonneville-Midway 230-kV line, which has a very wide right-of-way. The maximum and edge of right-of-way field levels for the realigned Sickler-Schultz 500-kV line (Configurations A-2 and A-3) would be 262 mG and 60 mG, respectively.

4.4 Environmental Magnetic Fields

Transmission lines are not the only source of magnetic fields; as with 60-Hz electric fields, 60-Hz magnetic fields are present throughout the environment of a society that relies on electricity as a principal energy source. The magnetic fields associated with the proposed Schultz - Hanford/Wautoma 500-kV line can be compared with fields from other sources. The range of 60-Hz magnetic-field exposures in publicly accessible locations such as open spaces, transmission-line rights-of-way, streets, pedestrian walkways, parks, shopping malls, parking lots, shops, hotels, public transportation, and so on range from less than 0.1 mG to about 1 G, with the highest values occurring near small appliances with electric motors. In occupational settings in electric utilities, where high currents are present, magnetic-field exposures for workers can be above 1 G. At 60 Hz, the magnitude of the natural magnetic field is approximately 0.0005 mG.

Several investigations of residential fields have been conducted. Short-term measurements of magnetic fields in 483 residences in the Denver area resulted in mean fields of 0.76 mG (Standard Deviation (SD) = 0.79 mG) under low-power conditions: with all appliances and lights off (Savitz, 1987). Approximately six percent of the low-power residences had fields greater than 2.5 mG. The high-power (appliances and lights on) mean fields for 481 residences were 1.05 mG (SD = 1.3 mG) (Savitz, 1987). The average low-power magnetic field for the 133 residences with buried-cable electrical service in the study was 0.49 mG (SD = 0.53 mG).

Kaune et al. (1987) reported on 24-hour magnetic-field measurements made in 43 residences in the Seattle area. The mean for these measurements was 1.0 mG (median = 0.6 mG; SD = 1.2 mG). The magnetic-field data demonstrated a diurnal variation that coincided with utility loads: peak values at 8 am and 6-7 pm, and minimum values very early in the morning. No correlation of magnetic field with individual power consumption in a house was observed. The Denver and Seattle studies both concluded that the predominant sources of residential magnetic fields were external to the home (e.g., transmission and distribution lines). The studies also identified ground-return currents in residences as a possible important source of residential magnetic fields.

In a large study to identify and quantify significant sources of 60-Hz magnetic fields in residences, measurements were made in 996 houses, randomly selected throughout the country (Zaffanella, 1993). The most common sources of residential fields were power lines, the grounding system of residences, and appliances. Field levels were characterized by both point-in-time (spot) measurements and 24-hour measurements. Spot measurements averaged over all rooms in a house exceeded 0.6 mG in 50 percent of the houses and 2.9 mG in 5 percent of houses. Power lines generally produced the largest average fields in a house over a 24-hour period. On the other hand, grounding system currents proved to be a more significant source of the highest fields in a house. Appliances were found to produce the highest local fields; however, fields fell off rapidly with increased distance. For example, the median field near microwave ovens was 36.9 mG at a distance of 10.5 in (0.27 m) and 2.1 mG at 46 in (1.17 m). Across the entire sample of 996 houses, higher magnetic fields were found in, among others, urban areas (vs.

rural); multi-unit dwellings (vs. single-family); old houses (vs. new); and houses with grounding to a municipal water system.

In an extensive measurement project to characterize the magnetic-field exposure of the general population, over 1000 randomly selected persons in the United States wore a personal exposure meter for 24 hours and recorded their location in a simple diary (Zaffanella and Kalton, 1998). Based on the measurements of 853 persons, the estimated 24-hour average exposure for the general population is 1.24 mG and the estimated median exposure is 0.88 mG. The average field "at home, not in bed" is 1.27 mG and "at home, in bed" is 1.11 mG. Average personal exposures were found to be largest "at work" (mean of 1.79 mG and median of 1.01 mG) and lowest "at home, in bed" (mean of 1.11 mG and median of 0.49 mG). Average fields in school were also low (mean of 0.88 mG and median of 0.69 mG). Factors associated with higher exposures at home were smaller residences, duplexes and apartments, metallic rather than plastic water pipes, and nearby overhead distribution lines.

As noted above, magnetic fields from appliances are localized and decrease rapidly with distance from the source. Localized 60-Hz magnetic fields have been measured near about 100 household appliances such as ranges, refrigerators, electric drills, food mixers, and shavers (Gauger, 1985). At a distance of 1 ft. (0.3 m), the maximum magnetic field ranged from 0.3 to 270 mG, with 95 percent of the measurements below 100 mG. Ninety-five percent of the levels at a distance of 4.9 ft. (1.5 m) were less than 1 mG. Devices that use light-weight, high-torque motors with little magnetic shielding exhibited the largest fields. These included vacuum cleaners and small hand-held appliances and tools. Microwave ovens with large power transformers also exhibited relatively large fields. Electric blankets have been a much-studied source of magnetic-field exposure because of the length of time they are used and because of the close proximity to the body. Florig and Hoburg (1988) estimated that the average magnetic field in a person using an electric blanket was 15 mG, and that the maximum field could be 100 mG. New "low-field" blankets have magnetic fields at least 10 times lower than those from conventional blankets (Bassen et al., 1991).

In a domestic magnetic-field survey, Silva et al. (1989) measured fields near different appliances at locations typifying normal use (e.g., sitting at a typewriter or standing at a stove). Specific appliances with relatively large fields included can openers (n = 9), with typical fields ranging from 30 to 225 mG and a maximum value up to 2.7 G; shavers (n = 4), with typical fields from 50 to 300 mG and maximum fields up to 6.9 G; and electric drills (n = 2), with typical fields from 56 to 190 mG and maximum fields up to 1.5 G. The fields from such appliances fall off very rapidly with distance and are present only for short periods. Thus, although instantaneous magnetic-field levels close to small hand-held appliances can be quite large, they do not contribute to average area levels in residences.

Although studies of residential magnetic fields have not all considered the same independent parameters, the following consistent characterization of residential magnetic fields emerges from the data:

(1) External sources play a large role in determining residential magnetic-field levels. Transmission lines, when nearby, are an important external source. Unbalanced ground currents on neutral conductors and other conductors, such as water pipes in and near a house, can represent a significant source of magnetic field. Distribution lines per se, unless they are quite close to a residence, do not appear to be a traditional distance-dependent source.

(2) Homes with overhead electrical service appear to have higher average fields than those with underground service.

(3) Appliances represent a localized source of magnetic fields that can be much higher than average or area fields. However, fields from appliances approach area levels at distances greater than 3 ft. (1 m) from the device.

Although important variables in determining residential magnetic fields have been identified, quantification and modeling of their influence on fields at specific locations is not yet possible. However, a general characterization of residential magnetic-field level is possible: average levels in the United States are in the range of 0.5 to 1.0 mG, with the average field in a small number of homes exceeding this range by as much as a factor of 10 or more. Average personal exposure levels are slightly higher, possibly due to use of appliances and varying distances to other sources. Maximum fields can be much higher.

Magnetic fields in commercial and retail locations are comparable with those in residences. As with appliances, certain equipment or machines can be a local source of higher magnetic fields. Utility workers who work close to transformers, generators, cables, transmission lines, and distribution systems clearly experience high-level fields. Other sources of fields in the workplace include motors, welding machines, computers, and VDTs. In publicly accessible indoor areas, such as offices and stores, field levels are generally comparable with residential levels, unless a high-current source is nearby.

Because high-current sources of magnetic field are more prevalent than high-voltage sources, occupational environments with relatively high magnetic fields encompass a more diverse set of occupations than do those with high electric fields. For example, in occupational magnetic-field measurements reported by Bowman et al. (1988), the geometric mean field from 105 measurements of magnetic field in "electrical worker" job locations was 5.0 mG. "Electrical worker" environments showed the following elevated magnetic-field levels (geometric mean greater than 20 mG): industrial power supplies, alternating current (ac) welding machines, and sputtering systems for electronic assembly. For secretaries in the same study, the geometric mean field was 3.1 mG for those using VDTs (n = 6) and 1.1 mG for those not using VDTs (n = 3).

In a Canadian study, the geometric mean of the time-weighted average field for the weekly work exposure of 20 utility workers was 16.6 mG, compared to 1.6 mG for 16 office workers (Deadman et al., 1988). The geometric mean field for the office environment was comparable to that observed during non-work periods for office workers and comparable to that for both groups during sleep (when the exposure meter was not worn).

Measurements of personal exposure to magnetic fields were made for 1,882 volunteer utility workers for a total of 4,411 workdays (Bracken, 1990). Median workday mean exposures ranged from 0.5 mG for clerical workers without computers to 7.2 mG for substation operators. Occupations not specifically associated with transmission and distribution facilities had median workday exposures less than 1.5 mG, while those associated with such facilities had median exposures above 2.3 mG. Magnetic-field exposures measured in homes during this study were comparable with those recorded in offices.

Magnetic fields in publicly accessible outdoor areas seem to be, as expected, directly related to proximity to electric-power transmission and distribution facilities. Near such facilities, magnetic fields are generally higher than indoors (residential). Higher-voltage facilities tend to have higher fields. Typical maximum magnetic fields in publicly accessible areas near transmission facilities can range from less than a few milligauss up to 300 mG or more, near heavily loaded lines operated at 230 to 765 kV. The levels depend on the line load, conductor height, and location on the right-of-way. Because magnetic fields near high-voltage transmission lines depend on the current in the line, they can vary daily and seasonally. To characterize fields from the distribution system, Heroux (1987) measured 60-Hz magnetic fields with a mobile platform along 140 mi. (223 km) of roads in Montreal. The median field level averaged over nine different routes was 1.6 mG, with 90 percent of the measurements less than about 5.1 mG. Spot measurements indicated that typical fields directly above underground distribution systems were 5 to 19 mG. Beneath overhead distribution lines, typical fields were 1.5 to 5 mG on the primary side of the transformer, and 4 to 10 mG on the secondary side. At the surface of distribution poles, the magnetic field ranged from 10 to 100 mG, depending on structure type. Near ground-based transformers used in residential areas, fields were 80 to 1000 mG at the surface and 10 to 100 mG at a distance of 1 ft. (0.3 m).

The magnetic fields from the proposed 500-kV transmission line would be less than those from the existing 500-kV line in the same corridor. Thus, near the proposed line, magnetic fields would be well above average residential levels. However, the fields from the line would decrease rapidly and approach common ambient levels at distances greater than a few hundred feet from the line. Furthermore, the fields at the edge of the right-of-way would not be above those encountered during normal activities near common sources such as hand-held appliances.

5.0 Electric and Magnetic Field (EMF) Effects

Possible effects associated with the interaction of EMF from transmission lines with people on and near a right-of-way fall into two categories: short-term effects that can be perceived and may represent a nuisance, and possible long-term health effects. Only short-term effects are discussed here. The issue of whether there are long-term health effects associated with transmission-line fields is controversial. In recent years, considerable research on possible biological effects of EMF has been conducted. A review of these studies and their implications for health-related effects is provided in a separate technical report for the environmental impact statement for the proposed Schultz - Hanford Area Transmission Project.

5.1 Electric Fields: Short-term Effects

Short-term effects from transmission-line electric fields are associated with perception of induced currents and voltages or perception of the field. Induced current or spark discharge shocks can be experienced under certain conditions when a person contacts objects in an electric field. Such effects occur in the fields associated with transmission lines that have voltages of 230-kV or higher. These effects could occur under the proposed Schultz - Hanford/Wautoma 500-kV line.

Steady-state currents are those that flow continuously after a person contacts an object and provides a path to ground for the induced current. The amplitude of the steady-state current depends on the induced current to the object in question and on the grounding path. The magnitude of the induced current to vehicles and objects under the proposed line will depend on the electric-field strength and the size and shape of the object. When an object is electrically grounded, the voltage on the object is reduced to zero, and it is not a source of current or voltage shocks. If the object is poorly grounded or not grounded at all, then it acquires some voltage relative to earth and is a possible source of current or voltage shocks.

The responses of persons to steady-state current shocks have been extensively studied, and levels of response documented (Keesey and Letcher, 1969; IEEE, 1978). Primary shocks are those that can result in direct physiological harm. Such shocks will not be possible from induced currents under the existing or proposed lines, because clearances above ground required by the NESC preclude such shocks from large vehicles and grounding practices eliminate large stationary objects as sources of such shocks.

Secondary shocks are defined as those that could cause an involuntary and potentially harmful movement, but no direct physiological harm. Secondary shocks could occur under the proposed 500-kV line when making contact with ungrounded conducting objects such as vehicles or equipment. However, such occurrences are anticipated to be very infrequent. Shocks, when they occur under the 500-kV line, are most likely to be at a nuisance level. Induced currents are extremely unlikely to be perceived off the right-of-way of the proposed line.

Induced currents are always present in electric fields under transmission lines and will be present near the proposed line. However, during initial construction, BPA routinely grounds metal objects that are located on or near the right-of-way. The grounding eliminates these objects as sources of induced current and voltage shocks. Multiple grounding points are used to provide redundant paths for induced current flow. After construction, BPA would respond to any complaints and install or repair grounding to mitigate nuisance shocks.

Unlike fences or buildings, mobile objects such as vehicles and farm machinery cannot be grounded permanently. Limiting the possibility of induced currents from such objects to persons is accomplished in several ways. First, required clearances for above-ground conductors tend to limit field strengths to levels that do not represent a hazard or nuisance. The NESC (IEEE, 1990) requires that, for lines with voltage exceeding 98 kV line-to-ground (170 kV line-to-line), sufficient conductor clearance be maintained to limit the induced short-circuit current in the largest anticipated vehicle under the line to 5 milliamperes (mA) or less. This can be accomplished by limiting access or by increasing conductor clearances in areas where large vehicles could be present. BPA and other utilities design and operate lines to be in compliance with the NESC.

For the proposed line, conductor clearances (50°C conductor temperature) would be increased to at least 54 ft. (16.5 m) over road crossings along the route, resulting in a maximum field of 3.9 kV/m or less at the 3.28 ft. (1 m) height. The largest truck allowed on roads in Washington without a special permit is 14 feet high by 8.5 feet wide by 75 feet long (4.3 x 2.6 x 22.9 m). The induced currents to such a vehicle oriented perpendicular to the line in a maximum field of 3.9 kV/m (at 3.28-foot height) would be 3.5 mA (Reilly, 1979). For smaller trucks, the maximum induced currents for perpendicular orientation to the proposed line would be less than this value. (Larger special-permitted trucks, such as triple trailers, can be up to 105 feet in length. However, because they average the field over such a long distance, the maximum induced current to a 105-foot vehicle oriented perpendicular to the 500-kV line at a road crossing would be 3.3 mA.) Thus, the NESC 5-mA criterion would be met for perpendicular road crossings of the proposed line. These large vehicles are not anticipated to be off highways or oriented parallel to the proposed line. As discussed below, these are worst-case estimates of induced currents at road crossings; conditions for their occurrence are rare. The conductor clearance at each road crossing would be checked during the design stage of the line to ensure that the NESC 5-mA criterion is met. Furthermore, it is BPA policy to limit the maximum induced current from vehicles to 2 mA in commercial parking lots. Line clearances would also be increased in accordance with the NESC, such as over railroads and water areas suitable for sailboating.

Several factors tend to reduce the levels of induced current shocks from vehicles:

(1) Activities are distributed over the whole right-of-way, and only a small percentage of time is spent in areas where the field is at or close to the maximum value.

(2) At road crossings, vehicles are aligned perpendicular to the conductors, resulting in a substantial reduction in induced current.

(3) The conductor clearance at road crossings may not be at minimum values because of lower conductor temperatures and/or location of the road crossing away from midspan.

(4) The largest vehicles are permitted only on certain highways.

(5) Off-road vehicles are in contact with soil or vegetation, which reduces shock currents substantially.

Induced voltages occur on objects, such as vehicles, in an electric field where there is an inadequate electrical ground. If the voltage is sufficiently high, then a spark discharge shock can occur as contact is made with the object. Such shocks are similar to "carpet" shocks that occur, for example, when a person touches a doorknob after walking across a carpet on a dry day. The number and severity of spark discharge shocks depend on electric-field strength. Based on the low frequency of complaints reported by Glasgow and Carstensen (1981) for 500-kV ac transmission lines (one complaint per year for each 1,500 mi. or 2400 km of 500-kV line), nuisance shocks, which are primarily spark discharges, do not appear to be a serious impediment to normal activities under 500-kV lines.

In high electric fields, it is theoretically possible for a spark discharge from the induced voltage on a large vehicle to ignite gasoline vapor during refueling. The probability for exactly the right conditions to occur for ignition is extremely remote. The additional clearance of conductors provided at road crossings reduces the electric field in areas where vehicles are prevalent and reduces the chances for such events. Vehicles should not be refueled under the proposed line unless specific precautions are taken to ground the vehicle and the fueling source.

Under certain conditions, the electric field can be perceived through hair movement on an upraised hand or arm of a person standing on the ground under high-voltage transmission lines. The median field for perception in this manner was 7 kV/m for 136 persons; only about 12 percent could perceive fields of 2 kV/m or less (Deno and Zaffanella, 1982). In areas under the conductors at midspan, the fields at ground level would exceed the levels where field perception normally occurs. In these instances, field perception could occur on the right-of-way of the proposed line. It is unlikely that the field would be perceived beyond the edge of the right-of-way. Where vegetation provides shielding, the field would not be perceived.

Conductive shielding reduces both the electric field and induced effects such as shocks. Persons inside a vehicle cab or canopy are shielded from the electric field. Similarly, a row of trees or a lower-voltage distribution line reduces the field on the ground in the vicinity. Metal pipes, wiring, and other conductors in a residence or building shield the interior from the transmission-line electric field.

Thus, potential impacts of electric fields can be mitigated through grounding policies, adherence to the NESC, and increased clearances above the minimums specified by the NESC. Worst-case levels are used for safety analyses but, in practice, induced currents and voltages are reduced considerably by unintentional grounding. Shielding by conducting objects, such as vehicles and vegetation, also reduces the potential for electric-field effects.

5.2 Magnetic Field: Short-term Effects

Magnetic fields associated with transmission and distribution systems can induce voltage and current in long conducting objects that are parallel to the transmission line. As with electric-field induction, these induced voltages and currents are a potential source of shocks. A fence, irrigation pipe, pipeline, electrical distribution line, or telephone line forms a conducting loop when it is grounded at both ends. The earth forms the other portion of the loop. The magnetic field from a transmission line can induce a current to flow in such a loop if it is oriented parallel to the line. If only one end of the fence is grounded, then an induced voltage appears across the open end of the loop. The possibility for a shock exists if a person closes the loop at the open end by contacting both the ground and the conductor. The magnitude of this potential shock depends on the following factors: the magnitude of the field; the length of the object (the longer the object, the larger the induced voltage); the orientation of the object with respect to the transmission line (parallel as opposed to perpendicular, where no induction would occur); and the amount of electrical resistance in the loop (high resistance limits the current flow).

Magnetically induced currents from power lines have been investigated for many years; calculation methods and mitigating measures are available. A comprehensive study of gas pipelines near transmission lines developed prediction methods and mitigation techniques specifically for induced voltages on pipelines (Dabkowski and Taflove, 1979; Taflove and Dabkowski, 1979). Similar techniques and procedures are available for irrigation pipes and fences. Grounding policies employed by utilities for long fences reduce the potential magnitude of induced voltage.

The magnitude of the coupling with both pipes and fences is very dependent on the electrical unbalance (unequal currents) among the three phases of the line. Thus, a distribution line where a phase outage may go unnoticed for long periods of time can represent a larger source of induced currents than a transmission line where the loads are well-balanced (Jaffa and Stewart, 1981).

Knowledge of the phenomenon, grounding practices, and the availability of mitigation measures mean that magnetic-induction effects from the proposed 500-kV transmission line will be minimal.

Magnetic fields from transmission and distribution facilities can interfere with certain electronic equipment. Magnetic fields can cause distortion of the image on VDTs and computer monitors. The threshold field for interference depends on the type and size of monitor and the frequency of the field. Interference has been observed for certain monitors at fields at or below 10 mG (Baishiki et al., 1990; Banfai et al., 2000). Generally, the problem arises when computer monitors are in use near electrical distribution facilities in large office buildings. Fields from the proposed line would fall below this level at approximately 185 ft. (56.4 m) from the centerline.

Interference from magnetic fields can be eliminated by shielding the affected monitor or moving it to an area with lower fields. Similar mitigation methods could be applied to other sensitive electronics, if necessary. Interference from 60-Hz fields with computers and control circuits in vehicles and other equipment is not anticipated at the field levels found under and near the proposed 500-kV transmission line.

6.0 Regulations

Regulations that apply to transmission-line electric and magnetic fields fall into two categories. Safety standards or codes are intended to limit or eliminate electric shocks that could seriously injure or kill persons. Field limits or guidelines are intended to limit electric- and magnetic-field exposures that can cause nuisance shocks or might cause health effects. In no case has a limit or standard been established because of a known or demonstrated health effect.

The proposed line would be designed to meet the NESC (IEEE, 1990), which specifies how far transmission-line conductors must be from the ground and other objects. The clearances specified in the code provide safe distances that prevent harmful shocks to workers and the public. In addition, people who live and work near transmission lines must be aware of safety precautions to avoid electrical (which is not necessarily physical) contact with the conductors. For example, farmers should not up-end irrigation pipes under a transmission or other electrical line. In addition, as a matter of safety, the NESC specifies that electric-field-induced currents from transmission lines must be below the 5 mA ("let go") threshold deemed a lower limit for primary shock. BPA publishes and distributes a brochure that describes safe practices to protect against shock hazards around power lines (USDOE, 1995).

Field limits or guidelines have been adopted in several states and countries and by national and international organizations. Electric-field limits have generally been based on minimizing nuisance shocks or field perception. The intent of magnetic-field limits has been to limit exposures to existing levels, given the uncertainty of their potential for health effects.

There are currently no national standards in the United States for 60-Hz electric and magnetic fields. Several states have been active in establishing mandatory or suggested limits on 60-Hz electric and (in two cases) magnetic fields. Six states have specific electric-field limits that apply to transmission lines: Florida, Minnesota, Montana, New Jersey, New York, and Oregon. These regulations are summarized in Table 5, adapted from TDHS Report (1989). Florida and New York have established regulations for magnetic fields. The state of Washington does not have limits for either electric or magnetic fields from transmission lines.

Electric-field limits for the states have been given in terms of maximum field or edge-of-right-of-way field, or both. Except for Florida, regulations have not explicitly stated the operating conditions under which the limits apply. The Florida regulation, adopted after extensive public hearings and controversy, states: "Although there is no conclusive evidence that there is any danger or hazard to public health at levels of existing 60-hertz electric and magnetic fields found in Florida, there is evidence of a potential for adverse health effects on the public. Further research is needed to determine if there are effects and the exposure levels at which effects may occur" (Florida Department of Environmental Regulation, 1989: Chapter 17-274:2). The Florida electric-field strength standard is based on 1) the avoidance of perception of the field at the edge or on the right-of-way, and 2) the levels near existing facilities. The electric-field strength limit in Florida has been set at 2 kV/m at the edge of the right-of-way and 8 kV/m on the right-of-way for 230-kV or smaller lines. For 500-kV lines, the electric field shall not exceed 10 kV/m on the right-of-way and 2 kV/m at the edge.

The Florida magnetic-field limit at the edge of the right-of-way is 150 mG for lines of 230 kV or less, and 200 mG for 500-kV lines. There is no stated limit on the right-of-way.

The Minnesota 8-kV/m maximum field limit is applied on a case-by-case basis by the Minnesota Environmental Quality Board (MEQB), which has jurisdiction over lines of nominal voltage 200 kV and higher. The limit is included in Construction Permits granted by the MEQB rather than in a formal rule (e.g., MEQB, 1977). Minnesota does not have an edge-of-right-of-way field limit.

The Montana Board of Natural Resources and Conservation (BNRC) imposed a 1 kV/m electric-field limit at the edge of the right-of-way in residential and subdivided areas for the BPA Garrison-Spokane 500-kV Transmission Project (BNRC, 1983). The administrative rules incorporating this requirement were adopted in 1984 (Jamison, 1986). These rules apply to lines designed for operation at 69 kV and higher, as the BNRC has routing authority over them. (An affected landowner may waive the 1 kV/m requirement.) At road crossings, a 7-kV/m limit must be observed. The 1-kV/m electric-field limit was adopted because of the degree of protection and assurance to the public it provided and because of the small amount of additional right-of-way required (Jamison, 1986). Although Montana does not have a magnetic-field limit, the imposition of the 1-kV/m electric-field limit ensures that edge-of-right-of-way magnetic fields will be less than 50 mG (Jamison, 1986).

In New Jersey, the Department of Environmental Protection (NJDEP), Bureau of Radiation Protection, established interim guidelines for maximum field levels at the edge of the right-of-way (NJDEP, 1981). Their 3-kV/m limit is in the form of a resolution and is not enforced, but serves rather as a guideline for evaluating complaints.

The New York edge-of-right-of-way electric-field limit resulted from the extensive public hearings on 765-kV lines before the New York Public Service Commission (NYPSC) from 1975 to 1977. The opinions issued by the NYPSC in this case required that the interim edge-of-right-of-way electric-field limit be equivalent to that for 345-kV lines (NYPSC, 1978b; 1978a). This resulted in an edge-of-right-of-way limit of approximately 1.6 kV/m. This limit was explicitly implemented by specification of a 350-ft. (107-m) right-of-way width for 765-kV lines. In addition, electric fields on public roads, private roads, and other terrain were limited to 7, 11, and 11.8 kV/m, respectively. These values were intended to limit the induced current to 4.5 mA for the largest anticipated vehicle. The NYPSC also required that the utilities involved fund additional research in the area of biological effects of EMF. The final report of the New York State Scientific Advisory Program was issued in 1987 (Ahlbom et al., 1987). New York adopted an edge-of-right-of-way magnetic-field standard of 200 mG in August 1990 (TDHS Report, 1990).

Oregon's formal rule in its transmission line siting procedures specifically addresses field limits. The Oregon limit of 9 kV/m for electric fields is applied to areas accessible to the public (Oregon, 1980). The Oregon rule also addresses grounding practices, audible noise, and radio interference.

Government agencies and utilities operating transmission systems have established design criteria that include EMF levels. BPA has maximum allowable electric fields of 9 and 5 kV/m on and at the edge of the right-of-way, respectively (USDOE, 1996). BPA also has maximum-allowable electric-field strengths of 5 kV/m, 3.5 kV/m, and 2.5 kV/m for road crossings, shopping center parking lots, and commercial/industrial parking lots, respectively. These levels are based on limiting the maximum short-circuit currents from anticipated vehicles to less than 1 mA in shopping center lots and to less than 2 mA in commercial parking lots.

Electric-field limits for overhead power lines have also been established in other countries (Maddock, 1992). Limits for magnetic fields from overhead power lines have not been explicitly established anywhere except in Florida and New York. However, general guidelines and limits on EMF have been established for occupational and public exposure in several countries and by national and international organizations.

The American Conference of Governmental Industrial Hygienists (ACGIH) sets guidelines (Threshold Limit Values or TLV) for occupational exposures to environmental agents (ACGIH, 2000). In general, a TLV represents the level below which it is believed that nearly all workers may be exposed repeatedly without adverse health effects. For EMF, the TLVs represent ceiling levels. For 60-Hz electric fields, occupational exposures should not exceed the TLV of 25 kV/m. However, the ACGIH also recognizes the potential for startle reactions from spark discharges and short-circuit currents in fields greater than 5-7 kV/m, and recommends implementing grounding practices. They recommend the use of conductive clothing for work in fields exceeding 15 kV/m. The TLV for occupational exposure to 60-Hz magnetic fields is a ceiling level of 10 G (10,000 mG) (ACGIH, 2000).

Electric and magnetic fields from various sources (including automobile ignitions, appliances and, possibly, transmission lines) can interfere with implanted cardiac pacemakers. In light of this potential problem, manufacturers design devices to be immune from such interference. However, research has shown that these efforts have not been completely successful and that a few models of pacemakers could be affected by 60-Hz fields from transmission lines. There were also numerous models of pacemakers that were not affected by fields even larger than those found under transmission lines. Because of the known potential for interference with pacemakers by 60-Hz fields, field limits for pacemaker wearers have been established by the ACGIH. They recommend that wearers of pacemakers and similar medical-assist devices limit their exposure to electric fields of 1 kV/m or less and to magnetic fields to 1 G (1,000 mG) or less (ACGIH, 2000).

The International Committee on Non-ionizing Radiation Protection (ICNIRP), working in cooperation with the World Health Organization (WHO) has developed guidelines for occupational and public exposures to EMF (ICNIRP, 1998). For occupational exposures at 60 Hz, the recommended limits to exposure are 8.3 kV/m for electric fields and 4.2 G (4,200 mG) for magnetic fields. The electric-field level can be exceeded, provided precautions are taken to prevent spark discharge and induced current shocks. For the general public, the ICNIRP guidelines recommend exposure limits of 4.2 kV/m for electric fields and 0.83 G (830 mG) for magnetic fields (ICNIRP, 1998).

ICNIRP has also established guidelines for contact currents, which could occur when a grounded person contacts an ungrounded object in an electric field. The guideline levels are 1.0 mA for occupational exposure and 0.5 mA for public exposure.

The electric fields from the proposed 500-kV line would meet the ACGIH standards, provided wearers of pacemakers and similar medical-assist devices are discouraged from unshielded right-of-way use. (A passenger in an automobile under the line would be shielded from the electric field.) The electric fields in limited areas on the right-of-way would exceed the ICNIRP guideline for public exposure. The magnetic fields from the proposed line would be below the ACGIH and IRPA/INIRC limits. The electric fields present on the right-of-way could induce currents in ungrounded vehicles that exceeded the ICNIRP level of 0.5 mA.

The estimated peak electric fields on the right-of-way of the proposed transmission line would meet limits set in Florida, New York and Oregon, but not those of Minnesota and Montana (see Table 5). The BPA maximum allowable electric field limit would be met for all configurations of the proposed line. The edge of right-of-way electric fields from the proposed line would be below limits set in Florida and New Jersey, but above those in Montana and New York.

The magnetic field at the edge of the right-of-way from the proposed line would be below the regulatory levels of states where such regulations exist.

7.0 Audible Noise

7.1 Basic Concepts

Audible noise (AN), as defined here, represents an unwanted sound, as from a transmission line, transformer, airport, or vehicle traffic. Sound is a pressure wave caused by a sound source vibrating or displacing air. The ear converts the pressure fluctuations into auditory sensations. AN from a source is superimposed on the background or ambient noise that is present before the source is introduced.

The amplitude of a sound wave is the incremental pressure resulting from sound above atmospheric pressure. The sound-pressure level is the fundamental measure of AN; it is generally measured on a logarithmic scale with respect to a reference pressure. The sound-pressure level (SPL) in decibels (dB) is given by:

$$SPL = 20 \log (P/P_o) dB$$

where P is the effective rms (root-mean-square) sound pressure, P_o is the reference pressure, and the logarithm (log) is to the base 10. The reference pressure for measurements concerned with hearing is usually taken as 20 micropascals (Pa), which is the approximate threshold of hearing for the human ear. A logarithmic scale is used to encompass the wide range of sound levels present in the environment. The range of human hearing is from 0 dB up to about 140 dB, a ratio of 10 million in pressure (EPA, 1978).

Logarithmic scales, such as the decibel scale, are not directly additive: to combine decibel levels, the dB values must be converted back to their respective equivalent pressure values, the total rms pressure level found, and the dB value of the total recalculated. For example, adding two sounds of equal level on the dB scale results in a 3 dB increase in sound level. Such an increase in sound pressure level of 3 dB, which corresponds to a doubling of the energy in the sound wave, is barely discernible by the human ear. It requires an increase of about 10 dB in SPL to produce a subjective doubling of sound level for humans. The upper range of hearing for humans (140 dB) corresponds to a sharply painful response (EPA, 1978).

Humans respond to sounds in the frequency range of 16 to 20,000 Hz. The human response depends on frequency, with the most sensitive range roughly between 2000 and 4000 Hz. The frequency-dependent sensitivity is reflected in various weighting scales for measuring audible noise. The A-weighted scale weights the various frequency components of a noise in approximately the same way that the human ear responds. This scale is generally used to measure and describe levels of environmental sounds such as those from vehicles or occupational sources. The A-weighted scale is also used to characterize transmission-line noise. Sound levels measured on the A-scale are expressed in units of dB(A) or dBA.

AN levels and, in particular, corona-generated audible noise (see below) vary in time. In order to account for fluctuating sound levels, statistical descriptors have been developed for environmental noise. Exceedence levels (L levels) refer to the A-weighted sound level that is exceeded for a specified percentage of the time. Thus, the L_5 level refers to the noise level that is exceeded only 5 percent of the time. L_{50} refers to the sound level exceeded 50 percent of the time. Sound-level measurements and predictions for transmission lines are often expressed in terms of exceedence levels, with the L_5 level representing the maximum level and the L_{50} level representing a median level.

Table 6 shows AN levels from various common sources. Clearly, there is wide variation. Noise exposure depends on how much time an individual spends in different locations. Outdoor noise generally does not contribute to indoor levels (EPA, 1974). Activities in a building or residence generally dominate interior AN levels. The amount of sound attenuation (reduction) provided by buildings is given in Table 7. Assuming that residences along the line route fall in the "warm climate, windows open" category, the typical sound attenuation provided by a house is about 12 dBA.

The BPA design criterion for corona-generated audible noise (L_{50}, foul weather) is 50 ±2 dBA at the edge of the right-of-way (Perry, 1982). The Washington Administrative Code provides noise limitations by class of property, residential, commercial or industrial (Washington State, 1975). Transmission lines are classified as industrial and may cause a maximum permissible noise level of 60 dBA to intrude into residential property. During nighttime hours (10:00 pm to 7:00 am), the maximum permissible limit for noise from industrial to residential areas is reduced to 50 dBA. This latter level applies to transmission lines that operate continuously. The state of Washington Department of Ecology accepts the 50 dBA level at the edge of the right-of-way for transmission lines, but encouraged BPA to design lines with lower audible noise levels (WDOE, 1981).

The EPA has established a guideline of 55 dBA for the annual average day-night level (L_{dn}) in outdoor areas (EPA, 1978). In computing this value, a 10 dB correction (penalty) is added to night-time noise between the hours of 10 pm and 7 am.

7.2 Transmission-line Audible Noise

Corona is the partial electrical breakdown of the insulating properties of air around the conductors of a transmission line. In a small volume near the surface of the conductors, energy and heat are dissipated. Part of this energy is in the form of small local pressure changes that result in audible noise. Corona-generated audible noise can be characterized as a hissing, crackling sound that, under certain conditions, is accompanied by a 120-Hz hum.

Corona-generated audible noise is of concern primarily for contemporary lines operating at voltages of 345 kV and higher during foul weather. The conductors of high-voltage transmission lines are designed to be corona-free under ideal conditions. However, protrusions on the conductor surface—particularly water droplets on or dripping off the conductors—cause electric fields near the conductor surface to exceed corona onset levels, and corona occurs. Therefore, audible noise from transmission lines is generally a foul-weather (wet-conductor) phenomenon. Wet conductors can occur during periods of rain, fog, snow, or icing. Based on meteorologic records near the route of the proposed transmission line, such conditions are expected to occur less than 7 percent of the time during the year. For a few months after line construction, residual grease or oil on the conductors can cause water to bead up on the surface. This results in more corona sources and slightly higher levels of audible noise and electromagnetic interference if the line is energized. However, the new conductors "age" in a few months, and the level of corona activity decreases to the predicted equilibrium value. During fair weather, insects and dust on the conductor can also serve as sources of corona. The proposed line has been designed with three subconductors per phase to yield acceptable corona levels.

7.3 Predicted Audible Noise Levels

The predicted levels of corona-generated audible noise for the proposed line operated at a voltage of 540 kV are given in Table 8 and plotted in Figure 4 for selected configurations. For comparison, Table 8 also gives the calculated levels for the existing parallel lines. Audible noise levels are calculated for average voltage and average conductor heights for fair- and foul-weather conditions. The calculated median level (L_{50}) during foul weather at the edge of the proposed Schultz - Wautoma right-of-way is about 50 dBA, which is comparable with levels at the edges of existing 500-kV lines in Washington and lower than the levels from the existing 500-kV lines in the corridor just east of Schultz substation.

For configurations with parallel 230-kV lines (Configurations D-1 to D-4), the AN level at the edge of the right-of-way adjacent to the proposed line would be 50 dBA. For the Configuration A-4, which entails replacement of an existing 500-kV line with the proposed line, the AN level at the edge of the right-of-way would decrease by about 8 dBA. The AN at the edge of the right-of-way of the realigned Sickler-Schultz 500-kV line would be 59 dBA. The proposed Schultz-Wautoma line would increase the level at the edge of the existing 230-kV lines by 8-to-12 dBA. This increase would be perceived as a doubling of the noise level.

During fair-weather conditions, which occur about 92 percent of the time, audible noise levels would be about 20 dBA lower (if corona were present). These lower levels could be masked by ambient noise on and off the right-of-way.

7.4 Discussion

The calculated foul-weather corona noise levels for the proposed line would be comparable to or less than those from existing 500-kV lines in Washington. During fair weather, noise from the conductors might be perceivable on the right-of-way, but beyond the right-of-way it will likely be masked or so low as not to be perceived.

Off the right-of-way, the levels of audible noise from the proposed line would be well below the 55 dBA level that can produce interference with speech outdoors. Since residential buildings provide significant sound attenuation (-12 dBA with windows open; -24 dBA with windows closed), the noise levels off the right-of-way would be well below the 45 dBA level required for interference with speech indoors. It is also highly unlikely that indoor noise levels from the line would exceed the 35 dBA level where sleep interference can occur (EPA, 1973; EPA, 1978). Since corona is a foul-weather phenomenon, people tend to be inside with windows possibly closed, providing additional attenuation when corona noise is present. In addition, ambient noise levels can be high during such periods (due to rain hitting foliage or buildings), and can mask corona noise.

The 50-dBA level at the edge of the right-of-way for the proposed line would meet Washington Administrative Code limits for transmission lines. Noise levels near the existing Vantage-Schultz and Sickler-Schultz 500-kV lines exceed the limit and presumably are allowed because of the ages of the lines.

The computed annual L_{dn} level for transmission lines operating in areas with about 7 percent foul weather is about $L_{dn} = L_{50} - 4$ dB (Bracken, 1987). Therefore, assuming such conditions in the Schultz - Hanford area, the estimated L_{dn} at the edge of the right-of-way would be approximately 46 dBA, which is below the EPA L_{dn} guideline of 55 dBA.

7.5 Conclusion

Along the proposed line route, there would be an increase in the perceived noise above ambient levels during foul weather at the edges of new right-of-way. Along those sections of the proposed route where new right-of-way parallels existing 230-kV right-of-way, increases in line noise levels during foul weather at the edge of the right-of-way adjacent to the existing lines would be perceived as a doubling of the noise level. Along new and existing corridors, the corona-generated noise during foul weather might be masked to some extent by naturally occurring sounds such as wind and rain on foliage. During fair weather, the noise off the right-of-way would probably not be detectable above ambient levels. The noise levels from the proposed line would be below levels identified as causing interference with speech or sleep. The audible noise from the transmission line would be below EPA guideline levels and would meet the BPA design criterion that complies with the Washington state noise regulations.

8.0 Electromagnetic Interference

8.1 Basic Concepts

Corona on transmission-line conductors can also generate electromagnetic noise in the frequency bands used for radio and television signals. The noise can cause radio and television interference (RI and TVI). In certain circumstances, corona-generated electromagnetic interference (EMI) can also affect communications systems and other sensitive receivers. Interference with electromagnetic signals by corona-generated noise is generally associated with lines operating at voltages of 345 kV or higher. This is especially true of interference with television signals. The three-conductor bundle design of the proposed 500-kV line is intended to mitigate corona generation and thus keep radio and television interference levels at acceptable levels.

Spark gaps on distribution lines and on low-voltage wood-pole transmission lines are a more common source of RI/TVI than is corona from high-voltage electrical systems. This gap-type interference is primarily a fair-weather phenomenon caused by loose hardware and wires. The proposed transmission line would be constructed with modern hardware that eliminates such problems and therefore minimizes gap noise. Consequently, this source of EMI is not anticipated for the proposed line.

No state has limits for either RI or TVI. In the United States, electromagnetic interference from power transmission systems is governed by the Federal Communications Commission (FCC) Rules and Regulations presently in existence (FCC, 1988). A power transmission system falls into the FCC category of "incidental radiation device," which is defined as "a device that radiates radio frequency energy during the course of its operation although the device is not intentionally designed to generate radio frequency energy." Such a device "shall be operated so that the radio frequency energy that is emitted does not cause harmful interference. In the event that harmful interference is caused, the operator of the device shall promptly take steps to eliminate the harmful interference." For purposes of these regulations, harmful interference is defined as: "any emission, radiation or induction which endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radio communication service operating in accordance with this chapter" (FCC, 1988: Vol II, part 15. 47CFR, Ch. 1).

Electric power companies have been able to work quite well under the present FCC rule because harmful interference can generally be eliminated. It has been estimated that more than 95 percent of power-line sources that cause interference are due to gap-type discharges. These can be found and completely eliminated, when required to prevent interference (USDOE, 1980). Complaints related to corona-generated interference occur infrequently. This is especially true with the advent of cable television and satellite television, which are not subject to corona-generated interference. Mitigation of corona-generated interference with conventional radio and television receivers can be accomplished in several ways, such as use of a directional antenna or relocation of an existing antenna (USDOE, 1977; USDOE, 1980; Loftness et al., 1981).

8.2 Radio Interference (RI)

Radio reception in the AM broadcast band (535 to 1605 kilohertz (kHz)) is most often affected by corona-generated EMI. FM radio reception is rarely affected. Generally, only residences very near to transmission lines can be affected by RI. The IEEE Radio Noise Design Guide identifies an acceptable limit of fair-weather RI as expressed in decibels above 1 microvolt per meter (dBµV/m) of about 40 dBμV/m at 100 ft. (30 m) from the outside conductor (IEEE Committee Report, 1971). As a general rule, average levels during foul weather (when the conductors are wet) are 16 to 22 dBμV/m higher than average fair-weather levels.

8.3 Predicted RI Levels

Table 9 gives the predicted fair- and foul-weather RI levels at 100 ft. (30 m) from the outside conductor for the proposed 500-kV line in the eight configurations. Median foul-weather levels would be about 17 dB higher than the fair-weather levels. The predicted L_{50} fair-weather level at the edge of the new right-of-way is 46 dBμV/m for 540-kV line operation; at 100 ft. (30 m) from the outside conductor, the level is 40 dBμV/m or less. Predicted fair-weather L_{50} levels are comparable with those for other existing 500-kV lines and lower than that from the existing 500-kV Sickler-Schultz line (47 dBμV/m at 100 ft. [30 m]). Predictions indicate that fair-weather RI will meet the IEEE 40 dBμV/m criterion at distances greater than about 100 ft. (30 m) from the outside conductor of the proposed line in all configurations.

8.4 Television Interference (TVI)

Corona-caused TVI occurs during foul weather and is generally of concern for transmission lines with voltages of 345 kV or above, and only for conventional receivers within about 600 ft. (183 m) of a line. As is the case for RI, gap sources on distribution and low-voltage transmission lines are the principal observed sources of TVI. The use of modern hardware and construction practices for the proposed line would minimize such sources.

8.5 Predicted TVI Levels

Table 10 shows TVI levels predicted at 100 ft. (30 m) from the outside conductor of the proposed line operating at 540 kV and from existing lines. At this distance, the foul-weather TVI level predicted for the proposed line is 26 dBμV/m or less. This is comparable with TVI levels from other existing BPA 500-kV lines, and lower than that from the existing Sickler-Schultz 500-kV line (33 dBμV/m at 100 ft. [30 m]).

There is a potential for interference with television signals at locations very near the proposed line in fringe reception areas. However, several factors reduce the likelihood of occurrence. Corona-generated TVI occurs only in foul weather; consequently, signals will not be interfered with most of the time, which is characterized by fair weather. Because television antennas are directional, the impact of TVI is related to the location and orientation of the antenna relative to the transmission line. If the antenna were pointed away from the line, then TVI from the line would affect reception much less than if the antenna were pointed towards the line. Since the level of TVI falls off with distance, the potential for interference becomes minimal at distances greater than several hundred feet from the centerline.

Other forms of TVI from transmission lines are signal reflection (ghosting) and signal blocking caused by the relative locations of the transmission structure and the receiving antenna with respect to the incoming television signal. Television systems that operate at higher frequencies, such as satellite receivers, are not affected by corona-generated TVI. Cable television systems are similarly unaffected.

Interference with television reception can be corrected by any of several approaches: improving the receiving antenna system; installing a remote antenna; installing an antenna for TV stations less vulnerable to interference; connecting to an existing cable system; or installing a translator (cf. USDOE, 1977). BPA has an active program to identify, investigate, and mitigate legitimate RI and TVI complaints. It is anticipated that any instances of TVI caused by the proposed line could be effectively mitigated.

8.6 Interference with Other Devices

Corona-generated interference can conceivably cause disruption on other communications bands such as the citizen's (CB) and mobile bands. However, mobile-radio communications are not susceptible to transmission-line interference because they are generally frequency modulated (FM). Similarly, cellular telephones operate at a frequency of about 900 MHz, which is above the frequency where corona-generated interference is prevalent. In the unlikely event that interference occurs with these or other communications, mitigation can be achieved with the same techniques used for television and AM radio interference.

8.7 Conclusion

Predicted EMI levels for the proposed 500-kV transmission line are comparable to those from existing 500-kV lines. If interference should occur, there are various methods for correcting it; BPA has a program to respond to legitimate complaints. Therefore, the anticipated impacts of corona-generated interference on radio, television, or other reception would be minimal.

9.0 Other Corona Effects

Corona is visible as a bluish glow or as bluish plumes. The proposed 500-kV line is designed to have lower corona levels than is present on the older 500-kV lines in the area. Therefore corona on the conductors would be less visible on this line than on others and would be observable only under the darkest conditions and probably only with the aid of binoculars. Without a period of adaptation for the eyes and without intentional looking for the corona, it probably would not be noticeable.

When corona is present, the air surrounding the conductors is ionized and many chemical reactions take place, producing small amounts of ozone and other oxidants. Ozone is approximately 90 percent of the oxidants, while the remaining 10 percent is composed principally of nitrogen oxides. The national primary ambient air quality standard for photochemical oxidants, of which ozone is the principal component, is 235 micrograms/cubic meter) or 120 parts per billion. The maximum incremental ozone levels at ground level produced by corona activity on the proposed transmission line during foul weather would be much less than 1 part per billion. This level is insignificant when compared with natural levels and fluctuations in natural levels.

10.0 Summary

Electric and magnetic fields from the proposed transmission line have been characterized using well-known techniques accepted within the scientific and engineering community. The expected electric-field levels from the proposed line at minimum design clearance would be comparable to those of other 500-kV lines in Washington and elsewhere. The expected magnetic-field levels from the proposed line would be comparable to or less than those from other 500-kV lines in Washington and elsewhere.

The peak electric field expected under the proposed line would be 8.9 kV/m; the maximum value at the edge of the right-of-way would be about 2.0 kV/m. Clearances at road crossings would be increased to reduce the peak electric-field value to 3.9 kV/m.

Under maximum current conditions, magnetic-field levels would be as follows:

- the maximum magnetic fields under the proposed line would be 244 mG;
- at the edge of the right-of-way nearest to the proposed 500-kV line, the magnetic field would be 55 to 66 mG, depending on the configuration.

The electric fields from the proposed line would meet regulatory limits for public exposure in some states, but could exceed the regulatory limits or guidelines for peak fields established in other states and by ICNIRP. The magnetic fields from the proposed line would be within the regulatory limits of the two states that have established them and within guidelines for public exposure established by ICNIRP. Washington does not have any electric- or magnetic-field regulatory limits or guidelines.

Short-term effects from transmission-line fields are well understood and can be mitigated. Nuisance shocks arising from electric-field induced currents and voltages could be perceivable on the right-of-way of the proposed line. It is common practice to ground permanent conducting objects during and after construction to mitigate against such occurrences.

Corona-generated audible noise from the line would be perceivable during foul weather. The levels would be comparable to those near existing 500-kV transmission lines in Washington, would be in compliance with noise regulations in Washington, and would be below levels specified in EPA guidelines.

Corona-generated electromagnetic interference from the proposed line would be comparable to or less than that from existing 500-kV lines in Washington. Radio interference levels would be below limits identified as acceptable. Television interference, a foul-weather phenomenon, is anticipated to be comparable to or less than that from existing 500-kV lines in Washington; if legitimate complaints arise, BPA has a mitigation program.

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Table 1: Physical and electrical characteristics of Schultz-Hanford Area Project configurations (4 pages).

	New Configurations			
Segment-Configuration	**A-1**	**A-2**	**A-3**	
Line Description	**Schultz-Hanford 500-kV Only**	**Sickler-Schultz 500-kV Only**	**Sickler-Schultz 500-kV**	**Rocky Reach-Maple Valley 345-kV**
Voltage, kV Maximum/Average[1]	550/540	550/540	550/540	362/358
Peak current, A Existing/Proposed[2]	— /1436	— /-1478	— /-1478	-459/-470
Electric phasing	BAC	BAC	BAC	ABC
Clearance, ft. minimum/Average[1]	33/47	33/47	33/47	31/45
Centerline distance-direction from Schultz – Hanford 500-kV Line, ft.	—	N/A	N/A	150-S[3]
Centerline distance to edge of ROW, ft.	75	75	75	75
Tower configuration	Delta	Delta	Delta	Flat
Phase spacing, ft.	40 H, 28.7 V	40H, 27.5V	40H, 27.5V	36H
Conductor: #/diameter, in.; spacing, in.	3/1.302; 17.04	2/1.602; 18	2/1.602; 18	1/1.602

1 Average voltage and average clearance used for corona calculations.
2 Minus sign indicates current flow in opposite direction to flow in parallel proposed Schultz – Hanford line.
3 Distance from centerline of realigned Sickler-Schultz 500-kV line.

Table 1, continued

	Existing Configurations						
Segment-Configuration	**A-4**						
Line Description	**Grand Coulee-Schultz 500-kV DC (DC)**		**Columbia-Ellensburg 115-kV**	**Covington-Columbia #3 & Olympia-Grand Coulee DC**		**Sickler-Schultz 500-kV**[4]	**Vantage-Schultz 500-kV**[3]
	#2	**#1**		**230-kV**	**287-kV**		
Voltage, kV Maximum/Average[1]	550/540	550/540	121/117	242/235	301/292	550/540	550/540
Peak current, A Existing/Proposed[2]	-1470/-1653	-1470/-1653	-477/-453	-316/-341	-494/-486	-1338/—	1355/738
Electric phasing	BAC	BCA	CBA	BCA	BAC	BAC	ABC
Clearance, ft. minimum/Average[1]	33/47	33/47	25/35	30/42	30/42	33/47	33/47
Centerline distance-direction from Schultz–Hanford 500-kV line, ft.	500-N		375-N	250-N		125-N	0[3]
Centerline distance to edge of ROW, ft.	62.5	—	—	—	—	—	75
Tower configuration	Vertical	Vertical	Flat	Vertical	Vertical	Delta	Flat
Phase spacing, ft.	36.5, 56.5, 36.5H; 36V	36.5, 56.5, 36.5H; 36V	12H	31, 47, 31H; 21V	31, 47, 31H; 21V	40H, 27.5V	49H
Conductor: #/Diameter, in. ; spacing, in.	3/1.602; 17.04	3/1.602; 17.04	1/1.108	1/1.382	1/1.382	2/1.602; 18	1/2.50

1 Average voltage and average clearance used for corona calculations.
2 Minus sign indicates current flow in opposite direction to flow in parallelproposed Schultz – Hanford line.
4 Proposed Schultz-Hanford/Wautoma 500-kV line will replace existing Vantage-Schultz 500-kV and existing Vantage-Schultz 500-kV will replace Sickler-Schultz 500-kV. Sickler-Schultz 500-kV will be realigned north of Schultz substation (Configurations A-2 and A-3).

Table 1, continued

	Existing Configurations				
Segment-Configuration	**D-1**	**D-2**			
Line Description	**Vantage-Midway 230-kV**	**N. Bonneville - Midway 230-kV**	**Midway-Moxee 115-kV**	**Midway-Grandview 115-kV**	**Big Eddy-Midway 230-kV**
Voltage, kV Maximum/Average[1]	242/235	242/235	121/117	121/117	242/235
Peak current, A Existing/Proposed[2]	609/593	537/518	153/154	308/293	779/730
Electric phasing	ABC	ABC	ABC	ABC	ABC
Clearance, ft. minimum/Average[1]	30/42	30/42	25/35	25/35	30/42
Centerline distance-direction from Schultz–Wautoma 500-kV line, ft.	125-E	375-E	287.5-E	237.5-E	137.5-E
Centerline distance to edge of ROW, ft.	50	187.5	—	—	62.5
Tower configuration	Flat	Flat	Flat	Flat	Flat
Phase spacing, ft.	27H	27H	12H	12H	27H
Conductor: #/Diameter, in.; spacing, in.	1/1.0	1/1.108	1/0.655	1/0.563	1/1.382

1 Average voltage and average clearance used for corona calculations.
2 Minus sign indicates current flow in opposite direction to flow in parallel proposed Schultz – Hanford line.

Table 1, continued:

	Existing Configurations			
Segment-Configuration	**D-3**			**D-4**
Line Description	**N. Bonneville - Midway 230-kV**	**Midway-Grandview 115-kV**	**Big Eddy-Midway 230-kV**	**Big Eddy-Midway 230-kV**
Voltage, kV Maximum/Average[1]	242/235	121/117	242/235	242/235
Peak current, A Existing/Proposed[2]	537/518	308/293	779/730	779/730
Electric Phasing	ABC	ABC	ABC	ABC
Clearance, ft. minimum/Average[1]	30/42	25/35	30/42	30/42
Centerline distance-direction from Schultz–Wautoma 500-kV line, ft.	325-E	237.5-E	137.5-E	137.5-E
Centerline distance to edge of ROW, ft.	187.5	—	62.5	62.5
Tower configuration	Flat	Flat	Flat	Flat
Phase spacing, ft.	27H	12H	27H	27H
Conductor: #/diameter, in. ; spacing, in.	1/1.108	1/0.563	1/1.382	1/1.382

1 Average voltage and average clearance used for corona calculations.
2 Minus sign indicates current flow in opposite direction to flow in parallel proposed Schultz – Hanford line.

Table 2: Possible segment configurations for Schultz - Hanford Area Project

Segment-Configuration	Description of other lines in corridor with Schultz–Hanford/Wautoma 500-kV line	Possible segments with same configuration	Miles
A-1	Schultz–Hanford/Wautoma 500-kV line only	A, B, C, E, F	22.4, 10.3, 30.6, 23.8, 31.9
A-2	Realigned Sickler-Schultz 500-kV only. (No Schultz-Hanford/Wautoma 500-kV)	A	1.0
A-3	Realigned Sickler-Schultz 500-kV Rocky Reach-Maple Valley 345-kV (No Schultz-Hanford/Wautoma 500-kV)	A	1.15
A-4	Grand Coulee-Schultz #2 and #1 DC 500-kV Columbia-Ellensburg 115-kV Covington-Columbia #3 230-kV/ Olympia-Grand Coulee 287-kV DC Vantage-Schultz 500-kV	A	1.88
D-1	Vantage-Midway 230-kV	D	19.4
D-2	N. Bonneville-Midway 230-kV Midway-Moxee 115-kV Midway-Grandview 115-kV Big Eddy-Midway 230-kV	D	4.51
D-3	N. Bonneville-Midway 230-kV Midway-Grandview 115-kV Big Eddy-Midway 230-kV	D	1.19
D-4	Big Eddy-Midway 230-kV	D	2.2

Table 3: Calculated electric fields for configurations of the proposed Schultz–Hanford/Wautoma 500-kV line operated at maximum voltage. Configurations are described in Tables 1 and 2. (6 pages)

a) Configuration A-1: Schultz – Hanford 500-kV line only

Configuration	Proposed A-1		Existing	
ROW width, ft.	150		—	
Line	Schultz–Hanford/Wautoma 500-kV		—	
Clearance	min.	avg.	—	—
Peak field, kV/m	8.9	4.9	—	—
Edge of ROW, kV/m	2.0	2.0	—	—

b) Configuration A-2: Realigned Sickler-Schultz - 500-kV line only

Configuration	Proposed A-2		Existing	
ROW width, ft. (m)	150 (46)		—	
Line	Sickler-Schultz 500-kV		—	
Clearance	min.	avg.	—	—
Peak field, kV/m	8.4	4.6	—	—
Edge of ROW, kV/m	1.8	1.8	—	—

c) Configuration A-3: Realigned Sickler-Schultz 500-kV and Rocky Reach-Maple Valley 345-kV lines

Configuration	Proposed A-3				Existing A-3	
ROW width, ft.	300				150	
Line	Sickler-Schultz 500-kV		Rocky Reach-Maple Valley 345-kV		Rocky Reach-Maple Valley 345-kV	
Clearance	min.	avg.	min.	avg.	min.	avg.
Peak field, kV/m	8.5	4.7	5.4	3.1	5.2	2.9
Edge of ROW, kV/m	1.9	1.9	2.1	1.9	2.0	1.8

Table 3, continued

d) Configuration A-4: Schultz-Hanford/Wautoma 500-kV line and six existing lines east of Schultz Substation

Configuration	**Proposed A-4**									
ROW width, ft.	637.5									
Line	Grand Coulee-Schultz DC 500-kV		Columbia-Ellensburg 115-kV		Covington-Columbia #3/ Olympia-Grand Coulee 230-/287-kV DC		Vantage-Schultz 500-kV		Schultz-Hanford/ Wautoma 500-kV	
Clearance	min	avg.	min	Avg.	min.	avg.	min	avg.	min	avg.
Peak field, kV/m	9.7	5.9	1.7	1.0	2.9/3.2	1.8/1.8	8.6	4.6	8.8	4.9
Edge of Row, kV/m	2.1	2.1	—	—	—	—	—	—	2.0	2.0

Configuration	**Existing A-4**									
ROW width, ft.	637.5									
Line	Grand Coulee-Schultz 500-kV DC		Columbia-Ellensburg 115-kV		Covington-Columbia #3/ Olympia-Grand Coulee 230-/287-kV DC		Sickler-Schultz 500-kV		Vantage-Schultz 500-kV	
Clearance	min	avg.	min	avg.	min	avg.	min.	Avg.	min	avg.
Peak field, kV/m	9.7	5.9	1.7	1.0	2.9/3.2	1.8/1.8	8.5	4.5	8.4	5.1
Edge of Row, kV/m	2.1	2.1	—	—	—	—	—	—	5.2	4.0

Table 3, continued

e) Configuration D-1: Schultz-Wautoma 500-kV and Vantage-Midway 230-kV lines

Configuration	**Proposed D-1**				**Existing D-1**	
ROW width, ft.	250				100	
Line	Vantage-Midway 230-kV		Schultz-Wautoma 500-kV		Vantage-Midway 230-kV	
Clearance	min.	avg.	min.	avg.	min.	avg.
Peak field, kV/m	3.3	2.0	8.9	5.0	3.1	1.8
Edge of ROW, kV/m	2.2	1.7	2.0	2.0	2.0	1.5

Table 3, continued

f) Configuration D-2: Schultz-Wautoma 500-kV and four existing parallel lines south of Midway Substation

Segment-Configuration	Proposed D-2									
ROW width, ft.	575									
Line	N. Bonneville-Midway 230-kV		Midway-Moxee 115-kV		Midway-Grandview 115-kV		Big Eddy-Midway 230-kV		Schultz-Wautoma 500-kV	
Clearance	min.	avg.	min.	avg.	min.	avg.	min.	avg.	min.	avg.
Peak field, kV/m	3.2	1.9	0.9	0.4	0.9	0.4	3.2	1.9	8.9	5.0
Edge of ROW, kV/m	0.1	0.1	—	—	—	—	—	—	2.0	2.0

Segment-Configuration	Existing D-2							
ROW width, ft.	487.5							
Line	N. Bonneville-Midway 230-kV		Midway-Moxee 115-kV		Midway-Grandview 115-kV		Big Eddy-Midway 230-kV	
Clearance	min.	avg.	min.	avg.	Min.	avg.	min.	avg.
Peak field, kV/m	3.2	1.9	0.8	0.4	1.0	0.4	3.3	1.9
Edge of ROW, kV/m	0.1	0.1	—	—	—	—	1.4	1.2

Table 3, continued

g) Configuration D-3: Schultz-Wautoma 500-kV and three existing parallel lines south of Midway Substation

Segment-Configuration	**Proposed D-3**							
ROW width, ft.	525							
Line Description	N. Bonneville-Midway 230-kV		Midway-Grandview 115-kV		Big Eddy-Midway 230-kV		Schultz-Wautoma 500-kV	
Clearance	min.	avg.	Min.	avg.	min.	avg.	min.	Avg.
Peak field, kV/m	3.2	1.9	0.9	0.4	3.2	1.8	8.9	5.0
Edge of ROW, kV/m	0.1	0.1	—	—	—	—	2.0	2.0

Segment-Configuration	**Existing D-3**					
ROW width, ft.	437.5					
Line Description	N. Bonneville-Midway 230-kV		Midway-Grandview 115-kV		Big Eddy-Midway 230-kV	
Clearance	min.	avg.	min.	avg.	min.	avg.
Peak field, kV/m	3.2	1.9	1.0	0.4	3.3	1.9
Edge of ROW, kV/m	0.1	0.1	—	—	1.4	1.2

Table 3, continued

h) Configuration D-4: Schultz-Wautoma 500-kV and Midway-Big Eddy 230-kV lines.

Segment-Configuration	**Proposed D-4**				**Existing D-4**	
ROW width, ft.	275				125	
Line	Midway-Big Eddy 230-kV		Schultz-Wautoma 500-kV		Midway-Big Eddy 230-kV	
Clearance	min.	avg.	min.	avg.	min.	avg.
Peak field, kV/m	3.4	2.0	8.9	4.9	3.2	1.9
Edge of ROW, kV/m	1.5	1.3	2.0	2.0	1.3	1.2

Table 4: Calculated magnetic fields for configurations of the proposed Schultz–Hanford/Wautoma 500-kV line operated at maximum current.
Configurations are described in Tables 1 and 2. (4 pages)

a) Configuration A-1: Schultz–Hanford 500-kV line only

Configuration	Proposed A-1		Existing	
ROW width, ft.	150		—	
Line	Schultz–Hanford/Wautoma 500-kV		—	
Clearance	Min.	avg.	—	—
Peak field, mG	244	137	—	—
Edge of ROW, mG	55	46	—	—

b) Configuration A-2: Realigned Sickler-Schultz - 500-kV line only

Configuration	Proposed A-2		Existing	
ROW width, ft.	150		—	
Line	Sickler-Schultz 500-kV		—	
Clearance	min.	avg.	—	—
Peak field, mG	262	145	—	—
Edge of ROW, mG	57	48	—	—

c) Configuration A-3: Realigned Sickler-Schultz 500-kV and Rocky Reach-Maple Valley 345-kV lines

Configuration	Proposed A-3				Existing A-3	
ROW width, ft.	300				150	
Line	Sickler-Schultz 500-kV		Rocky Reach-Maple Valley 345-kV		Rocky Reach-Maple Valley 345-kV	
Clearance	min.	avg.	min.	avg.	min.	avg.
Peak field, mG	257	141	111	69	101	62
Edge of ROW, mG	60	50	40	33	35	28

Table 4, continued

d) Configuration A-4: Schultz-Hanford/Wautoma 500-kV line and six existing lines east of Schultz Substation

Configuration	**Proposed A-4**									
ROW width, ft.	637.5									
Line	Grand Coulee-Schultz DC 500-kV		Columbia-Ellensburg 115-kV		Covington-Columbia #3/ Olympia-Grand Coulee 230-/287-kV DC		Vantage-Schultz 500-kV		Schultz-Hanford/ Wautoma 500-kV	
Clearance	min	avg.	min	avg.	min.	avg.	min	Avg.	min	avg.
Peak field, mG	233	150	112	87	68	42	122	69	239	134
Edge of Row, mG	138	109	—	—	—	—	—	—	60	51

Configuration	**Existing A-4**									
ROW width, ft.	637.5									
Line	Grand Coulee-Schultz 500-kV DC		Columbia-Ellensburg 115-kV		Covington-Columbia #3/ Olympia-Grand Coulee 230-/287-kV DC		Sickler-Schultz 500-kV		Vantage-Schultz 500-kV	
Clearance	min.	avg.	min	avg.	min	avg.	min.	avg.	Min.	avg.
Peak field, mG	206	132	108	85	90	69	253	190	302	203
Edge of Row, mG	121	94	—	—	—	—	—	—	158	119

Table 4, continued

e) Configuration D-1: Schultz-Wautoma 500-kV and Vantage-Midway 230-kV lines

Configuration	Proposed D-1				Existing D-1	
ROW width, ft.	250				100	
Line	Vantage-Midway 230-kV		Schultz-Wautoma 500-kV		Vantage-Midway 230-kV	
Clearance	min.	avg.	min.	avg.	min.	avg.
Peak field, mG	139	89	239	132	133	84
Edge of ROW, mG	72	55	59	49	67	49

Table 4, continued

f) Configuration D-2: Schultz-Wautoma 500-kV and four existing parallel lines south of Midway Substation

Segment-Configuration	**Proposed D-2**									
ROW width, ft.	637.5									
Line	N. Bonneville-Midway 230-kV		Midway-Moxee 115-kV		Midway-Grandview 115-kV		Big Eddy-Midway 230-kV		Schultz-Wautoma 500-kV	
Clearance	min.	avg.	min.	avg.	min.	avg.	min.	avg.	min.	avg.
Peak field, mG	109	66	37	20	40	20	158	98	237	130
Edge of ROW, mG	7	7	—	—	—	—	—	—	60	50

Segment-Configuration	**Existing D-2**							
ROW width, ft.	487.5							
Line	N. Bonneville-Midway 230-kV		Midway-Moxee 115-kV		Midway-Grandview 115-kV		Big Eddy-Midway 230-kV	
Clearance	min.	avg.	min.	Avg.	min.	avg.	Min.	avg.
Peak field, mG	112	68	38	21	40	18	165	101
Edge of ROW, mG	7	7	—	—	—	—	62	50

Table 4, continued

g) Configuration D-3: Schultz-Wautoma 500-kV and three existing parallel lines south of Midway Substation

Segment-Configuration	**Proposed D-3**							
ROW width, ft.	587.5							
Line Description	N. Bonneville-Midway 230-kV		Midway-Grandview 115-kV		Big Eddy-Midway 230-kV		Schultz-Wautoma 500-kV	
Clearance	min.	avg.	min.	avg.	min.	avg.	Min.	avg.
Peak field, mG	108	66	58	35	157	97	237	130
Edge of ROW, mG	7	7	—	—	—	—	60	50

Segment-Configuration	**Existing D-3**					
ROW width, ft.	437.5					
Line Description	N. Bonneville-Midway 230-kV		Midway-Grandview 115-kV		Big Eddy-Midway 230-kV	
Clearance	min.	avg.	Min.	avg.	min.	avg.
Peak field, mG	111	67	58	33	165	101
Edge of ROW, mG	7	7	—	—	62	50

Table 4, continued

h) Configuration D-4: Schultz-Wautoma 500-kV and Midway-Big Eddy 230-kV lines.

Segment-Configuration	**Proposed D-4**				**Existing D-4**	
ROW width, ft.	275				125	
Line	Midway-Big Eddy 230-kV		Schultz-Wautoma 500-kV		Midway-Big Eddy 230-kV	
Clearance	min.	avg.	min.	avg.	min.	avg.
Peak field, mG	167	106	238	131	170	107
Edge of ROW, mG	60	50	59	49	59	47

**Table 5:	States with transmission-line field limits**

STATE AGENCY	WITHIN RIGHT-OF-WAY	AT EDGE OF RIGHT-OF-WAY	COMMENTS
a. 60-Hz ELECTRIC FIELD LIMIT, kV/m			
Florida Department of Environmental Regulation	8 (230 kV) 10 (500 kV)	2	Codified regulation, adopted after a public rulemaking hearing in 1989.
Minnesota Environmental Quality Board	8	—	12-kV/m limit on the HVDC nominal electric field.
Montana Board of Natural Resources and Conservation	7[1]	1[2]	Codified regulation, adopted after a public rulemaking hearing in 1984.
New Jersey Department of Environmental Protection	—	3	Used only as a guideline for evaluating complaints.
New York State Public Service Commission	11.8 (7,11)[1]	1.6	Explicitly implemented in terms of a specified right-of-way width.
Oregon Facility Siting Council	9	—	Codified regulation, adopted after a public rulemaking hearing in 1980.
b. 60-Hz MAGNETIC FIELD LIMIT, mG			
Florida Department of Environmental Regulation	—	150 (230 kV) 200 (500 kV)	Codified regulations, adopted after a public rulemaking hearing in 1989.
New York State Public Service Commission	—	200	Adopted August 29, 1990.

1	At road crossings
2	Landowner may waive limit

Sources: TDHS Report, 1989;TDHS Report, 1990

Table 6: Common noise levels

Sound Level, dBA	Noise Source or Effect
128	Threshold of pain
108	Rock-and-roll band
80	Truck at 50 ft.
70	Gas lawnmower at 100 ft.
60	Normal conversation indoors
50	Moderate rainfall on foliage
50	Edge of proposed 500-kV right-of-way during rain
40	Refrigerator
25	Bedroom at night
0	Hearing threshold

Adapted from: USDOE, 1996.

Table 7: Typical sound attenuation (in decibels) provided by buildings

	Windows opened	Windows closed
Warm climate	12	24
Cold climate	17	24

Source: EPA, 1978.

Table 8: Predicted foul-weather audible noise (AN) levels at edge of right-of-way (ROW) for proposed Schultz–Hanford/Wautoma 500-kV line. AN levels expressed in decibels on the A-weighted scale (dBA). L_{50} and L_5 denote the levels exceeded 50 and 5 percent of the time, respectively. For the parallel-line configurations[1], the AN level at the edge of the proposed Schultz-Hanford Area Project ROW is given first.

	Foul-weather AN					
	Proposed			Existing		
Configuration[1]	**ROW ft. (m)**	**L_{50}, dBA**	**L_5, dBA**	**ROW ft. (m)**	**L_{50}, dBA**	**L_5, dBA**
A-1	150 (46)	50	54	—	—	—
A-2	150 (46)	59	63	—	—	—
A-3	300 (91)	59, 57	63, 61	150 (46)	54	57
A-4	637.5 (194)	57, 54	60, 57	637.5 (194)	65, 57	69, 61
D-1	250 (76)	50, 48	53, 52	100 (30)	44	47
D-2	637.5 (194)	50, 42	53, 46	487.5 (149)	39, 37	42, 41
D-3	587.5 (179)	50, 42	53, 46	437.5 (133)	39, 37	43, 41
D-4	275 (84)	50, 46	53, 49	125 (38)	37	40

1 Configurations are described in Tables 1 and 2.

Table 9: Predicted fair-weather radio interference (RI) levels at 100 feet (30.5 m) from the outside conductor of the proposed Schultz–Hanford/Wautoma 500-kV line. RI levels given in decibels above 1 microvolt/meter (dBμV/m) at 1.0 MHz. L_{50} denotes level exceeded 50 percent of the time. For the parallel-line configurations the RI level on the side of the proposed Schultz-Hanford Area ROW is given first.

	Fair-weather RI	
	Proposed	Existing
Configuration[1]	L_{50}, dBμV/m	L_{50}, dBμV/m
A-1	40	—
A-2	47	—
A-3	47, 39	39
A-4	40, 38	47, 38
D-1	39, 31	31
D-2	39, 28	22, 28
D-3	39, 28	22, 28
D-4	39, 30	22

1 Configurations are described in Tables 1 and 2.

Table 10: Predicted maximum foul-weather television interference (TVI) levels predicted at 100 feet (30.5 m) from the outside conductor of the proposed Schultz–Hanford/Wautoma 500-kV line. TVI levels given in decibels above 1 microvolt/meter (dBμV/m) at 75 MHz. For the parallel-line configurations, the TVI level on the side of the proposed Schultz-Hanford Area ROW is given first.

	Foul-weather TVI	
	Proposed	**Existing**
Configuration[1]	**Maximum (foul), dBμV/m**	**Maximum (foul), dBμV/m**
A-1	26	-
A-2	33	-
A-3	33, 26	26
A-4	26, 19	33, 19
D-1	25, 17	18
D-2	25, 15	9, 15
D-3	25, 15	9, 15
D-4	25, 11	9

1 Configurations are described in detail in Tables 1 and 2.

Figure 1: Configurations for proposed Schultz-Hanford Area Project 500-kV line: a) Proposed line with no parallel lines (Configuration A-1); b) Realigned Sickler-Schultz 500-kV with no parallel lines (Configuration A-2); c) Realigned Sickler-Schultz 500-kV line with parallel 345-kV line (Configuration A-3); d) Schultz-Hanford/Wautoma 500-kV line with six parallel lines east of Schultz Substation(Configuration A-4); e) Proposed Schultz – Wautoma 500-kV line with parallel Vantage – Midway 230-kV line (Configuration D-1); f) Proposed Schultz-Wautoma 500-kV line with four parallel existing lines south of Midway Substation (Configuration D-2); g) Proposed Schultz-Wautoma 500-kV line with three parallel existing lines south of Midway Substation (Configuration D-3); and h) Proposed Schultz-Wautoma 500-kV line with parallel Midway-Big Eddy 230-kV line (Configuration D-4). (8 pages)

a) Proposed line with no parallel lines (Configuration A-1) (not to scale)

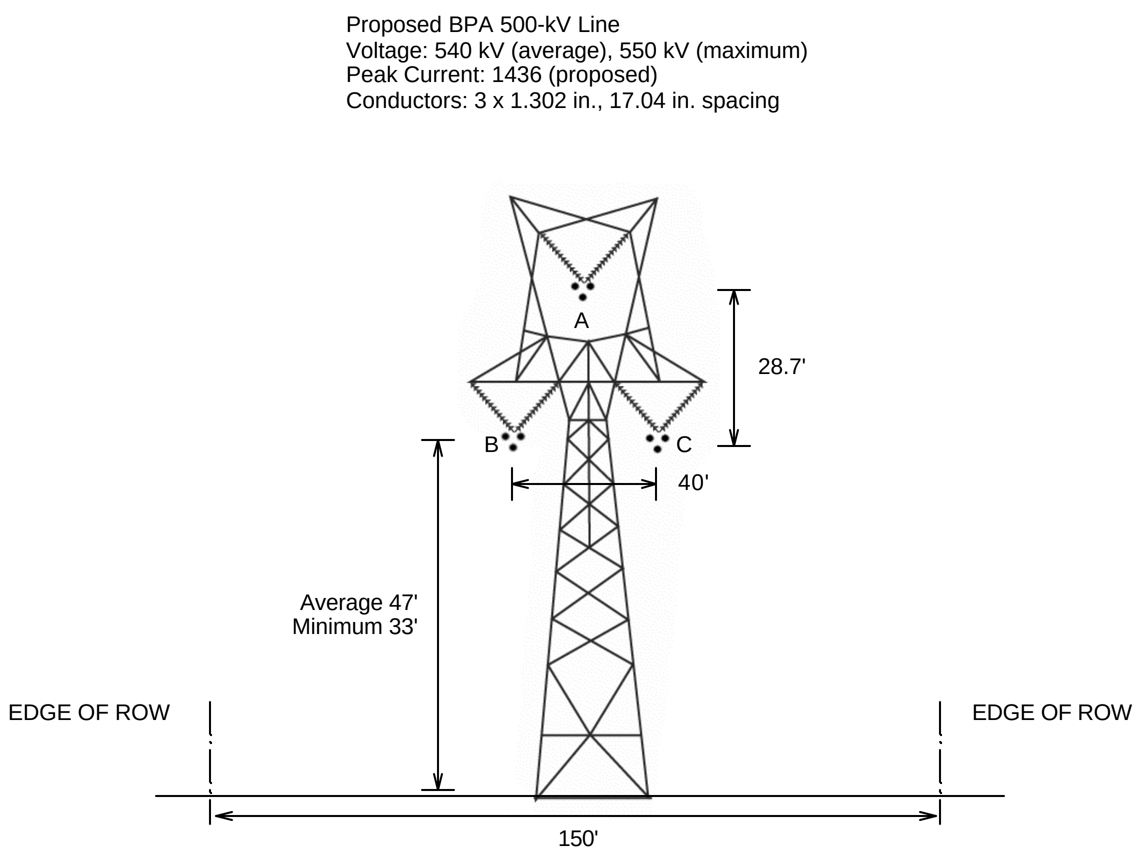


Figure 1, continued

b) Realigned Sickler-Schultz 500-kV line with no parallel lines (Configuration A-2) (not to scale)

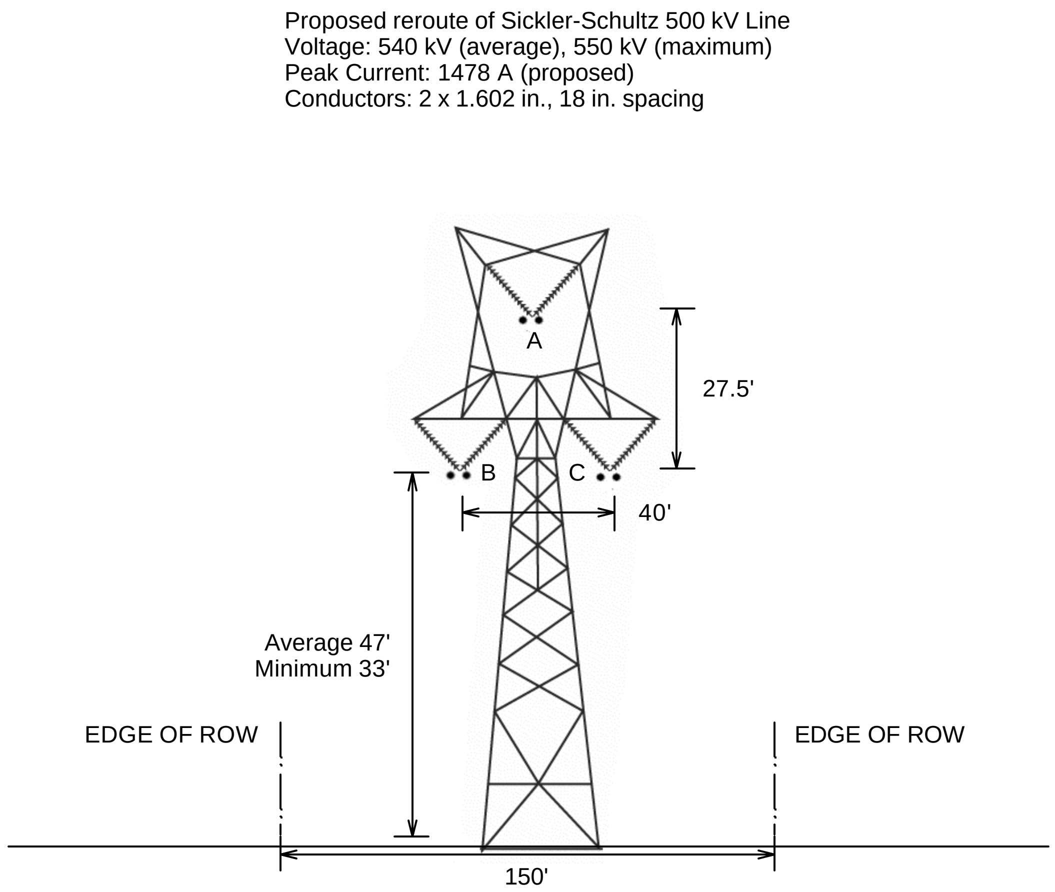


Figure 1, continued

c) Realigned Sickler-Schultz 500-kV line with parallel Rocky Reach-Maple Valley 345-kV line (Configuration A-3) (not to scale)

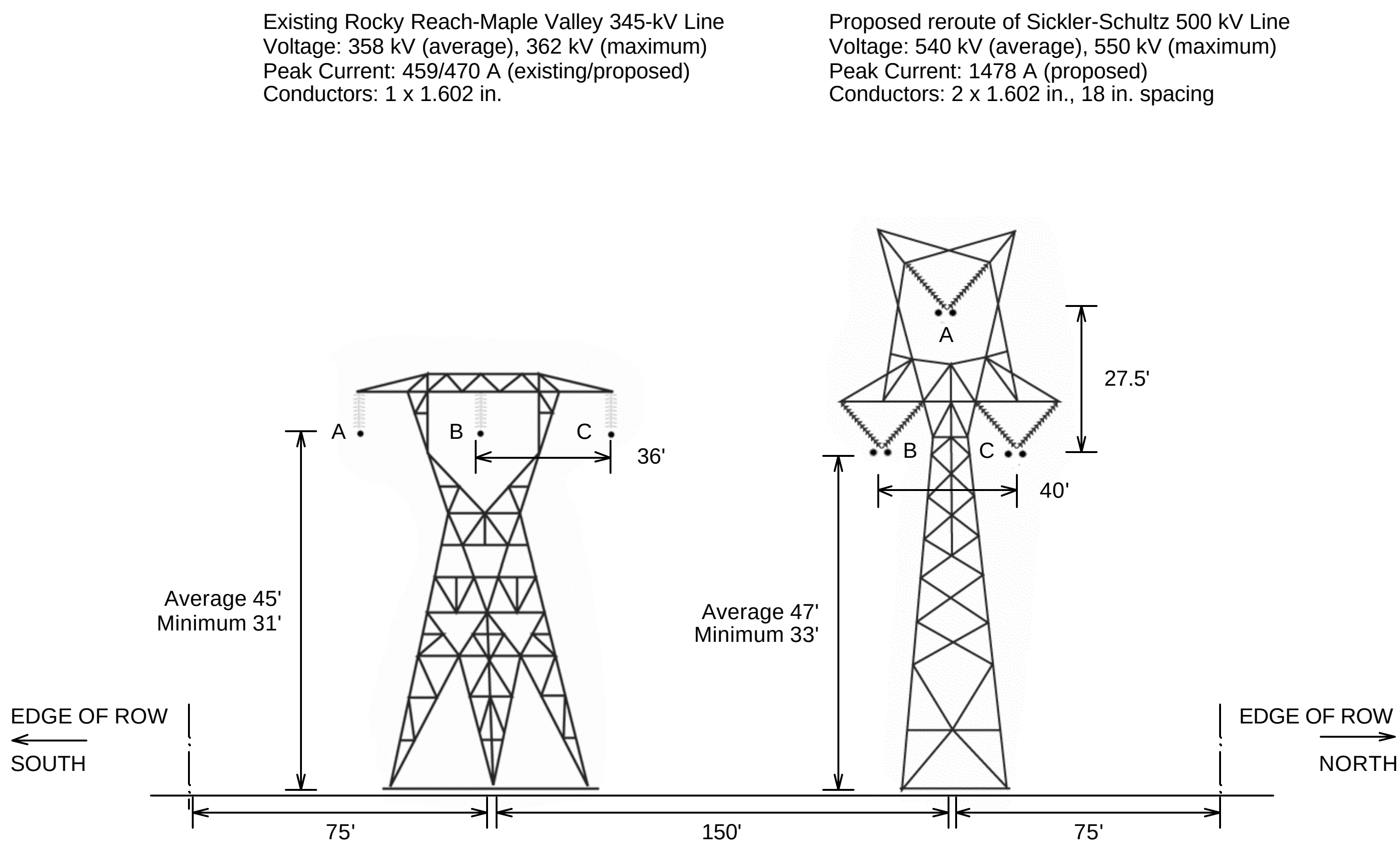


Figure 1, continued

d) Schultz-Hanford/Wautoma 500-kV line with six parallel lines east of Schultz Substation(Configuration A-4) (not to scale)

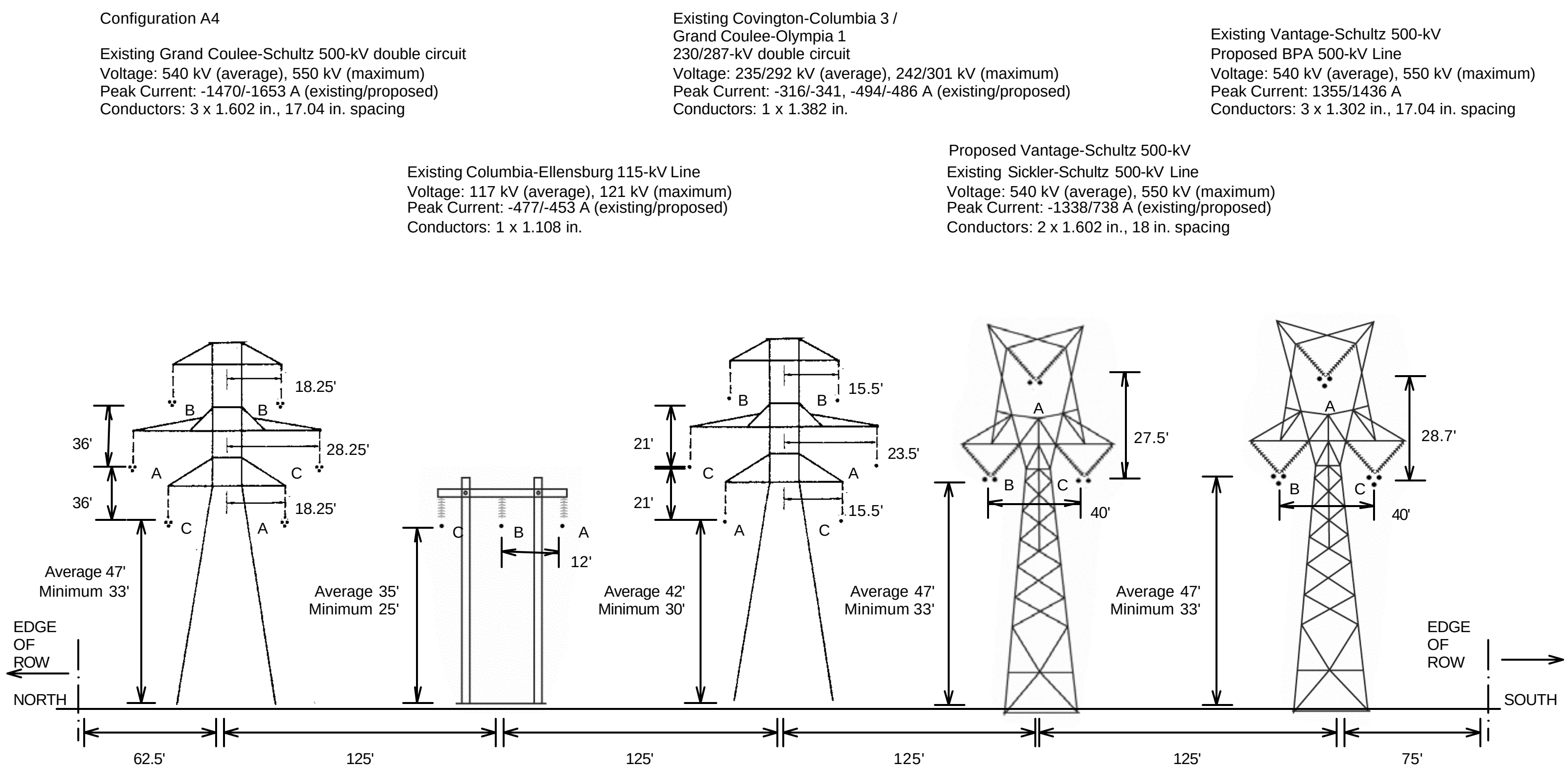


Figure 1, continued

e) Proposed Schultz – Wautoma 500-kV line with parallel Vantage – Midway 230-kV line (Configuration D-1). (Not to scale)

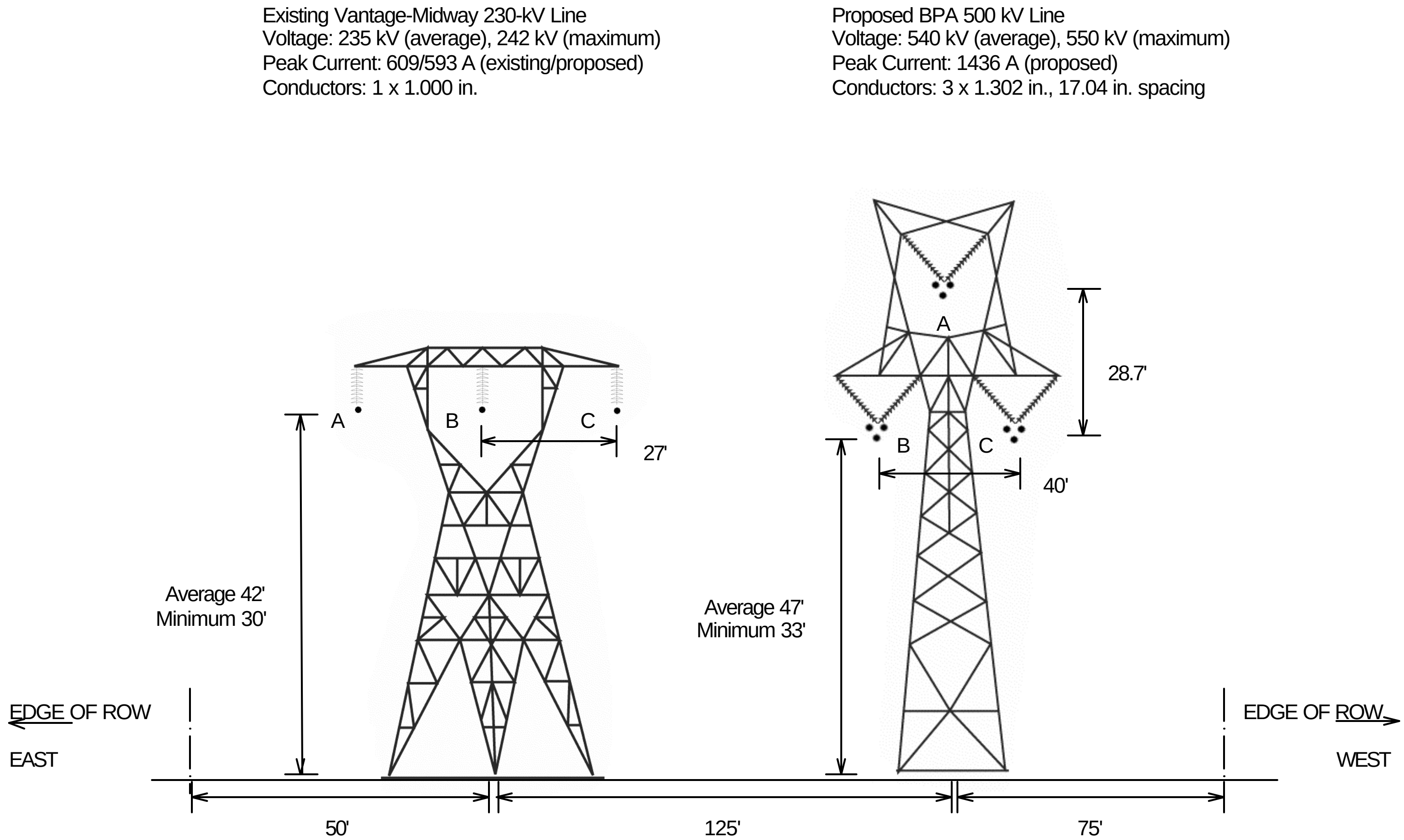


Figure 1, continued

f) Proposed Schultz-Wautoma 500-kV line with four parallel existing lines south of Midway Substation (Configuration D-2) (not to scale)

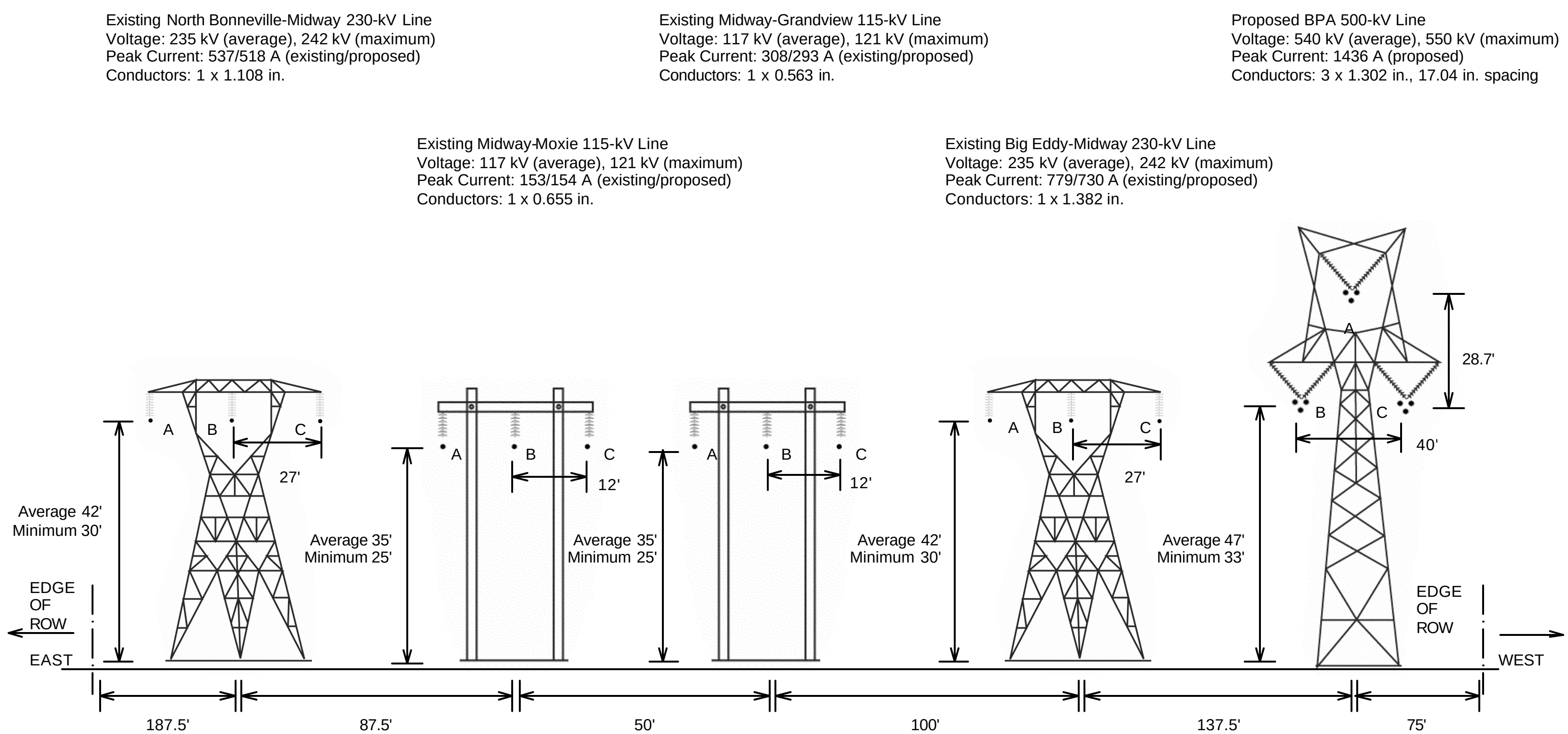


Figure 1, continued

g) Proposed Schultz-Wautoma 500-kV line with three parallel existing lines south of Midway Substation (Configuration D-3) (not to scale)

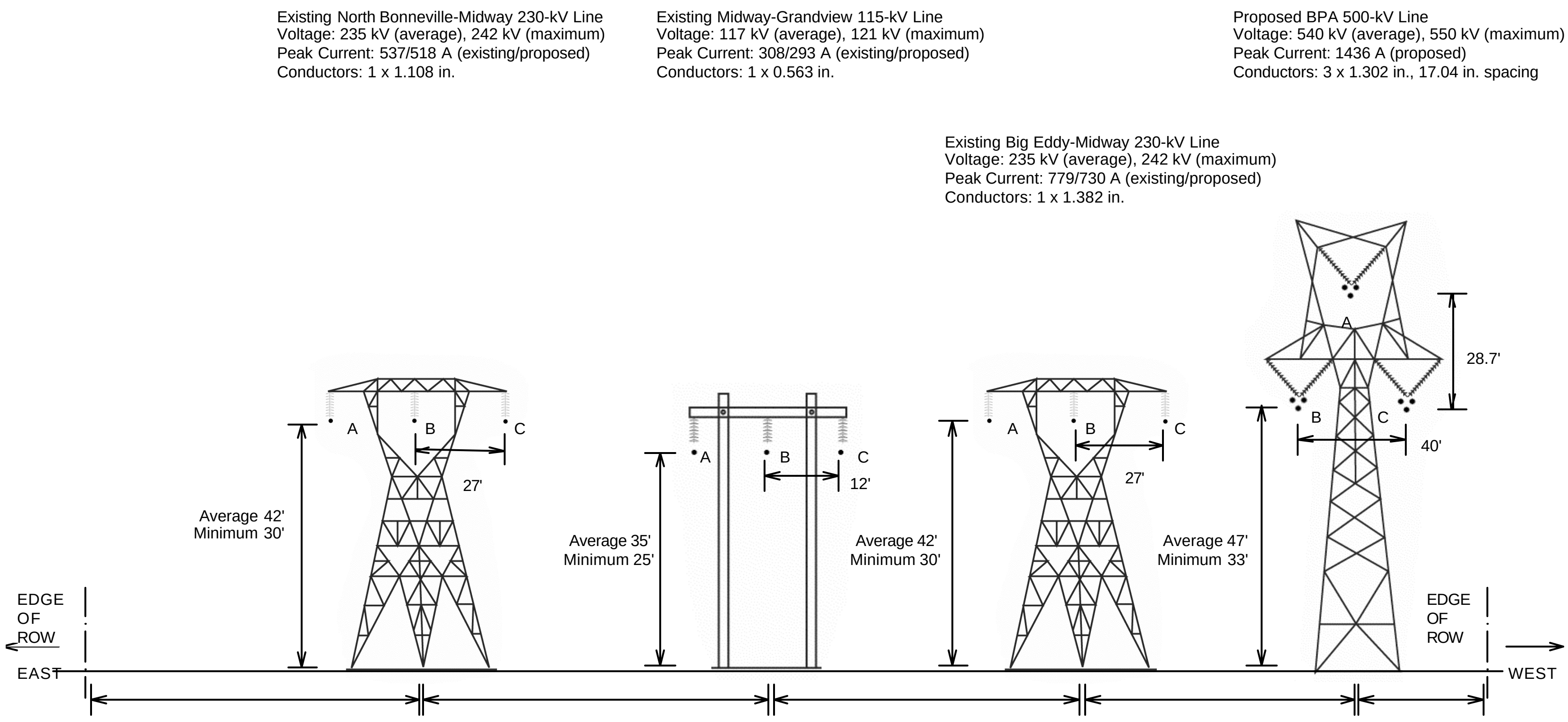


Figure 1, continued

h) Proposed Schultz-Wautoma 500-kV line with parallel Midway-Big Eddy 230-kV line (Configuration D-4) (not to scale)

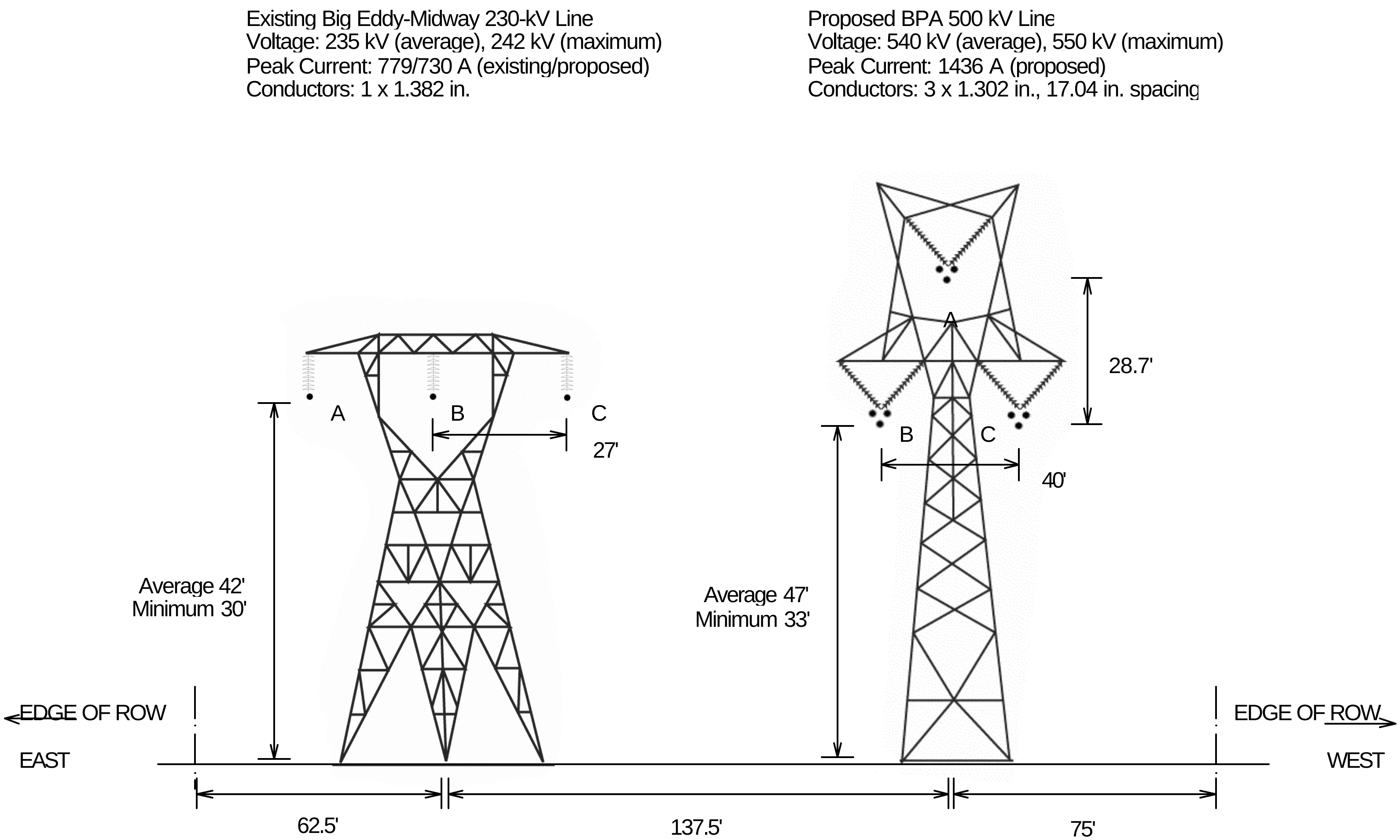


Figure 2: Electric-field profiles for selected configurations of proposed Schultz–Hanford/Wautoma 500-kV line: a) Proposed line with no parallel line (Configuration A-1); b) proposed line with parallel 230-kV line (Configuration D-1); c) proposed line with parallel 115-kV and 230-kV lines (Configuration D-3). Fields for maximum voltage and minimum clearances are shown. (2 pages)

a) Proposed line with no parallel line (Configuration A-1).

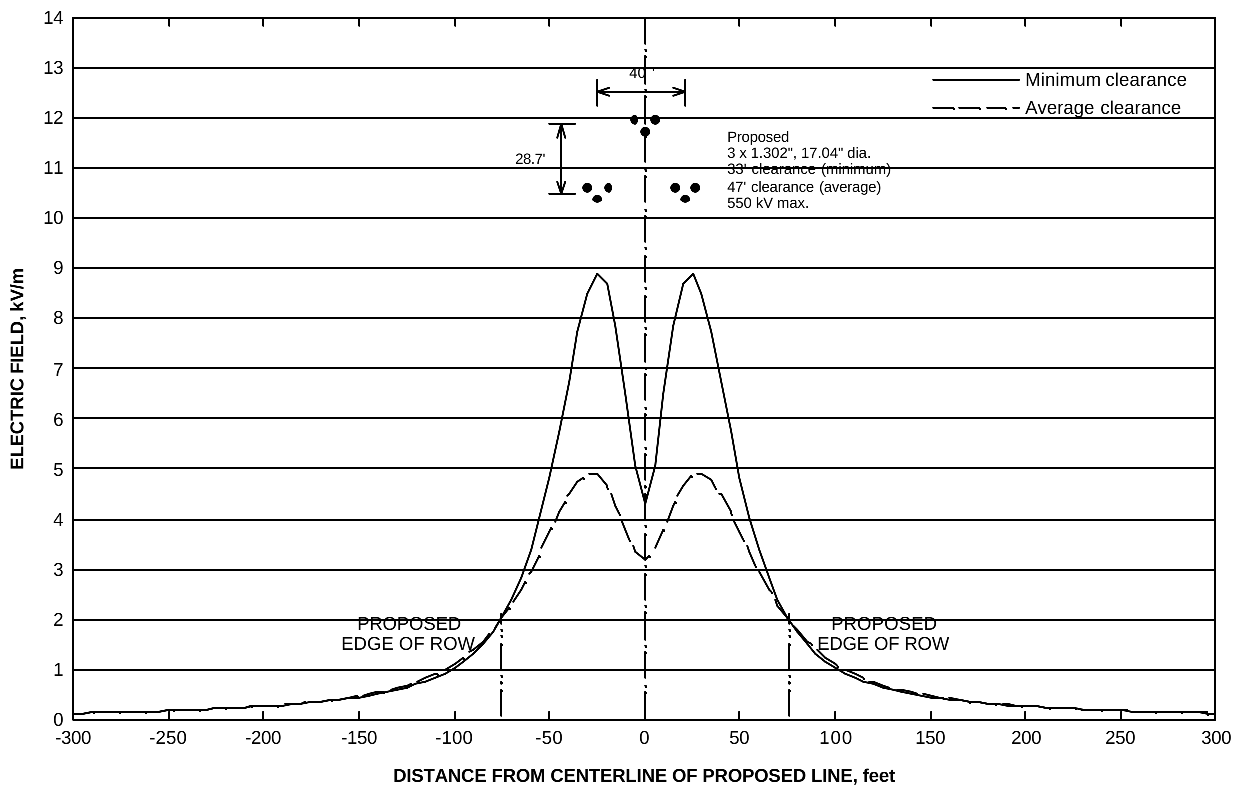
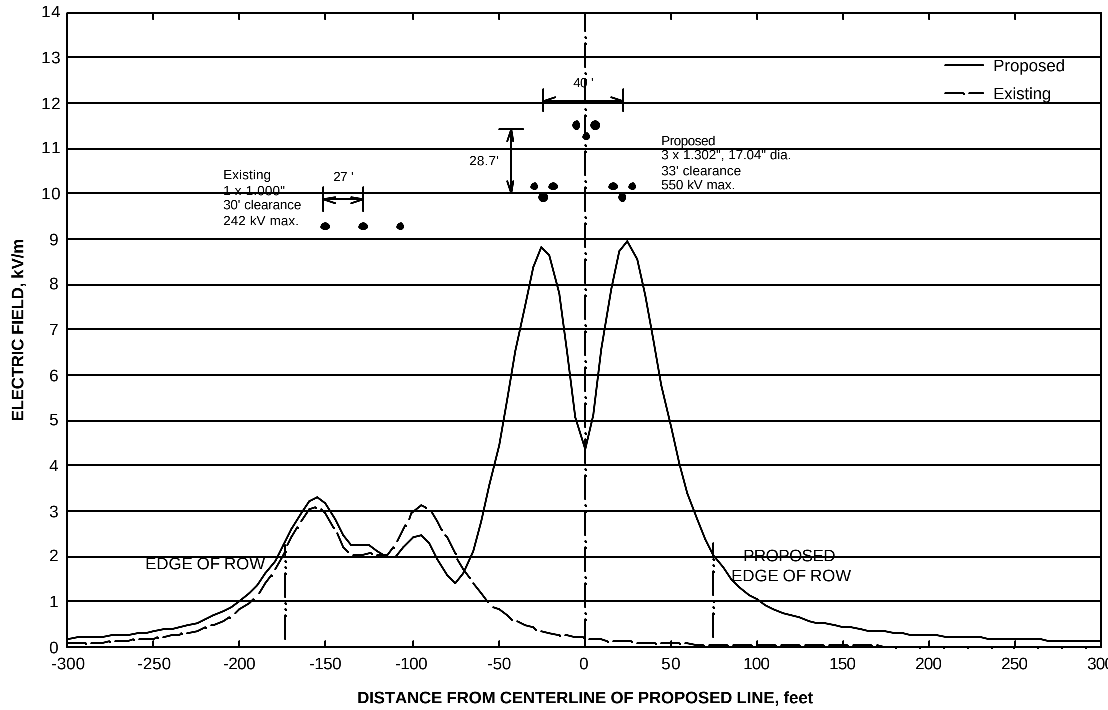


Figure 2, continued

b) Proposed line with parallel 230-kV line (Configuration D-1)



c) Proposed line with parallel 115-kV and 230-kV lines (Configuration D-3)

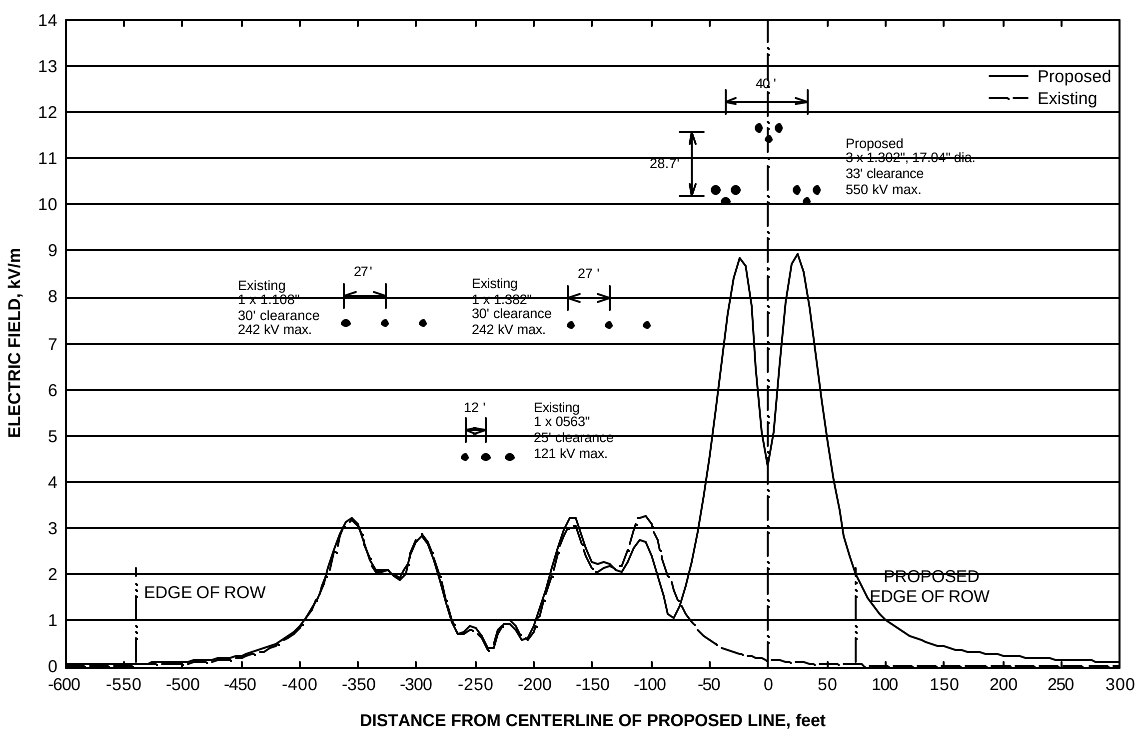


Figure 3: Magnetic-field profiles for selected configurations of the proposed Schultz–Hanford/Wautoma 500-kV line under maximum current conditions: a) proposed line with no parallel line (Configuration A-1); b) proposed line with parallel 230-kV line (Configuration D-1); and c) proposed line with parallel 115-kV and 230-kV lines (Configuration D-3). (2 pages)

a) Proposed line with no parallel line (Configuration A-1)

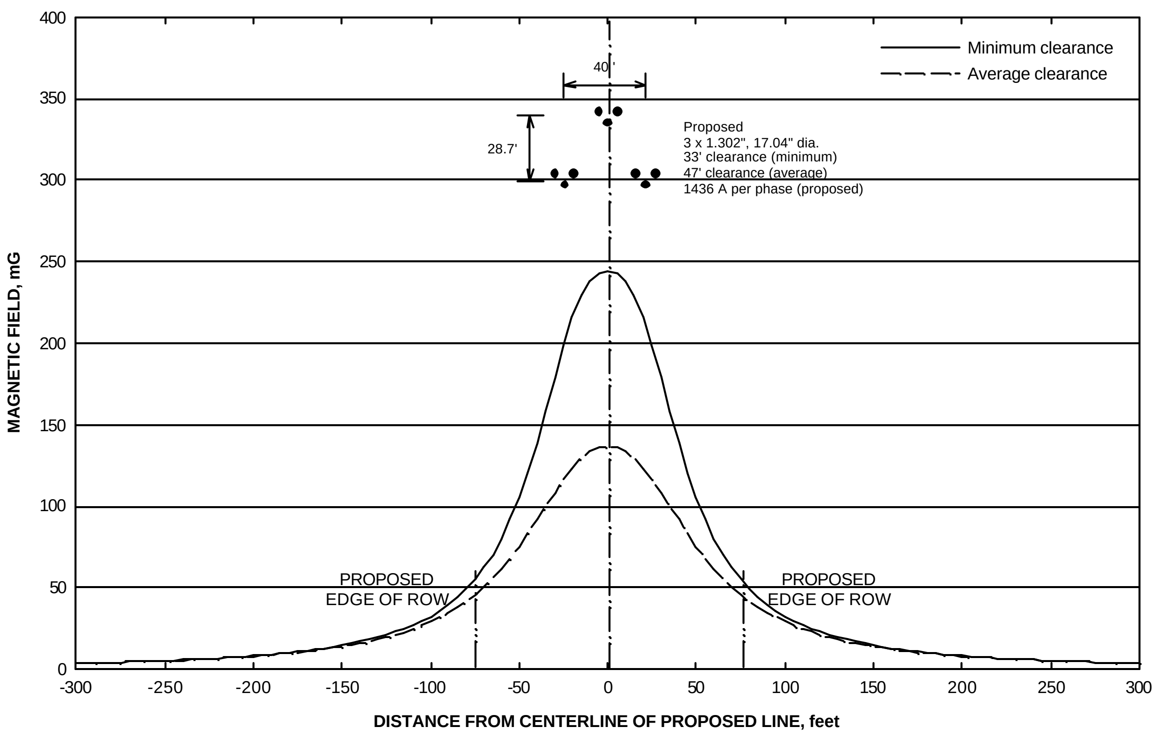
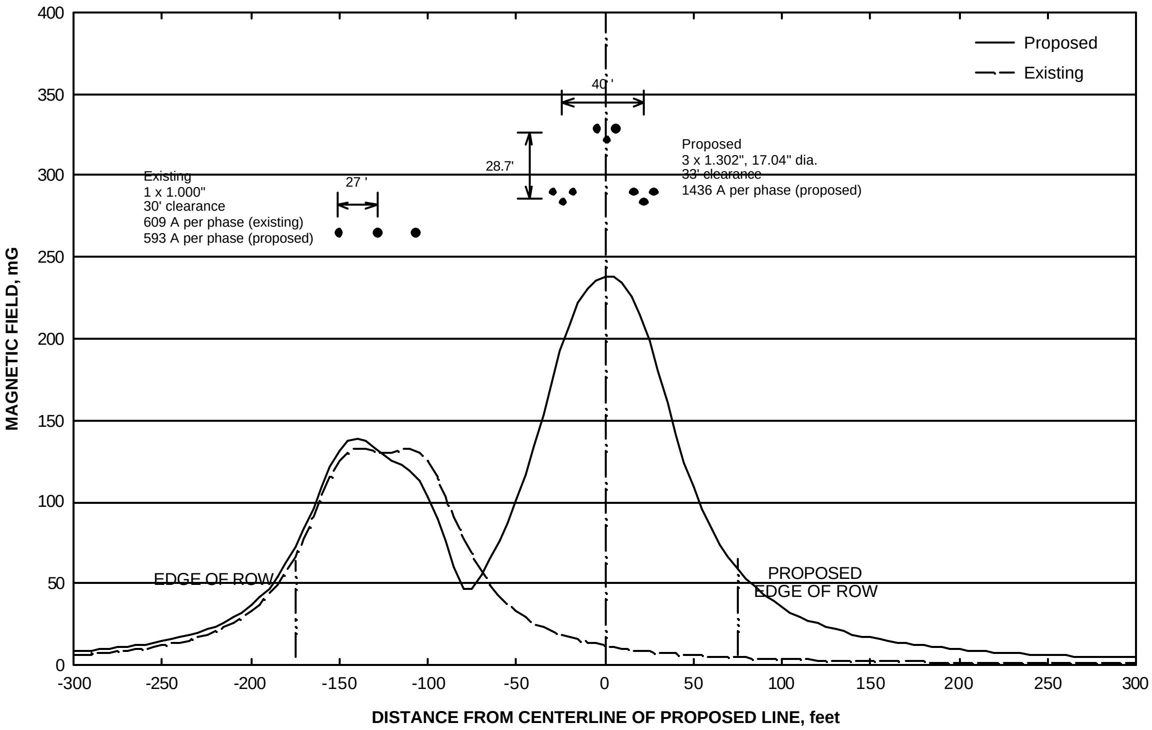


Figure 3, continued

b) Proposed line with parallel 230-kV line (Configuration D-1).



c) Proposed line with parallel 115-kV and 230 kV lines (Configuration D-3)

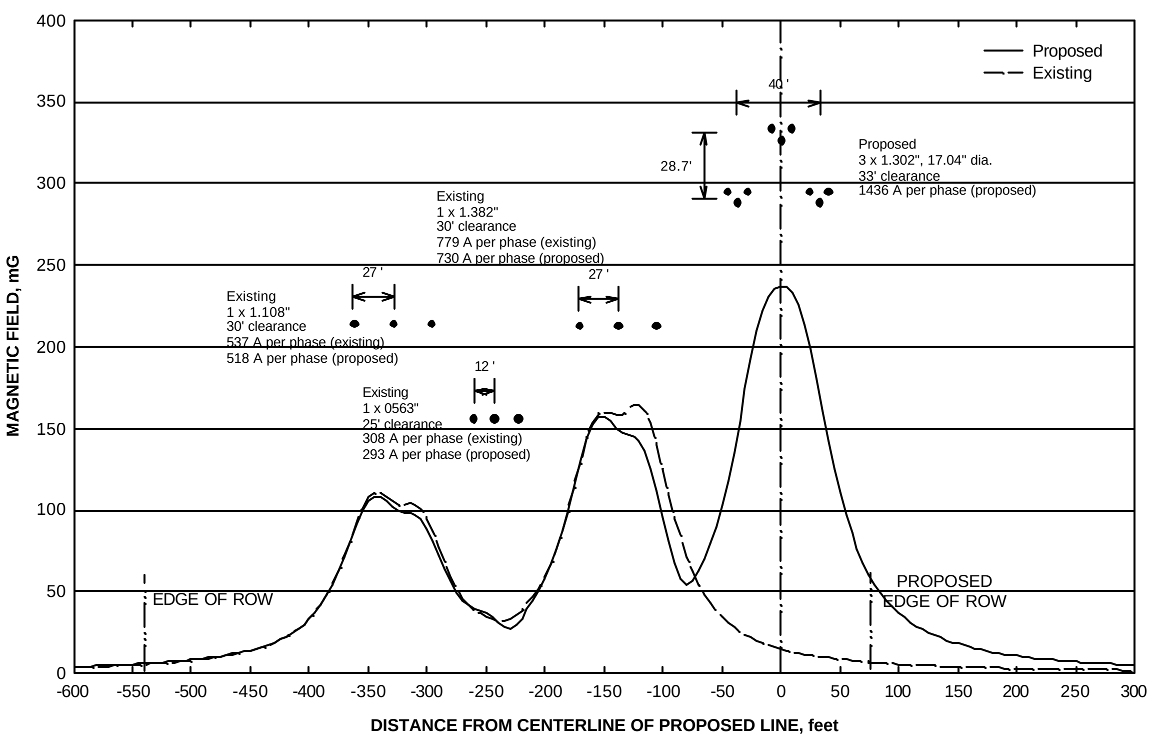


Figure 4: Predicted foul-weather L_{50} audible noise levels from selected configurations of proposed Schultz–Hanford/Wautoma 500-kV line a) proposed line with no parallel line (Configuration A-1); b) proposed line with parallel 230-kV line (Configuration D-1); and c) proposed line with parallel 115-kV and 230-kV lines (Configuration D-3). (2 pages)

a) Proposed line with no parallel line (Configuration A-1).

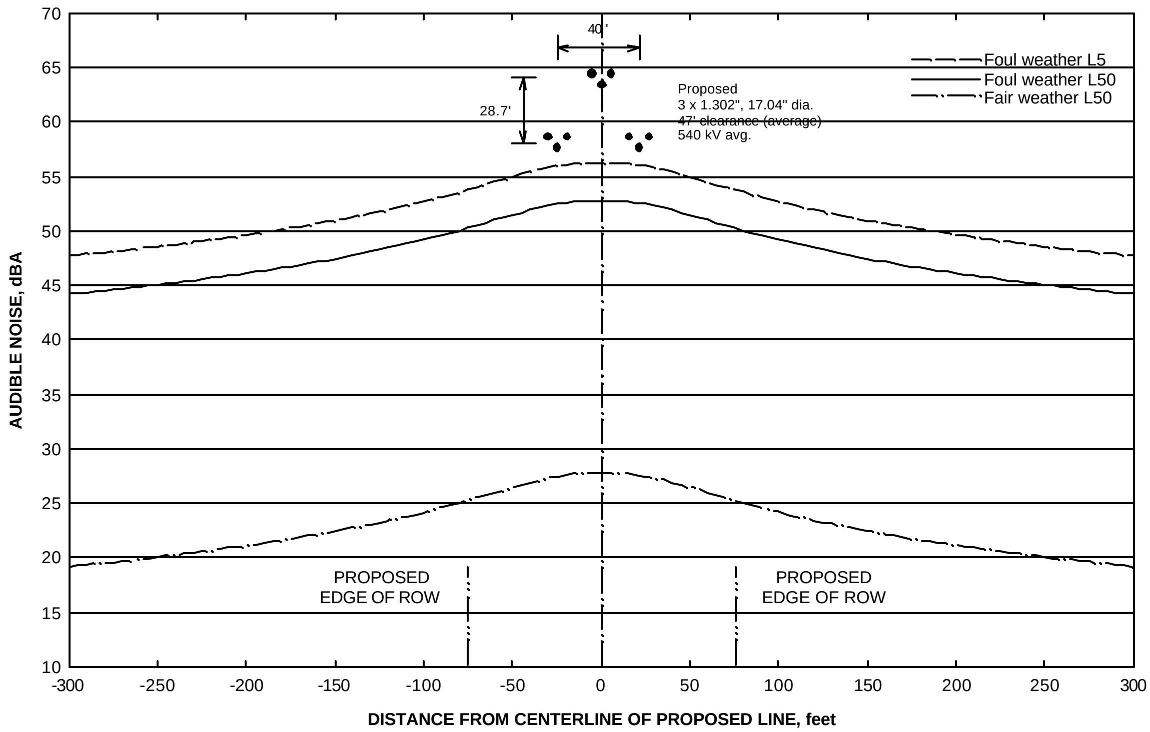
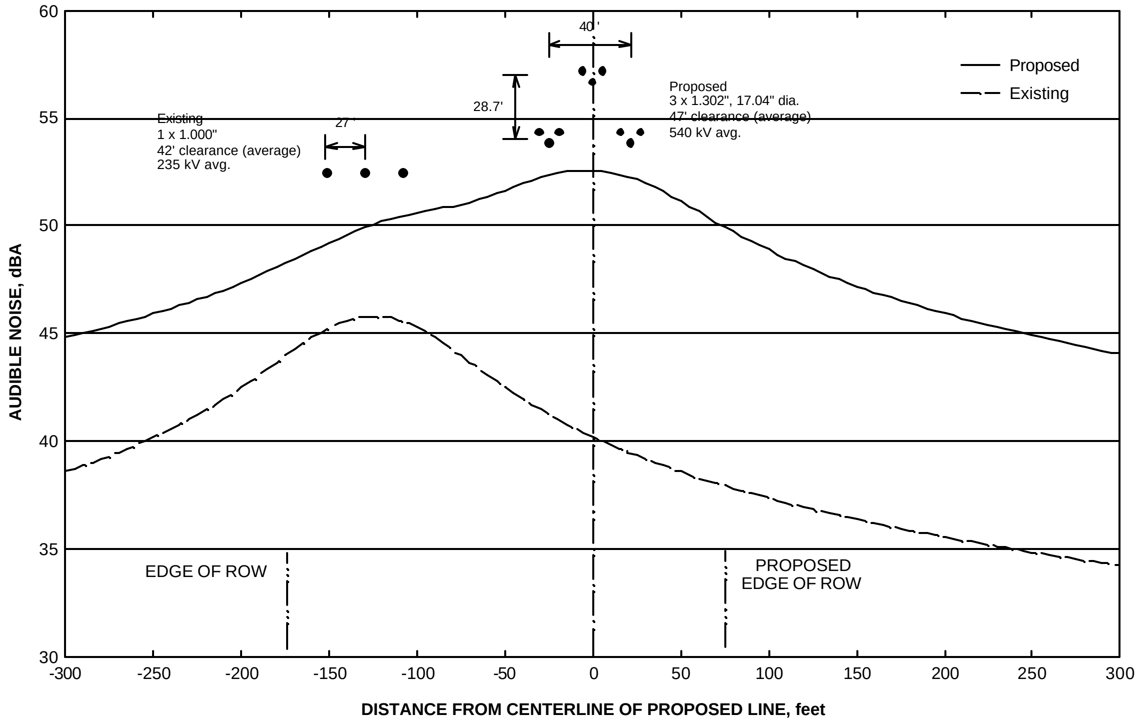
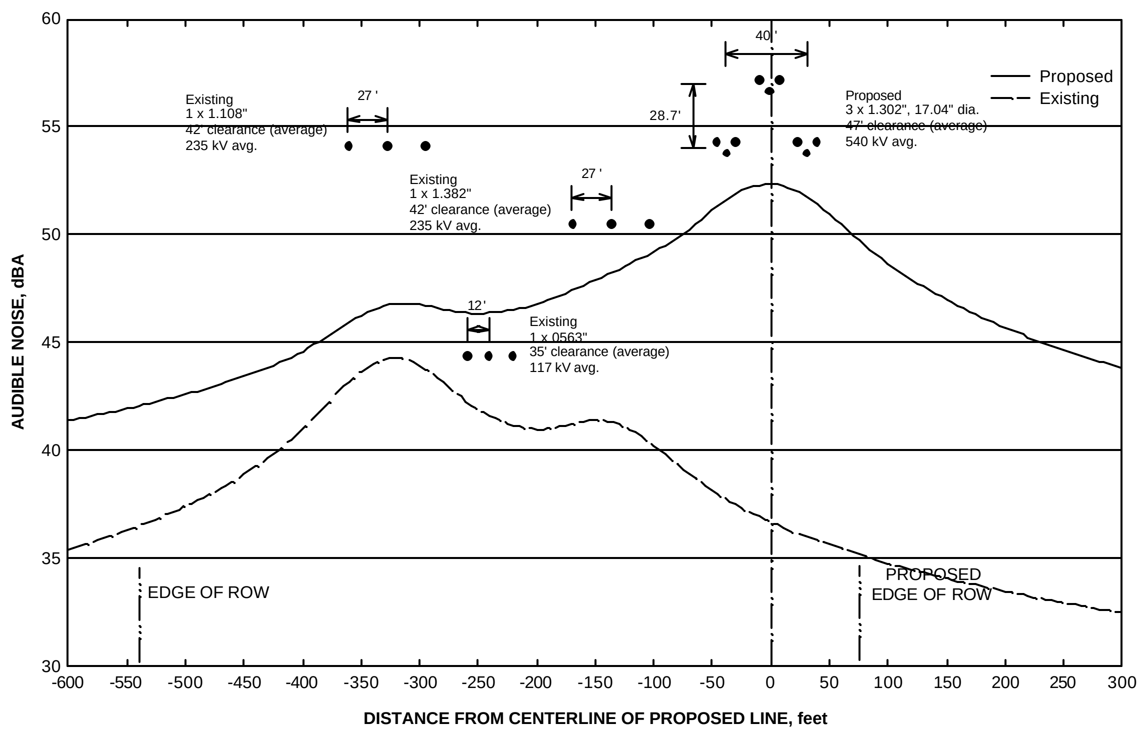


Figure 4, continued

b) Proposed line with parallel 230-kV line (Configuration D-1).



c) Proposed line with parallel 115-kV and 230-kV lines (Configuration D-3).



SCHULTZ - HANFORD AREA TRANSMISSION LINE PROJECT

ADDENDUM to

APPENDIX I

ELECTRICAL EFFECTS

August 28, 2001

Prepared by
T. Dan Bracken, Inc.

For

Parsons Brinckerhoff

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ADDENDUM

In the course of evaluating routing options for the proposed Schultz-Hanford Area Transmission Line Project, additional corridor options were identified. These new corridor options entail different configurations than those analyzed in the original Electrical Effects and Health Assessment appendices prepared for the project. The purpose of this addendum is to report the levels of electric fields, magnetic fields, audible noise, radio interference, and television interference anticipated from these new configurations. The calculation methods and impacts related to fields and corona-generated audible noise and electromagnetic interference are discussed in the Electrical Effects appendix.

A.1 New configurations

The new corridor options for the Schultz - Hanford 500-kV line are as follows: 1) a section of Alternative G where the proposed Schultz – Hanford/Wautoma 500-kV line would parallel the existing Pacificorp 230-kV Wanapum – Pomona Heights line just west of the Columbia River crossing into Vantage Substation; and 2) a section of Alternative D1 where the proposed line would be placed on a double-circuit tower with the existing BPA Vantage – Midway 230-kV line. Figure A1 shows these configurations; their physical and electrical characteristics are given in Tables A1 and A2.

A.2 Electric-field levels

Calculated electric fields for the two new configurations are summarized in Table A3 and plotted in Figure A2. The levels in Configuration G are very similar to those in the other configurations (D1 to D4) where the proposed 500-kV line parallels existing 230-kV lines. The calculated maximum electric fields under the proposed double-circuit line in Configuration D-1A are slightly higher than those for other configurations of the proposed 500-kV line and exceed 9 kV/m, the BPA limit for electric fields. The maximum field could be reduced below 9 kV/m by an increase in the minimum conductor height of 0.3 feet. The electric fields at the edge of the right-of-way would be lower for the double-circuit configuration (D-1A) than for the single-circuit delta configuration used elsewhere.

A.3 Magnetic-field levels

Calculated magnetic-field levels for the two new configurations are summarized in Table A4 and plotted in Figure A3. The levels for Configuration G are consistent with those for other configurations that include a single-circuit tower for the proposed 500-kV line. The maximum magnetic field under Configuration G would be 248 mG. Magnetic fields under the proposed double-circuit line of Configuration D-1A are somewhat lower with a maximum field on the right-of-way of 187 mG.

A.4 Audible noise levels

Corona-generated audible noise levels from the new configurations are shown in Table A5. The foul weather L_{50} and L_5 levels predicted for these configurations will be comparable with those for the previously considered configurations. The foul weather L_{50} level at the edge of the right-of-way will not exceed the 50-dBA limit established by BPA.

A.5 Electromagnetic interference

Corona-generated electromagnetic interference levels for the new configurations are shown in Tables A6 and A7 for radio interference (1 MHz) and television interference (75 MHz), respectively. The levels are comparable with those predicted for the other proposed configurations and are within acceptable levels.

A.6 Conclusions

The predicted levels for electric fields, magnetic fields, and corona effects from the new configurations are very similar to those calculated for the original configurations. Therefore, they do not change the basic conclusions of either the Electrical Effects or Health Assessment appendices prepared previously.

List of Preparers

T. Dan Bracken was the principal author of this report. He received a B.S. degree in physics from Dartmouth College and M.S. and Ph.D. degrees in physics from Stanford University. Dr. Bracken has been involved with research on and characterization of electric- and magnetic-field effects from transmission lines for over 27 years, first as a physicist with the Bonneville Power Administration (BPA) (1973 - 1980) and since then as a consultant. His firm, T. Dan Bracken, Inc., offers technical expertise in areas of electric- and magnetic-field measurements, instrumentation, environmental effects of transmission lines, exposure assessment, and project management. Joseph Dudman of T. Dan Bracken, Inc., provided data entry, graphics, and clerical support in the preparation of the report.

Judith H. Montgomery of Judith H. Montgomery/Communications served as technical editor for the report. She holds an A.B. degree in English literature from Brown University, 1966; and a Ph.D. degree in American literature from Syracuse University, 1971. Dr. Montgomery has provided writing, editing, and communications services to government and industry for 20 years. Her experience includes preparation of National Environmental Policy Act documents and technical papers dealing with transmission-line environmental impact assessment and other utility-related activities.

Table A1: Physical and electrical characteristics of additional Schultz-Hanford Area Project configurations.

Segment-Configuration	Proposed A-1	Existing G	Proposed D-1A	
Line Description	**Schultz-Hanford/ Wautoma 500-kV**	**Wanapum – Pomona Heights 230-kV**	**Schultz – Hanford/Wautoma & Existing BPA Vantage – Midway 230-kV**	
			500-kV	**230-kV**
Voltage, kV Maximum/Average[1]	550/540	242/235	550/540	242/235
Peak current, A Existing/Proposed[2]	— /1436	-640/ -640	— /1436	609/593
Electric phasing	BAC	ABC	ABC	CBA
Clearance, ft. Minimum/Average[1]	33/47	30/42	33/47	33/47
Centerline distance/direction from Schultz – Hanford/ Wautoma 500-kV Line, ft.	—	137.5/S	—	
Centerline distance to edge of ROW, ft.	75	62.5	75	
Tower configuration	Delta	Flat	Double-circuit Vertical	
Phase spacing, ft.	40 H, 28.7 V	17.5H	36.5 H, 56.5 H, 36.5 H, 36 V	
Conductor: #/diameter, in.; spacing, in.	3/1.302; 17.04	1/1.38	3/1.302; 17.04	3/1.302; 17.04

1 Average voltage and average clearance used for corona calculations.
2 Minus sign indicates current flow in opposite direction to flow in parallel proposed Schultz – Hanford line.
H = horizontal V = vertical

Table A2: Possible additional segment configurations for Schultz - Hanford Area Project

Segment-Configuration	Description of other lines in corridor with Schultz–Hanford/Wautoma 500-kV line	Miles
G	Pacificorp Wanapum – Pomona Heights 230-kV	6
D-1A	Vantage – Midway 230-kV	8

Table A3: Calculated electric fields for configurations of the proposed Schultz – Hanford/Wautoma 500-kV line operated at maximum voltage. Configurations are described in Tables A1 and A2.

a) Configuration G: Schultz – Hanford/Wautoma 500-kV line and Pacificorp Wanapum – Pomona Heights 230-kV line

Configuration	Proposed G				Existing G	
ROW width, ft.	275				125	
Line	Schultz – Hanford/ Wautoma 500-kV		Pacificorp Wanapum – Pomona Heights 230-kV		Pacificorp Wanapum – Pomona Heights 230-kV	
Clearance	min.	avg.	min.	avg.	min.	avg.
Peak field, kV/m	8.9	4.9	2.7	1.5	2.7	1.5
Edge of ROW, kV/m	2.0	2.0	1.0	0.9	0.8	0.8

b) Configuration D-1A: Schultz – Hanford/Wautoma 500-kV and Vantage – Midway 230-kV lines

Configuration	Proposed D-1A				Existing D-1A	
ROW width, ft.	125				100	
Line	Vantage – Midway & Schultz – Hanford/Wautoma				Vantage – Midway 230-kV	
	230-kV		500-kV			
Clearance	min.	avg.	min.	avg.	min.	avg.
Peak field, kV/m	5.1*	3.4*	9.1	5.0	3.1	1.8
Edge of ROW, kV/m	1.4	1.0	1.2	1.3	2.0	1.5

* At centerline.

Table A4: Calculated magnetic fields for configurations of the proposed Schultz–Hanford/Wautoma 500-kV line operated at maximum current. Configurations are described in Tables A1 and A2.

a) Configuration G: Schultz – Hanford/Wautoma 500-kV and Pacificorp Wanapum – Pomona Heights 230-kV line

Configuration	**Proposed G**				**Existing G**	
ROW width, ft.	275				125	
Line	Schultz – Hanford/ Wautoma 500-kV		Pacificorp Wanapum – Pomona Heights 230-kV		Pacificorp Wanapum – Pomona Heights 230-kV	
Clearance	min.	avg.	Min.	avg.	min.	avg.
Peak field, mG	248	140	130	75	125	70
Edge of ROW, mG	53	44	26	20	29	24

b) Configuration D-1A: Schultz – Hanford/Wautoma 500-kV and Vantage – Midway 230-kV line

Configuration	**Proposed D-1A**				**Existing D-1A**	
ROW width, ft.	125				100	
Line	Vantage – Midway & Schultz – Hanford/Wautoma				Vantage – Midway 230-kV	
	230-kV		500-kV			
Clearance	min.	avg.	min.	avg.	min.	avg.
Peak field, mG	167	95	187	103	133	84
Edge of ROW, mG	44	36	64	51	67	49

Table A5: Predicted foul-weather audible noise (AN) levels at edge of right-of-way (ROW) for proposed Schultz – Hanford/Wautoma 500-kV line. AN levels expressed in decibels on the A-weighted scale (dBA). L_{50} and L_5 denote the levels exceeded 50 and 5 percent of the time, respectively. For the parallel-line configurations[1], the AN level at the edge of the proposed Schultz-Hanford Area Transmission Project ROW is given first.

	Foul-weather AN					
	Proposed			Existing		
Configuration[1]	**ROW ft. (m)**	**L_{50}, dBA**	**L_5, dBA**	**ROW ft. (m)**	**L_{50}, dBA**	**L_5, dBA**
G	275 (84)	48, 45	52, 49	125	39	42
D-1A	125 (38)	49, 48	53, 52	100 (30)	43	46

1 Configurations are described in Tables A1 and A2.

Table A6: Predicted fair-weather radio interference (RI) levels at 100 feet (30.5 m) from the outside conductor of the proposed Schultz – Hanford/Wautoma 500-kV line. RI levels given in decibels above 1 microvolt/meter (dBμV/m) at 1.0 MHz. L_{50} denotes level exceeded 50 percent of the time. For the parallel-line configurations, the RI level on the side of the proposed Schultz – Hanford Area Transmission Line Project ROW is given first.

	Fair-weather RI	
	Proposed	**Existing**
Configuration[1]	**L_{50}, dBmV/m**	**L_{50}, dBmV/m**
G	38, 29	26
D-1A	41, 38	30

1 Configurations are described in Tables A1 and A2.

Table A7: Predicted maximum foul-weather television interference (TVI) levels predicted at 100 feet (30.5 m) from the outside conductor of the proposed Schultz – Hanford/Wautoma 500-kV line. TVI levels given in decibels above 1 microvolt/meter (dBμV/m) at 75 MHz. For the parallel-line configurations, the TVI level on the side of the proposed Schultz – Hanford Area Transmission Line Project ROW is given first.

	Foul-weather TVI	
	Proposed	**Existing**
Configuration[1]	**Maximum (foul), dBmV/m**	**Maximum (foul), dBmV/m**
G	24, 12	13
D-1A	24, 19	17

1 Configurations are described in detail in Tables A1 and A2.

Figure A1: Additional configurations for proposed Schultz-Hanford Area Transmission Line Project 500-kV line: a) Proposed line with parallel Pacificorp Wanapum – Pomona Heights 230-kV line (Configuration G); and b) Proposed line on double-circuit tower with existing BPA 230-kV line (Configuration D-1A). (2 pages)

a) Proposed 500-kV line parallel to Pacificorp Wanapum – Pomona Heights 230-kV line (Configuration G) (not to scale)

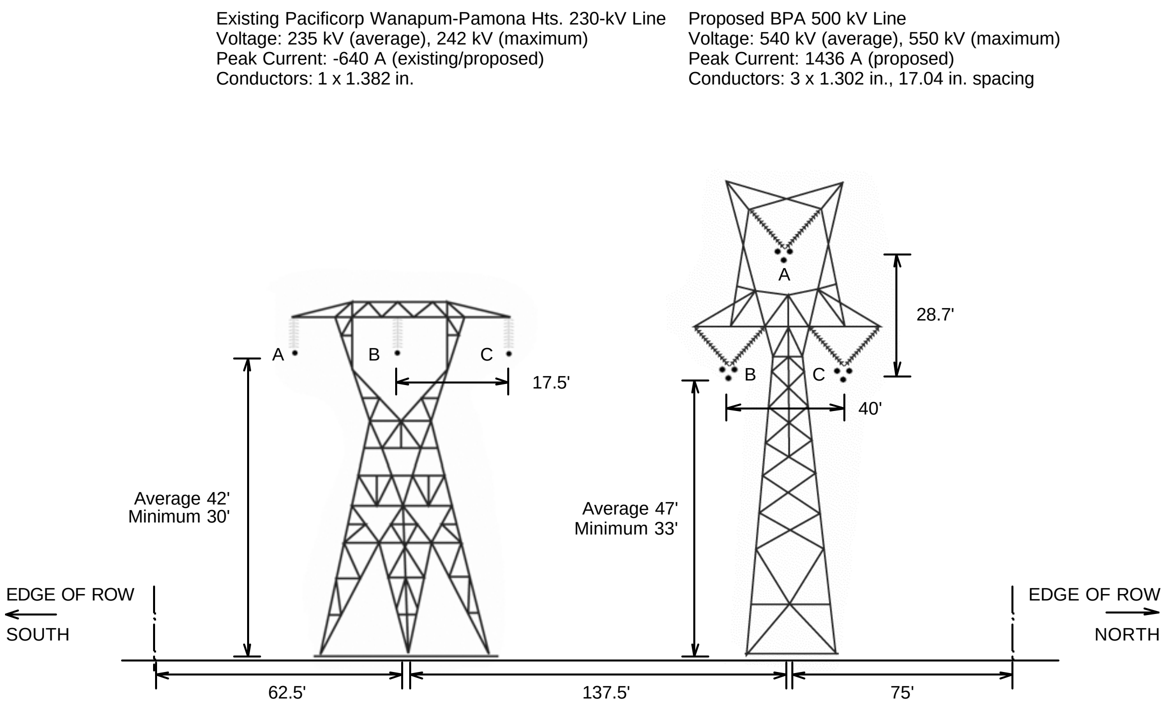


Figure A1, continued

b) Proposed 500-kV line on double-circuit tower with existing BPA Vantage – Midway 230-kV line (Configuration D-1A) (Not to scale)

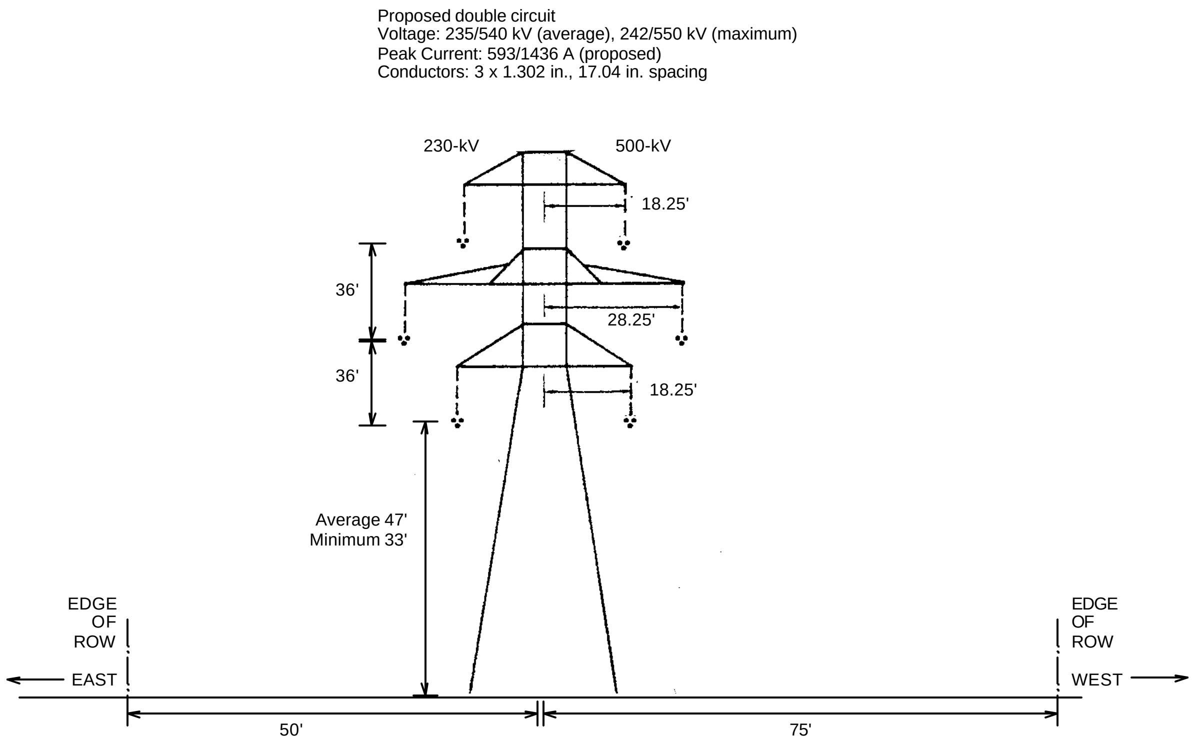


Figure A2: Electric-field profiles for additional configurations of proposed Schultz – Hanford/Wautoma 500-kV line: a) Proposed 500-kV line parallel to Pacificorp Wanapum – Pomona Heights 230-kV line (Configuration G); and b) proposed 500-kV line on double-circuit tower with existing BPA Vantage – Midway 230-kV line (Configuration D-1A). Fields for maximum voltage and minimum clearances are shown. (2 pages)

a) Proposed 500-kV line parallel to Pacificorp Wanapum – Pomona Heights 230-kV line (Configuration G).

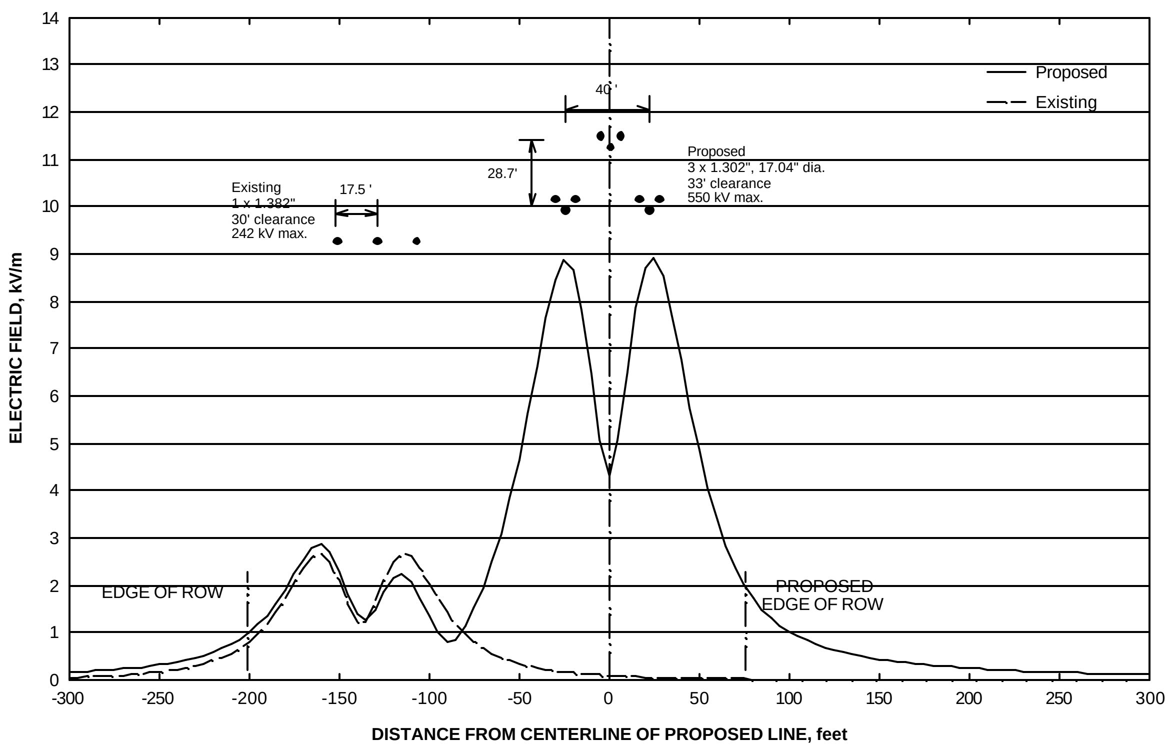


Figure A2, continued

b) Proposed 500-kV line on double-circuit tower with existing BPA Vantage – Midway 230-kV line (Configuration D-1A)

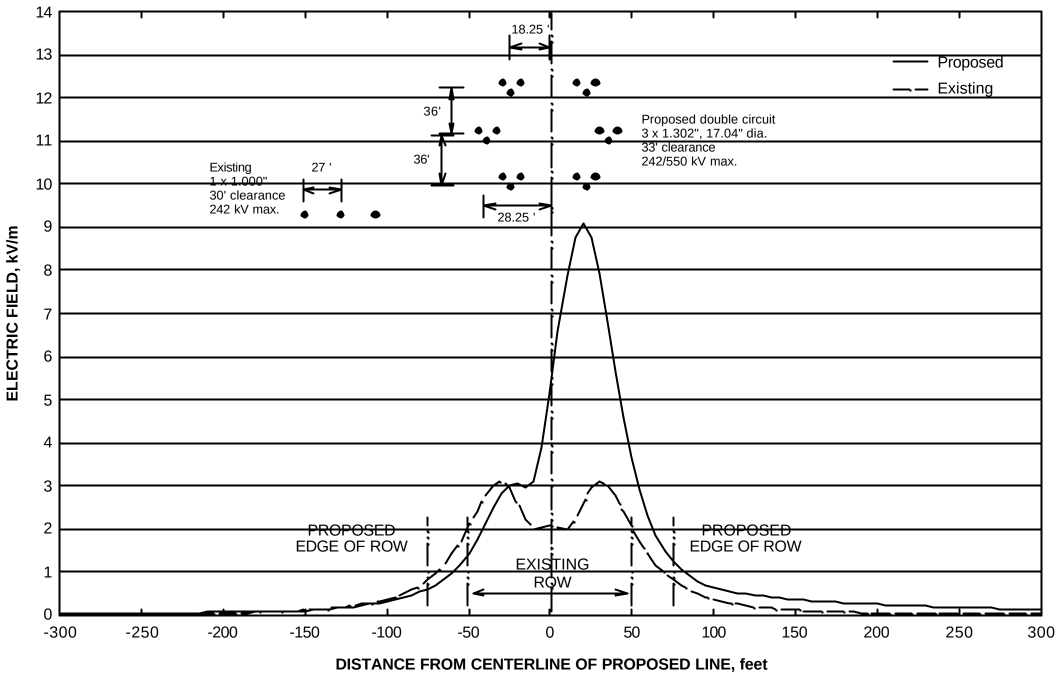


Figure A3: Magnetic-field profiles for additional configurations of the proposed Schultz–Hanford/Wautoma 500-kV line under maximum current conditions: a) Proposed 500-kV line parallel to Pacificorp Wanapum – Pomona Heights 230-kV line (Configuration G); and b) proposed 500-kV line on double-circuit tower with BPA Vantage – Midway 230-kV line (Configuration D-1A). (2 pages)

a) Proposed 500-kV line parallel to Pacificorp Wanapum – Pomona Heights 230-kV line (Configuration G).

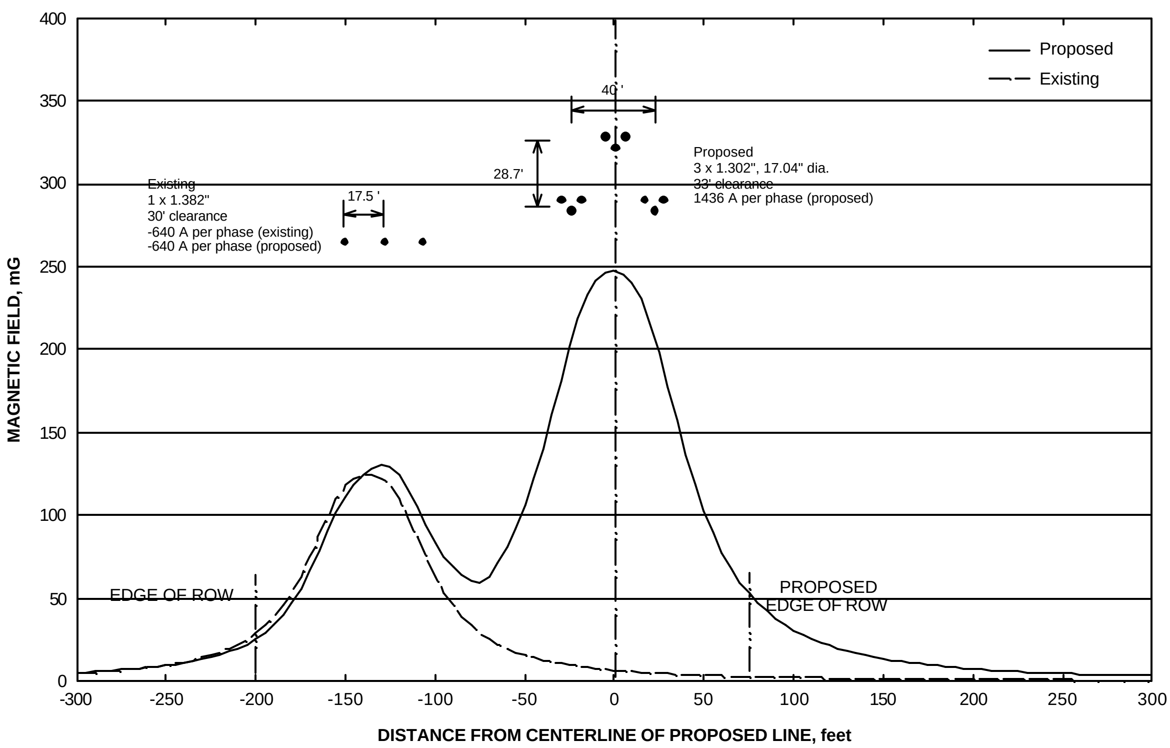
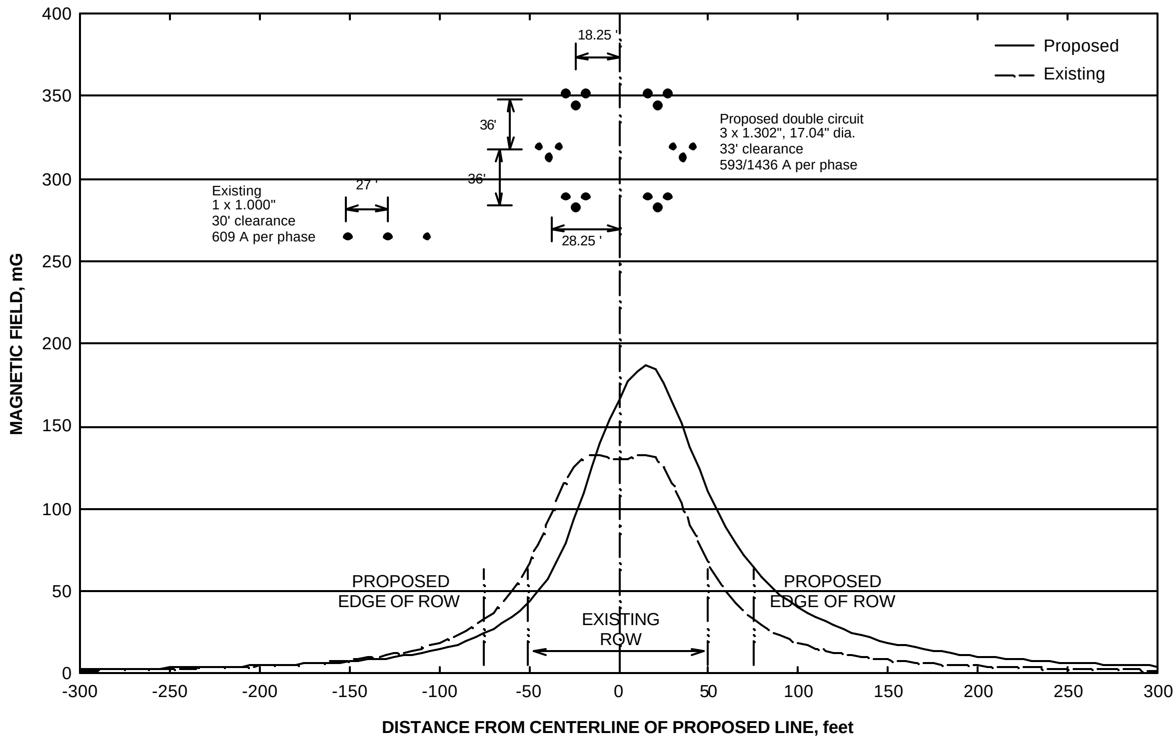


Figure A3, continued

b) Proposed 500-kV line on double-circuit tower with BPA Vantage – Midway 230-kV line (Configuration D-1A)



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Appendix J – Assessment of Research Regarding EMF and Health and Environmental Effects

<u>SCHULTZ - HANFORD AREA</u>
<u>TRANSMISSION-LINE PROJECT</u>

APPENDIX J:

ASSESSMENT OF RESEARCH REGARDING EMF AND HEALTH AND ENVIRONMENTAL EFFECTS

July 3, 2001

Prepared by

Exponent

and

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for

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APPENDIX J: ASSESSMENT OF RESEARCH REGARDING EMF AND HEALTH AND ENVIRONMENTAL EFFECTS

1.0 Introduction

Over the last 20 years, research has been conducted in the United States and around the world to examine whether exposures to electric and magnetic fields (EMF) at 50/60 hertz (Hz) from electric power lines are a cause of cancer, or adversely affect human health. The research included epidemiology studies that suggested a link with childhood for some types of exposures, as well as other epidemiology studies that did not; it also included lifetime animal studies, which showed no evidence of adverse health effects. Comprehensive reviews of the research conducted by governmental scientific agencies in the U.S. and in the United Kingdom (UK) had examined the research, and did not find a basis for imposing additional restrictions (NIEHS, 1999; IEE, 2000).

The Bonneville Power Authority (BPA) requested that Exponent review the research on EMF and health and focus on exposures that might occur from the Schultz – Hanford Area Project. In December 2000, Exponent prepared a report to the BPA that summarized our assessment of the research regarding EMF and health (to be published as an appendix to the Kangley-Echo Lake Transmission Project environmental impact statement, summer 2001). This report was prepared after the National Institute of Environmental Health Sciences (NIEHS) had just completed the Congressionally funded research program known as RAPID (Research and Public Information Dissemination Program), and after publication of the NIEHS Working Group Report (NIEHS, 1998). Consequently, our report to the BPA presented the conclusions of these scientific panels, and reviewed the major research studies published after the NIEHS report was completed.

This update concentrates on recent major research studies to explain how they contribute to the assessment of effects of EMF on health. The focus is on both epidemiologic and laboratory research, because these research approaches provide different and complementary information for determining whether an environmental exposure can affect human health.

2.0 Health

2.1 The NIEHS Report and Research Program

In 1998, the NIEHS completed a comprehensive review of the scientific research on health effects of EMF. The NIEHS had been managing a research program that Congress funded in 1996, in response to questions regarding exposure to EMF from power sources. The program was known as the RAPID Program (Research and Public Information Dissemination Program). The NIEHS convened a panel of scientists (the "Working Group") to review and evaluate the RAPID Program research and other research. Their report, *Assessment of Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields,* was completed in July 1998 (NIEHS, 1998).

The director of the NIEHS prepared a health risk assessment of EMF and submitted his report to Congress in June 1999 (NIEHS, 1999). Experts at NIEHS, who had considered the previous Working

Group report, reports from four technical workshops, and research that became available after June 1998, concluded as follows:

> The scientific evidence suggesting that ELF-EMF [extremely low frequency-electric and magnetic field] exposures pose any health risk is weak. The strongest evidence for health effects comes from associations observed in human populations with two forms of cancer: childhood leukemia and chronic lymphocytic leukemia in occupationally exposed adults. . . . In contrast, the mechanistic studies and animal toxicology literature fail to demonstrate any consistent pattern . . . . No indication of increased leukemias in experimental animals has been observed. . . . The lack of consistent, positive findings in animal or mechanistic studies weakens the belief that this association is actually due to ELF-EMF, but it cannot completely discount the epidemiology findings. . . . The NIEHS does not believe that other cancers or other non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern (pp. 9-10).

Although the results of the RAPID research are described in some detail in the 1998 report, many of the studies had not been published in the peer-reviewed literature. Recognizing the need to have these results reviewed and considered for publication, the NIEHS arranged for a special edition of the journal *Radiation Research* (Radiation Research, 153(5), 2000) to be devoted to this topic.[1]

2.2 Update of Research Related to Cancer

The California Department of Health Services conducted a workshop in 1999 to discuss epidemiologic research on EMF and health. The reports presented at this workshop recently became available (published in January 2001) as a supplement to the journal, *Bioelectromagnetics*. Many of the papers were technical discussions of methodology issues in epidemiologic studies of EMF, including discussions of how better to understand the conflicting results reported in previous studies (Neutra and Del Pizzo, 2001). For example, one study evaluates the extent to which systematic errors (known in epidemiology as selection bias or information bias) occurred in EMF studies and if so, whether they can be measured (Wartenberg, 2001a). Other researchers discuss epidemiologic approaches to study how possible confounding factors, such as the age and type of home and traffic density, might affect the interpretation of studies of EMF and childhood cancer (Langholz, 2001; Reynolds et al., 2001).

For this update, we review papers from this workshop that provide new information or statistical analyses. Several of the studies are "meta-analyses," an approach that incorporates statistical methods to analyze differences and aggregate the results of smaller studies. The section below includes a review of meta-analyses of the studies of childhood leukemia through 1999, and a meta-analysis of studies of breast cancer in adults (Erren et al., 2001).

2.2.1 Epidemiology Studies of Children

The question of power lines and childhood cancer has been based on the assumption that the relevant exposure associated with power lines is the magnetic field, rather than the electric field. This assumption rests on the fact that electric fields are shielded from the interior of homes (where people spend the vast majority of their time) by walls and vegetation, while magnetic fields are not. The magnetic field in the

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[1] See, for instance, the articles cited in the **List of References** under Balcer- Kubiczek, Boorman, Loberg, and Ryan.

vicinity of a power line results from the flow of current; higher currents result in higher levels of magnetic fields.

Epidemiologic studies report results in the form of statistical associations. The term "statistical association" is used to describe the tendency of two things to be linked or to vary in the same way, such as level of exposure and occurrence of disease. However, statistical associations are not automatically an indication of cause and effect, because the interpretation of numerical information depends on the context, including (for example) the nature of what is being studied, the source of the data, how the data were collected, and the size of the study. The larger studies and more powerful studies of EMF have not reported convincing statistical associations between power lines and childhood leukemia (e.g., Linet et al., 1997; McBride et al., 1999; UKCCS, 1999). Despite the larger sample size, these studies usually had a limited number of cases exposed over 2 or 3 milligauss (mG).

The following discussion briefly describes major studies.

- A study from British Columbia, Canada, included 462 children who had been diagnosed with leukemia and an equal number of children without leukemia for comparison (McBride et al., 1999). Magnetic-field exposure was assessed for each of the children in several ways: personal monitors were worn in a backpack for 48 hours, a monitor took measurements in the bedroom for 24 hours, the wiring outside the house was rated by potential exposure level, and measurements were taken around the outside perimeter of the homes. Regardless of the method used to estimate magnetic-field exposure, the magnetic-field exposure of children who had leukemia was not greater than that of the children in the comparison group.

- A study conducted in Ontario, Canada reported on the magnetic-field exposure of a smaller group of children (Green et al., 1999a). No increased risk estimates were found with the average magnetic fields in the bedroom or the interior, or with any of the three methods of estimating exposure from wire configuration codes. (Wire codes are a method of estimating relative exposure intensity based on the configuration of the power lines.) A still smaller group of 88 children with leukemia and their controls wore personal monitors to measure magnetic fields (Green et al., 1999b). Associations with magnetic fields were reported in some of the analyses, but most of the risk estimates had a broad margin of error and major methodological problems in the study preclude any clear interpretation of the findings.

- The United Kingdom Childhood Cancer Study, the largest study to date, included a total of 1073 childhood leukemia cases (UKCCS, 1999). Exposure was assessed by spot measurements in the home (bedroom and family room) and school, and summarized by averaging these over time. No evidence was found to support the idea of an increased risk of leukemia from exposures to magnetic fields from power sources inside or outside of the home.

- The UKCCS investigators had obtained magnetic-field measurements on only a portion of the cases in their study (UKCCS, 1999). To obtain additional information, they used a method to assess exposure to magnetic fields without entering homes; they were thus able to analyze 50% more subjects (UKCCS, 2000). For all these children, they measured distances to power lines and substations. This information was used to calculate the magnetic field from these external field sources, based on power-line characteristics related to production of magnetic fields. The results of the second UKCCS study showed no evidence for an association with leukemia for magnetic fields calculated to be between 1 mG and 2 mG, 2 mG and 4 mG, or 4 mG or greater at the residence, in contrast to the weak association reported for measured fields of 4 mG or greater in the first report (UKCCS, 1999).

Recently, researchers reanalyzed the data from previous epidemiology studies of magnetic fields and childhood leukemia (Ahlbom et al., 2000; Greenland et al., 2000). The researchers pooled the data on individuals from each of the studies, creating a study with a larger number of subjects and therefore greater statistical power than any single study. A pooled analysis is preferable to other types of meta-analyses in which the results from several studies are combined from grouped data obtained from the published studies. These analyses focused on studies that assessed exposure to magnetic fields using 24-hour measurements or calculations based on the characteristics of the power lines and current load. Both Greenland et al. and Ahlbom et al. used exposure categories of <0.1 microtesla (µT) (<1 mG) as a reference category. The statistical results of these analyses can be summarized as follows:

- The pooled analyses provided no indication that wire codes are more strongly associated with leukemia than measured fields.

- Pooling these data corroborates an absence of an association between childhood leukemia and magnetic fields for exposures below 0.3 µT (3 mG).

- Pooling these data results in a statistical association with leukemia for exposures greater than 0.3 or 0.4 µT (3-4 mG).

The authors are appropriately cautious in the interpretation of their analyses, and they clearly identify the limitations in their evaluation of the original studies. Magnetic fields above 0.3 µT in residences are estimated to be rather rare, about 3% in the U.S. (Zaffanella, 1993). Limitations include sparse data (few cases) to adequately characterize a relationship between magnetic fields and leukemia, uncertainties related to pooling different magnetic-field measures without evidence that all of the measures are comparable, and the incomplete and limited data on important confounders (other risk factors for disease that may distort the analysis) such as housing type and traffic density.

A meta-analysis of the data from epidemiologic studies of childhood leukemia studies was presented at the California Workshop and recently published (Wartenberg, 2001b). This meta-analysis did not have the advantage of obtaining and pooling the data on all of the individuals in the studies, unlike those published before it (Ahlbom et al., 2000; Greenland et al., 2000). Rather than individual data, Wartenberg (2001b) used an approach that extracted the published results, reported as grouped data from several published studies. He used 19 studies overall, after excluding 7 studies that had insufficient data on individuals or deficiencies in the exposure assessment data. He reported a weak association for a) "proximity to electrical facilities" based on wire codes or distance, and b) magnetic-field level over 2 mG, based on either calculations from wiring and loading characteristics (if available) or on spot magnetic-field measurements. The results show more cases than controls exposed to measured or calculated fields above 2 mG. The author concludes that the analysis supports an association, although the size of the effect is small to moderate, but also notes "limitations due to design, confounding, and other biases may suggest alternative interpretations" (Wartenberg, 2001b:S-100).

The results of this meta-analysis are not directly comparable to previous ones regarding fields of 3 or 4 mG because the analysis was not based on individual data. The comparison of grouped data used different cut points for the analysis and different criteria for the comparison group. None of these three analyses (Ahlbom et al., 2000; Greenland et al., 2000; Wartenberg, 2001b) includes the results of the UK analysis of over 3000 cases based on calculated fields, which found no association between EMF and childhood cancer, regardless of the exposure level.

2.2.2 Epidemiology Studies of Adults

Studies of adults with certain types of cancer, such as brain cancer, breast cancer, or leukemia, have reported associations with exposure to magnetic fields at residences, but results have not been consistent across studies. Contradictory results among studies argue against a conclusion that the association reflects a cause-and-effect relationship. Studies that include more people, obtain more detailed and individual exposure assessments, or include people who have higher exposures are weighed more heavily by scientists in their assessments of risk.

A study of 492 adult cases of brain cancer in California included measurements of magnetic fields taken in the home and at the front door, and considered the types of power-line wiring (Wrensch et al., 1999). The authors report no evidence of increased risk with higher exposures, no association with type of power line, and no link with levels measured at the front door.

A number of recent studies of breast cancer had focused on electric blankets as a source of high exposure. Electric blankets are assumed to be one of the strongest sources of EMF exposure in the home. Three studies of electric blanket use found no evidence that long-term use increased the risk of breast cancer. Women who developed breast cancer reported no difference in total use of electric blankets, use in recent years, or use many years in the past:

- Gammon et al. (1998) reported that, even for those who kept the blanket on most of the time, no increase in risk was found for those who had longer duration of use (measured in months).

- A study of 608 breast cancer cases also found no evidence of increased use of electric blankets or other home appliances in cases compared to controls, and no indication of increasing risk with a longer time of use (Zheng et al., 2000).

- In a cohort of over 120,000 female nurses, data were obtained on known risk factors for breast cancer as well as electric blanket use (Laden et al., 2000). For a large subset of this group, the questions about exposure were asked before the disease occurred, a step taken to eliminate bias in recalling exposure.

Erren (2001) reported the results of a meta-analysis of the studies of breast cancer, in which the results of 24 different studies in women were statistically aggregated. When the results of all 24 studies were pooled, including studies of workplace exposures, the estimate indicated an association between EMF and a small excess breast cancer risk. The pooled results for exposure to EMF in the vicinity of electrical facilities did not show an association with breast cancer, nor did the results for exposure to EMF from appliance use. However, the meta-analysis also showed a lack of consistency among the results of the individual studies, a broad variation in the designs, and a wide range of methods used to assess exposure. No adjustments were made to the data to give increased weight to studies based on more comprehensive exposure assessments. The author also noted that the weak statistical association might be an artifact rather than an indication of cause-and-effect (Erren, 2001).

2.2.3 Laboratory Studies of EMF

Laboratory studies complement epidemiologic studies of people because the heredity, diet, and other health-related exposures of animals can be better controlled or eliminated. The assessment of EMF and health, as for any other exposure, includes chronic, long-term studies in animals (*in vivo* studies) and studies of changes in genes or other cellular processes observed in isolated cells and tissues in the laboratory (*in vitro*).

Although the results of the RAPID Program are described in some detail in the NIEHS reports (NIEHS, 1998), many of the studies had not been published in the peer-reviewed literature. The RAPID research program included studies of four biological effects, each of which had been observed in only one laboratory. These effects are as follows: effects on gene expression, increased intracellular calcium in a human cell line, proliferation of cell colonies on agar, and increased activity of the enzyme ornithine decarboylase (ODC). Some scientists have suggested that these biological responses are signs of possible adverse health effects of EMF. It is standard scientific procedure to attempt to replicate results in other laboratories, because artifacts and investigator error can occur in scientific investigations. Replications, often using more experiments or more rigorous protocols, help to ensure objectivity and validity. Attempts at replication can substantiate and strengthen an observation, or they may discover the underlying reason for the observed response.

Studies in the RAPID program reported no consistent biological effects of EMF exposure on gene expression, intracellular calcium concentration, growth of cell colonies on agar, or ODC activity (Boorman et al., 2000b). For example, Loberg et al. (2000) and Balcer-Kubiczek et al. (2000) studied the expression of hundreds of cancer-related genes in human mammary or leukemia cell lines. They found no increase in gene expression with increased intensity of magnetic fields. To test the experimental procedure, they used X-rays and treatments known to affect the genes. These are known as positive controls and, as expected, caused gene expression in exposed cells.

Scientists have concluded that the combined animal bioassay results provide no evidence that magnetic fields cause, enhance, or promote the development of leukemia and lymphoma, or mammary cancer (e.g., Boorman et al., 1999; McCormick et al., 1999; Boorman et al., 2000 a,b).

2.2.4 Summary Regarding Cancer

The latest epidemiologic studies of childhood cancer, considered in the context of the other data, provide no persuasive and consistent evidence that leukemia in children is causally associated with magnetic fields measured at the home, calculated based on distance and current loading, or with wire codes. Recent meta-analyses reported no association between childhood cancer and magnetic fields below 2 or 3 mG. Although some association was reported for fields above this level, fields at most residences are likely to be below 3 or 4 mG. The authors of each of these analyses list several biases and problems that render the data inconclusive, and prevent resolution of the inconsistencies in the epidemiologic data. For this reason, laboratory studies can provide important complementary information. Large, well-conducted animal studies provide no convincing evidence that exposure increases the risk of cancer. Animal studies, and studies of initiation and promotion, provide no basis to conclude that EMF increases leukemia, lymphoma, breast, brain or any other type of cancer.

2.3 Research Related to Reproduction

Previous epidemiologic studies reported no association with birth weight or fetal growth retardation after use of sources of relatively strong magnetic fields, such as electric blankets, or sources of typically weaker magnetic fields such as power lines (Bracken et al., 1995; Belanger et al., 1998).

A recent epidemiology study examined miscarriages[2] in relation to exposures to magnetic fields from electric bed heating (electric blankets, heated waterbeds and mattress pads), which result in higher exposures than residential fields in general (Lee et al., 2000). The researchers assessed exposure prior to

[2] The medical term for miscarriage is spontaneous abortion.

the birth (a prospective study) and included information to control for potential confounding factors (other exposures and conditions that affect the risk of miscarriage). This study had a large number of cases and high participation rates. Miscarriage rates were lower among users of electric bed heating.

Studies of laboratory animals exposed to pure 60-Hz fields have shown no increase in birth defects, no multigenerational effects, and no changes that would indicate an increase in miscarriage or loss of fertility (e.g., Ryan et al., 1999; Ryan et al., 2000). Exposed and unexposed litters were no different in the amount of fetal loss and the number and type of birth defects, indicating no reproductive effect of EMF.

In summary, the recent evidence from epidemiology and laboratory studies provides no indication that exposure to power-frequency EMF has an adverse effect on reproduction, pregnancy, or growth and development of the embryo. The results of these recent studies are consistent with the conclusions of the NIEHS.

2.4 Recent Reviews by Scientific Advisory Groups

Reviews of the scientific research regarding EMF and health by the Health Council of the Netherlands were published in 2000 and updated in May 2001. The Institute of Electrical Engineers of the UK published a review in 2000. The National Radiological Protection Board of Great Britain (NRPB) Advisory Group on Non-Ionising Radiation published the most recent review in 2001. This review includes research published in 2000, and includes the most comprehensive discussion of the individual research studies.

2.4.1 National Radiological Protection Board of Great Britain (NRPB) Advisory Group on Non-Ionising Radiation

The conclusions from the report prepared by the NRPB's Advisory Group on Non-Ionising Radiation (AGNIR) on extremely low frequency (ELF) EMF and the risk of cancer are consistent with previous reviews. The eight members from universities, medical schools, and cancer research institutes reviewed the reports of experimental and epidemiological studies, including reports in the literature in 2000. Their general conclusions are as follows:

> Laboratory experiments have provided no good evidence that extremely low frequency electromagnetic fields are capable of producing cancer, nor do human epidemiological studies suggest that they cause cancer in general. There is, however, some epidemiological evidence that prolonged exposure to higher levels of power frequency magnetic fields is associated with a small risk of leukaemia in children. In practice, such levels of exposure are seldom encountered by the general public in the UK [or in the US] (NRBP, 2001: 164).

The group further recognizes that the scientific evidence suggesting that exposure to power-frequency electromagnetic fields poses an increased risk of cancer is very weak. Virtually all of the cellular, animal and human laboratory evidence provides no support for an increased risk of cancer incidence following such exposure to power frequencies, although sporadic positive findings have been reported. In addition, the epidemiological evidence is, at best, weak.

These conclusions of the Advisory Group are consistent with previous reviews by the NIEHS (1999) and the Health Council of the Netherlands (HCN, 2000). The NRPB response to the Advisory Group report states "the review of experimental studies by [the Advisory Group] AGNIR gives no clear support for a causal relationship between exposure to ELF-EMFs and cancer" (NRPB, 2001:1).

2.4.2 Health Council of the Netherlands

The Health Council of the Netherlands has prepared an update of its 1992 Advisory Report on exposure to electromagnetic fields (0 Hz to 10 MHz) (HCN, 2000). Eight members of the Expert Committee prepared the report. The Expert Committee based its analysis on the review and summaries of the studies provided in the NIEHS (1998) and concurred with the views of the director of the NIEHS (1999). For the update, the Committee evaluated a number of publications that appeared after these reports, e.g., McBride (1999) and Green et al. (1999a), and wrote:

> The committee thinks that the quality of the relevant epidemiological research has improved considerably since the publication of the advisory report in 1992. Even so, this research has not resulted in unequivocal, scientifically reliable conclusions (p. 15).

The Council emphasizes that the associations with EMF reported in epidemiologic studies are strictly statistical and do not demonstrate a cause-and-effect relationship. In their view, experimental research does not demonstrate a causal link or a mechanism to explain EMF as a cause of disease in humans. They concluded that there is no reason to recommend measures to limit residence near overhead power lines (HCN, 2000).

2.4.3 Institution of Electrical Engineers (IEE) of Great Britain

One of the recent reviews was that of the Institution of Electrical Engineers (IEE) of Great Britain (IEE, 2000). In 1992, the IEE set up a Working Party whose eight members review the relevant scientific literature and prepare reports of their views. Their conclusion is based on recent major epidemiologic studies and the scientific literature built up over the past 20 years. In May 2000, the Working Party concluded " . . . that there is still not convincing scientific evidence showing harmful effects of low level electromagnetic fields on humans" (IEE, 2000:1).

3.0 Ecological Research

Scientists have studied the effects of high-voltage transmission lines on many plant and animal species in the natural environment. In this section, we briefly review the research on the effects of EMF on ecological systems to assess the likelihood of adverse impacts. In addition to the comprehensive review of research on this topic by wildlife biologists at the BPA (Lee et al., 1996), we searched the published scientific literature for more recent studies published between 1995 and February 2001.

3.1 Fauna

The habitat on the transmission right-of-way and surrounding area shields most wildlife from electric fields. Vegetation in the form of grasses, shrubs, and small trees largely shields small ground-dwelling species such as mice, rabbits, foxes and snakes from electric fields. Species that live underground, such as moles, woodchucks, and worms, are further shielded from electric fields by the soil. Hence, large species such as deer and domestic livestock (e.g., sheep and cattle) have greater potential exposures to electric fields since they can stand taller than surrounding vegetation. However, the duration of exposure for deer and other large animals is likely to be limited to foraging bouts or the time it takes them to cross under the line. Furthermore, all species would be exposed to higher magnetic fields under a transmission-line than elsewhere, as the vegetation and soil do not provide shielding from this aspect of the transmission-line electrical environment.

Field studies have been performed in which the behavior of large mammals in the vicinity of high-voltage transmission lines was monitored. No effects of electric or magnetic fields were evident in two studies from the northern United States on big game species, such as deer and elk, exposed to a 500-kV transmission line (Goodwin 1975; Picton et al., 1985). In such studies, a possible confounding factor is audible noise. Audible noise associated with high-voltage power transmission lines (with voltages greater than 110-kV) is due to corona. Audible noise generated by transmission lines reaches its highest levels in inclement weather (rain or snow).

Much larger populations of animals that might spend time near a transmission line are livestock that graze under or near transmission lines. To provide a more sensitive and reliable test for adverse effects than informal observation, scientists have studied animals continuously exposed to fields from the lines in relatively controlled conditions. For example, grazing animals such as cows and sheep have been exposed to high-voltage transmission lines and their reproductive performance examined (Lee et al., 1996). In some studies, the effects of exposure over one or more successive breedings were examined (Angell et al., 1990). Compared to unexposed animals in a similar environment, it was found that the exposure did not affect reproductive functions or pregnancy of cows (Algers and Hennichs, 1985; Algers and Hultgren, 1987).

A group of investigators from Oregon State University, Portland State University, and other academic centers evaluated the effects of long-term exposure to EMF from a 500-kV transmission line operated by BPA on various cellular aspects of immune response, including the production of proteins by leukocytes (IL-1 and IL-2) of sheep. In previous unpublished reports, the researchers found differences in IL-1 activity between exposed and control groups. However, in their most recent replication, the authors found no evidence of differences in these measures of immune function. The sheep were exposed to 27 months of continuous exposure to EMF, a period of exposure much greater than the short, intermittent exposures of sheep grazing under transmission lines. Mean exposures of magnetic and electric fields were 3.5-3.8 µT (35-38 mG) and 5.2-5.8 kV/m, respectively (Hefeneider et al., 2001).

Scientists from Illinois Institute of Technology (IIT) monitored the possible effects of electric and magnetic fields on fauna and flora in Michigan and Wisconsin from 1969 – 1997 to evaluate the effects of an above-ground, military communications antenna operating at 76 Hz. The antenna produces EMF similar in physical characteristics to those produced by high-voltage transmission lines but of much lower intensity. This study included embryonic development, fertility, postnatal growth, maturation, aerobic metabolism, and homing behavior, and showed no adverse impacts of ELF electric and magnetic fields on the animals (NRC, 1997).

The hormone melatonin, secreted at night by the pineal gland, plays a role in animals that are seasonal breeders. Studies in laboratory mice and rats have suggested that exposure to electric and/or magnetic fields might affect levels of the hormone melatonin, but results have not been consistent (Wilson et al., 1981; Holmberg, 1995; Kroeker et al., 1996; Vollrath et al., 1997; Huuskonen et al., 2001). However, when researchers examined sheep and cattle exposed to EMF from transmission lines exceeding 500-kV, they found no effect on the levels of the hormone melatonin in blood, weight gain, onset of puberty, or behavior in sheep and cattle (Stormshak et al., 1992; Lee et al., 1993; Lee et al., 1995; Burchard et al., 1998).

Another part of the IIT study examined the effect of the antenna system fields on the growth, development, and homing behavior of birds. Studies of embryonic development (Beaver et al., 1993), fertility, postnatal growth, maturation, aerobic metabolism, and homing behavior showed no adverse impacts of ELF electric and magnetic fields on the animals (NRC, 1997). Fernie and colleagues studied the effects of continuous EMF exposure of raptors to an electric field of 10 kV/m in a controlled, laboratory setting. The exposure was designed to mimic exposure to a 765-kV transmission line.

Continuous EMF exposure was found to reduce hatching success, yet increase egg size, fledging success, and embryonic development (Fernie et al., 2000). In a study of the effects on body mass and food intake of reproducing falcons, the authors found that EMF lengthened the photoperiod as a result of altered melatonin levels in the male species, yet concluded that "EMF effects on adult birds may only occur after continuous, extended exposure" (p. 620), which is not likely to occur from resting on power lines (Fernie and Bird, 1999).

Several avian species are reported to use the earth's magnetic field as one of the cues for navigation. It has been proposed that deposits of magnetite in specialized cells in the head are the mechanism by which the birds can detect variations in the inclination and intensity of a dc magnetic field (Kirschvink and Gould, 1981; Walcott et al., 1988). In early studies of transmission lines, it was reported that the migratory patterns of birds appeared to be altered near transmission lines (Southern, 1975; Larkin and Sutherland, 1977). However, these studies were of crude design, and Lee et al. (1996) concluded that, "During migration, birds must routinely fly over probably hundreds (or thousands) of electrical transmission and distribution lines. We are not aware of any evidence to suggest that such lines are disrupting migratory flights" (p. 4-59). No further studies on this topic were identified in the literature.

Bees, like birds, are able to detect the earth's dc magnetic fields. They are known to use magnetite particles, which are contained in an abdominal organ, as a compass (Kirschvink and Gould, 1981). In the laboratory, they are able to discriminate between a localized magnetic anomaly and a uniform background dc magnetic field (Walker et al., 1982; Kirschvink et al., 1992).

Greenberg et al. (1981) studied honeybee colonies placed near 765-kV transmission lines. They found that hives exposed to electric fields of 7 kV/m had decreased hive weight, abnormal amounts of propolis (a resinous material) at hive entrances, increased mortality and irritability, loss of the queen in some hives, and a decrease in the hive's overall survival compared to hives that were not exposed. Exposure to electric fields of 7-12 kV/m may induce a current or heat the interior of the hive; however, placing the hive farther from the line, shielding the hive, or using hives without metallic parts eliminates this problem. ITT studied the effects of EMF on bees exposed to the 76-Hz antenna system at lower intensities and concluded that these behavioral effects of "ELF-EMF impacts are absent or at most minimal" (NRC, 1997:102).

Reptiles and amphibians contribute to the overall functioning of the forest ecosystems. However, little research has been performed on the effects of EMF on reptiles and amphibians in their natural habitat.

3.2 Flora

Numerous studies have been carried out to assess the effect of exposure of plants to transmission-line electric and magnetic fields. These studies have involved both forest species and agriculture crops. Researchers have found no adverse effects on plant responses, including seed germination, seedling emergence, seedling growth, leaf area per plant, flowering, seed production, germination of the seeds, longevity, and biomass production (Lee et al., 1996).

The only confirmed adverse effect of transmission lines on plants was reported for transmission lines with voltages above 1200-kV. For example, Douglas Fir trees planted within 15 m of the conductors were shorter than trees planted away from the line. Shorter trees are believed to result from corona-induced damage to the branch tips. Trees between 15 and 30 m away from the line suffered needle burns, but those 30 m and beyond were not affected (Rogers et al., 1984). These effects would not occur at the lower field intensities expected beyond the right-of-way of the proposed 500-kV transmission line.

3.3 Summary

The habitat on the transmission-line rights-of-way and surrounding areas shield smaller animals from electric fields produced by high-voltage transmission lines; thus, vegetation easily shields small animals from electric fields. The greatest potential for larger animals to be exposed to EMF occurs when they are passing beneath the lines. Studies of animal reproductive performance, behavior, melatonin production, immune function, and navigation have found minimal or no effects of EMF. Past studies have found little effect of EMF on plants; no recent studies of plants growing near transmission lines have been performed. In summary, the literature published to date has shown little evidence of adverse effects of EMF from high-voltage transmission lines on wildlife and plants. At the field intensities associated with the proposed 500-kV, no adverse effects on wildlife or plants are expected.

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