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

Central Ferry-Lower Monumental 500-kilovolt Transmission Line Project

Draft Environmental Impact Statement

July 2010

DOE/EIS-0422

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Bonneville Power Administration

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Responsible Agency: U.S. Department of Energy (DOE), Bonneville Power Administration (BPA)

Cooperating Agency: Washington Energy Facility Site Evaluation Council (EFSEC)

Title of Proposed Project: Central Ferry-Lower Monumental 500-kilovolt Transmission Line Project, DOE/EIS - 0422

State Involved: Washington

Abstract: BPA is proposing to construct, operate, and maintain a 38- to 40-mile-long 500-kilovolt (kV) transmission line in Garfield, Columbia, and Walla Walla counties, Washington. The proposed line would extend west from BPA's planned Central Ferry Substation in Garfield County to BPA's Lower Monumental Substation located in Walla Walla County. BPA is considering four routing alternatives for the proposed Central Ferry-Lower Monumental transmission line; portions of all four routes would parallel existing BPA lines in the area. Two of the routing alternatives for the transmission line are about 38 miles long, and the other two are about 40 miles long.

During BPA's 2008 Network Open Season (NOS) process, studies found that there was not enough available transmission capacity to accommodate all requests for long-term service from the Lower Snake River area in southeast Washington to load centers west of the Cascades and to major transmission lines serving the region's growing energy needs. Wind generation facilities built and proposed in the Lower Snake River area will increase the amount of power being produced in southeast Washington. Further studies revealed that building a new 500-kV line from BPA's planned Central Ferry Substation to BPA's Lower Monumental Substation would allow BPA to increase the electrical capacity of the transmission system in the southeast Washington area and accommodate the requests for firm transmission service. BPA is also considering the No Action Alternative.

The proposed project could create impacts to the following resources: soils; land use; vegetation; recreation; wildlife; water resources and fish; visual resources; cultural resources; social and economic resources; transportation; noise, public health and safety; air quality; and greenhouse gas emissions. Chapter 3 of the Environmental Impact Statement (EIS) describes the affected environment and potential impacts in detail.

Public comments are being accepted through August 16, 2010.

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For additional copies of this document, please call 1-800-622-4519 and ask for the document by name. The EIS is also on the Internet at:

http://www.efw.bpa.gov/environmental_services/Document_Library/Central_Ferry-Lower_Monumental/

You may also request copies by writing to:

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For additional information on DOE NEPA activities, please contact Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance, GC-20, U.S. Department of Energy, 1000 Independence Avenue S.W., Washington D.C. 20585-0103, phone: 1-800-472-2756 or visit the DOE NEPA Web site at neap.energy.gov.

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Acronyms and Abbreviations

ADT	Average Daily Traffic
AOU	American Ornithologists' Union
APLIC	Avian Power Line Interaction Committee
ATC	Available Transmission Capacity
B&B	Bed and Breakfast
BFCOG	Benton-Franklin Council of Governments
BFD	Bird Flight Diverter
BLM	U.S. Bureau of Land Management
BMP	best management practice
BPA	Bonneville Power Administration
CAA	Clean Air Act
CCD	Columbia Conservation District
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CRP	Conservation Reserve Program
COTR	Contracting Officer's Technical Representative
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CWA	Clean Water Act
DAHP	Department of Archaeology and Historic Preservation
Ecology	Washington State Department of Ecology
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EMF	electric and magnetic field
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FLPMA	Federal Land Policy Management Act
FSA	Farm Service Agency
GIS	Geographic Information Systems
IBA	Important Bird Area
kV	kilovolt
LOS	Level of Service

MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MW	megawatt
NAS	National Audubon Society
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NLCD	USGS National Land Cover Database
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	NOAA Fisheries Service
NOI	Notice of Intent
NOS	Network Open Season
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
PHS	Priority Habitats and Species (WDFW Database)
POD	Point of Delivery
POR	Point of Receipt
PRTPO	Palouse Regional Transportation Planning Organization
RCRA	Resource Conservation and Recovery Act
ReGap	Northwest Regional Gap Analysis Project
RAS	Remedial Action Schemes
RCW	Revised Code of Washington
RM	River Mile
SHPO	State Historic Preservation Officer
SR	State Route
SWPPP	Stormwater Pollution Prevention Plan
TES	Threatened, Endangered, and Sensitive
TNC	The Nature Conservancy
TSD	treatment, storage, and disposal.
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency

USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WAC	Washington Administrative Code
Washington EFSEC	Washington Energy Facility Site Evaluation Council
Washington OFM	Washington Office of Financial Management
WBC	Washington Biodiversity Council
WDFW	Washington Department of Fish and Wildlife
WDGER	Washington Division of Geology and Earth Resources
WDNR	Washington Department of Natural Resources
WECC	Western Electricity Coordinating Council
WNHP	Washington Natural Heritage Program
WRIA	Water Resource Inventory Areas
WRCC	Western Regional Climate Center
WSNWCB	Washington State Noxious Weed Control Board
WSDOT	Washington State Department of Transportation

Summary

This summary covers the major points of the draft environmental impact statement (DEIS) prepared for the proposed Central Ferry-Lower Monumental 500-kilovolt (kV) Transmission Line Project. This DEIS was prepared by Bonneville Power Administration (BPA). The proposed project involves construction of a new transmission line between BPA's Central Ferry and Lower Monumental substations in Garfield and Walla Walla counties, Washington.

S.1 Purpose of and Need for Action

BPA is a federal agency responsible for purchasing, developing, marketing, and transmitting electrical power to utility, industrial, and other customers in the Pacific Northwest. BPA has a statutory obligation to ensure it has sufficient capability to serve its customers through a safe and reliable transmission system.

The Federal Columbia River Transmission Act directs BPA to construct improvements, additions, and replacements to its transmission system that the BPA Administrator determines are necessary to provide service to BPA's customers and maintain electrical stability and reliability (16 United States Code [U.S.C.] § 838b[b-d]). The proposed project is needed to increase the electrical capacity of the transmission system in the southeast Washington area in response to requests that BPA has received for use of the system.

To help guide its approach to receiving, managing, and responding to requests for transmission service over its transmission system, BPA has adopted an Open Access Transmission Tariff for its transmission system (BPA 2008). This tariff is generally consistent with the Federal Energy Regulatory Commission (FERC) *pro forma* open access tariff. BPA's tariff has procedures that provide access to BPA's transmission system for all eligible service requests on a first-come, first-served basis, subject to a determination that there is sufficient available transmission capacity (ATC) on BPA's transmission system. ATC is the measure of the transfer capability remaining on a transmission line or network to carry additional load, over and above already committed uses. If additional transmission capacity is needed to provide the requested service, the tariff provides that any development of facilities to provide this additional capacity must meet all BPA requirements and will be subject to appropriate prior environmental review under the National Environmental Policy Act (NEPA).

Consistent with its tariff, BPA accepts requests for transmission service in a transmission service request queue. Towards the end of the last decade, the amount of requested service in this queue, measured in megawatts (MW), far exceeded projected load growth in the Pacific Northwest region. For example, in March 2008, BPA's transmission service request queue contained about 9,200 MW of requests for service on BPA's system, exclusive of requests for service on the Southern and Montana Interties. At the same time, BPA forecasts only 2,500 average MW of load growth for all utilities within the Pacific Northwest through 2017. Because the amount of requests in the queue far exceeded forecast load growth for the region, it was clear that some transmission service requests in the queue were speculative; however, it was not possible to determine which ones. This uncertainty made it extremely difficult to accurately plan for truly necessary system upgrades, and the sheer volume of requests was making the queue congested and unmanageable.

To help address this issue, BPA developed and initiated a FERC-approved Network Open Season (NOS) process in March 2008 (hereinafter referred to as the 2008 NOS). During the 2008 NOS, utilities, power generators (including wind generators), power marketers, and others could submit requests for use of BPA’s transmission system to transmit their power. BPA then was able to determine which of these requests could be served by ATC and which of these requests would require system upgrades to provide the requested service.

For those service requests requiring system upgrades, BPA then conducted studies of separate “clusters” of requests to determine the transmission system expansions needed to serve those requests. In conducting these studies, BPA took into consideration reliability criteria established by the North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC). NERC is the national electric reliability organization and WECC is the regional reliability organization. Utilities are required to meet both sets of standards when planning new facilities.

As discussed above, there is insufficient existing ATC in the Lower Snake area in southeast Washington to accommodate all of the requests BPA has received for use of the system. Most of the ATC in this area is already committed to local generation and transfers of electric power from Montana and Idaho to the Northwest. If BPA’s existing transmission system in the Lower Snake area only was used to respond to the service requests that BPA has received, it is likely that BPA’s system would become overloaded at certain times of the year. This could lead to outages of not only existing BPA and other utility transmission lines in the Lower Snake area, but other portions of the regional transmission system through “cascading” outages.

In evaluating various ways to address the need, BPA considered a variety of methods to improve its transmission infrastructure in the Lower Snake area including upgrades of existing transmission lines and Remedial Action Schemes (RAS) to manage existing transmission service commitments in the Lower Snake area. Up until now, these actions have allowed BPA to avoid the need to build new substations and transmission lines. However, the volume of service requests currently facing BPA exceeds the capability of these measures.

In meeting the need for action, BPA will attempt to achieve the following objectives:

- Optimize electrical capacity/performance of the proposed new line.
- Maintain reliability of BPA’s transmission system to BPA and industry standards.
- Meet BPA’s contractual and statutory obligations.
- Minimize project costs where possible.
- Minimize impacts to the human environment.

Lead and Cooperating Agencies

BPA is the lead agency for the Central Ferry-Lower Monumental Transmission Line Project EIS. The Washington Energy Facility Site Evaluation Council (Washington EFSEC) will participate in preparation of this EIS as a cooperating agency under NEPA. BPA is also coordinating with the Washington Department of Natural Resources (WDNR) to attempt to ensure that environmental issues relevant to WDNR and its SEPA needs are addressed, to the fullest extent practicable in BPA’s NEPA process for the proposed project.

Public Involvement

During the development of this EIS, BPA solicited input from the public, agencies, interest groups, and others to help determine what issues should be studied in the EIS. BPA requested comments through publishing notices in the Federal Register, mailing letters to approximately 176 people and agencies requesting comments, holding one public meeting, posting information on the project Web site, and meeting with state agencies. Most scoping comments received by BPA focused on potential impacts on land use and the future development of wind resource areas, wildlife, soils, water resources, visual resources, and cultural resources. Commenters also expressed preferences for one of the routing alternatives based on concerns for loss of farmland and future wind resource lands.

S.2 Alternatives

BPA is considering four alternatives to meet the purpose and need: the North Alternative, the South Alternative, the Combination A Alternative, and the Combination B Alternative. BPA is also considering the No Action Alternative. Under the No Action Alternative, a new line would not be constructed.

Regardless of the action alternative, the proposed transmission line would extend from BPA's new Central Ferry Substation generally west to its existing Lower Monumental Substation, a distance of about 40 miles. The new line would begin at the new Central Ferry Substation near the Port of Central Ferry along the Snake River (Garfield County) and follow a westerly path south of the Snake River through Garfield, Columbia, and Walla Walla counties to the existing Lower Monumental Substation (Walla Walla County) (Figure S-1).

Transmission Line Right-of-way

All action alternatives would require a 150-foot-wide right-of-way easement for the entire length of the transmission line corridor. Because the proposed project would generally parallel existing 500-kV transmission lines in the project vicinity, BPA also has routed all action alternatives to ensure that adequate physical separation exists between the proposed line and the existing lines for reliability purposes. The simultaneous outage of multiple important lines in an area greatly increases the chances for blackouts. In order to minimize the risk of simultaneous outage, the proposed line would be routed at least 1,200 to 2,500 feet from the existing lines in areas where the lines would be parallel.

Transmission Towers

The towers for the proposed 500-kV line would be 104- to 189-foot-tall single-circuit, lattice steel towers with spans of approximately 1,200 feet between towers. The towers would be made of galvanized steel and would appear shiny for two to four years before they dull with the weather. About 167 to 178 transmission towers would be needed to carry the conductors for the proposed transmission line.

Four types of footings (plate, grillage, rock anchor, or concrete shaft) would be used depending on the terrain, soil, and tower type. The area excavated for each tower footing would range from 4 feet by 4 feet up to 15 feet by 15 feet. For plate and grillage footings, a trackhoe would be used to excavate the footings. For rock anchor or concrete shaft footings, a drill would be used to make an appropriately-sized vertical shaft for the footings. Each tower would occupy a permanent area of approximately 0.13 acre, with a temporary disturbance during construction of approximately 0.5 acre.

Conductors

Conductors, wires that carry the electrical current on a transmission line, are suspended from towers with insulators. Insulators are made of non-conductive materials (porcelain or composite materials) that prevent electric current from passing through towers to the ground.

Overhead Ground Wire and Counterpoise

Two small wires (0.5-inch diameter), called overhead ground wires, would be attached to the top of the transmission towers. Overhead ground wires are used for lightning protection. In order to take the lightning charge from the overhead ground wire and dissipate it into the earth, a series of wires called counterpoise would be buried in the ground at each tower. Counterpoise would vary from one to six runs of wire that extend up to 250 feet from the tower, with three counterpoise running out from each side of the tower footings.

Fiber Optic Cable

A fiber optic cable also would be strung on the towers along portions of the transmission line. The fiber would be used for communications as part of the power system. Fiber optic cables are less than 1 inch in diameter and are installed either as the overhead ground wire or independently on the towers. Every 3 to 5 miles there would be a splice location for the stringing and tensioning of the fiber optic cable.

Pulling/Tensioning Sites

Pulling/tensioning sites are temporarily disturbed areas from which the conductors are pulled and tightened to the correct tension during construction. About 22 pulling/tensioning sites would be required along the proposed project's approximately 38- to 40-mile length.

Each site would temporarily disturb an area approximately 300 feet long by 100 feet wide, or about 0.75 acre each. Pulling and tensioning of the proposed line also would require "snubs," which are trenches approximately 6 feet deep by 4 feet wide by 10 feet long that are used to tie off the conductors after they are pulled through the towers and before they are strung under tension.

Access Roads

BPA's access road system would require a combination of permits and road easements across public and private ownership. Roads would be located within the transmission line rights-of-way wherever possible. Where conditions require, such as steep terrain, roads would be constructed and maintained outside the right-of-way.

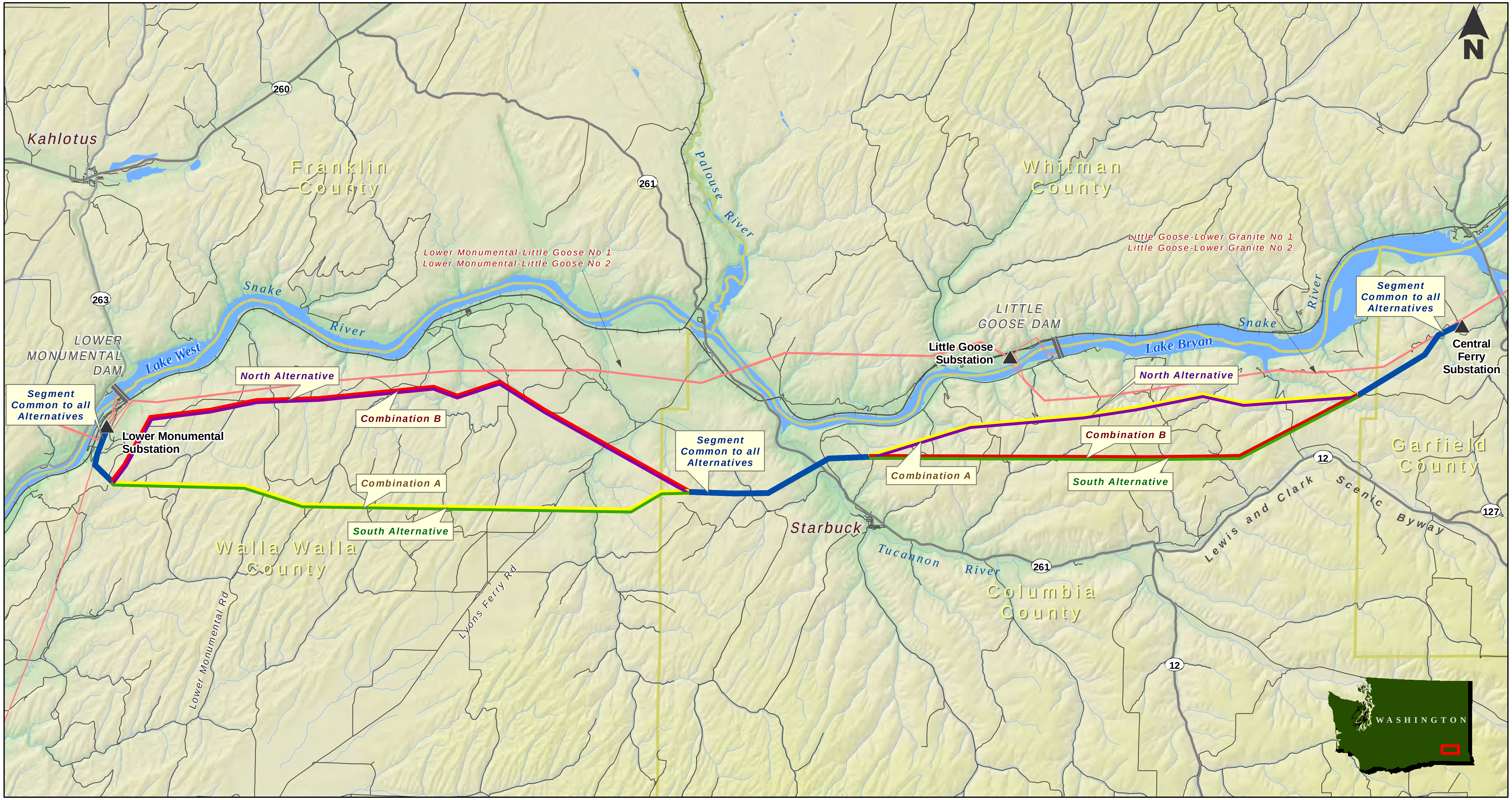
Access roads would require a 14-foot-wide travel surface (wider on curves), with an approximately 20- to 40-foot-wide total area disturbed (including drainage ditches). Fifty-foot wide easements would be obtained from landowners for roads that require new construction, and 20-foot-wide easements would be obtained for existing roads that may need improvements. Road grades would vary depending on the erosion potential of the soil: 6 to 8 percent on erodible soils, 10 to 15 percent for erosion resistant soils. For short distances on steep terrain, a maximum of 18 percent grades could occur.

Roads would be rocked where needed for dust abatement, stability, load bearing, and seasons of use. Other improvements could include clearing brush; widening existing roads; improving or smoothing out curves; upgrading existing road surfaces from native to aggregate; adding ditches and/or culverts, rolling dips, or waterbars; and building or reinforcing existing bridges.

Project area roads that likely would need some type of improvement to allow line access include Fletcher Road, Powers Road, Tucker Road, Riveria Road, Ferrell Road, Archer Road, Hagen Road, Scot Station Road, Whitetail Road, Canyon Bottom Way, and New York Gulch Road.

If towers are placed in agricultural fields, BPA would typically build only temporary access to the tower sites to construct the line.

BPA, in coordination with landowners, may place gates at the entrances to access roads to prevent public access to private lands and the transmission line rights-of-way.



BONNEVILLE POWER ADMINISTRATION

Data Source:
Bonneville Power Administration Regional GIS Database.
All data is best available, 12/15/2009

0 2.5 5 10 Miles

Proposed Route Alternatives
(Route sections shown adjacent to one another share the same proposed alignment)

- Segments Common to all Alternatives
- North Alternative
- South Alternative
- Combination A Alternative
- Combination B Alternative

- Substation
- Federal Dam
- Existing BPA Transmission Lines
- County Boundary
- Major Highway
- Roads
- Railroad

Bonneville Power Administration
Central Ferry-Lower Monumental 500-kV
Transmission Line Project
Figure S-1
Project Area Map

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Lower Monumental Substation Modifications

The main equipment that would be installed at the Lower Monumental Substation as part of the proposed project would include power circuit breakers (switching devices to automatically interrupt power flow), disconnect switches (devices to mechanically disconnect equipment), bus tubing and pedestals (the ridged aluminum pipes that the power flows on within the substation), and transmission dead-end towers (the structures that bring the line into the substation).

To allow entry of the proposed transmission line into Lower Monumental Substation, three existing transmission lines would require realignment in the vicinity of Lower Monumental Substation. This would require excavation of new footings and construction of five to six new steel lattice towers for the relocated portions of the existing transmission lines as they enter Lower Monumental Substation. Counterpoise also would be installed at these new towers. Existing access roads would most likely be sufficient, although some new spur roads may be constructed to provide access to the new towers.

Staging Areas

One or two temporary staging areas would be needed along or near the proposed transmission line for construction crews to store materials, equipment, and vehicles. Staging areas can be from 5 to 15 acres in size, depending on the number or location needed.

Vegetation Clearing

Most of the vegetation along the proposed transmission line routes is low-growing sagebrush or agricultural fields, both of which are compatible with transmission lines. BPA does not anticipate any tree removal where the four routing alternatives cross the Tucannon River.

Maintenance

During the life of the project, BPA would perform routine, periodic maintenance and emergency repairs to the transmission line. For lattice steel structures, maintenance usually involves replacing insulators and checking for loose hardware. BPA typically conducts routine helicopter inspection patrols twice a year.

Vegetation also would be maintained along the line for safe operation and to allow access to the line. It is expected that any of the proposed transmission line corridors would require little vegetation maintenance because they primarily consist of wheat, brush, and other low-growing vegetation.

Final Design and Construction

Prior to actual construction of the transmission line, final design work would be completed to determine the precise location of all project components. As final design is completed, construction of the transmission line would begin. Access roads would be constructed or improved. Holes for tower footings would be dug and put in place at each tower site. Towers would be either assembled at the tower site and lifted into place by a large crane or assembled at a staging area and set in place by a large helicopter. The towers would be then bolted to the tower legs, which are attached to the footings.

Next, the conductor would be strung from tower to tower and fitted together using either hydraulic compression or implosive devices. Nine conductors (three bundles each with three conductors) would need to be fitted approximately once every 1.5 to 2 miles. After the conductor has been fitted together, pulling/tensioning equipment would be used to place the conductor in the appropriate tension so that minimum conductor heights are met.

Following construction of the towers, any access roads damaged during construction would be improved. Site restoration and revegetation at tower sites, along access roads, and in other disturbed areas, also would occur following completion of construction.

Construction Schedule and Work Crews

Construction of the proposed transmission line would take place during a 2-year period between 2011 and 2013. Initial construction work for the first few months of the construction period would involve acquisition of easements, clearing of the right-of-way and construction/improvement of access roads. Tower pad and line construction then would most likely occur during a 1-year period following this initial construction work. A typical crew can usually construct about 8 miles of transmission line in about 3 months. In areas where terrain is steep, progress may be slower. Other activities that would occur during the construction period would include acquisition of any additional easements needed, substation work including work to connect the new line and other existing lines into the substations, and tower site and road restoration work.

S.2.1 Proposed Action Alternatives

All four action alternatives begin at BPA's Central Ferry Substation near the Port of Central Ferry in Garfield County, Washington, and generally head in a westerly direction to BPA's existing Lower Monumental Substation in Walla Walla County, Washington (see Figure S-1). All four action alternatives share the same proposed Tucannon River crossing route.

North Alternative

This route extends southwest from Central Ferry Substation for about 11 miles mostly parallel to and about 1,200 to 2,500 feet south of BPA's two existing Little Goose-Lower Granite 500-kV steel lattice transmission lines, to a point almost directly south of the Little Goose hydroelectric project on the Snake River. At this point, the route angles away from the existing lines and proceeds in a southwest direction for about 6 miles before crossing the Tucannon River directly north of the town of Starbuck.

From the Tucannon River crossing, the North Alternative route continues southwest and west for about 3 miles before angling northwest for about 5 miles to a point approximately 1,500 feet south of BPA's two existing Lower Monumental-Little Goose 500-kV steel lattice transmission lines. From this point, the route continues west for about 14 miles to BPA's existing Lower Monumental Substation. Much of this latter segment of the route runs parallel to and approximately 1,500 feet south of the existing lines. This alternative is about 40 miles long.

There would be approximately 178 transmission towers for the North Alternative. This action alternative would require about 33 miles of new road construction and about 5 miles of road improvements. Fiber optic cable would be installed along a portion of the North Alternative.

South Alternative

This route extends southwest from Central Ferry Substation for about 3 miles mostly parallel to and approximately 1,200 to 2,500 feet south of BPA's two existing Little Goose-Lower Granite 500-kV steel lattice transmission lines. The route then diverges from these existing lines as they angle to the west and continues southwest and then west for about 15 miles before crossing the Tucannon River directly north of the town of Starbuck.

From the Tucannon River crossing, the South Alternative route proceeds west for about 20 miles to BPA's existing Lower Monumental Substation. This alternative is about 38 miles long.

There would be approximately 167 transmission towers for the South Alternative. This action alternative would require about 35 miles of new road construction and about 13 miles of road improvements. Like the North Alternative, a fiber optic cable would be installed along a portion of the South Alternative.

Combination A Alternative

The Combination A Alternative route follows the North Alternative route from Central Ferry Substation until it reaches the Tucannon River where it then follows the South Alternative route to Lower Monumental Substation. This alternative is about 38 miles long.

There would be approximately 167 transmission towers for the Combination A Alternative. This action alternative would require about 33 miles of new road construction and about 9 miles of road improvements. A fiber optic cable would be placed in the same location as described above for the North Alternative.

Combination B Alternative

The Combination B Alternative route follows the South Alternative route from Central Ferry Substation until it reaches the Tucannon River where it then follows the North Alternative route to Lower Monumental Substation. This alternative is about 40 miles long.

There would be approximately 178 transmission towers for the Combination B Alternative. This action alternative would require about 35 miles of new road construction and about 10 miles of road improvements. A fiber optic cable would be placed in the same location as described above for the South Alternative.

S.2.2 No Action Alternative

Under the No Action Alternative, BPA would not build the proposed Central Ferry-Lower Monumental transmission line. Without building the proposed line, BPA would not be able to offer long-term firm transmission service for all of the service requests that the proposed line is intended to accommodate. However, BPA may be able to provide other forms of transmission service, such as non-firm service to some or all of these customers.

S.2.3 Alternatives Considered but Eliminated from Detailed Study

During the scoping process, BPA considered a wide range of potential alternatives for the proposed action. Alternatives that did not meet the need and purposes, including whether they were practical or feasible, or would obviously have greater adverse environmental effects than the proposed action, were eliminated from detailed study. The following alternatives did not meet the need and purposes.

Non-Transmission Alternatives

BPA considered whether a non-transmission alternative such as distributed generation, demand side management, general conservation, or RAS changes would meet the project need and purposes. Concerning distributed generation, demand side management, and general conservation, BPA's proposed action involves responding to existing requests for transmission service over a portion of its transmission system that has limited ATC. These three non-transmission alternatives would not address the specific need for additional capacity in the Lower Snake area. BPA's planning studies showed that even if all service requests were subjected to the Lower Snake RAS and this RAS equipment was upgraded to optimize transfer capability, BPA still could not grant the requested 1,100 MW of additional firm transmission service. Because they would not meet this identified need, these non-transmission alternatives were considered but eliminated from detailed study in this EIS.

Undergrounding the Transmission Line

Underground transmission cables are highly complex when compared to overhead transmission lines. For 500-kV transmission lines, underground cable may be 5 to 10 times as costly as overhead designs. Because costs are so high, BPA uses underground cable in limited, special reliability, or routing situations, such as near nuclear stations; at long water crossings; or in highly developed urban areas.

Transmission Line Alternatives

Use Existing Transmission System Without Upgrades

Because of the severe technical operational issues associated with using the existing transmission system without upgrades, and because this alternative would not meet the identified need while achieving the project purpose of maintaining system reliability to BPA and industry standards, this alternative was eliminated from further consideration.

Lower Voltage Line Upgrades

BPA also considered lower voltage upgrades to address the potential for thermal overloads and voltage criteria violations at the transfer levels required to meet both existing transmission service commitments and requested service. A preliminary analysis revealed that upgrading these lines would require full reconstruction of the lines, which would necessitate extended outages resulting in significant impacts to the customers of these utilities. In addition, these upgrades would not mitigate voltage criteria violations that were also identified at the full requested transfer levels, which would require reactive power devices. Therefore, this alternative was eliminated from further consideration.

Central Ferry-Walla Walla-McNary 500-kV line

This alternative would entail construction of a new 500-kV transmission line from Central Ferry to a new 500-kV substation in the Walla Walla area, and a new 500-kV line from Walla Walla to BPA's McNary Substation. This alternative would not meet the need and purposes because the line would need to be at least double the length and double the cost of the proposed Central Ferry-Lower Monumental line, and other utilities did not indicate an interest in participating due to the higher cost, lead time, and risk compared with their preferred project alternative. Therefore, this alternative was eliminated from further consideration.

S.3 Affected Environment, Environmental Consequences, and Mitigation Measures

S.3.1 Affected Environment

The proposed project is located in Garfield, Columbia, and Walla Walla counties in southeastern Washington. The town of Starbuck is the closest community to the proposed project. Other communities in the general vicinity include Pomeroy, Dayton, Prescott, Waitsburg, and Walla Walla. Communities further away but still within the affected environment for the Socioeconomics and Public Facilities analysis include the Tri-Cities of Kennewick, Pasco, and Richland, Washington, located west of Walla Walla County in Franklin and Benton counties. The majority of the proposed project area is sparsely populated with development mainly limited to rural homes, ranches, and farms. The Columbia Plateau physiographic region, in which the proposed project would be located, has been occupied by human populations for at least 10,000 years. Indigenous oral history information holds that Native people have lived in the project area since the beginning of time. Several tribes occupied portions of the landscape in and around the project area including the Walla Walla, Nez Perce, Palouse, Cayuse, and Umatilla tribes.

The proposed project lies within the Columbia Plateau Ecoregion, a semi-arid ecoregion that encompasses nearly one-third of the state of Washington. Summers are hot and dry, and winters are cold and overcast. Topography in the project area is characterized by gently rolling to moderately hilly plateaus incised by rivers and streams, with elevations ranging from 500 to 1,800 feet above sea level. The lower Snake River flows north of the project corridor from east to west and forms the northern and western boundaries of the project area. This stretch of the river is flanked by basalt cliffs and represents a distinct departure from the uniform rolling hills on either side of the river. The Tucannon River, the other perennial waterbody in the project area, flows north through the project corridor to its confluence with the Snake River. The remaining streams within the project corridor have seasonal flow (i.e., primarily spring snow melt and high rainfall runoff).

Much of the project area was historically dominated by native grasslands and shrub-steppe vegetation communities, but has been converted to agricultural uses. Although native grassland communities remain in scattered pockets within the project area, invasive species have displaced native forbs and bunchgrasses in much of the project area. Wildlife habitat within the project area includes cropland (dry-land wheatfields), disturbed and native grasslands, and sparse patches of shrub-steppe community. Additional habitats important to wildlife found within, or very near, the proposed project include cliffs and rock outcrops, as well as riparian areas found along the Tucannon and Snake rivers.

Land in the project area is primarily in private ownership with some state and federal parcels and is mainly used for crops and livestock grazing. Other land uses in the project vicinity include lands participating in the Conservation Reserve Program (CRP), fallow land, state and county roads, commercial gravel pits, electric transmission lines, and outdoor recreational sports and activities (e.g., hunting and fishing). A small portion of the project corridor (3 to 4 percent, depending on the alternative corridor) is designated as prime farmland or prime farmland if irrigated, with the majority of this designation being prime farmland if irrigated. More than half of the project corridor is designated as farmland of statewide importance.

Recreational activities in the project area include boating, fishing, hunting, camping, hiking, wildlife watching, sightseeing, photography, and cultural and historical tourism, such as re-tracing the Lewis and Clark expedition. General day-use activities, including swimming, picnicking, and sports games, also occur in the broader project area. Many of these activities are focused along the banks of the Snake River north and west of the project corridor. Recreation areas in the vicinity of the project area include those associated with Lake Bryan, Lake West, and Lake Sacajawea, as well as the Lewis and Clark National Historic Trail.

Roads in the project area are a combination of paved and highway system roads, as well as improved and unimproved roads. Major highways in the project area include U.S. Highway 12, State Route (SR) 127, SR 261, and SR 263.

S.3.2 Environmental Consequences and Mitigation Measures

The following sections provide a summary of the environmental impacts and mitigation for proposed action alternatives and the No Action Alternative by potentially affected resource. Mitigation measures listed under each resource section would apply to all of the proposed action alternatives.

S.3.2.1 Geology and Soils

Environmental Consequences of Action Alternatives

An assessment of the proposed project's potential impacts on geology and soils is presented in Section 3.1 of the EIS. Permanent impacts from construction would include some alterations to local topography, but no sensitive or hazardous geologic resources would be impacted.

Soils would be disturbed during construction, related to vegetation removal, grading, trenching, and construction traffic. The erosion hazard classes of the soils that would be affected by construction are displayed by alternative in Table S-1; most of the projected disturbance would occur on soils with severe soil erosion potential. Temporary erosion impacts would, however, be ***low*** with the implementation of the erosion limiting mitigation measures identified in the following subsection. With the proposed mitigation measures in place, permanent soil erosion impacts would also be ***low***.

Table S-1. Erosion Hazard Classes Potentially Affected by Construction of the Action Alternatives (acres)

Action Alternative/ Project Component	Slight	Moderate	Severe	Total
North Alternative	0.9	47.1	306.6	354.6
South Alternative	0.4	23.0	319.5	343.0
Combination A Alternative	0.4	31.2	304.9	336.5
Combination B Alternative	0.9	39.0	321.6	361.1

Source: NRCS 2009a, 2009b, 2009c
Numbers are rounded and may not sum exactly.

Project construction could also result in the compaction of soils. Soil compaction would occur if heavy equipment or repeated vehicle traffic press soil particles together, especially if the soils are moist or wet. Soils in the project area generally have low to moderate resistance to soil compaction, meaning that traffic and equipment operating directly on soils would likely cause soil compaction. To limit soil compaction, heavy equipment and vehicles would only be operated on access roads and within approved construction footprints, and off-road construction would be limited during wet conditions. Implementation of these and other mitigation measures identified below would reduce compaction, and long-term impacts to soils would be ***low***. Table S-2 identifies the projected acres that would be impacted by construction of the action alternatives by soil compaction resistance class. Permanent road design would take slopes, soil types, bedrock, and other factors into account based on site specific information. With the proposed mitigation measures in place, permanent soil compaction impacts would be ***low***.

Table S-2. Compaction Resistance Classes Potentially Affected by Construction of the Action Alternatives (acres)

Action Alternative/ Project Component	Low[1/]	Moderate[2/]	Not Rated[3/]	Total
North Alternative	153.1	196.3	5.2	354.6
South Alternative	114.1	223.9	5.3	343.0
Combination A Alternative	105.7	225.6	5.3	336.5
Combination B Alternative	161.5	194.4	5.2	361.1

Notes:
Numbers are rounded and may not sum exactly.
1/ A low resistance to compaction rating indicates that one or more soil characteristics exist that favor the formation of a compacted layer.
2/ Soils with a moderate resistance to compaction have features that are favorable to resisting compaction.
3/ Some units have not been rated by the NRCS; this is often because the rating is not applicable, such as for bedrock or water.
Source: NRCS 2009a, 2009b, 2009c

Mitigation Measures

- Prior to construction, conduct a detailed geologic hazard assessment for the selected action alternative. This assessment will include a review of geologic maps and aerial photomaps combined with surface condition assessments at each proposed tower location and surrounding terrain. In addition, subsurface information will be obtained from water well logs, material exposed in existing road and stream-cut slopes, and construction/design information from the existing transmission lines in the project area. Particular attention will be given to on-site evaluation of the slope stability of each proposed tower location. Tower or road locations found to be within previously unidentified active slides, bedrock hollows, or other geologic hazard areas will be relocated outside the limits of these areas.
- Prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) to lessen soil erosion and improve water quality of stormwater run-off. SWPPPs are developed to prevent movement of sediment off site to adjacent water bodies during short term or temporary soil disturbance at construction sites. The SWPPP for this project will address stabilization practices, structural practices and stormwater management.
- Design access roads to control runoff and prevent erosion by using low grades, outsloping, intercepting dips, water bars, or ditch-outs, or a combination of these methods.
- Minimize construction equipment use within 150 feet of a waterbody (stream or river).
- Surface all permanent access roads with rock to help prevent erosion and rutting of road surfaces and to support vehicle traffic.
- Minimize construction on steep, unstable slopes, if possible.
- Save topsoil removed for structure and new access road construction for on-site restoration activities to promote regrowth from the native seed bank in the topsoil. If contaminated, follow-up weed control would be needed.
- Cover exposed piles of soil with plastic or similar material to reduce erosion potential from rain or wind.
- Cut or crush vegetation, rather than blade, in areas that will remain vegetated in order to maximize the ability of plant roots to keep soil intact and prevent sediment movement offsite.
- Revegetate or reseed all disturbed areas with a native plant/grass seed mixture suited to the site and landowner, to promote vegetation that will hold soil in place.
- Till or scarify compacted soils before reseeding where necessary.
- Monitor erosion control best management practices (BMPs) to ensure proper function and nominal erosion levels.
- Monitor revegetation and site restoration work for adequate growth; implement contingency measures as necessary.
- Mark construction limits within agricultural fields or grasslands to minimize disturbance.
- Inspect and maintain project facilities, including the access roads.
- Inspect and maintain tanks and equipment containing oil, fuel, or chemicals for drips or leaks and to prevent spills onto the ground or into state waters.
- Maintain and repair all equipment and vehicles on impervious surfaces away from all sources of surface water.
- Refuel and maintain equipment at least 25 feet from any natural or manmade drainage conveyance including streams, wetlands, ditches, catch basins, ponds, and pipes, and

provide spill containment and cleanup. Utilize pumps, funnels, and absorbent pads for all equipment fueling and maintenance operations.

- Provide spill prevention kits at designated locations on the project site and at the hazardous material storage areas.
- Minimize the number of road stream crossings.
- Stabilize cut and fill slopes.

Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to geology and soils.

S.3.2.2 Land Use

Environmental Consequences of Action Alternatives

An assessment of the project's potential impacts on land use is presented in Section 3.2 of the EIS. Land in the project area is primarily in private ownership, with more than 95 percent of the land within the project corridor (transmission line right-of-way and access roads) for each alternative privately owned. Other land owners include the WDNR and the U.S. Army Corps of Engineers.

Construction of the action alternatives would result in temporary impacts to land use from use of heavy equipment causing soil and crop disturbance, noise, and dust. While construction would cause localized temporary disturbance, temporary impacts to land uses would be ***low***. All temporarily disturbed areas including temporary access roads would be restored to their original condition following construction activities and landowners would be reimbursed for impacts related to facility construction.

Although construction of the proposed project would result in the development of a new utility corridor, the permanent impacts from construction would be ***low*** because the proposed project would not substantially affect overall land use patterns in the project area. Table S-3 identifies the potentially affected acres by land use and action alternative.

Table S-3. Impacts to Land Use (acres)

Action Alternative/ Project Component	Agriculture	Grassland	Developed	Total
Temporary Construction Impacts				
North Alternative	96.6	251.8	6.3	354.6
South Alternative	101.3	237.3	4.6	343.0
Combination A	93.1	238.9	4.6	336.5
Combination B	104.8	250.2	6.3	361.1
Permanent Impacts				
North Alternative	57.1	120.4	2.0	179.5
South Alternative	58.1	128.0	2.0	188.1
Combination A	54.8	121.3	2.0	178.1
Combination B	60.4	127.1	2.0	189.5

Numbers are rounded and may not sum exactly.
Source: USGS 2001

Construction would result in temporary disturbance to farmlands of statewide importance and prime farmland, if irrigated. Impacts could include damage to crops and soil compaction, but would be temporary and localized and, therefore, considered ***low***. There would be no disturbance to prime farmland. Permanent impacts to farmlands of statewide importance would range from about 0.01 percent to 0.02 percent of the county alternative, depending on alternative and, therefore, permanent impacts are expected to be ***low***. Permanent impacts to prime farmland, if irrigated, would range from 5 to 8 acres, approximately 0.01 percent of land in this classification in the affected counties, and are, as a result, expected to be ***low***. Impacts to prime farmland are summarized by action alternative in Table S-4.

Table S-4. Impacts to Prime Farmland (acres)

Action Alternative/ Project Component	Prime Farmland	Farmland of Statewide Importance	Prime Farmland if Irrigated	Not Prime Farmland	Total
Temporary Construction Impacts					
North Alternative	0	248.8	11.3	94.6	354.6
South Alternative	0	209.4	16.1	117.5	343.0
Combination A	0	209.3	16.1	111.0	336.5
Combination B	0	248.9	11.3	100.9	361.1
Permanent Impacts					
North Alternative	0	127.9	4.6	47.0	179.5
South Alternative	0	115.2	7.8	65.1	188.1
Combination A	0	111.4	7.8	58.8	178.1
Combination B	0	131.7	4.6	53.3	189.5

Numbers are rounded and may not sum exactly.
Source: NRCS 2009a, 2009b, 2009c

Lands participating in the Natural Resources Conservation Service's (NRCS's) CRP may be crossed by the proposed project (the acreage crossed is unknown); however, it is assumed no adjustment would be made to CRP enrollees' annual lease payments, despite the potential for reduction in CRP acres under this alternative.

There are no residences in the vicinity of the North or Combination B alternatives project corridor; therefore, these alternatives would have no impact on private residences. A private residence is located approximately 400 feet to the north of the South and Combination A alternatives, in the vicinity of Lyons Ferry Road in Walla Walla County. Construction-related impacts in the vicinity of this residence would include short-term noise, construction traffic, and dust.

Mitigation Measures

- Provide a schedule of construction activities to all landowners whose lands could be affected by construction.
- Compensate landowners for any new land rights required for right-of-way easements, or to construct new, temporary, or permanent access roads.
- Plan and conduct construction activities to minimize temporary disturbance, displacement of crops, and interference with agricultural activities.
- Use BMPs to limit erosion and the spread of noxious weeds.
- Restore compacted cropland soils to pre-construction conditions.
- Compensate landowners for any damage to property during construction and maintenance activities.
- Minimize or eliminate public access to project facilities through postings and installation of gates and barriers at appropriate access points and, at the landowner's request, on private property.

Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to land use.

S.3.2.3 Vegetation

Environmental Consequences of Action Alternatives

An assessment of the project's potential impacts on vegetation is presented in Section 3.3 of the EIS. Construction of the action alternatives would result in temporary ground disturbance that could affect vegetation communities, federal and state Threatened, Endangered, and Sensitive (TES) plant species, and the spread of noxious weeds. Permanent impacts to vegetation would result from placement of transmission tower footings, new permanent access roads, and fiber optic wood poles. Table S-5 summarizes the potentially affected acres by vegetation community and alternative.

Table S-5. Impacts to Vegetation Communities (acres)

Action Alternative/Project Component	Cropland	Disturbed Grassland	Native Grassland	Potential Native Grassland[1/]	Total
Temporary Construction Impacts					
North Alternative	83.8	213.6	18.7	38.5	354.6
South Alternative	65.0	231.8	14.0	32.1	343.0
Combination A	64.1	231.8	14.1	26.5	336.5
Combination B	84.8	213.6	18.6	44.1	361.1
Permanent Impacts					
North Alternative	45.4	109.8	10.1	14.1	179.5
South Alternative	41.4	120.5	8.8	17.3	188.1
Combination A	43.7	111.3	9.7	13.3	178.0
Combination B	43.0	118.9	9.2	18.2	189.5

Numbers are rounded and may not sum exactly.

1/ This category consists of areas that were not surveyed in September 2009 and based on a review of aerial photography have the potential to contain native grassland.

With the implementation of mitigation, construction-related impacts to vegetation in cropland and disturbed grassland communities would be considered short-term because the vegetation would generally be reestablished within 2 years, resulting in a ***low*** level of impact in these areas. Impacts to native grassland would also be considered short-term. However, impacts to native grassland would be considered ***moderate to high*** under the North and Combination B alternatives, and ***moderate*** under the South and Combination A alternatives, due to the limited distribution of relatively intact areas of native grassland in the project area. Potential impacts would be moderate to high under the North and Combination B alternatives because they would both cross a larger, relatively undisturbed area of native grassland located west of the Tucannon River.

The proposed project has the potential to impact TES plant species through habitat modification and direct removal/mortality. No TES plant species were observed during general vegetation surveys conducted for the project in September 2009. Additional surveys will be conducted in the spring/summer of 2010. If any TES plant species are found, potential impacts will be assessed and mitigation measures will be developed, as appropriate.

The project could result in the spread of noxious weeds, especially along newly constructed assess roads. This potential impact would be reduced by the implementation of mitigation measures. Construction-related ground disturbance would increase the potential for noxious weed introduction in areas of native grassland and cultivated areas that are currently free of noxious weeds, and impacts to these areas would, therefore, be considered ***moderate***. Permanent impacts associated with operation would also be ***moderate*** in these areas. Impacts in areas that are already disturbed and characterized by a high abundance of noxious weeds and non-native species would be ***low***.

Noxious weed impacts to a larger, relatively undisturbed area of native grassland located along the North and Combination B alternatives alignment west of the Tucannon River crossing would be ***moderate*** to ***high***, as this is one of the few relatively intact areas of native grassland in the project area.

Mitigation Measures

Vegetation Communities

- Limit ground-disturbing activities to tower sites, access roads, and staging areas; stake or flag native grassland or sensitive cropland areas prior to initiating construction.
- Limit road improvements to the minimum amount necessary to safely move equipment, materials, and personnel into and out of the construction area.
- Avoid introduction of non-native seed into areas of native grassland and/or areas where non-native species are not yet well established.
- Use an approved native seed mix to re-vegetate areas of native grassland disturbed during construction activities.
- Use an approved mixture of native and non-native species or seed for re-vegetation in areas were non-native species are already well established (i.e., disturbed grassland).
- Use a seed mix approved by the local Farm Service Agency to re-vegetate areas of CRP land that are disturbed during construction activities.

Threatened, Endangered, and Sensitive Plant Species

- Conduct additional surveys for TES plant species in all areas of native grassland, as well as areas classified as potential habitat, during spring/summer 2010.
- Consult with the U.S. Fish and Wildlife Service concerning any federally listed TES plant species that are identified and implement any mitigation measures to eliminate or reduce adverse impacts to these species.

Noxious Weeds

- Comply with all federal, state, and county noxious weed control regulations and guidelines.
- Wash all equipment using pressure or steam before entering the project area and when leaving discrete patches of noxious weeds.
- Map and flag noxious weed populations for construction crews so these populations can be avoided when possible. Clean vehicles after leaving these areas to avoid the spread of noxious weeds.
- Use seed mixes to revegetate construction areas that meets the requirements of federal, state, and county noxious weed control regulations and guidelines.
- Use certified weed-free straw for erosion control during construction and restoration activities.
- Cooperate with private, county, state, and federal landowners to treat noxious weeds along access roads that will be used to bring construction equipment into the project area to reduce the introduction and spread of noxious weeds and noxious weed seeds.

- Apply herbicides according to labeled rates and recommendations to ensure protection of surface water, ecological integrity, and public health and safety.
- Conduct a post-construction noxious weed survey to determine whether noxious weeds have been spread within the project area. Take corrective action if needed.

Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed, and vegetation communities and TES plant species found within the project area would likely remain in their current state. Current ongoing activities, such as farming and grazing, would continue to affect vegetation communities and have the potential to affect TES plant species. Noxious weeds would continue to spread in the project area at current rates, with treatment conducted at landowner discretion.

S.3.2.4 Recreation

Environmental Consequences of Action Alternatives

An assessment of the project's potential impacts on recreational resources is presented in Section 3.4 of the EIS. Construction, operation, and maintenance of the action alternatives would not occur at or near recreation sites around Lake Bryan, Lake West, or Lake Sacajawea. The proposed project would have ***no*** effect on access to these recreation sites or the two historic Lewis and Clark expedition campsites located along the lower Snake River. Transmission towers and conductors would be visible from some of these recreation sites, as well as the Lewis and Clark National Historic Trail, and could reduce the quality of outdoor recreation experiences at these locations. These impacts would, however, be low because the visual setting is just one aspect of the recreation experience and there are already high-voltage transmission lines visible from parts of these areas.

U.S. Route 12, which is part of the Lewis and Clark Trail Scenic Byway, passes through the project area, approximately 0.8 mile south of the project corridor at its closest point. Construction, operation, and maintenance of the action alternatives would not occur immediately adjacent to U.S. Route 12 and would not permanently alter access to this route. However, this highway would be used for the movement of vehicles and heavy equipment and materials to construction work areas under all of the action alternatives. Impacts to sightseeing along U.S. Route 12 would, therefore, be ***moderate*** during construction. Following construction, impacts to sightseeing from U.S. Route 12 would be ***moderate*** to ***high*** under the South and Combination B alternatives. The proposed transmission line and structures would not be visible from this location under the North and Combination A alternatives.

There are three locations where the public may hunt on private land in the general project area, but none are located along any of the action alternatives. Although no formal data exists and these areas are not open to the public, hunting is also believed to occur on most private lands elsewhere in the project vicinity. In addition, WDNR allows hunting on the lands it manages in the project area. Construction activities could result in displacement of wildlife within adjacent areas, either away from or toward hunting areas. These adverse and beneficial impacts would be localized and limited to the construction phase of the project, with overall impacts expected to be ***temporary*** and ***low***.

Mitigation Measures

Potential recreation impacts are primarily associated with changes in viewsheds. Mitigation measures for potential visual impacts are discussed below under Visual Resources.

Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to recreation.

S.3.2.5 Wildlife

Environmental Consequences of Action Alternatives

An assessment of the project's potential impacts on wildlife resources is presented in Section 3.5 of the EIS. Potential impacts from construction could include changes to or removal of habitat; increased risk of mortality due to collision or increased human access to habitat; disturbance during critical periods, such as nesting or wintering periods; and temporary disturbance and displacement due to construction activities.

A total of 25 wildlife species of concern (i.e., species listed under the Endangered Species Act [ESA] as endangered, threatened, proposed, candidate, and species of concern and those on the Washington Department of Fish and Wildlife [WDFW] Species of Concern list) with the potential to occur in Garfield, Columbia, and Walla Walla counties. Although not listed under the ESA or included on the WDFW Species of Concern list, WDFW also identified mule deer as a potential species of interest. Nine of the identified species are not addressed further because they are not known or documented to occur within the project area, the project area is outside the known range of the species, or breeding and/or foraging habitat does not exist within or adjacent to the project corridor.

The general wildlife habitat types that would be potentially impacted include Grassland/Shrub-Steppe, Rock Outcrops, Cliffs, Riparian Areas, and Croplands. The identified species of interest are identified by habitat type in Table S-6.

Table S-6. Potential Species of Interest by Habitat Type

Grassland/Shrub-Steppe	Rock Feature		Riparian	Cropland	Not Present
	Cliff Faces	Rock Outcrops			
Sagebrush lizard Golden eagle Ferruginous hawk Merlin Peregrine falcon Loggerhead shrike Sage sparrow Preble's shrew Washington ground squirrel White-tailed jackrabbit Black-tailed jackrabbit Mule deer	Golden eagle Ferruginous hawk Peregrine falcon Long-eared myotis Pallid Townsend's big-eared bat Mule deer	Sagebrush lizard Ferruginous hawk	Bald eagle Peregrine falcon Lewis' woodpecker Long-eared myotis Townsend's big-eared bat	Merlin White-tailed jackrabbit Black-tailed jackrabbit Mule deer	Rocky Mountain-tailed frog Striped whipsnake Greater sage-grouse Burrowing owl Olive-sided flycatcher Yellow-billed cuckoo Sage thrasher Oregon vesper sparrow Canada lynx

Grassland/Shrub-Steppe Associated Species

With mitigation measures in place, impacts to the sagebrush lizard, sage sparrow, Preble's shrew, merlin, peregrine falcon, loggerhead shrike, and black-tailed jackrabbits would be ***low*** under all of the action alternatives. Impacts to the Washington ground squirrel (if present) as well as the white-tailed jackrabbits would be ***low*** to ***moderate***. Impacts to the bald eagle and ferruginous hawk based on impact to grassland/shrub-steppe habitat would be ***moderate*** under all of the action alternatives. Impacts to mule deer would be ***low*** under the South and Combination B alternatives, and ***low*** to ***moderate*** under the North and Combination A alternatives.

Cliff Associated Species

Impacts to cliff associated species are expected to be ***low*** to ***moderate*** under all action alternatives, and include general disturbance related to construction noise.

Rock Outcrop Associated Species

Multiple rock outcrops are located near the North and Combination A alternatives, while very few rock outcrops are located near the South and Combination B alternatives. Impacts to the sagebrush lizard would be ***low*** under all of the action alternatives. Impacts to the ferruginous hawk would be ***low*** under the South or Combination B alternatives, and ***moderate*** to ***high*** under the North and Combination A alternatives.

Riparian Associated Species

The only riparian habitat found in the project area is located where the project would cross the Tucannon River. This area would be spanned under all of the action alternatives and no riparian vegetation would be removed or disturbed during construction. Impacts to riparian-associated species would, therefore, be ***low*** under all of the action alternatives.

Cropland Associated Species

Cropland areas serve as low quality habitat for wildlife and disturbance to cropland would have a ***low*** level of impact on cropland-associated wildlife species of interest (merlin, white-tailed jackrabbit, black-tailed jackrabbit, and mule deer).

Mitigation Measures

Mitigation measures listed in Section 3.3.3 Vegetation and Section 3.1.3 Geology and Soils would minimize impacts to wildlife species and their habitat. Additionally, the following mitigation measures would minimize or reduce impacts:

- Install bird flight diverters where the project corridor crosses the riparian corridor of the Tucannon River.
- Avoid construction activities within 0.6 mile of any active raptor nest during the raptor nesting season (e.g., March 1 to August 15 for ferruginous hawks, February 15 to July 15 for golden eagles), if possible.
- Avoid construction activities within Priority Habitats and Species–designated mule deer winter range during the mule deer winter range period from November 1 through March 31, if possible.
- If identified, confirmed Washington ground squirrel colonies will be avoided during peak above-ground activity in the spring
- Maintain all existing BPA gates. Wherever permitted by landowners or land-managing agencies, gates will be installed to limit vehicular use of new access roads.
- Use slow speeds when operating vehicles or equipment during construction activities located in grasslands or croplands.

Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to wildlife.

S.3.2.6 Water Resources and Fish

Environmental Consequences of Action Alternatives

An assessment of the project's potential impacts on water and fish resources is presented in Section 3.6 of the EIS. There would be ***no*** direct impact to any perennial waterbody, wetland, or floodplain under any of the action alternatives. The Tucannon River is the only perennial waterbody that would be crossed by the action alternatives. This river would be spanned under all of the action alternatives and no riparian vegetation would be removed or disturbed during construction. Table S-7 lists the intermittent drainages that would be crossed by alternative. With mitigation measures in place (see below), impacts on intermittent drainages would be ***low*** under all of the action alternatives. There would be ***no*** impact to wellhead production areas or source water protection areas under any of the action alternatives.

Table S-7. Intermittent Drainages Crossed by Proposed Access Roads

Action Alternative	Named Drainages	Total Drainages Crossed
North Alternative	Fields Gulch, Rabbit Hollow	8
South Alternative	Rabbit Hollow, Walker Canyon	15
Combination A Alternative	Walker Canyon	10
Combination B Alternative	Fields Gulch, Rabbit Hollow	13

Potential impacts to fish resources would be ***none*** to ***low*** under all of the action alternatives. Other than the Tucannon River, the stream channels crossed by the action alternatives and their access roads are all intermittent channels well upstream of streams that may contain fish. Any local slight sediment increases to intermittent streams would be dispersed and settle before reaching any potential downstream streams that may contain fish. Construction near the Tucannon River would be limited with tower sites located 970 feet and 1,610 feet from the stream (east and west side of the river, respectively) and no new access roads constructed near or crossing the river for all action alternatives. As a result, the chance of eroded sediment reaching the Tucannon River would be remote and no increases in suspended sediment are anticipated.

Mitigation Measures

Mitigation measures listed in Section 3.1.3, Geology and Soils, would minimize impacts to water resources and fish. Additionally, the following mitigation measures would minimize or avoid impacts:

- Design culverts and drainage controls placed in non-fish bearing streams to preserve natural drainage patterns.
- Maintain unobstructed passage for water at all culverts placed in non-fish bearing streams and promptly remove any blockages to protect the roadbed and prevent sedimentation of downstream waterbodies.
- Install and maintain water and sediment control measures at all waterbodies (including dry waterbodies) crossed by access roads or otherwise impacted by surface disturbance.
- Regularly inspect and maintain the condition of access roads, culverts, and sediment control measures to prevent long-term impacts during operation and maintenance.
- Avoid storing, transferring, or mixing of oils, fuels, or other hazardous materials where accidental spills could enter surface or groundwater. Have spill response and clean-up materials on site and clean up all spills immediately.

- Maintain, fuel, and repair heavy equipment and vehicles using spill prevention and control measures. Contaminated surfaces will be cleaned immediately following any spill incident.
- Use secondary containment for on-site fueling tanks.
- Limit fuel tank and truck storage to at least 100 feet from all streams, dry or flowing. Limit vehicle fueling to 25 feet from all streams, dry or flowing.
- Limit herbicide application to hand spraying at least 100 feet from all fish-bearing stream channels and use only EPA-approved herbicides that are non-toxic to aquatic resources.

Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to water resources and fish.

S.3.2.7 Visual Resources

Environmental Consequences of Action Alternatives

An assessment of the project's potential impacts on visual resources is presented in Section 3.7 of the EIS. This analysis assesses the potential impact of the projects on the general regional setting, as well as impacts to three specific areas: (1) the Lewis and Clark National Historic Trail and lower Snake River corridor; (2) the section of the Lewis and Clark Trail Scenic Byway that passes through the project area (U.S. Route 12); and (3) the town of Starbuck.

Key evaluation criteria for the visual analysis are visibility, visual compatibility with the landscape, and viewer sensitivity. Impacts to views in the project area based on an analysis of the potential visual impacts from nine selected viewpoints. The use of viewpoints allows the actual viewer experience with the landscape to be considered. Table S-8 summarizes the projected visual impacts by area, viewpoint, and alternative.

Table S-8. Permanent Visual Impact by Viewpoint and Action Alternative

Landscape Setting and Area	Viewpoint	Action Alternative			
		North	South	Combination A	Combination B
Regional	1[1/]	Low	Low	Low	Low
	6	Low	Moderate	Moderate	Low
	7	Low	None	None	Low
	8	Low	Low	Low	Low
Historic Trail and Lower Snake River	3	High	High	High	High
	5[1/]	High	High	High	High
	9	Moderate	Low	Low	Moderate
Scenic Byway and US Route 12	2	None	High	None	High
Starbuck	4[1/]	High	High	High	High

Notes:
None – The action alternative would not be visible from this viewpoint.
1/ Impacts from these viewpoints are common to all action alternatives.

Regional Setting

Construction of the North or Combination B Alternative would have ***low*** impacts on the project's general regional setting from all four selected viewpoints. Construction of the South or

Combination A Alternative would have ***none*** to ***moderate*** impacts on the project's general regional setting (depending on the viewpoint assessed).

Lewis and Clark National Historic Trail and the Lower Snake River Corridor

Visual impacts to the Lewis and Clark National Historic Trail and the lower Snake River corridor would be ***moderate*** or ***high*** under the North and Combination B alternatives and ***low*** or ***high*** for the South and Combination A alternatives (depending on the viewpoint assessed).

Lewis and Clark Trail Scenic Byway (U.S. Route 12)

Visual impacts to the Lewis and Clark Trail Scenic Byway (U.S. Route 12) would be **high** for the South and Combination B alternatives. The North and Combination B alternatives would have ***no*** impacts on the Lewis and Clark Trail Scenic Byway (U.S. Route 12).

Starbuck

Visual impacts to the town of Starbuck would be ***high*** under all of the action alternatives.

Mitigation Measures

- Preserve vegetation within the 150-foot-wide right-of-way that would not interfere with the conductor or maintenance access needs. Most of the vegetation along the proposed transmission line routes is low-growing sagebrush or agricultural crops, both of which are compatible with transmission line safety and operations.
- Locate construction staging areas away from visually sensitive locations. The contractor hired to construct the transmission line would be responsible for determining appropriate staging locations, but potential staging locations include parking lots in Starbuck and Dayton, and possibly Pomeroy.
- Use non-reflective conductors.
- Use non-reflective insulators (i.e., non-ceramic or porcelain).
- Locate new access roads within previously disturbed areas wherever possible.
- Revegetate disturbed areas with approved species.
- Require that contractors maintain a clean construction site and all related equipment, materials, and litter be removed following completion of construction.

Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to visual resources.

S.3.2.8 Cultural Resources

Environmental Consequences of Action Alternatives

An assessment of the project's potential impacts on cultural resources is presented in Section 3.8 of the EIS. The project crosses the ancient lands of many Columbia River basin tribes. No impacts to known cultural resources are anticipated during operation and maintenance of the proposed transmission line. In addition, impacts to unknown sites are not anticipated (***none*** to ***low***), due to the procedures that require construction to stop and appropriate protective measures to be determined if artifacts are found

Possible impacts to traditional cultural properties (TCPs) will not be known until the Nez Perce Tribes and the Confederated Tribes of the Umatilla Indian Reservation complete their TCP studies for this project. Following preparation of the studies, appropriate protective measures would be implemented, if necessary.

Mitigation Measures

- Design the transmission line so that tower sites are placed to avoid cultural resources.
- Design new access roads to avoid cultural resources and minimize the potential for trespassing access, where practicable.
- Improve the existing road system in a manner that minimizes new roads and avoids cultural resource sites. If improvements are needed on existing roads that cross through cultural resource sites, such improvements would be constructed in a manner to avoid/minimize impacts, such as using fabric and rock or other mitigation agreed to during the consultation process.
- Consult with the Washington Department of Archaeology and Historic Preservation (DAHP), the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation regarding National Register of Historic Places (NRHP) eligibility of cultural sites and TCPs.
- Develop an Inadvertent Discovery Plan that details crew member responsibilities for reporting in the event of a discovery during construction.
- Ensure tribal monitors from the Nez Perce Tribe and/or the Confederated Tribes of the Umatilla Indian Reservation are present if work within prehistoric sites or TCPs cannot be avoided.
- Prevent unauthorized collection of cultural materials by ensuring a professional archaeologist and tribal monitor are present during any excavation within known sites.
- Prepare a Mitigation Plan to protect sites in-situ if final placement of project elements results in unavoidable adverse impacts to a significant cultural resource.
- Stop work immediately and notify local law enforcement officials, appropriate BPA personnel, Washington DAHP, the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, and WDNR, if on state lands, if cultural resources, either archaeological or historical materials, are discovered during construction activities.

Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to cultural resources.

S.3.2.9 Socioeconomics and Public Facilities

Environmental Consequences of Action Alternatives

An assessment of the project’s potential impacts on socioeconomics and public facilities is presented in Section 3.9 of the EIS. Construction would be spread over a 2-year period (from July 2011 to July 2013). Employment over this period would follow a bell-shaped pattern, ranging from an initial workforce of about 40 workers to a peak of 170 workers at about six months, and then declining to 40 workers and less as construction comes to a close.

Population and Housing

During the peak construction period, up to 150 workers could temporarily relocate to nearby communities for the duration of their employment or commute in from their permanent residences on Sunday night and stay in overnight lodging on weekdays, returning home on Fridays. Assuming some of these workers (10 percent) would be accompanied by their families, the projected temporary population increase would be equivalent to 0.2 percent of the total estimated population in Columbia, Garfield, and Walla Walla counties in 2009. Very few, if any, of the workers employed during the construction phase of the project would be expected to permanently relocate to the area. Impacts to population would be ***low*** and ***short-term***.

Temporary housing resources in the immediate vicinity of the project area include four recreational vehicle (RV) parks, two in Columbia County and two in Garfield County, with three additional RV parks located farther afield in the city of Walla Walla. Review of the rental housing units and hotel and motel rooms that would normally be vacant and available for rent suggests that there would be insufficient temporary housing in Columbia and Garfield counties to accommodate the total projected demand during the construction peak. Regional resources, including additional housing resources in the city of Walla Walla and the Tri-Cities, would, however, be more than sufficient to accommodate the estimated project-related demand for housing. Impacts to housing resources would, therefore, be ***low*** and ***short-term.***

Economic Conditions

Construction would result in potential benefits to local and regional economies through employment opportunities and purchases of goods and services. However, estimated local project-related expenditures, employment, and construction-related earnings are small relative to the total amount of economic activity, employment, and income in the three potentially affected counties, and are short-term in nature. As a result, the overall impact of construction-related activities on the local and regional economies, while positive, is expected to be ***short-term*** and ***low***. Potential economic impacts to agriculture and recreation and tourism would be ***low***. Overall economic impacts from operation would be ***low***.

Community Services

Construction would result in an increased demand for local services, including law enforcement, fire protection, medical facilities, education, and solid waste disposal. The proposed action alternatives would have ***no*** impact on law enforcement, medical facilities, and solid waste disposal. Impacts to fire protection, with mitigation in place, and education would be ***low***.

Property Values

Impacts on property values and salability might occur on an individual basis as a result of the new transmission line under all of the proposed action alternatives. However, these impacts would be highly variable, individualized, and unpredictable. These impacts are expected be ***low*** and ***short-term.***

Mitigation Measures

- Compensate landowners at market value for any new land rights required for corridor easements or acquired for new temporary or permanent access roads on private lands.
- Initiate discussions with local fire districts prior to construction and work with the districts and other appropriate emergency response to develop a Fire and Emergency Response Plan that addresses potential wildland fires and other emergencies.

Environmental Consequences of the No Action Alternative

The proposed project would not be built under the No Action Alternative and there would be no positive economic impacts due to construction-related expenditures or impacts to housing and other socioeconomic resources. In addition, under the No Action Alternative, BPA would be unable to provide the full amount of firm transmission service that has been requested. Congestion on the existing lines moving power east to west through the area would limit the ability to transfer additional power through the Columbia Gorge area and could make it more difficult for existing or new generation facilities (including wind facilities) to sell their power.

S.3.2.10 Transportation

Environmental Consequences of Action Alternatives

An assessment of the project's potential impacts on transportation is presented in Section 3.10 of the EIS. Temporary impacts to roads during project construction would include increased traffic and damage to existing roadways, traffic delays as a result of heavy and light vehicles accessing the project corridor, improvements to existing access roads, and construction of new temporary access roads.

Overall, the proposed project would generate up to an estimated 120 vehicle round trips per day (65 trucks and 55 passenger vehicles) during the peak construction period. Construction-related traffic impacts to local roadways are expected, with mitigation in place, to be ***low*** to ***moderate*** under all of the action alternatives. With mitigation in place, impacts related to potential damage to existing roads would be ***low***. Impacts from existing road improvements and new road construction would, with mitigation in place, be expected to be ***low*** under all of the action alternatives. No new bridges would be required under any of the alternatives and impacts to existing bridges are expected to be ***none*** to ***low***.

The proposed transmission line would be located about 0.5 mile east of the Lower Monumental Airstrip under the North and Combination B alternatives, and the North and Combination A alternatives would be about 1.5 miles south of the Little Goose Airstrip. The South Alternative would be 2.7 miles south of the Little Goose Airstrip. These airstrips are used occasionally and pilots are used to avoiding existing transmission lines; therefore, impacts on air traffic using these airstrips would be ***low*** under all of the action alternatives.

There would be ***no*** impacts to railroads or waterways under any of the action alternatives.

Mitigation Measures

- Obtain a Haul Road Agreement and any additional permits or approvals from state and local agencies prior to construction. These documents will identify any special conditions to be addressed by BPA and their contractors during construction and operation of the project.
- Prepare an erosion control plan that includes measures to stabilize construction entrances and exits to prevent sediments from being transported onto adjacent roadways.
- Route traffic around affected intersections if construction vehicles cause temporary traffic blockages on local roadways.
- Employ traffic control flaggers and post warning signs of construction activity and merging traffic when necessary.
- Comply with applicable seasonal road restrictions for construction traffic, where practicable.
- Restore public roadways to their pre-construction conditions or better upon completion of project construction activities.
- Design and construct new access roads to minimize runoff and soil erosion.
- Reclaim any road-related disturbance areas after construction is completed.
- Install gates at the entrances to access roads when required or requested by landowners to reduce unauthorized use. Coordinate gate locks with landowners to ensure that both BPA and the landowner have access.

- Work with WDNR concerning a possible cooperative agreement for the control of unauthorized public access and use on state lands that could result from the proposed project. The agreement could address various provisions related to unauthorized access, such as additional measures to be taken to discourage unauthorized use of the project corridor and associated access roads, periodic inspection for unauthorized access and any resulting damage, and repair of any damage from unauthorized access.
- Install marker balls on the conductor and lights on towers at the Tucannon River crossing if required by the Federal Aviation Administration.

Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to transportation.

S.3.2.11 Noise, Public Health, and Safety

Environmental Consequences of Action Alternatives

An assessment of the project's potential impacts on noise, public health, and safety is presented in Section 3.11 of the EIS.

Noise

Construction activities would create noise that would be intermittent and short-term. Noise levels below 50 decibels (A-weighted) (dBA) would result in a ***low*** impact to receptors. If construction noise levels exceed 50 dBA, noise impacts would be ***moderate*** **to** ***high***. The project corridor consists mainly of open range, undeveloped land, and agricultural land with few residences that could be affected by noise from construction activity. One residence was identified within 1,000 feet of the proposed transmission line alignments, approximately 400 feet north of the South and Combination A alternatives in Walla Walla County. If construction noise levels exceed 50 dBA at this residence, the impact would be ***short-term*** and ***moderate to high***.

Other residences are concentrated in the town of Starbuck, approximately 1.5 miles south of the project corridor at its closest point. The level of noise impacts to those residents from most construction activities and project related traffic would be ***low***. Helicopter use could increase noise and affect residents living in Starbuck; this impact would be ***short-term*** and ***moderate to high.*** Noise impacts during operation and maintenance of the project would be ***none*** to ***low***.

Possible occasional midday blasting might be required at some tower sites in rocky areas where conventional excavation of tower footings would not be practical. Blasting would produce a short noise like a thunderclap that could be audible for 0.5 mile or more from the site. Implosive fittings would also be used to hook conductors together. This disturbance would be localized to the immediate area.

Public Health and Safety

During construction, there would be a risk of fire and injury associated with the use of heavy equipment, cranes, helicopters, potential bedrock blasting, and other risks associated with working near high-voltage lines. With mitigation in place, these risks would be ***low***. Impacts from operation and maintenance of the line would be ***negligible***, but would include additional risk for fire and injuries as maintenance workers and vehicles travel along the corridor to perform required maintenance.

Transmission lines, like all electric devices and equipment, produce electric and magnetic fields. The calculated electric field would meet BPA's electric-field guideline of 5 kV per meter at the edge of the right-of-way under all of the action alternatives.

Several common construction materials (e.g., concrete, paint, and wood-pole preservatives) and petroleum products (e.g., fuels, lubricants, and hydraulic fluids) would be used during construction. With mitigation measures in place, impacts associated with the use of these materials would be ***none*** to ***low*** under all of the action alternatives.

Mitigation Measures

- Install sound-control devices on all construction equipment.
- Install muffled exhaust on all construction equipment and vehicles except helicopters.
- Notify landowners directly impacted along the corridor prior to construction activities, including blasting.
- Hold crew safety meetings during construction at the start of each workday to go over potential safety issues and concerns.
- Secure the site at the end of each workday to protect equipment and the general public.
- Train employees, as necessary, in structure climbing, cardiopulmonary resuscitation, first aid, rescue techniques, and safety equipment inspection.
- Fuel all highway-authorized vehicles off-site to minimize the risk of fire. Fueling of construction equipment that is transported to the site via truck and is not highway authorized will be done in accordance with regulated construction practices and state and local laws. Helicopters will be fueled and housed at local airfields or at staging areas.
- Adhere to BPA's specifications for grounding fences and other objects on and near the existing and proposed rights-of-way during construction.
- Construct and operate the new transmission line in accordance with the National Electrical Safety Code, as required by law.
- Restore reception quality if radio or television interference occurs as a result of the transmission line. Reception needs to be as good or better than before the interference.
- Carry fire suppression equipment including (but not limited to) shovels, buckets, and fire extinguishers on all operation and maintenance vehicles.
- Use established access roads during routine operation and maintenance activities.
- Clear vegetation according to BPA standards to avoid contact with transmission lines.
- Contact the appropriate BPA representative if hazardous materials, toxic substances, or petroleum products are discovered within the project area that would pose an immediate threat to human health or the environment. Other conditions such as large dump sites, drums of unknown substances, suspicious odors, stained soil, etc. must also be reported immediately to BPA.
- Limit construction activities to daytime hours (i.e., only between 7:00 a.m. and 7:00 p.m.)
- Prepare and maintain a safety plan in compliance with Washington requirements. This plan would be kept on site and would detail how to manage hazardous materials, such as fuel, and how to respond to emergency situations.
- Ensure that helicopter pilots and contractors take into account public safety during flights. For example, flight paths could be established for transport of project components to avoid flying over populated areas or near schools (Helicopter Association 1993).
- Take appropriate safety measures for blasting consistent with state and local codes and regulations. Lock up or remove all explosives from the work site at the end of the workday.

- Install implosive fittings used to connect the conductors in a way that minimizes potential health and safety risks.
- Stay on established access roads during routine operation and maintenance activities.
- Submit final tower locations and conductor heights to the Federal Aviation Administration for review. Install lights or marker balls as required.

Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to noise and public health and safety.

S.3.2.12 Air Quality

Environmental Consequences of Action Alternatives

An assessment of the project's potential impacts on air quality is presented in Section 3.12 of the EIS. Air quality impacts associated with the construction of the action alternatives would be the same regardless of which action alternative is constructed. Construction activities that could impact air quality include road building and grading, on-site travel on unpaved surfaces, work area clearing and preparation, and soil disrupting operations. These impacts would be ***short-term*** and ***low*** with mitigation in place. Air quality impacts during operation and maintenance of the proposed project would be ***none*** to ***low***.

Mitigation Measures

- Use water trucks to control dust during construction operations.
- Cover construction materials if they are a source of blowing dust.
- Limit the amount of exposed soil, including dirt piles and open pits, to a minimum.
- Prevent wind erosion by reseeding disturbed areas with grass or an appropriate seed mixture as soon as reasonably possible following construction activities.
- Avoid burning during construction activities.
- Ensure construction vehicles travel at low speeds on gravel roads and at the construction sites to minimize dust.
- Comply with Washington State tailpipe emission standards for all on-road vehicles.
- Ensure all vehicle engines are in good operating condition to minimize exhaust emissions.
- Use low sulfur fuel for on-road diesel vehicles.

Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to air quality.

S.3.2.13 Greenhouse Gases

Environmental Consequences of Action Alternatives

An assessment of the project's potential impacts on greenhouse gas emissions is presented in Section 3.13 of the EIS. Greenhouse gas concentrations could be impacted by the proposed project when carbon stored in vegetation and soils is released during construction as vegetation decays and soils are disturbed. Soil disturbance would occur throughout the project area when holes are excavated for tower footings and access roads are constructed. Emissions from construction, operations, and maintenance-related vehicles on and off the project corridor would also impact atmospheric greenhouse gas concentrations incrementally because construction equipment and vehicles would be fueled by gasoline and diesel combustion motors.

Greenhouse gas emissions were estimated for all action alternatives based on the approximate number of vehicles to be used during project construction and the approximate distance those vehicles would travel during the construction period. Construction would result in an estimated 3,066 metric tons of carbon dioxide (CO_2) emissions, and an estimated 3,069 metric tons of CO_2 equivalent emissions, per year. This translates roughly to the annual CO_2 emissions of 532 passenger vehicles. While all emissions of greenhouse gases are significant in that they contribute to global greenhouse gas concentrations and climate change, the total CO_2 emissions from the proposed project would be very ***low*** compared to emissions from other contributors.

During operation and maintenance of the transmission line, a helicopter would be used twice a year for aerial inspections and approximately four vehicle round trips per year would occur. The associated impact on greenhouse gas concentrations would be ***low***.

Mitigation Measures

- During construction, trucks and heavy equipment will limit engine idling time and equipment will be shut down when not in use except when activities occur in cold weather. Provide clear signage that posts this requirement for workers at all entrances to the work sites.
- During construction, all vehicles will comply with applicable federal and state air quality regulations for tailpipe emissions. Certification that vehicles meet applicable regulations will be provided to BPA in writing.
- Encourage carpooling and the use of shuttle vans among construction workers to minimize construction-related traffic and associated emissions.
- Locate all staging areas as close to construction areas as practicable to minimize driving distances between staging areas and construction sites.
- Locate staging areas in previously graded or graveled areas to minimize soil and vegetation disturbance where practicable.
- Maintain and certify in writing that all construction equipment is in proper working condition according to manufacturer’s specifications.
- Train equipment operators in the proper use of equipment.
- Use the proper size of equipment for the job.
- Use alternative fuels such as propane or solar for generators at construction sites, or use electrical power where practicable.
- Reduce electricity use in the construction office by using compact fluorescent bulbs, and powering off computers every night.
- Submit a plan for approval to recycle or salvage non-hazardous construction and demolition debris where practicable.
- Submit a plan for approval to dispose of wood poles locally where practicable.
- Use locally sourced rock for road construction.

Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to greenhouse gas concentrations.

S.3.3 Cumulative Impact Analysis

An assessment of the project's potential cumulative impacts is presented in Section 3.14 of the EIS. "Cumulative impacts" are the impacts on the environment which result from the incremental impact of an action—such as the action alternatives—when added to other past, present, and reasonably foreseeable future actions.

Past actions that have adversely affected natural and human resources in the project area include construction and operation of the lower Snake River dams, past agricultural activities, highway and railroad construction, construction and operation of existing BPA transmission lines and Lower Monumental Substation, and commercial and residential development.

Reasonably foreseeable future actions that may occur in the vicinity of the proposed project could include ongoing agricultural activities, grazing permits and leases on state and private lands, construction of Central Ferry Substation, development of wind energy facilities and associated power transmission infrastructure, continuing hydroelectric operations, fish harvest, and residential and commercial development.

The proposed action alternatives in combination with past, present, and reasonably foreseeable actions could potentially result in cumulative impacts to a number of resources. These resources include the following: soils; land use; vegetation; recreation; wildlife; water resources and fish; visual resources; cultural resources; social and economic resources; transportation; noise, public health, and safety; air quality; and greenhouse gas emissions. The contribution of the action alternatives to cumulative impacts would vary, with the greatest contribution occurring in cumulative impacts on visual resources.

Chapter 1 Purpose of and Need for Action

This chapter describes the need for the Bonneville Power Administration (BPA) to increase the electrical capacity of the transmission system in the southeast Washington area in response to requests for use of the system. This chapter also identifies the purposes that BPA is attempting to achieve in meeting this need, as well as the lead and cooperating agencies for this Environmental Impact Statement (EIS). The end of the chapter provides a summary of the public scoping process conducted for the EIS and information about the scope and organization of this EIS.

1.1 Background

BPA is a federal agency in the Pacific Northwest that owns and operates about three-fourths of the high-voltage transmission lines in its service territory. BPA's more than 15,000 circuit miles of high-voltage transmission lines serve customers in Idaho, Oregon, Washington, western Montana, and small parts of eastern Montana, California, Nevada, Utah, and Wyoming. Although BPA is part of the U.S. Department of Energy, the agency is self-funding and covers its costs by selling its products and services at cost. BPA's transmission lines move most of the Northwest's high-voltage power from facilities that generate the power to customers throughout the region. BPA has a statutory obligation to ensure it has sufficient capability to serve its customers through a safe and reliable transmission system. The Federal Columbia River Transmission Act directs BPA to construct improvements, additions, and replacements to its transmission system that the BPA Administrator determines are necessary to provide service to BPA's customers and maintain electrical stability and reliability (16 U.S.C. § 838b[b-d]).

To help guide its approach to receiving, managing, and responding to requests for transmission service over its transmission system, BPA has adopted an Open Access Transmission Tariff for its transmission system (BPA 2008). This tariff is generally consistent with the Federal Energy Regulatory Commission (FERC) *pro forma* open access tariff. BPA's tariff has procedures that provide access to BPA's transmission system for all eligible service requests on a first-come, first-served basis, subject to a determination that there is sufficient available transmission capacity (ATC) on BPA's transmission system. ATC is the measure of the transfer capability remaining in the physical transmission network for further commercial activity, over and above already committed uses. If additional transmission capacity is needed to provide the requested service, the tariff provides that any development of facilities to provide this additional capacity must meet all BPA requirements and will be subject to appropriate prior environmental review under the National Environmental Policy Act (NEPA).

Consistent with its tariff, BPA accepts requests for transmission service in a transmission service request queue. Towards the end of the last decade, the amount of requested service in this queue, measured in megawatts (MW), far exceeded projected load growth in the Pacific Northwest region. For example, in March 2008, BPA's transmission service request queue contained about 9,200 MW of requests for service on BPA's network, exclusive of requests for service on the Southern and Montana Interties. At the same time, BPA forecasts only 2,500 average MW of load growth for all utilities within the Pacific Northwest through 2017. Because the amount of requests in the queue far exceeded forecast load growth for the region, it was clear that some transmission service requests in the queue were speculative; however, it was not possible to determine which ones. This uncertainty made it extremely difficult to accurately plan for truly necessary system upgrades, and the sheer volume of requests was making the queue congested and unmanageable.

To help address this issue, BPA developed and initiated a FERC-approved Network Open Season (NOS) process in March 2008 (hereinafter referred to as the 2008 NOS). During the 2008 NOS, utilities, power generators (including wind generators), power marketers, and others could submit requests for use of BPA's transmission system to transmit their power. BPA then was able to determine which of these requests could be served by ATC and which of these requests would require system upgrades to provide the requested service.

For those service requests requiring system upgrades, BPA then conducted studies of separate "clusters" of requests to determine the transmission system expansions needed to serve those requests. In conducting these studies, BPA took into consideration reliability criteria established by the North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC) (see box below). NERC is the national electric reliability organization and WECC is the regional reliability organization. Utilities are required to meet both sets of standards when planning new facilities.

About NERC

NERC is a self-regulatory organization that has statutory responsibility to regulate bulk power system users, owners, and operators through the adoption and enforcement of standards for fair, ethical, and efficient practices.

NERC develops and enforces reliability standards; assesses adequacy annually via a 10-year forecast and winter and summer forecasts; monitors the bulk power system; and educates, trains, and certifies industry personnel. NERC is subject to oversight by FERC and governmental authorities in Canada.

As of June 18, 2007, FERC granted NERC the legal authority to enforce reliability standards with all U.S. users, owners, and operators of the bulk power system, and made compliance with those standards mandatory and enforceable. More information is available on NERC's Web site: http://www.nerc.com (North American Electric Reliability Corporation, January 2010).

About WECC

WECC is the regional entity responsible for coordinating and promoting bulk electric system reliability in the west. WECC's service territory extends from Canada to Mexico. It includes the provinces of Alberta and British Columbia, the northern portion of Baja California, Mexico, and all or portions of the 14 western states.

In addition to coordinating system reliability, WECC ensures open and non-discriminatory transmission access among members, provides a forum for resolving transmission access disputes, and provides an environment for coordinating the operating and planning activities of its members as set forth in its bylaws.

Membership in WECC is open to all entities with an interest in the operation of the bulk electric system in the west. All meetings are open and anyone may participate in WECC's standards development process. More information is available on WECC's Web site: http://www.wecc.biz/. (WECC, December 2009).

One of the service request clusters that BPA studied during the 2008 NOS involved a total of 1,100 MW of long-term firm transmission service requests with a point of receipt (POR) between Lower Granite and Little Goose substations in southeast Washington (see Figure 1-1). These firm service requests from multiple customers are associated with moving electrical power from existing and proposed wind projects from the Lower Snake area in southeast Washington to load centers west of the Cascades and along the west coast. BPA's study of this cluster found that a new 500-kilovolt (kV) transmission line from BPA's planned Central Ferry Substation in Garfield County, Washington, to BPA's existing Lower Monumental Substation in Walla Walla County, Washington, would allow BPA to accommodate these requests for firm transmission service. In February 2009, BPA concluded the 2008 NOS process and announced that it would proceed with an environmental evaluation under NEPA of this potential new line.

1.2 Need for Action

BPA needs to increase the electrical capacity of the transmission system in the southeast Washington area in response to requests that BPA has received for use of the system. As discussed above, there is insufficient existing ATC in this area to accommodate all of these requests. Most of the ATC in this area is already committed to local generation and transfers of electric power from Montana and Idaho to the Northwest. If BPA's existing transmission system in the Lower Snake area only was used to respond to the service requests that BPA has received, it is likely that BPA's system would become overloaded at certain times of the year. This could lead to outages of not only existing BPA and other utility transmission lines in the Lower Snake area, but other portions of the regional transmission system through "cascading" outages.

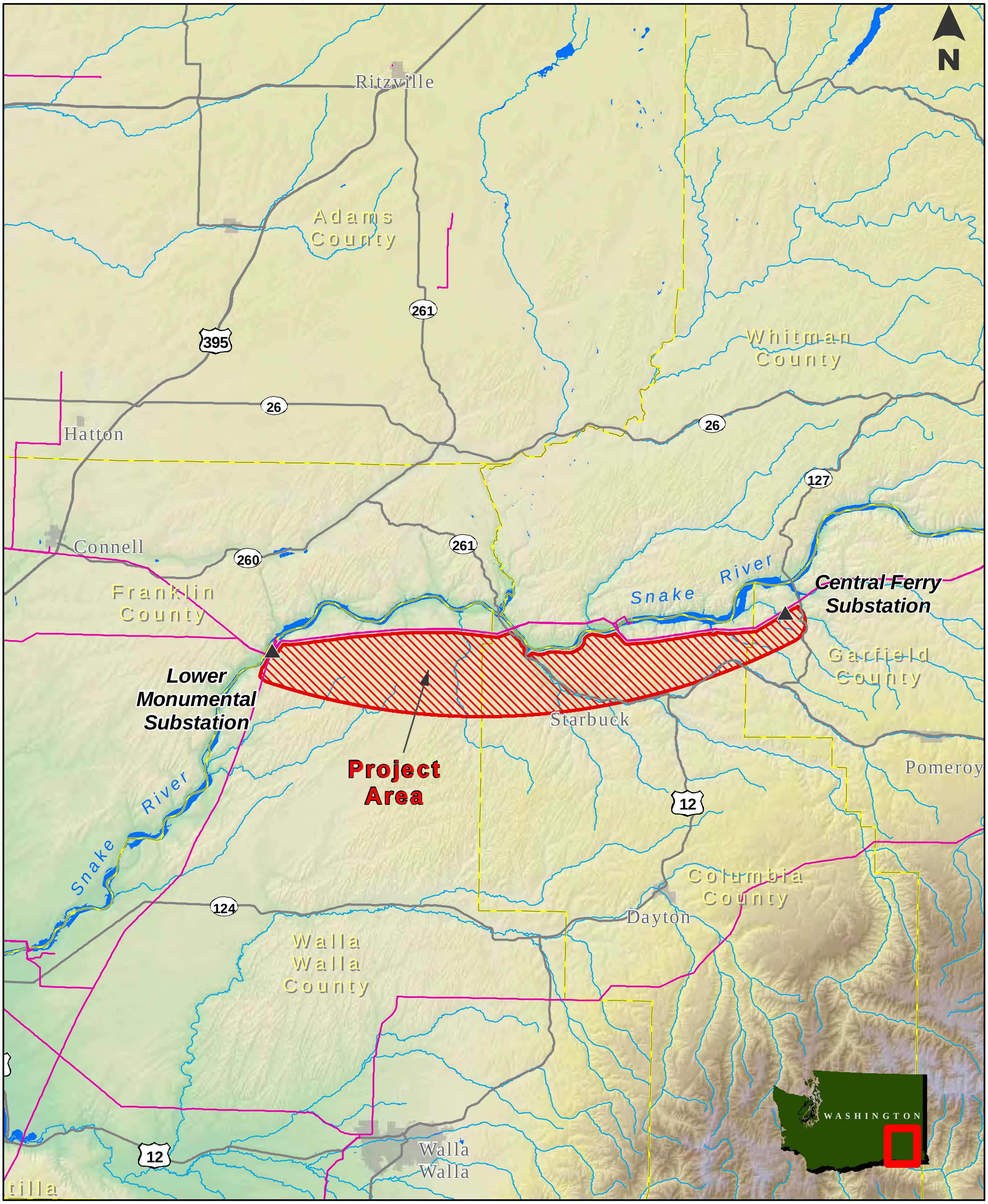
In evaluating various ways to address the need, BPA considered a variety of methods to improve its transmission infrastructure in the Lower Snake area. BPA has previously undertaken upgrades of existing transmission lines in this area to maximize the use of the existing lines. BPA also has implemented operational procedures such as Remedial Action Schemes to manage existing transmission service commitments in the Lower Snake area. Up until now, these actions have allowed BPA to avoid the need to build new substations and transmission lines. However, the volume of service requests currently facing BPA exceeds the capability of these measures (see Section 2.5).

1.3 Purposes

In meeting the need for action, BPA will attempt to achieve the following objectives:

- Optimize electrical capacity/performance of the proposed new line
- Maintain reliability of BPA's transmission system to BPA and industry standards
- Meet BPA's contractual and statutory obligations
- Minimize project costs where possible
- Minimize impacts to the human environment

These project purposes are used to compare the proposed action alternatives described in the EIS (see Table 2-3).



Data Source:
Bonneville Power Administration Regional GIS Database.
All data is best available, 12/15/2009

0 5 10 20 Miles

Project Area
Substation
Existing BPA Transmission Lines
County Boundary
Major Highway

Bonneville Power Administration
Central Ferry-Lower Monumental 500-kV
Transmission Line Project
Figure 1-1
Project Vicinity Map

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1.4 Agency Roles

1.4.1 Lead and Cooperating Agencies

BPA is proposing to take action to respond to requests for transmission service over its transmission system and is, therefore, the lead agency under NEPA for this EIS. As such, BPA is primarily responsible for preparing the EIS. BPA will use the EIS to make the following decisions:

- BPA must decide whether to build a new 500-kV transmission line to meet the need (see Chapter 2 for descriptions of the alternatives).
- If the decision is to build the transmission line, BPA must choose a routing alternative and various measures to mitigate construction and operational impacts.

The Council on Environmental Quality regulations implementing NEPA allow for the designation of other federal, state, and local agencies and Indian tribes as cooperating agencies for an EIS where appropriate. In furtherance of existing cooperative agreements between BPA and the State of Washington, the Washington Energy Facility Site Evaluation Council (Washington EFSEC) will participate in preparation of this EIS as a cooperating agency under NEPA. Among other things, this state agency will assist BPA in preparing the environmental evaluation of alternative transmission line routes, developing possible mitigation measures, and identifying state interests that should be addressed in the EIS.

1.4.2 Other Agencies That May Use this EIS

Chapter 4 of this EIS identifies other federal, state, and local agencies that may have involvement in reviewing portions of the proposed project. These agencies may use all or part of this EIS to fulfill their applicable environmental review requirements for any actions they may need to take for the proposed project. For example, portions of all of the routing alternatives for the proposed project cross land that is owned by the State of Washington and managed by the Washington State Department of Natural Resources (WDNR). Before WDNR can take action to authorize use of WDNR-managed lands, they must comply with the requirements of the Washington State Environmental Policy Act (SEPA), Chapter 43.21C RCW. BPA is coordinating with WDNR to attempt to ensure that environmental issues relevant to WDNR and its SEPA needs are addressed, to the fullest extent practicable in BPA's NEPA process for the proposed project. Accordingly, it is expected that WDNR will use relevant information from this EIS to help fulfill their SEPA requirements for their actions related to the proposed project.

1.5 Public Involvement

At the close of the 2008 NOS process described in Section 1.1, BPA held an open house-style meeting to give the public an opportunity to learn more about three proposed transmission line projects, including the Central Ferry-Lower Monumental project. BPA held the meeting on May 26, 2009, in Vancouver, Washington. At the meeting, BPA staff described the general need for each project, the upcoming environmental processes for each project, and how the public could be involved in the environmental reviews. The proposed schedules for each project were also available. BPA staff collected comments at the meeting about the NOS process.

After this NOS close-out public meeting, BPA began the process of soliciting input from the public, agencies, and others to help determine what issues should be studied in the EIS for the proposed Central Ferry–Lower Monumental project. Because these issues help define the scope of the EIS, this process is called "scoping."

To initiate the formal EIS scoping process, BPA published a Notice of Intent (NOI) to prepare an EIS for the proposed project in the Federal Register on June 19, 2009 (Vol. 74, No. 117). BPA also mailed letters on June 16, 2009, to about 176 potentially interested and affected persons, agencies, tribes, and organizations. The NOI and the public letter provided information about the proposed project and gave notice of the EIS scoping period and BPA's intent to prepare an EIS. The NOI and public letter also requested public comments on issues to be addressed in the EIS, and provided information on how to submit EIS scoping comments by mail, via fax, by telephone, through the BPA Web site, and/or at scoping meetings. Both the NOI and the public letter were posted at a project Web site established by BPA to provide information about the project and the EIS process (available at http://www.efw.bpa.gov/environmental_services/Document_Library/Central_Ferry-Lower_Monumental/).

The formal public scoping period for the EIS occurred between June 19, 2009, and August 3, 2009. A public EIS scoping meeting was held during this scoping period in Starbuck, Washington, on July 13, 2009. During this meeting, attendees could find out more about the EIS process and the proposed project, and were able to submit any EIS scoping comments they had at that time. About 41 people attended this scoping meeting. BPA staff also conducted meetings with representatives of various Washington state agencies, including Washington EFSEC, Department of Natural Resources (WDNR), Department of Fish and Wildlife (WDFW), State Parks and Recreation Commission (Parks), Department of Ecology (Ecology), and the Department of Archaeology and Historic Preservation (DAHP) to help identify issues relevant to these agencies. Meetings also were held by BPA with representatives of the Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) to identify tribal issues to be considered in the EIS.

BPA received EIS scoping comments from 31 individuals and agencies. These commenters provided 189 separate comments on the proposed project. All the scoping comments received were posted on the BPA Web site. The following discussion provides a summary of the scoping comments received by BPA.

Environmental Impacts – Sixty-five percent (123) of all comments were about the potential environmental impacts of the proposed routes:

- Forty comments dealt with potential impacts to agricultural land use and the future development of wind resource areas along the proposed routes.
- Resource impacts related to fish and wildlife and soils, geology, and water resources received between 19 and 29 comments each. Commenters noted concerns for impacts to deer and their habitat, raptors nesting within the project area, and for riparian areas along the Tucannon River. Also of concern were potential impacts from soil erosion, including the possible sedimentation of project area streams.
- Weed management was a concern not only for agricultural lands, but also for grazed and fallow lands.
- Other resource impacts receiving 8 or fewer comments each included recreation, public health and safety, transportation, cultural resources, socioeconomic, visual resources, air quality, and cumulative impacts.

Alternatives – Forty-six percent (86) of all comments focused on the proposed locations of the North and South alternatives:

- Commenters expressed a preference for either the North or South alternative based on current farming practices and the landscape's capacity to support wind turbines in the future. Commenters were concerned about losing prime farmland and wind resource lands.

- Some commenters on the east end of the routes stated their preference for the North Alternative because it would avoid currently farmed areas and future wind development areas along ridgelines.
- Other commenters on the west end of the routes preferred the South Alternative because it would avoid agricultural lands.
- Many commenters asked why one alternative could not be located adjacent to existing lines for its entire length; the possible wide separation between existing and proposed lines was a concern. Commenters suggested routing alternatives for portions of both the North and South alternatives.

Other Comments – The remaining comments supported the project, questioned the distance wind turbines needed to be from the new line and how wide the transmission line easement would need to be, inquired whether the proposed route would impact historic properties within the project area, and asked how the line would impact Conservation Reserve Program (CRP) lands.

1.6 Organization of this EIS

The remainder of this EIS is organized as follows:

- Chapter 2 describes the proposed action alternatives, the No Action Alternative, and alternatives considered but eliminated from detailed study. It summarizes and compares the differences between the various action alternatives and the No Action Alternative, in particular concerning potential environmental impacts.
- Chapter 3 describes the existing environment that could be affected by the proposed project and the possible environmental consequences of the proposed action alternatives and No Action Alternative. An assessment of the direct, indirect, and cumulative effects on geology and soils; land use; vegetation; recreation; wildlife; water resources and fish; visual resources; cultural resources; socioeconomics and public facilities; noise, public health and safety; air quality; and greenhouse gases is provided. Impacts can range from no or low impact to high impact.
- Chapter 4 discusses environmental consultation requirements as well as the licenses, permits, and other approvals that must be obtained to implement the proposed action.
- Chapter 5 discusses the project’s consistency with state substantive standards.
- Chapters 6 and 7 provide the references used in preparation of this EIS and a glossary of terms.
- Chapters 8 and 9 list the individuals who helped prepare the EIS and the individuals, agencies, and groups that were notified of the availability of the EIS.
- An index is included as Chapter 10.
- Supporting technical information is provided in the appendices.

Chapter 2 Proposed Action and Alternatives

This chapter describes the proposed action alternatives, the No Action Alternative, and alternatives that were considered but eliminated from detailed study for the proposed Central Ferry-Lower Monumental transmission line project. More specifically, this chapter provides the following information:

- An overview of how action alternatives considered in this Environmental Impact Statement (EIS) were developed
- A description of proposed project components
- A description of each proposed action alternative
- A description of the No Action Alternative
- A discussion of alternatives that were considered but eliminated from detailed study
- A comparison of the action alternatives and the No Action Alternative

2.1 Alternatives Development

The Bonneville Power Administration (BPA) has conducted extensive work, both internally and through public involvement, in identifying potential alternative routes for the proposed action. In 2008, BPA recognized the potential need for the proposed line and began preliminary evaluation of where such a line might be located. After completion of the 2008 Network Open Season (NOS) process that confirmed that there were sufficient requests in BPA's transmission service queue to justify further pursuing this potential line (see Section 1.1), an interdisciplinary team of BPA engineers, environmental specialists, geographic information system (GIS) specialists, transmission line maintenance personnel, realty specialists, and others worked together to determine potential routes for the proposed line. Initially, two potential routes, referred to as the North Alternative and the South Alternative, were identified.

In June 2009, BPA published its Notice of Intent (NOI) for this EIS in the *Federal Register* and distributed a public scoping letter to regional and other interests in order to begin the formal EIS scoping process (see Section 1.5). The NOI and scoping letter identified the two routing options as alternatives that would be considered in the EIS for the proposed project. As part of the scoping process, BPA requested public input on the potential routes for the proposed action. Based on public input and further evaluation during and after the EIS public scoping period, BPA considered two additional route alternatives that are comprised of combinations of the initial two action alternatives. The result of this extensive work has been the identification of four basic routes for the proposed transmission line. These routes are referred to as the North Alternative, the South Alternative, the Combination A Alternative, and the Combination B Alternative (see Figure 2-1). The proposed action alternatives are described in detail in Section 2.3 of this chapter.

2.2 Project Components

While each of the alternatives considered in this EIS would differ in their routing, they would all share certain common elements. This section describes those aspects of the proposed project that would be common across all of the routing alternatives.

Location

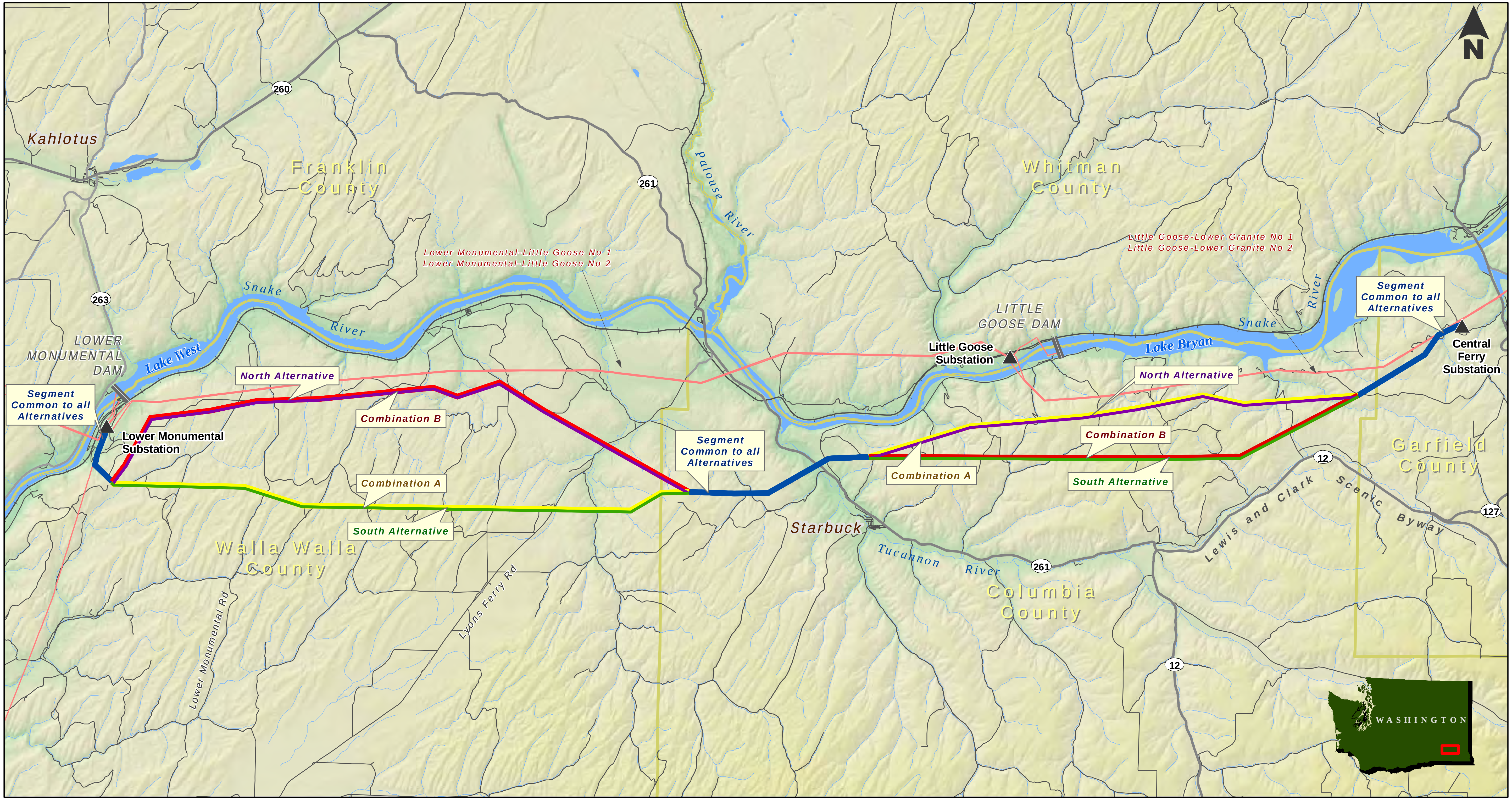
Regardless of alternative, the proposed transmission line would extend from BPA's new Central Ferry Substation generally west to its existing Lower Monumental Substation, a distance of about 40 miles. The new line would begin at the new Central Ferry Substation near the Port of Central Ferry (Garfield County) along the Snake River and follow a westerly path south of the Snake River through Garfield, Columbia, and Walla Walla counties to the existing Lower Monumental Substation (Walla Walla County) (Figure 2-1). Regardless of alternative, the transmission line would cross mostly private land with some federal and Washington state lands.

Transmission Line Right-of-way

All action alternatives would require a new 150-foot wide right-of-way for the entire length of the transmission line corridor. This width is BPA's standard minimum width for 500-Kilovolt (kV) transmission line rights-of-way, and is intended to ensure that the line is kept at a safe distance from other objects and structures such as trees and buildings.

Because BPA does not currently hold land rights for the proposed transmission line, BPA would need to acquire new right-of-way easements or agreements for the proposed line from existing landowners whose land is crossed by the transmission line corridor. These easements or agreements would give BPA the rights to construct, operate, and maintain the line in perpetuity. As it does with all of its transmission lines, BPA would not permit any uses of the transmission line right-of-way that are unsafe or might interfere with constructing, operating, or maintaining the transmission facilities. These restrictions would be part of the legal rights that BPA would acquire for the transmission line. See Section 3.2 Land Use for more information on the effect of these restrictions on landowners' use of their land.

Because there are existing 500-kV transmission lines in the project vicinity that the proposed project would generally parallel, BPA also has routed all action alternatives to ensure that adequate physical separation exists between the proposed line and the existing lines for reliability purposes. The simultaneous outage of multiple important lines in an area greatly increases the chances for blackouts. The events that could cause simultaneous outage of lines include one tower falling into an adjacent line, aircraft flying into the lines, fire on the right-of-way causing smoke to envelop more than one line, lightning strikes, and failure of a power circuit breaker at a substation if the two lines share a common breaker. These risks are lessened by separating the high-risk lines by a distance which is the length of the longest span of adjacent lines at the point of separation (a long span can be 2,500 feet or more), but not less than 500 feet. An exemption is provided for up to five spans going into a substation. In the case of the proposed transmission line, BPA has determined that it cannot place this line directly adjacent to the existing 500-kV lines in the area without significantly reducing the usable transmission capacity provided by the proposed line. In order to minimize the risk of simultaneous outage, the proposed line would be routed at least 1,200 to 2,500 feet from the existing lines in areas where the lines would be parallel.



BONNEVILLE POWER ADMINISTRATION

Data Source:
Bonneville Power Administration Regional GIS Database.
All data is best available, 12/15/2009

0 2.5 5 10 Miles

Proposed Route Alternatives
(Route sections shown adjacent to one another share the same proposed alignment)

- Segments Common to all Alternatives
- North Alternative
- South Alternative
- Combination A Alternative
- Combination B Alternative
- Substation
- Federal Dam
- Existing BPA Transmission Lines
- County Boundary
- Major Highway
- Roads
- Railroad

Bonneville Power Administration
Central Ferry-Lower Monumental 500-kV
Transmission Line Project
Figure 2-1
Project Area Map

File Path: \\bud.bpa.gov\wg\gis\gis_data2\work\ryan\PROJECTS_2\09\RDB090006\EIS\ProjectArea_11x17.mxd, Date: March 19, 2010 9:07:51 AM

Transmission towers

The towers for the proposed new 500-kV line would be 104- to 189-feet-tall single-circuit, lattice steel towers with spans of approximately 1,200 feet between towers. Tower heights and spans along the line would vary depending on the terrain, need for road and river crossings, and other factors. The towers would be made of galvanized steel and may appear shiny for two to four years before they dull with the weather. About 167 to 178 transmission towers would be needed to carry the conductors for the proposed transmission line. The actual number of towers would depend on the action alternative.

BPA would use two types of lattice steel towers: suspension towers, and dead-end towers (see Figure 2-2). Suspension towers would be used to hold the conductors up along a straight or slightly angled path. Dead-end towers would be used where the line takes a turn or when entering substations. Dead-end towers are stronger and heavier than suspension towers.

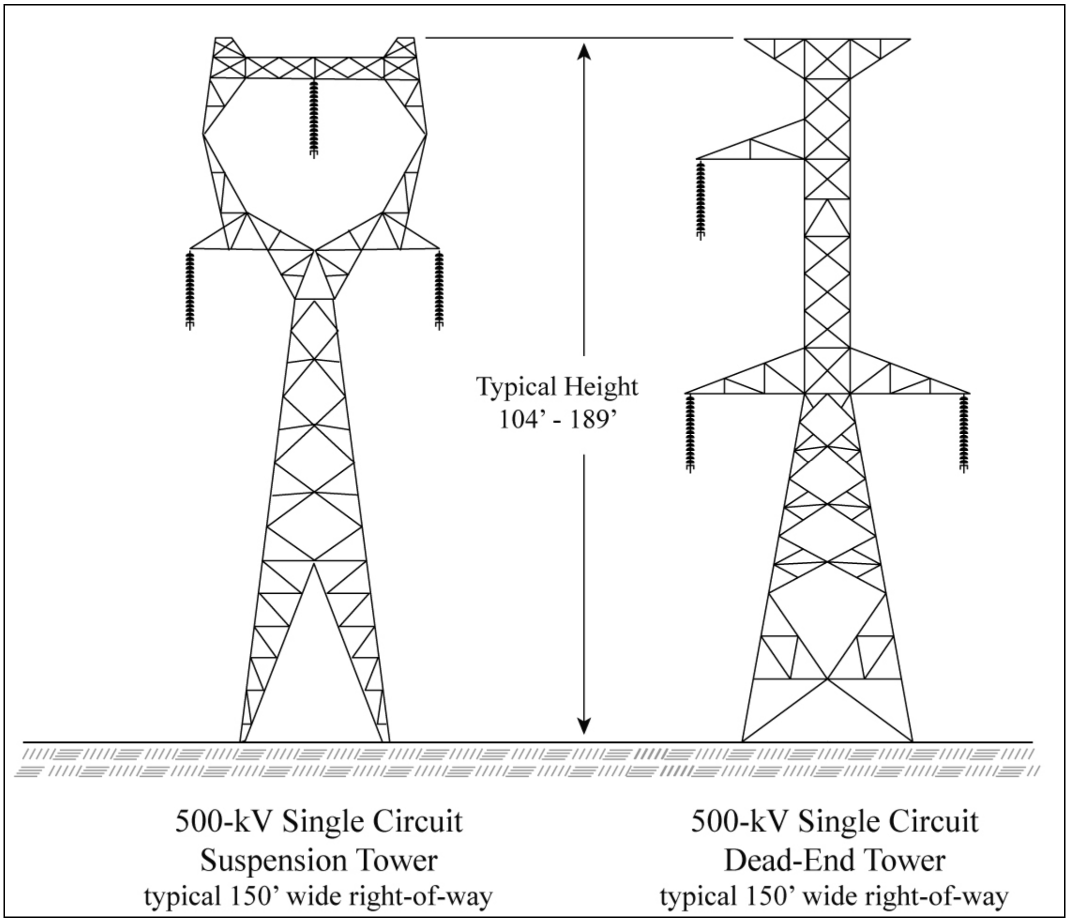


Figure 2-2. Typical Suspension Towers and Dead-end Towers for the Proposed 500-kV Transmission Line

Transmission towers would be attached to the ground with footings. The footings are a metal assembly in the ground at each of the four tower corners. Four types of footings would be used depending on the terrain, soil, and tower type:

- Plate footings would be used for suspension towers that are not built on solid bedrock; they consist of a 4-foot by 4-foot steel plate buried about 11 feet deep.

- Grillage footings would be used for dead-end towers that are not built on solid bedrock; they consist of a 15-foot by 15-foot assembly of steel I-beams that have been welded together and buried 14 to 16 feet deep.
- Rock anchor footings would be used for suspension towers that are built on solid bedrock. Holes would be drilled into the bedrock about 11 feet deep and steel anchor rods would be secured within the hole with concrete.
- Concrete shaft footings would be used for dead-end towers that are built on solid bedrock or in soils otherwise unfavorable for grillage footings. Concrete shaft footings would be engineered columns of concrete reinforced by steel rods about 4 to 8 feet in diameter. These footings would vary in depth depending on site-specific engineering requirements.

For plate and grillage footings, a trackhoe would be used to excavate an area for the footings. The excavated area would be at least 2 feet larger than the plate or grillage footings to be installed (if the soil is loose or sandy, then a wider hole may be necessary). Soil and rock removed for plate or grillage footings would be used to backfill the excavated area once the footings are installed.

For rock anchor or concrete shaft footings, a drill would be used to make an appropriately-sized vertical shaft for the footings. Soil and rock removed for rock anchor or concrete shaft footings would either be spread out onto an approved location or removed from the project area.

Each tower would occupy a permanent area of approximately 0.13 acre, with a temporary disturbance during construction of approximately 0.5 acre.

Conductors

The wires that carry the electrical current on the transmission line are called conductors. The transmission towers for the proposed line would support these conductors. The towers would carry three sets (called phases) of conductors arranged in a triangular design. Each phase would consist of a bundle of three 1.3-inch diameter conductor wires held in an arrangement by spacer brackets approximately 20 inches apart. From a distance, a bundle looks like a single wire.

The conductors would be attached to the towers using insulators. Insulators are bell-shaped devices that prevent the electricity from jumping from the conductors to the tower and going to the ground. The insulators are made of porcelain or composite materials and are non-reflective.

The conductor would need to be fitted together where one reel of conductor ends and a new one begins. Conductor fittings could be accomplished by either hydraulic compression or implosive devices. Hydraulic compression uses a press that compresses the fittings on the conductor. With implosive fittings, an explosive device is set off with a sound like a gunshot, causing the fitting to tighten around the conductor to provide a solid connection. Nine conductors (three bundles each with three conductors) would need to be fitted approximately once every 1.75 miles.

For safety reasons, BPA has established minimum conductor heights above ground and other obstacles which meet or exceed National Electrical Safety Code clearance requirements. For this proposed 500-kV line, standard minimum clearance of the conductor above the ground is 29 feet. The clearance requirement over highways is 45.5 feet; other clearances (railroads, rivers, etc.) are determined on a case-by-case basis. The proposed line would be designed to meet or exceed these requirements.

Overhead Ground Wire and Counterpoise

Two small wires (0.5-inch diameter), called overhead ground wires, would be attached to the top of the transmission towers. Overhead ground wires are used for lightning protection. When lightning strikes, the overhead ground wire takes the charge instead of the conductors.

In order to take the lightning charge from the overhead ground wire and dissipate it into the earth, a series of wires called counterpoise would be buried in the ground at the structures. Counterpoise could be needed at every tower, depending on the soil types present. Counterpoise would vary from one to six runs of wire that extend up to 250 feet from the tower, with three counterpoise running out from each side of the tower footings. BPA would use 3/8-inch diameter aluminum wire buried 12 to 18 inches deep, except in cultivated areas where it would be buried about 30 inches deep, or deeper where the farmer uses deeper plowing methods. Where three counterpoise wires would run in the same direction, one counterpoise would run down the center line of the right-of-way with the other two parallel and about 50 feet off the centerline of the right-of-way. Where obstructions or environmentally sensitive areas exist, the counterpoise would be redirected to avoid these obstructions or areas.

During construction, the counterpoise would be buried one of several ways. Installers could use backhoes, trenchers, vibrating plows, and occasionally hand dig, depending on the depth that the counterpoise is to buried, the terrain, and the presence and size of buried rock. With backhoes, an approximately 1- to 3-foot wide trench would be dug, with the removed soil and rock piled to the side and put back in the trench to cover the counterpoise wire. Using a trencher would open up a 4- to 6-inch trench by lifting up the soil to the side. This soil would be pushed back into the trench after the counterpoise is installed to cover the wire. A vibrating plow, which is used on larger tractors, would force a vibrating blade down into the ground. This blade is thick enough with a hole in the bottom for counterpoise wire to trail out of it at a specified depth. In areas where a tower would be located on solid rock, the counterpoise would be placed in crevices where possible; otherwise, counterpoise is not used.

Fiber Optic Cable

A fiber optic cable also would be strung on the towers along portions of the transmission line. The fiber would be used for communications as part of the power system. Fiber optics technology uses light pulses rather than radio or electrical signals to transmit messages. This communication system can gather information about the system (such as the line-in service and the amount of power being carried, meter reading at interchange points, and status of equipment and alarms). The fiber optic cable allows voice communications between power dispatchers and line maintenance crews and provides instantaneous commands that control the power system operation.

Fiber optic cables are less than 1 inch in diameter and are installed either as the overhead ground wire or independently on the towers. In rare instances where tower-to-tower spans are greater than 2,400 feet (such as the Tucannon River crossing span), it may be necessary to install an intermediate fiber optic wood pole between towers to support the fiber optic cable. Every 3 to 5 miles there would be a splice location for the stringing and tensioning of the fiber optic cable. Splices provide a connection point for successive reels of cable. Splices would be located either in splice enclosures mounted on the towers or in concrete vaults (about 4 feet by 4 feet by 4 feet) located in the ground between tower legs. An area approximately 0.75 acre in line with the conductors would be temporarily disturbed by a fiber optic reel truck and tensioning equipment, which would most likely be in the same location as the conductor pulling and tensioning sites.

Pulling/Tensioning Sites

Pulling/tensioning sites are temporarily disturbed areas from which the conductor is pulled and tightened to the correct tension once it is mounted on the transmission towers. As is typical for high-voltage transmission lines, pulling/tensioning sites for the proposed line would be located approximately every 1.75 miles along the transmission line route. Accordingly, about 22 pulling/tensioning sites would be required for construction of the proposed project along its entire approximately 40-mile length. All pulling/tensioning sites would be located within or immediately adjacent to the right-of-way for the transmission line. The appropriate locations for pulling/tensioning sites are determined by the construction contractor using environmental and land use information provided by BPA. Additional environmental review is conducted for these areas when they are identified, if necessary.

Each pulling/tensioning site would disturb an area approximately 300 feet long by 100 feet wide, or about 0.75 acre each. These sites would include a flat area to place a large flatbed trailer that holds the reels of conductor or pulling/tensioning machine. Depending on conditions, the site could be graded, crushed rock with fines could be placed, and/or the area could be reseeded.

Pulling and tensioning of the proposed lines also would require “snubs,” which are trenches approximately 6 feet deep by 4 feet wide by 10 feet long that are used to tie off the conductor after it is pulled through the towers and before it is strung under tension. These trenches would be backfilled following construction.

Access Roads

Access roads are the system of roads that BPA’s construction and maintenance crew would use to reach the towers or tower sites along the line. The roads are designed to be used by cranes, excavators, supply trucks, boom trucks, pole trucks, and line trucks. BPA’s road system consists of a mix of permits or access road easements across public and private ownership. Roads would be built within the transmission line right-of-way as much as possible. Where this is not possible, then a road would need to be constructed off the right-of-way.

Some parts of the various transmission line routes would be accessed from public roads. For areas where the proposed routes would parallel existing lines, existing access roads would be upgraded and used for the new line. Spur roads would be constructed from the existing access roads to the new tower sites and would generally be located within the transmission line right-of-way.

Access roads would require a 14-foot wide travel surface (wider on curves), with an approximately 20- to 40-foot wide total area disturbed (including drainage ditches). Fifty-foot wide easements would be obtained from landowners for new routes of access that require new construction, and 20-foot wide easements would be obtained for existing routes of access possibly requiring various improvements. Road grades would vary depending on the erosion potential of the soil: 6 to 8 percent on erodible soils, 10 to 15 percent for erosion resistant soils. For short distances on steep terrain, a maximum of 15 to 18 percent grades could occur.

Roads would be rocked where needed for dust abatement, stability, load bearing, and seasons of use. Other improvements could include clearing brush; widening existing roads; improving or smoothing out curves for vehicle use; upgrading existing road surfaces from native to aggregate; adding ditches and/or culverts, rolling dips, or waterbars; and building or reinforcing existing bridges. Drain dips or water bars may also be installed on steep slopes or where access roads cross drainages that carry seasonal runoff.

Project area roads that likely would need some type of improvement to allow line access include Fletcher Road, Powers Road, Tucker Road, Riveria Road, Ferrell Road, Archer Road, Hagen Road, Scot Station Road, Whitetail Road, Canyon Bottom Way, and New York Gulch Road.

If towers are placed in agricultural fields, BPA would typically build only temporary access to the tower site to construct the line. Once construction is complete, the road would be removed and the soil would be un-compacted for continued agricultural use. If the tower would need to be accessed for maintenance or emergency situations, depending on conditions included in the easement, BPA would pay the landowner for any crop damage. Alternately, permanent roads may be placed where they would have limited impact to the agricultural use.

BPA, in coordination with landowners, may place gates at the entrances to access roads to prevent public access to private lands and the transmission line right-of-way. There also would be gates in fences that separate animals or denote property lines. Gate locks, if required or requested, would be coordinated with the landowners to ensure that both BPA and the landowner have access.

Lower Monumental Substation Modifications

Substations connect different transmission lines together, disconnect lines when necessary, and regulate voltage of the system. The main equipment to be installed at Lower Monumental Substation as part of the proposed project would include power circuit breakers (switching devices to automatically interrupt power flow), switches (devices to mechanically disconnect equipment), bus tubing and pedestals (the ridged aluminum pipes that the power flows on within the substation), and transmission dead-end towers (the structures that bring the line into the substation).

To allow entry of the proposed transmission line into Lower Monumental Substation, three existing transmission lines would require realignment in the vicinity of Lower Monumental Substation. This would require excavation of new footings and construction of five to six new steel lattice towers for the relocated portions of the existing transmission lines as they enter Lower Monumental Substation. Counterpoise also would be installed at these new towers. Existing access roads would most likely be used although some new roads may be constructed to provide access to the new towers.

The locations of the five to six new steel lattice towers would likely be in areas that have already been disturbed or are heavily influenced by the existing transmission line towers in the immediate vicinity.

Staging Areas

One or two temporary staging areas would be needed along or near the proposed transmission line for construction crews to store materials and trucks. Staging areas can be from 5 to 15 acres depending on the number or location needed. The contractors hired to construct the transmission line would be responsible for determining appropriate staging area locations. Often, the contractor rents empty parking lots or sites already developed for use as staging areas. Environmental review of staging areas would be conducted prior to approval for use.

Vegetation Clearing

When vegetation grows or falls close to a transmission line, it can cause an electrical arc which can start a fire, cause an outage of the line, and/or injure or kill someone. Tall vegetation cannot be allowed to grow within the transmission line right-of-way. Tall trees that grow outside of the right-of-way that could fall into the line must also be removed. In deep valleys with sufficient clearance, trees may be left in place. Most of the vegetation along the proposed transmission line routes is low-growing sagebrush or agricultural fields, both of which are compatible with transmission lines. BPA does not anticipate any tree removal where the four routing alternatives cross the Tucannon River.

Maintenance

During the life of the project, BPA would perform routine, periodic maintenance and emergency repairs to the transmission line. For lattice steel structures, maintenance usually involves replacing insulators and checking for loose hardware.

BPA typically conducts routine inspection patrols of the 15,000-mile federal transmission system in the Pacific Northwest by helicopter. These patrols are a separate and independent activity from the proposed project, but are discussed here to provide information about this activity. BPA has conducted its routine helicopter patrols, both in populated and unpopulated areas, since the late 1940s. Transmission lines are inspected in this manner an average of about twice a year. These patrols are essential in determining where line maintenance is needed and ensuring the continued reliability of the transmission system. Helicopter teams look for damaged insulators, damaged support members, washed-out roads, hazardous vegetation, encroachments, and problems indicating that a repair may be needed. Aerial inspections typically are followed by annual ground inspections for each line. BPA has conducted routine inspection patrols for its existing transmission lines in the project vicinity by helicopter since construction of the lower Snake River dams.

Vegetation also would be maintained along the line for safe operation and to allow access to the line. It is expected that any of the proposed transmission line corridors would require little vegetation maintenance because they primarily consist of wheat, brush, and other low-growing vegetation.

BPA’s vegetation management would be guided by its Transmission System Vegetation Management Program EIS (BPA 2000a). BPA uses an integrated vegetation management strategy for controlling vegetation along its transmission line rights-of-way. This strategy involves choosing the appropriate method for controlling the vegetation based on the type of vegetation and its density, the natural resources present at a particular site, landowner requests, regulations, and costs. BPA may use a number of different methods: manual (hand-pulling, clippers, chainsaws), mechanical (roller-choppers, brush-hogs), biological (insects or fungus for attacking noxious weeds), and EPA-approved herbicides.

Prior to controlling vegetation, BPA would send notices to landowners and request information that might help in determining appropriate methods and mitigation measures (such as herbicide-free buffer zones around springs or wells). Noxious weed control is also part of BPA’s vegetation maintenance program. BPA works with the county weed boards and landowners on area-wide plans for noxious weed control.

Final Design and Construction

Prior to actual construction of the proposed transmission line, final design work would be completed to determine the precise location of all project components. To determine exact tower locations along a transmission line right-of-way, BPA collects terrain data primarily using LiDAR, a remote sensing technology employing eye-safe laser pulses originating from a helicopter or airplane, augmented as necessary by other terrain data collection methods such as photogrammetry and survey crews working on the ground. High-resolution aerial imagery is also collected to aid in the siting of towers. Towers are positioned during final design using the terrain data and aerial imagery in order to provide adequate conductor clearances above ground and other obstacles while generally minimizing the frequency, height, and impact of the towers. This same data is also used to locate access routes. Engineers also use environmental information and discussions with landowners to help determine tower and access road locations.

As final design is completed, construction of the proposed transmission line would begin. Initially, the right-of-way would be cleared of any vegetation that might hinder line safety or construction access. For this project, relatively little vegetation would be cleared because no tall growing species are present. Access roads then would be built or upgraded. Holes for tower footings would be dug with a trackhoe (drilling or blasting may also occur if rock is present) and footings put in place at each tower site. Towers would be either assembled at the tower site and lifted into place by a large crane (30- to 100-ton capacity) or assembled at a staging area and set in place by a large helicopter. The towers would be then bolted to the footings.

Next, the conductor would be strung from tower to tower through pulleys on the towers. A sock line (thick rope) would be placed in the pulleys and pulled through by a small helicopter. A hard line (smaller wire than conductor) would be attached to the end of the sock line and pulled back to where the conductor reel is located. The hard line would be connected to a plate that holds the bundle of conductors (one for each phase) which would be pulled through the pulleys to the other end of the pull and secured by snubbing the conductors in the snub trenches.

The conductor has to be fitted together when one reel of conductor ends and a new one begins. There are two types of conductor fittings: hydraulic compression and implosive devices. Hydraulic compression uses a press that compresses the fittings on the conductor. With implosive fittings, an explosive device is set off with a sound like a gunshot, causing the fitting to tighten around the conductor to provide a solid connection. Nine conductors (three bundles each with three conductors) would need to be fitted approximately once every 1.5 to 2 miles. After the conductor has been fitted together, pulling/tensioning equipment would be used to place the conductor in the appropriate tension so that minimum conductor heights are met.

Following construction of the towers, any access roads damaged during construction would be improved. Site restoration and revegetation at tower sites, along access roads, and in other disturbed areas, also would occur following completion of construction. Monitoring of these areas would occur until revegetation is complete.

Construction Schedule and Work Crews

The proposed timeframe for construction of the proposed transmission line would be a 2-year period. Assuming that BPA makes a decision in spring or summer 2011 to proceed with the proposed project following completion of the National Environmental Policy Act (NEPA) process, it is likely that project construction would extend from July 2011 to July 2013. Initial construction work for the first few months of the construction period would primarily involve clearing of the right-of-way and construction/improvement of project access roads, as discussed above. Tower pad and line construction then would most likely occur during a 1-year period following this initial construction work. A typical crew can usually construct about 8 miles of transmission line in about 3 months. In areas where terrain is steep, progress may be slower. Other activities that would occur during the construction period would include acquisition of any additional easements needed, substation work including work to connect the new line and other existing lines into the substations, and tower site and road restoration work.

The line would be constructed by one or more construction crews. A typical transmission line construction crew and associated equipment for a 500-kV line consists of the following:

- 40 to 170 construction workers (40 to 50 in the first 3 months, 170 at about 6 months during the peak construction period, and 40 to less as construction comes to close)
- 20 construction support vehicles such as pickups and vans
- 3 bucket trucks
- 1 conductor reel machine
- 3 large excavators including a trackhoe
- 1 line puller/tensioner
- 1 crane
- 1 helicopter

2.3 Proposed Action Alternatives

This section describes the four alternative routes for the proposed transmission line. All four action alternatives begin at BPA's Central Ferry Substation near the Port of Central Ferry in Garfield County, Washington and generally head in a westerly direction to BPA's existing Lower Monumental Substation in Walla Walla County, Washington. All four action alternatives share the same proposed Tucannon River crossing route. In addition to routing information specific to each alternative, any construction methods specific to an alternative are also described.

Table 2-1 summarizes the engineering characteristics for the action alternatives, which are described below. This information is based on preliminary project design that has been conducted to date for the proposed project. The evaluation of potential impacts to the natural and human environment in Chapter 3 of this EIS reflects this information. Table 2-2 identifies the construction related and permanent ground disturbance associated with each alternative.

North Alternative

The North Alternative route is shown in Figure 2-3. This route extends southwest from Central Ferry Substation for about 11 miles mostly parallel to and about 1,200 to 2,500 feet south of BPA's two existing Little Goose-Lower Granite 500-kV steel lattice transmission lines, to a point almost directly south of the Little Goose hydro project on the Snake River. At this point, the route angles away from the existing lines and proceeds in a southwest direction for about 6 miles before crossing the Tucannon River directly north of the town of Starbuck.

From the Tucannon River crossing, the North Alternative route continues southwest and west for about 3 miles before angling northwest for about 5 miles to a point approximately 1,500 feet south of BPA's two existing Lower Monumental-Little Goose 500-kV steel lattice transmission lines. From this point, the route continues west for about 14 miles to BPA's existing Lower

Monumental Substation. Much of this latter segment of the route runs parallel to and approximately 1,500 feet south of the existing lines. This alternative is about 40 miles long.

There would be approximately 178 transmission towers for the North Alternative. This action alternative would require about 33 miles of new road construction and about 5 miles of road improvements. Gates could be installed on these access roads, depending on landowner preferences.

Table 2-1. Engineering Characteristics of the Proposed Action Alternatives

Characteristic	North Alternative	South Alternative	Combination A Alternative	Combination B Alternative
Line length	40 miles	38 miles	38 miles	40 miles
Voltage	500 kV	500 kV	500 kV	500 kV
Corridor width	150 feet	150 feet	150 feet	150 feet
Tower style and material	Steel lattice	Steel lattice	Steel lattice	Steel lattice
Tower height	104 to 189 feet	104 to 189 feet	104 to 189 feet	104 to 189 feet
Number of new towers	178	167	167	178
Span length between towers	1,200 feet (average)	1,200 feet (average)	1,200 feet (average)	1,200 feet (average)
Miles of new access roads needed	33 miles	35 miles	33 miles	35 miles
Miles of access roads needing improvement	5 miles	13 miles	9 miles	10 miles
Number of pulling/tensioning sites	23	22	22	23
Number of fiber optic wood poles	4	11	4	11
Construction Costs	$99 million	$99 million	$99 million	$99 million

Table 2-2. Ground Disturbance of the Proposed Action Alternatives (acres)

Disturbance	North Alternative	South Alternative	Combination A Alternative	Combination B Alternative
Construction				
Tower Installation	92	85	86	91
Counterpoise Installation	104	97	97	104
Access Roads	143	146	139	150
Pulling/Tensioning Sites	16	15	15	16
Total Construction	**355**	**343**	**337**	**361**
Permanent				
Tower Footings	23	21	21	23
Access Roads	157	167	157	167
Total Permanent	**180**	**188**	**178**	**190**

Notes:
1/ Acres impacted are adjusted to account for overlap between disturbance categories.
2/ Permanent disturbance is a subsection of the area that would be disturbed during construction.
3/ Access road disturbance is assumed to be the same during both phases of the project (construction and permanent). However, the permanent access road-related disturbance appears higher than during construction because the overlap between tower installation (construction) and roads is greater than the overlap between tower footing (permanent) and roads. As a result, the share of disturbance attributed to roads appears higher in the permanent estimates.

The fiber optic cable for communications that is described in Section 2.2 would be installed along a portion of the North Alternative. This cable would extend from BPA's Lower Monumental Substation east to BPA's Little Goose Substation, a distance of approximately 26 miles (see Figure 2-3). Starting at the Lower Monumental Substation, the first 24 miles of the cable would be suspended from the proposed North Alternative's steel towers. After this first 24 miles, the fiber optic cable would be routed north for a distance of approximately 0.5 mile. This portion of the fiber optic cable would be suspended from approximately 4 proposed single wood poles. The cable then would be connected to the existing Little Goose-Lower Granite No. 2 tower 2/3[1]. From tower 2/3, the cable would proceed northwest, suspended from the existing Little Goose-Lower Granite No. 2 towers for a distance of approximately 1.5 miles to BPA's Little Goose Substation.

South Alternative

The South Alternative route is shown in Figure 2-3. This route extends southwest from Central Ferry Substation for about 3 miles mostly parallel to and approximately 1,200 to 2,500 feet south of BPA's two existing Little Goose-Lower Granite 500-kV steel lattice transmission lines. The route then diverges from these existing lines as they angle to the west and continues southwest and then west for about 15 miles before crossing the Tucannon River directly north of the town of Starbuck.

From the Tucannon River crossing, the South Alternative route proceeds west for about 20 miles to BPA's existing Lower Monumental Substation. This alternative is about 38 miles long.

There would be approximately 167 transmission towers for the South Alternative. This action alternative would require about 35 miles of new road construction and about 13 miles of road improvements. Gates could be installed on these access roads, depending on landowner preferences.

Like the North Alternative, a fiber optic cable would be installed along a portion of the South Alternative, and would extend from BPA's Lower Monumental Substation east to BPA's Little Goose Substation, a distance of approximately 27 miles (see Figure 2-3). Starting at the Lower Monumental Substation, the first 24 miles of the cable would be suspended from the South Alternative's steel towers. After this first 24 miles, the fiber optic cable would be routed north for a distance of approximately 1.75 miles. This portion of the fiber optic cable would be suspended from approximately 11 proposed single wood poles. As with the North Alternative, the cable then would be connected to the existing Little Goose-Lower Granite No. 2 tower 2/3 and proceed northwest along this line's existing towers for about 1.5 miles to BPA's Little Goose Substation.

Combination A Alternative

The Combination A Alternative route follows the North Alternative route from Central Ferry Substation until it reaches the Tucannon River where it then follows the South Alternative route to Lower Monumental Substation (see Figure 2-3). This alternative is about 38 miles long.

There would be approximately 167 transmission towers for the Combination A Alternative. This action alternative would require about 33 miles of new road construction and about 9 miles of road improvements. Gates could be installed on these access roads, depending on landowner preferences.

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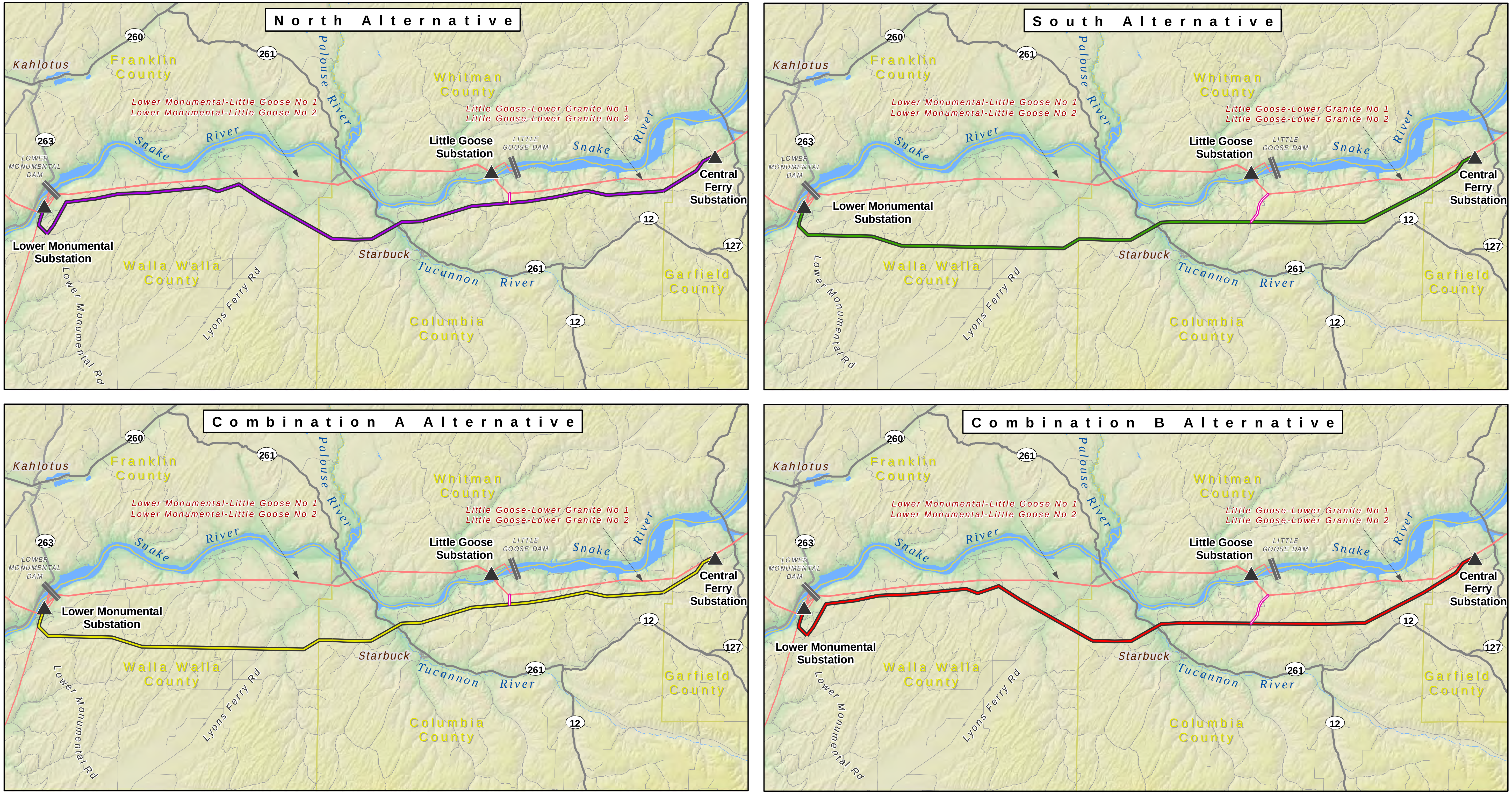
[1] BPA transmission structures each have individual numbers (e.g., 1/1, 1/2, etc.). The first number in the pair represents the line-mile number; the second number indicates whether the tower is the first, second, third, etc. tower in that mile. In this case, Little Goose-Lower Granite tower 2/3 is in line-mile 2/tower number 3, indicating that the entire transmission line begins at Little Goose Substation.



BONNEVILLE POWER ADMINISTRATION

Data Source:
Bonneville Power Administration Regional GIS Database.
All data is best available, 12/15/2009

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0 5 10 20 Miles

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Proposed Route Alternatives
- North Alternative
- South Alternative
- Combination A Alternative
- Combination B Alternative

- Proposed Fiber Line
- Substation
- Federal Dam
- Existing BPA Transmission Lines

- County Boundary
- Major Highway
- Roads

Bonneville Power Administration
Central Ferry-Lower Monumental 500-kV
Transmission Line Project
Figure 2-3
Proposed Route Map

A fiber optic cable would be placed in the same location as described above for the North Alternative.

Combination B Alternative

The Combination B Alternative route follows the South Alternative route from Central Ferry Substation until it reaches the Tucannon River where it then follows the North Alternative route to Lower Monumental Substation (see Figure 2-3). This alternative is about 40 miles long.

There would be approximately 178 transmission towers for the Combination B Alternative. This action alternative would require about 35 miles of new road construction and about 10 miles of road improvements. Gates could be installed on these access roads, depending on landowner preferences.

A fiber optic cable would be placed in the same location as described above for the South Alternative.

2.4 No Action Alternative

Under the No Action Alternative, BPA would not build the proposed Central Ferry-Lower Monumental transmission line. Without building the proposed line, BPA would not be able to offer long-term firm transmission service for all of the service requests that the proposed line is intended to accommodate. However, BPA may be able to provide other forms of transmission service, such as non-firm service, to some or all of these customers.

2.5 Alternatives Considered but Eliminated from Detailed Study

As described in Section 2.1, BPA considered a wide range of potential alternatives for the proposed action. This range included alternatives developed by BPA based on its knowledge of and experience in transmission line design and possible environmental issues, as well as alternatives that either were suggested or responded to concerns raised during the scoping process for this EIS. For each potential alternative, BPA assessed whether the alternative was reasonable under NEPA and thus merited detailed evaluation in this EIS, or was not reasonable and thus could be eliminated from detailed study.

BPA considered several factors in making this assessment of potential alternatives. BPA considered whether the potential alternative would meet the identified need for the proposed action while facilitating achievement of the project's purposes (see Chapter 1). In addition, BPA considered whether the alternative would be practical and feasible from a technical and economic standpoint and using common sense, consistent with Council on Environmental Quality (CEQ) guidance on assessing the reasonableness of alternatives. Finally, BPA considered whether the alternative would have obviously greater adverse environmental effects than the proposed action.

Alternatives deemed to not merit detailed evaluation in this EIS were those that did not meet the stated need for the proposed action, that were not practical or feasible, or that would have obviously greater adverse environmental effects than the proposed action. This section summarizes the alternatives that were considered but have been eliminated from detailed study in this EIS.

Non-Transmission Alternatives

BPA considered whether there could be a solution to the project need that would not require construction of a new transmission line. Some examples of non-transmission alternatives include: distributed generation (siting generation closer to the load so power does not have to be transmitted over the line in question), demand side management (reduces the load during peak demand times), and general conservation (reducing load by using more energy-efficient appliances). Remedial Action Scheme (RAS) changes is another non-transmission alternative.

Concerning distributed generation, demand side management, and general conservation, BPA's proposed action involves responding to existing requests for transmission service over a portion of its transmission system that has limited available transmission capacity (ATC). These three non-transmission alternatives would not address the specific need for additional capacity in the Lower Snake area. Because they would not meet this identified need, these non-transmission alternatives were considered but eliminated from detailed study in this EIS.

Concerning RAS, BPA uses RAS to prevent transmission planning reliability criteria violations, such as facility overloads and system instability, resulting from severe unplanned transmission line outages. RAS equipment requires local generators to automatically cut or "drop" their generation to protect the transmission system when the capacity of the system is reached or an unplanned outage occurs. Typical actions include tripping generators offline and switching reactive power devices with high-speed control systems. In the proposed project area, BPA uses RAS extensively to manage existing commitments in the Lower Snake area. The Lower Snake RAS and Western Montana RAS systems currently allow BPA to provide safe and reliable system operation with the existing generators in this area.

BPA evaluated whether additional RAS measures could be implemented to accommodate the 1,100 megawatt (MW) of additional firm transmission service requested in the Lower Snake area. In order to maintain transmission system reliability, BPA must limit the total amount of generation that may be tripped by RAS. The total amount of existing generation that is currently subject to tripping by the Lower Snake RAS and Western Montana RAS is already very close to this limit under certain conditions. BPA's planning studies showed that even if all service requests were subjected to the Lower Snake RAS and this RAS equipment was upgraded to optimize transfer capability, BPA still could not grant the requested 1,100 MW of additional firm transmission service. Therefore, this alternative was eliminated from further consideration because it would not meet the identified need for the proposed project.

Undergrounding the Transmission Line

During the scoping process, some commenters suggested burying the new transmission line. Underground transmission cables are highly complex when compared to overhead transmission lines and lower-voltage distribution cables used to deliver power to individual homes. For a 500-kV line, three individual cables would need to be manufactured and installed at a total cost of 5 to 10 times the cost of an overhead design.

Because costs are so high, BPA uses underground cable only in limited situations. Underground cables are considered where an overhead route is not possible, such as for long water crossings (e.g., in the San Juan Islands) or in highly developed urban areas. In addition, underground transmission cables used by BPA are short in comparison to typical overhead transmission lines. BPA's longest underground transmission cable is a 9-mile-long submarine cable in the San Juan Islands.

In addition to significantly higher construction costs, installation and maintenance of underground transmission cables also result in much higher maintenance costs, and environmental impacts that are typically the same or greater than impacts associated with an overhead line. Installation of underground cable would require the use of large excavators and other heavy equipment to dig a continuous cable trench a minimum of 10 feet wide and 6 feet deep. All trees and brush would need to be cleared along this construction corridor. This construction activity would cause substantial surface and subsurface disturbance, soil erosion potential, potential impacts to cultural resources, and noise and air quality impacts along the transmission line route.

In areas where bedrock is near the surface, construction would also require blasting, which would result in noise and air quality impacts not experienced during construction of overhead lines. In areas where the cables would cross waterbodies such as the Tucannon River, construction could require excavation in wetlands and riparian areas that would be avoided with an overhead transmission line. The cables that would be installed likely would be oil-filled, which would require above-ground termination and oil storage equipment at several locations along the line. Large vaults approximately 12 feet by 60 feet would be needed every 0.5 mile to allow splicing of the cables.

Once the cables are installed, a permanent corridor approximately 150 feet wide would be required, with a continuous parallel access road along the route of the buried transmission line to allow necessary maintenance and repair of the cables. Although there would be no overhead transmission line structures or conductors, this permanent corridor and the aboveground equipment associated with an underground line would have visual impacts.

Repairs would require excavation along the affected reach. Because the cables would be underground, the cables would be more susceptible to damage and failure due to geological hazards such as seismic activity, landslides, and soil erosion. Failures also can result from aging of the cables, heat stress, and a variety of other external and internal causes. In addition, because the cables would be buried, it would be much more difficult to locate failed or damaged cables, and service would likely take weeks or months to restore compared to the hours or days it takes to restore service on an overhead line.

Underground cable remains a tool available for low-voltage distribution and for special high-voltage situations, but because of its high cost and environmental impacts, it is not considered a reasonable alternative to solve the high-voltage transmission need identified in Chapter 1. It therefore was eliminated from detailed evaluation.

Transmission Line Alternatives

Use Existing Transmission System Without Upgrades

The transmission service requests received by BPA could not be granted with existing transmission facilities due to thermal overloads and voltage criteria violations at the transfer levels required to meet existing commitments. The transmission studies conducted by BPA have shown that adding 1,100 MW of requested firm service to existing firm commitments, without providing system upgrades, could result in violations of applicable transmission planning standards. Providing this requested service would exceed the ATC of BPA’s existing transmission lines in the Lower Snake area, which likely would result in thermal overloads and associated outages during certain times. Given the interconnected nature of the regional transmission system, any such outage could “cascade” to other transmission lines owned by BPA and other utilities. The most likely would be a common mode outage on parallel 500-kV transmission facilities owned by BPA and other utilities between Central Ferry and Lower Monumental substations. However, other portions the regional transmission system could also be affected through further cascading outages.

Because of the severe technical operational issues associated with using the existing transmission system without upgrades, and because this alternative would not meet the identified need while achieving the project purpose of maintaining system reliability to BPA and industry standards, this alternative was eliminated from further consideration.

Lower Voltage Line Upgrades

BPA also considered lower voltage upgrades to address the potential for thermal overloads and voltage criteria violations at the transfer levels required to meet both existing transmission service commitments and requested service. This alternative would upgrade to a higher current rating the facilities that were identified as being at risk for thermal overloads. These facilities include over 100 miles of transmission lines, primarily 230-kV lines owned by other utilities including PacifiCorp and Avista. A preliminary analysis revealed that upgrading these lines would require full reconstruction of the lines, which would necessitate extended outages resulting in significant impacts to the customers of these utilities. In addition, these upgrades would not mitigate voltage criteria violations that were also identified at the full requested transfer levels, which would require reactive power devices. Therefore, this alternative was eliminated from further consideration.

Central Ferry - Walla Walla - McNary 500-kV line

This alternative would entail construction of a new 500-kV transmission line from Central Ferry to a new 500-kV substation in the Walla Walla area, and a new 500-kV line from Walla Walla to BPA's McNary Substation. A preliminary estimate for the total length was between 90 and 100 miles. This alternative was considered because PacifiCorp has proposed a new 230-kV line from Walla Walla to Wallula to McNary in order to offer service related to proposed generation in the Walla Walla area. BPA performed a preliminary evaluation of this alternative to determine if it could meet the needs of both utilities, and held preliminary discussions with PacifiCorp.

This alternative was rejected for two reasons: 1) the line would need to be at least double the length and double the cost of the proposed Central Ferry-Lower Monumental line, and 2) PacifiCorp did not indicate an interest in participating due to the higher cost, lead time, and risk compared with their preferred project alternative. Therefore, this alternative was eliminated from further consideration.

2.6 Comparison of Alternatives

Table 2-3 compares the proposed action alternatives and the No Action Alternative to the purposes of the project described in Chapter 1, Section 1.3. Table 2-4 summarizes the environmental impacts and mitigation for the action alternatives described in Chapter 3.

Table 2-3. Comparison of Proposed Action Alternatives to Project Purposes

Purpose	North Alternative	South Alternative	Combination A Alternative	Combination B Alternative	No Action
Optimize electrical capacity/performance of the proposed new line	Constructing the proposed 500-kV transmission line in a new corridor would mitigate transmission constraints in SE Washington and allow BPA to meet transmission service requests.	Same as North Alternative	Same as North Alternative	Same as North Alternative	Existing transmission system limitations would be mitigated by curtailing and/or denying transmission service requests.
Maintain reliability of BPA's transmission system to BPA and industry standards	Constructing the proposed 500-kV transmission line would increase the reliability of the electrical grid in the region by providing an additional service line for power should there be an interruption in the operation of one of the other transmission lines in the area.	Same as North Alternative	Same as North Alternative	Same as North Alternative	By not constructing the proposed transmission line, there would be increased risk of power interruptions occurring in the region due to insufficient capacity in the grid as demand increases. Also, the ability for BPA to provide continuous electric service would be reduced should there be a failure in any of the other main transmission lines serving the region.
Meet BPA's contractual and statutory obligations	While BPA has no express contractual or statutory obligation to build the proposed line or provide the requested service, the proposed line would help BPA further its statutory mandates and tariff provisions that direct BPA to construct additions to the transmission system to integrate and transmit electric power and maintain system stability and reliability, as appropriate.	Same as North Alternative	Same as North Alternative	Same as North Alternative	By not constructing the line, BPA would not be acting in furtherance of its applicable statutory mandates or tariff provisions.
Minimize project costs where possible	The proposed transmission line project would cost about $99 million. For a line of this length, utilizing a relatively direct route between the two substations, the proposed line provides cost and administrative efficiency.	Same as North Alternative	Same as North Alternative	Same as North Alternative	No immediate costs would be involved if the line were not built.
Minimize impacts to the environment	This alternative has been designed to minimize impacts to the environment where feasible, and mitigation measures are identified to avoid or reduce these impacts.	Same as North Alternative, but because this alternative would require a slightly shorter transmission line with less ground disturbance, this alternative would further minimize environmental impacts as compared to the North Alternative.	Same as North Alternative, but because this alternative would require a slightly shorter transmission line with less ground disturbance, this alternative would further minimize environmental impacts as compared to the North Alternative.	Same as North Alternative	If the line were not built, there would not be any environmental impacts due to construction or operation.

Table 2-4. Summary of Impacts of the Proposed Action Alternatives and the No Action Alternative

Potential Impacts					Mitigation Measures
North Alternative	South Alternative	Combination A Alternative	Combination B Alternative	No Action Alternative	
Geology and Soils					
• Construction would result in about 355 acres of temporary ground disturbance (307 acres to areas classified as having severe erosion hazard, 47 acres of moderate, and 1 acre of slight potential for erosion). With mitigation in place, impacts would be ***low***. • About 153 acres of soils having a low resistance to soil compaction and 196 acres of soils with a moderate resistance to compaction would be impacted during construction. With mitigation in place, impacts would be ***low***.	• Construction would result in about 343 acres of temporary ground disturbance (320 acres to areas classified as having severe erosion hazard, 23 acres of moderate, and less than 1 acre of slight potential for erosion). With mitigation in place, impacts would be ***low***. • About 114 acres of soils having a low resistance to soil compaction and 224 acres of soils with a moderate resistance to compaction would be impacted during construction. With mitigation in place, impacts would be ***low***.	• Construction would result in about 337 acres of temporary ground disturbance (305 acres to areas classified as having severe erosion hazard, 31 acres of moderate, and less than 1 acre of slight potential for erosion). With mitigation in place, impacts would be ***low***. • About 106 acres of soils having a low resistance to soil compaction and 226 acres of soils with a moderate resistance to compaction would be impacted during construction. With mitigation in place, impacts would be ***low***.	• Construction would result in about 361 acres of temporary ground disturbance (322 acres to areas classified as having severe erosion hazard, 39 acres of moderate, and 1 acre of slight potential for erosion). With mitigation in place, impacts would be ***low***. • About 162 acres of soils having a low resistance to soil compaction and 194 acres of soils with a moderate resistance to compaction would be impacted during construction. With mitigation in place, impacts would be ***low***.	• Under the No Action Alternative the proposed project would not be built and there would be no impact on geology and soils.	• Prior to construction, conduct a detailed geologic hazard assessment for the selected action alternative. This assessment will include a review of geologic maps and aerial photomaps combined with surface condition assessments at each proposed tower location and surrounding terrain. In addition, subsurface information will be obtained from water well logs, material exposed in existing road and stream-cut slopes, and construction/design information from the existing transmission lines in the project area. Particular attention will be given to on-site evaluation of the slope stability of each proposed tower location. Tower or road locations found to be within previously unidentified active slides, bedrock hollows, or other geologic hazard areas will be relocated outside the limits of these areas. • Prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) to lessen soil erosion and improve water quality of stormwater run-off. SWPPPs are developed to prevent movement of sediment off-site to adjacent water bodies during short term or temporary soil disturbance at construction sites. The SWPPP for this project will address stabilization practices, structural practices and stormwater management. • Design access roads to control runoff and prevent erosion by using low grades, outsloping, intercepting dips, water bars, or ditch-outs, or a combination of these methods. • Minimize construction equipment use within 150 feet of a water body (stream or river). • Surface all permanent access roads with rock to help prevent erosion and rutting of road surfaces and to support vehicle traffic. • Minimize construction on steep, unstable slopes, if possible. • Save topsoil removed for structure and new access road construction for onsite restoration activities to promote regrowth from the native seed bank in the topsoil. If contaminated, follow-up weed control would be needed. • Cover exposed piles of soil with plastic or similar material to reduce erosion potential from rain or wind. • Cut or crush vegetation, rather than blade, in areas that will remain vegetated in order to maximize the ability of plant roots to keep soil intact and prevent sediment movement offsite. • Revegetate or reseed all disturbed areas with a native plant/grass seed mixture suited to the site and landowner, to promote vegetation that will hold soil in place. • Till or scarify compacted soils before reseeding where necessary. • Monitor erosion control best management practices (BMPs) to ensure proper function and nominal erosion levels. • Monitor revegetation and site restoration work for adequate growth; implement contingency measures as necessary. • Mark construction limits within agricultural fields or grasslands to minimize disturbance. • Inspect and maintain project facilities, including the access roads. • Inspect and maintain tanks and equipment containing oil, fuel, or chemicals for drips or leaks and to prevent spills onto the ground or into state waters. • Maintain and repair all equipment and vehicles on impervious surfaces away from all sources of surface water. • Refuel and maintain equipment at least 25 feet from any natural or manmade drainage conveyance including streams, wetlands, ditches, catch basins, ponds, and pipes, and provide spill containment and cleanup. Utilize pumps, funnels and absorbent pads for all equipment fueling and maintenance operations. • Provide spill prevention kits at designated locations on the project site and at the hazardous material storage areas. • Minimize the number of road stream crossings. • Stabilize cut and fill slopes.

Table 2-4. Summary of Impacts of the Proposed Action Alternatives and the No Action Alternative (continued)

Potential Impacts					Mitigation Measures
North Alternative	**South Alternative**	**Combination A Alternative**	**Combination B Alternative**	**No Action Alternative**	
Land Use					
• Construction activities would result in a total of 355 acres of impacts to lands; consisting of 97 acres of agricultural lands, 252 acres of grassland, and 6 acres of developed lands. Impacts would be temporary and localized and, therefore, ***low***. • Approximately 180 acres would be permanently converted to transmission line-related uses. This would consist of 57 acres of agricultural lands, 120 acres of grassland, and 2 acres of developed lands. • CRP lands may be crossed by the proposed project (the acreage crossed is unknown); however, it is assumed no adjustment would be made to CRP enrollees' annual lease payments, despite the potential for reduction in CRP acres under this alternative. • Construction would disturb 11 acres of Prime Farmland, if Irrigated and 249 acres of Farmland of Statewide Importance. • Approximately 5 acres of Prime Farmland, if Irrigated and 128 acres of Farmland of Statewide Importance would be permanently converted to transmission line-related uses. These acreages represent very small amounts of county totals (0.01 to 0.02 percent) and impacts are expected to be ***low***. • Transmission line easements would be obtained for crossings on private lands, and right-of-way grants would be obtained for crossings on federal and state lands. • No private residences or other structures would be impacted under this alternative	• Construction activities would result in a total of 343 acres of impacts to lands; consisting of 101 acres of agricultural lands, 237 acres of grassland, and 5 acres of developed lands. Impacts would be temporary and localized and, therefore, ***low***. • Approximately 188 acres would be permanently converted to transmission line-related uses. This would consist of 58 acres of agricultural lands, 128 acres of grassland, and 2 acres of developed lands. • CRP lands may be crossed by the proposed project (the acreage crossed is unknown); however, it is assumed no adjustment would be made to CRP enrollees' annual lease payments, despite the potential for reduction in CRP acres under this alternative. • Construction would disturb 16 acres of Prime Farmland, if irrigated and 209 acres of Farmland of Statewide Importance. • Approximately 8 acres of Prime Farmland, if Irrigated and 115 acres of Farmland of Statewide Importance would be permanently converted to transmission line-related uses. These acreages represent very small amounts of county totals (0.01 to 0.02 percent) and impacts are expected to be ***low***. • Transmission line easements would be obtained for crossings on private lands, and right-of-way grants would be obtained for crossings on federal and state lands. • One private residence, located 400 feet north of the proposed project, would be impacted during construction; potential impacts would include a short-term increase in noise, construction traffic levels, and dust.	• Construction activities would result in a total of 337 acres of impacts to lands; consisting of 93 acres of agricultural lands, 239 acres of grassland, and 5 acres of developed lands. Impacts would be temporary and localized and, therefore, ***low***. • Approximately 178 acres would be permanently converted to transmission line-related uses. This would consist of 55 acres of agricultural lands, 121 acres of grassland, and 2 acres of developed lands. • CRP lands may be crossed by the proposed project (the acreage crossed is unknown); however, it is assumed no adjustment would be made to CRP enrollees' annual lease payments, despite the potential for reduction in CRP acres under this alternative. • Construction would disturb 16 acres of Prime Farmland, if irrigated and 209 acres of Farmland of Statewide Importance. • Approximately 8 acres of Prime Farmland, if Irrigated and 111 acres of Farmland of Statewide Importance would be permanently converted to transmission line-related uses. These acreages represent very small amounts of county totals (0.01 to 0.02 percent) and impacts are expected to be ***low***. • Transmission line easements would be obtained for crossings on private lands, and right-of-way grants would be obtained for crossings on federal and state lands. • One private residence, located 400 feet north of the proposed project, would be impacted during construction; potential impacts would include a short-term increase in noise, construction traffic levels, and dust.	• Construction activities would result in a total of 361 acres of impacts to lands; consisting of 105 acres of agricultural lands, 250 acres of grassland, and 6 acres of developed lands. Impacts would be temporary and localized and, therefore, ***low***. • Approximately 190 acres would be permanently converted to transmission line-related uses. This would consist of 60 acres of agricultural lands, 127 acres of grassland, and 2 acres of developed lands. • CRP lands may be crossed by the proposed project (the acreage crossed is unknown); however, it is assumed no adjustment would be made to CRP enrollees' annual lease payments, despite the potential for reduction in CRP acres under this alternative. • Construction would disturb 11 acres of Prime Farmland, if irrigated and 249 acres of Farmland of Statewide Importance. • Approximately 5 acres of Prime Farmland, if Irrigated and 132 acres of Farmland of Statewide Importance would be permanently converted to transmission line-related uses. These acreages represent very small amounts of county totals (0.01 to 0.02 percent) and impacts are expected to be ***low***. • Transmission line easements would be obtained for crossings on private lands, and right-of-way grants would be obtained for crossings on federal and state lands. • No private residences or other structures would be impacted under this alternative.	• Under the No Action Alternative the proposed project would not be built and there would be no impact on land use.	• Provide a schedule of construction activities to all landowners that could be affected by construction. • Compensate landowners for any new land rights required for right-of-way easements, or to construct new, temporary or permanent access roads. • Plan and conduct construction activities to minimize temporary disturbance, displacement of crops, and interference with agricultural activities. • Use BMPs to limit erosion and the spread of noxious weeds. • Restore compacted cropland soils to pre-construction conditions. • Compensate landowners for any damage to property during construction and maintenance activities. • Minimize or eliminate public access to project facilities through postings and installation of gates and barriers at appropriate access points and, at the landowner's request, on private property.

Table 2-4. Summary of Impacts of the Proposed Action Alternatives and the No Action Alternative (continued)

Potential Impacts					Mitigation Measures
North Alternative	**South Alternative**	**Combination A Alternative**	**Combination B Alternative**	**No Action Alternative**	
Vegetation					
• Construction activities would result in a total of 355 acres of impacts to vegetation; consisting of 84 acres of croplands, 214 acres of disturbed grasslands, 19 acres of native grasslands, and 39 acres of potential native grasslands. • Approximately 180 acres of vegetation would be permanently converted to transmission line-related uses. This would consist of 45 acres of croplands, 110 acres of disturbed grasslands, 10 acres of native grasslands, and 14 acres of potential native grasslands. • Overall impacts to native grasslands would be ***moderate*** to ***high*** under this alternative, depending on the size/integrity of the community/area impacted. Impacts to croplands and disturbed habitats would be ***low***. • The project could result in the spread of noxious weeds, especially along newly constructed access roads. The spread of noxious weeds could impact native plant communities, as well as reduce the production value of croplands. This potential impact would be reduced by the implementation of mitigation measures. • The proposed project has the potential to impact threatened, endangered, and sensitive plant species through habitat modification and direct removal/mortality. Surveys for these species are scheduled for Spring/Summer 2010.	• Construction activities would result in a total of 343 acres of impacts to vegetation; consisting of 65 acres of croplands, 232 acres of disturbed grasslands, 14 acres of native grasslands, and 32 acres of potential native grasslands. • Approximately 188 acres of vegetation would be permanently converted to transmission line-related uses. This would consist of 41 acres of croplands, 121 acres of disturbed grasslands, 9 acres of native grasslands, and 17 acres of potential native grasslands. • Overall impacts to native grasslands would be ***moderate*** under this alternative, depending on the size/integrity of the community/area impacted. Impacts to croplands and disturbed habitats would be ***low***. • Impacts from noxious weeds would be similar to those described for the North Alternative. • Impacts to threatened, endangered, and sensitive (TES) plant species would be similar to those described for the North Alternative.	• Construction activities would result in a total of 337 acres of impacts to vegetation; consisting of 64 acres of croplands, 232 acres of disturbed grasslands, 14 acres of native grasslands, and 27 acres of potential native grasslands. • Approximately 178 acres of vegetation would be permanently converted to transmission line-related uses. This would consist of 44 acres of croplands, 111 acres of disturbed grasslands, 10 acres of native grasslands, and 13 acres of potential native grasslands. • Overall impacts to native grasslands are considered ***moderate*** under this alternative, depending on the size/integrity of the community/area impacted. Impacts to croplands and disturbed habitats would be ***low***. • Impacts from noxious weeds would be similar to those described for the North Alternative. • Impacts to threatened, endangered, and sensitive plant species would be similar to those described for the North Alternative.	• Construction activities would result in a total of 361 acres of impacts to vegetation; consisting of 85 acres of croplands, 214 acres of disturbed grasslands, 19 acres of native grasslands, and 44 acres of potential native grasslands. • Approximately 190 acres of vegetation would be permanently converted to transmission line-related uses. This would consist of 43 acres of croplands, 119 acres of disturbed grasslands, 9 acres of native grasslands, and 18 acres of potential native grasslands. • Overall impacts to native grasslands would be ***moderate*** to ***high*** under this alternative, depending on the size/integrity of the community/area impacted. Impacts to croplands and disturbed habitats would be ***low***. • Impacts from noxious weeds would be similar to those described for the North Alternative. • Impacts to threatened, endangered, and sensitive plant species would be similar to those described for the North Alternative.	• Under the No Action Alternative, construction of the proposed transmission line would not occur and vegetation communities and TES plant species found within the project area would likely remain in their current state. Current ongoing activities, such as farming and grazing, would continue to affect vegetation communities and have the potential to affect TES plant species in the project area under this alternative. Noxious weeds would continue to spread in the project area at current rates, with treatment conducted at landowner discretion.	**Vegetation Communities** • Limit ground-disturbing activities to tower sites, access roads, and staging areas; stake or flag native grassland or sensitive cropland areas prior to initiating construction. • Limit road improvements to the minimum amount necessary to safely move equipment, materials, and personnel into and out of the construction area. • Avoid introduction of non-native seed into areas of native grassland and/or areas where non-native species are not yet well established. • Use an approved native seed mix to re-vegetate areas of native grassland disturbed during construction activities. • Use an approved mixture of native and non-native species or seed for re-vegetation in areas were non-native species are already well established (i.e., disturbed grassland). • Use a seed mix approved by the local Farm Service Agency **Noxious Weeds** • Comply with all federal, state, and county noxious weed control regulations and guidelines. • Wash all equipment using pressure or steam before entering the project area and when leaving discrete patches of noxious weeds. • Map and flag noxious weed populations to construction so these populations can be avoided when possible. Clean vehicles after leaving these areas to avoid the spread of noxious weeds. • Use seed mixes to revegetate construction areas that meet the requirements of federal, state, and county noxious weed control regulations and guidelines. • Use certified weed-free straw for erosion control during construction and restoration activities. • Cooperate with private, county, state, and federal landowners to treat noxious weeds along access roads that will be used to bring construction equipment into the project area to reduce the introduction and spread of noxious weeds and noxious weed seeds. • Apply herbicides according to labeled rates and recommendations to ensure protection of surface water, ecological integrity, and public health and safety. • Conduct a post-construction noxious weed survey to determine whether noxious weeds have been spread within the project area. Take corrective action if needed. **Threatened, Endangered, and Sensitive Plant Species** • Conduct additional surveys for TES plant species in all areas of native grassland, as well as areas classified as potential habitat, during spring/summer 2010. • Consult with the U.S. Fish and Wildlife Service concerning any federally listed TES plant species that are identified and implement any mitigation measures to eliminate or reduce adverse impacts to these species.

Table 2-4. Summary of Impacts of the Proposed Action Alternatives and the No Action Alternative (continued)

Potential Impacts					Mitigation Measures
North Alternative	**South Alternative**	**Combination A Alternative**	**Combination B Alternative**	**No Action Alternative**	
Recreation					
• The proposed project would have ***no*** effect on access to recreational sites around Lake Bryan, Lake West, or Lake Sacajawea; however, transmission towers and conductors would be visible from these sites. This would result in some impacts (***low***) to recreational activities, due to project-related impacts to visual resources. • The proposed project would have ***no*** effect on access to the Snake River and campsites along the Lewis and Clark expedition; however, transmission towers and conductors would be visible from portions of the Snake River, as well as from two Lewis and Clark expedition campsites. This would result in some impacts (***low***) to recreational activities due to project related impacts to visual resources. • Construction would result in temporary impacts (***moderate***) to sightseeing opportunities along U.S. Route 12, due to the use of this highway for transporting construction equipment to and from construction sights. • Although the proposed project would not cross through public hunting areas, construction activities could result in displacement of wildlife within adjacent areas: either away from or to hunting areas. This could result in impacts (***low***) to hunting experiences within the vicinity of the project area.	• Impacts to recreational use of Lake Bryan, Lake West, or Lake Sacajawea would be similar to those described for the North Alternative. • Impacts to recreational use of the Snake River and the Lewis and Clark expedition campsites would be similar to those described for the North Alternative. • Construction would result in temporary impacts (***moderate*** to ***high***) to sightseeing opportunities along U.S. Route 12, due to the use of this highway for transporting construction equipment to and from construction sights. In addition, transmission towers and conductors would be visible from U.S. Route 12, resulting in permanent impacts to sightseeing opportunities along this highway. • Impacts to hunting opportunities near the project area would be similar to those described for the North Alternative.	• Impacts to Lake Bryan, Lake West, or Lake Sacajawea would be similar to those described for the North Alternative. • Impacts to recreational use of the Snake River and the Lewis and Clark expedition campsites would be similar to those described for the North Alternative. • Construction-related impacts to sightseeing opportunities along U.S. Route 12 would be the same as those described under the North Alternative. • Impacts to hunting opportunities near the project area would be similar to those described for the North Alternative.	• Impacts to Lake Bryan, Lake West, or Lake Sacajawea would be similar to those described for the North Alternative. • Impacts to recreational use of the Snake River and the Lewis and Clark expedition campsites would be similar to those described for the North Alternative. • Construction-related impacts to sightseeing opportunities along U.S. Route 12 would be the same as those described under the South Alternative. • Impacts to hunting opportunities near the project area would be similar to those described for the North Alternative.	• Under the No Action Alternative the proposed project would not be built and there would be no impact on recreation.	Potential recreation impacts are primarily associated with changes in viewsheds. Mitigation measures for potential visual impacts are discussed below under Visual Resources.

Table 2-4. Summary of Impacts of the Proposed Action Alternatives and the No Action Alternative (continued)

Potential Impacts					Mitigation Measures
North Alternative	**South Alternative**	**Combination A Alternative**	**Combination B Alternative**	**No Action Alternative**	
Wildlife					
Grassland/Shrub-Steppe Associated Species • Sagebrush Lizard – Impacts to sagebrush lizards are expected to be ***low*** because only low quality habitat would be impacted under this alternative. • Golden Eagle, Ferruginous Hawk, Merlin, Peregrine Falcon, and Loggerhead Shrike – Impacts to golden eagles and ferruginous hawks during construction would be ***moderate***. Impacts to merlin, peregrine falcons, and loggerhead shrikes would be ***low***. • Sage Sparrow – As this species would only be in the project area for a limited time, and mitigation measures would avoid impacts to this species during these times, potential impacts would be ***low*** • Preble's shrew – Impacts to the Preble's shrew are expected to be ***low*** because only low quality habitat is available and would be impacted under this alternative. • Washington Ground Squirrel – Potential impacts to this species are likely to be ***low*** to ***moderate***, as this species was known to occur within the project area, but current knowledge about its distribution are uncertain. • White- and Black-Tailed Jackrabbits – Potential impacts to white-tailed jackrabbits are likely to be ***low*** to ***moderate***; impacts to black-tailed jackrabbits would be low because they are less likely to use the project area. • Mule Deer – The impact on mule deer using disturbed grassland/shrub-steppe habitat would be ***low*** to ***moderate*** if proper mitigation measures are followed	Grassland/Shrub-Steppe Associated Species • Sagebrush Lizard – Impacts to sagebrush lizards are expected to be ***low*** because only low quality habitat would be impacted under this alternative. • Golden Eagle, Ferruginous Hawk, Merlin, Peregrine Falcon, and Loggerhead Shrike – Impacts to golden eagles and ferruginous hawks during construction would be ***moderate.*** Impacts to merlin, peregrine falcons, and loggerhead shrikes would be ***low***. • Sage Sparrow – As this species would only be in the project area for a limited time, and mitigation measures would avoid impacts to this species during these times, potential impacts would be ***low***. • Preble's shrew – Impacts to the Preble's shrew are expected to be ***low*** because only low quality habitat is available and would be impacted under this alternative. • Washington Ground Squirrel – Potential impacts to this species are likely to be ***low*** to ***moderate***, as this species was known to occur within the project area, but current knowledge about its distribution are uncertain. • White- and Black-Tailed Jackrabbits – Potential impacts to white-tailed jackrabbits are likely to be ***low*** to ***moderate***; impacts to black-tailed jackrabbits would be low because they are less likely to use the project area. • Mule Deer – The impact on mule deer using disturbed grassland/shrub-steppe habitat would be ***low*** if proper mitigation measures are followed, given that deer densities are relatively low to moderate in this area.	Grassland/Shrub-Steppe Associated Species • Sagebrush Lizard – Impacts to sagebrush lizards are expected to be ***low*** because only low quality habitat would be impacted under this alternative. • Golden Eagle, Ferruginous Hawk, Merlin, Peregrine Falcon, and Loggerhead Shrike – Impacts to golden eagles and ferruginous hawks during construction would be ***moderate***. Impacts to merlin, peregrine falcons, and loggerhead shrikes would be ***low***. • Sage Sparrow – As this species would only be in the project area for a limited time, and mitigation measures would avoid impacts to this species during these times, potential impacts would be ***low***. • Preble's shrew – Impacts to the Preble's shrew are expected to be ***low*** because only low quality habitat is available and would be impacted under this alternative. • Washington Ground Squirrel – Potential impacts to this species are likely to be ***low*** to ***moderate***, as this species was known to occur within the project area, but current knowledge about its distribution are uncertain. • White- and Black-Tailed Jackrabbits – Potential impacts to white-tailed jackrabbits are likely to be ***low*** to ***moderate***; impacts to black-tailed jackrabbits would be low because they are less likely to use the project area. • Mule Deer – The impact on mule deer using disturbed grassland/shrub-steppe habitat would be ***low*** to ***moderate*** if proper mitigation measures are followed.	Grassland/Shrub-Steppe Associated Species • Sagebrush Lizard – Impacts to sagebrush lizards are expected to be ***low*** because only low quality ***habitat*** would be impacted under this alternative. • Golden Eagle, Ferruginous Hawk, Merlin, Peregrine Falcon, and Loggerhead Shrike – Impacts to golden eagles and ferruginous hawks during construction would be ***moderate.*** Impacts to merlin, peregrine falcons, and loggerhead shrikes would be ***low***. • Sage Sparrow – As this species would only be in the project area for a limited time, and mitigation measures would avoid impacts to this species during these times, potential impacts would be ***low***. • Preble's shrew – Impacts to the Preble's shrew are expected to be ***low*** because only low quality habitat is available and would be impacted under this alternative. • Washington Ground Squirrel – Potential impacts to this species are likely to be ***low*** to ***moderate***, as this species was known to occur within the project area, but current knowledge about its distribution are uncertain. • White- and Black-Tailed Jackrabbits – Potential impacts to white-tailed jackrabbits are likely to be ***low*** to ***moderate***; impacts to black-tailed jackrabbits would be low because they are less likely to use the project area. • Mule Deer – The impact on mule deer using disturbed grassland/shrub-steppe habitat would be ***low*** if proper mitigation measures are followed, given that deer densities are relatively low to moderate in this area.	• Under the No Action Alternative the proposed project would not be built and there would be no impact on wildlife.	• Install bird flight diverters where the project corridor crosses the riparian corridor of the Tucannon River. • Avoid construction activities within 0.6 mile of any active raptor nest during the raptor nesting season (e.g., March 1 to August 15 for ferruginous hawks, February 15 to July 15 for golden eagles), if possible. • Avoid construction activities within PHS designated mule deer winter range during the mule deer winter range period from November 1 through March 31, if possible. • If identified, confirmed Washington ground squirrel colonies will be avoided during peak above-ground activity in the spring • Maintain all existing BPA gates. Wherever permitted by landowners or land managing agencies, install gates to limit vehicular use of new access roads. • Use slow speeds when operating vehicles or equipment during construction activities located in grasslands or croplands.

Table 2-4. Summary of Impacts of the Proposed Action Alternatives and the No Action Alternative (continued)

Potential Impacts					
North Alternative	**South Alternative**	**Combination A Alternative**	**Combination B Alternative**	**No Action Alternative**	**Mitigation Measures**
Rock Outcrop Associated Species • Multiple rock outcrops are located near this alternative (approximately 72 within 0.5 mile of the project corridor), indicating that there is a high likelihood for rock outcrop associated species to occur near the area. The proposed project would have ***low*** impacts on sagebrush lizards and ***moderate*** to ***high*** impacts on ferruginous hawks, due to potential flight impact with project structures as well as disturbance during construction. Cliff Associated Species • Impacts to cliff associated species are expected to be ***low*** to ***moderate***, and include general disturbance related to construction noise. Riparian Associated Species • As riparian areas are limited in the project area and no riparian vegetation would be removed during construction, impacts to riparian associated species would be ***low***. Cropland Associated Species • Cropland areas serve as low quality habitat for wildlife and disturbance to cropland would have a ***low*** level of impact on cropland-associated species.	Rock Outcrop Associated Species • Very few rock outcrops are located near this alternative, indicating that there is a low likelihood for rock outcrop associated species to occur near the area. The proposed project would have a ***low*** level of impact to these species, due to their low likelihood of occurring within the area. Cliff Associated Species • Impacts to cliff associated species are expected to be ***low*** to ***moderate***, and include general disturbance related to construction noise. Riparian Associated Species • As riparian areas are limited in the project area and no riparian vegetation would be removed during construction, impacts to riparian associated species would be ***low***. Cropland Associated Species • Cropland areas serve as low quality habitat for wildlife and disturbance to cropland would have a ***low*** level of impact on cropland-associated species.	Rock Outcrop Associated Species • Multiple rock outcrops are located near this alternative (approximately 63 within 0.5 mile of the project corridor), indicating that there is a high likelihood for rock outcrop associated species to occur near the area. The proposed project would have ***low*** impacts on sagebrush lizards and ***moderate*** to ***high*** impacts on ferruginous hawks, due to potential flight impact with project structures as well as disturbance during construction. Cliff Associated Species • Impacts to cliff associated species are expected to be ***low*** to ***moderate***, and include general disturbance related to construction noise. Riparian Associated Species • As riparian areas are limited in the project area and no riparian vegetation would be removed during construction, impacts to riparian associated species would be ***low***. Cropland Associated Species • Cropland areas serve as low quality habitat for wildlife and disturbance to cropland would have a ***low*** level of impact on cropland-associated species.	Rock Outcrop Associated Species • Very few rock outcrops are located near this alternative, indicating that there is a low likelihood for rock outcrop associated species to occur near the area. The proposed project would have a ***low*** level of impact to these species, due to their low likelihood of occurring within the area. Cliff Associated Species • Impacts to cliff associated species are expected to be ***low*** to ***moderate***, and include general disturbance related to construction noise. Riparian Associated Species • As riparian areas are limited in the project area and no riparian vegetation would be removed during construction, impacts to riparian associated species would be ***low***. Cropland Associated Species • Cropland areas serve as low quality habitat for wildlife and disturbance to cropland would have a ***low*** level of impact on cropland-associated species.		
Water Resources and Fish					
• Eight intermittent drainages would be crossed, two of which have names (Fields Gulch and Rabbit Hollow). Impacts to these drainages would be ***low***. • The Tucannon River would be the only perennial waterbody crossed; however, the nearest tower would be constructed about 970 feet east of the Tucannon River and all crossings would span this river. Therefore, there would be ***no*** direct impact to any perennial waterbody or wetland under this alternative. • There would be no impact to wellhead production areas or source water protection areas. • Potential impacts to fish resources would be ***none*** to ***low***, as the proposed project would have no impact to streamside forested vegetation or large woody debris input; culverts would not be installed in fish bearing streams; and potential increases in sedimentation would be low near fish populations.	• Fifteen intermittent drainages would be crossed, two of which have names (Rabbit Hollow and Walker Canyon). Impacts to these drainages would be ***low***. • Impacts to perennial waterbody and wetlands would be the same as those described for the North Alternative. • There would be no impact to wellhead production areas or source water protection areas. • Potential impacts to fish resources would be similar to those described for the North Alternative.)	• Ten intermittent drainages would be crossed, one of which has a name (Walker Canyon). Impacts to these drainages would be ***low***. • Impacts to perennial waterbody and wetlands would be the same as those described for the North Alternative. • There would be no impact to wellhead production areas or source water protection areas. • Potential impacts to fish resources would be similar to those described for the North Alternative.	• Thirteen intermittent drainages would be crossed, two of which have names (Fields Gulch and Rabbit Hollow). Impacts to these drainages would be ***low***. • Impacts to perennial waterbody and wetlands would be the same as those described for the North Alternative. • There would be no impact to wellhead production areas or source water protection areas. • Potential impacts to fish resources would be similar to those described for the North Alternative.	• Under the No Action Alternative the proposed project would not be built and there would be no impact on water resources or aquatic habitat and fish resources would occur.	• Design culverts and drainage controls placed in non-fish bearing streams to preserve natural drainage patterns. • Maintain unobstructed passage for water at all culverts placed in non-fish bearing streams and promptly remove any blockages to protect the roadbed and prevent sedimentation of downstream waterbodies. • Install and maintain water and sediment control measures at all waterbodies (including dry waterbodies) crossed by access roads or otherwise impacted by surface disturbance. • Regularly inspect and maintain the condition of access roads, culverts and sediment control measures to prevent long-term impacts during operation and maintenance. • Avoid storing, transferring, or mixing of oils, fuels, or other hazardous materials where accidental spills could enter surface or groundwater. Have spill response and clean-up materials onsite and clean-up all spills immediately. • Maintain, fuel, and repair heavy equipment and vehicles using spill prevention and control measures. Contaminated surfaces will be cleaned immediately following any spill incident. • Use secondary containment for on-site fueling tanks. • Limit fuel tank and truck storage to at least 100 feet from all streams, dry or flowing. Limit vehicle fueling to 25 feet from all streams, dry or flowing. • Limit herbicide application to hand spraying at least 100 feet from all fish-bearing stream channels and use only EPA-approved herbicides that are non-toxic to aquatic resources.

Table 2-4. Summary of Impacts of the Proposed Action Alternatives and the No Action Alternative (continued)

Potential Impacts					Mitigation Measures
North Alternative	**South Alternative**	**Combination A Alternative**	**Combination B Alternative**	**No Action Alternative**	
Visual Resources					
• Construction activities would cause temporary impacts on visual resources via tower and counterpoise installation, access road improvements and new access road construction, temporary pulling/tensioning sites, and installation of fiber optic wood poles. • Impacts from representative views of the General Regional Setting would be ***low***. • Impacts from representative views from the Lewis and Clark National Historic Trail and the lower Snake River corridor would be ***moderate*** and ***high*** (depending on viewpoint). • There would be ***no*** impacts from a representative view from the Lewis and Clark Trail Scenic Byway (U.S. Route 12). • Impacts from a representative view north of the town of Starbuck would be ***high***.	• Construction activities would cause temporary impacts on visual resources via tower and counterpoise installation, access road improvements and new access road construction, temporary pulling/tensioning sites, and installation of fiber optic wood poles. • Impacts from representative views of the General Regional Setting would be ***none*** to ***moderate*** (depending on viewpoint). • Impacts from representative views from the Lewis and Clark National Historic Trail and the lower Snake River corridor would be ***low*** and ***high*** (depending on viewpoint). • Impacts from a representative view from the Lewis and Clark Trail Scenic Byway (U.S. Route 12) would be ***high***. • Impacts from a representative view north of the town of Starbuck would be ***high***.	• Construction activities would cause temporary impacts on visual resources via tower and counterpoise installation, access road improvements and new access road construction, temporary pulling/tensioning sites, and installation of fiber optic wood poles. • Impacts from representative views of the General Regional Setting would be ***none*** to ***moderate***. • Impacts from representative views from the Lewis and Clark National Historic Trail and the lower Snake River corridor would be ***moderate*** and ***high*** (depending on viewpoint). • There would be ***no*** impacts from a representative view from the Lewis and Clark Trail Scenic Byway (U.S. Route 12). • Impacts from a representative view north of the town of Starbuck would be ***high***.	• Construction activities would cause temporary impacts on visual resources via tower and counterpoise installation, access road improvements and new access road construction, temporary pulling/tensioning sites, and installation of fiber optic wood poles. • Impacts from representative views of the General Regional Setting would be ***low***. • Impacts from representative views from the Lewis and Clark National Historic Trail and the lower Snake River corridor would be ***low, moderate,*** and ***high*** (depending on viewpoint). • Impacts from a representative view from the Lewis and Clark Trail Scenic Byway (U.S. Route 12) would be ***high***. • Impacts from a representative view north of the town of Starbuck would be ***high***.	• Under the No Action Alternative the proposed project would not be built and there would be no impact on visual resources.	• Preserve vegetation within the 150-foot-wide right-of-way that would not interfere with the conductor or maintenance access needs. Most of the vegetation along the proposed transmission line routes is low-growing sagebrush or agricultural crops, both of which are compatible with transmission line safety and operations. • Locate construction staging areas away from visually sensitive locations. The contractor hired to construct the transmission line would be responsible for determining appropriate staging locations, but potential staging locations include parking lots in Starbuck and Dayton, and possibly Pomeroy. • Use non-reflective conductors. • Use non-reflective insulators (i.e., non-ceramic or porcelain). • Locate new access roads within previously disturbed areas wherever possible. • Revegetate disturbed areas with approved species. • Require that contractors maintain a clean construction site and all related equipment, materials, and litter be removed following completion of construction.
Cultural Resources					
• The proposed project crosses the ancient lands of many Columbia River Basin tribes. However, impacts to unknown sites are not anticipated (***none*** to ***low***), due to the procedures that require construction to stop and appropriate protective measures to be determined if artifacts are found • ***No*** impacts to cultural resources are anticipated during operation and maintenance of the proposed project. • Possible impacts to TCPs will not be known until the Nez Perce Tribes and the Confederated Tribes of the Umatilla Indian Reservation complete their TCP studies for this project. Following preparation of the studies, appropriate protective measures would be implemented, if necessary	• Impacts would be similar to those described for the North Alternative.	• Impacts would be similar to those described for the North Alternative.	• Impacts would be similar to those described for the North Alternative.	• Under the No Action Alternative the proposed project would not be built and there would be no impact on cultural resources.	• Design the transmission line so that tower sites are placed to avoid cultural resources. • Design new access roads to avoid cultural resources and minimize the potential for trespassing access, where practicable. • Improve the existing road system in a manner that minimizes new roads and avoids cultural resource sites. If improvements are needed on existing roads that cross through cultural resources sites, such improvements would be constructed in a manner to avoid/minimize impacts, such as using fabric and rock or other mitigation agreed to during the consultation process. • Consult with the Washington DAHP, the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation regarding NRHP eligibility of cultural sites and TCPs. • Develop an Inadvertent Discovery Plan that details crew member responsibilities for reporting in the event a discovery during construction. • Ensure tribal monitors from the Nez Perce Tribe and/or the Confederated Tribes of the Umatilla Indian Reservation are present if work within prehistoric sites or TCPs cannot be avoided. • Prevent unauthorized collection of cultural materials by ensuring a professional archaeologist and tribal monitor are present during any excavation within known sites. • Prepare a Mitigation Plan to protect sites in situ if final placement of project elements results in unavoidable adverse impacts to a significant cultural resource. • Stop work immediately and notify local law enforcement officials, appropriate BPA personnel, Washington DAHP, the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, and WDNR, if on state lands, if cultural resources, either archaeological or historical materials, are discovered during construction activities.

Table 2-4. Summary of Impacts of the Proposed Action Alternatives and the No Action Alternative (continued)

Potential Impacts					
North Alternative	**South Alternative**	**Combination A Alternative**	**Combination B Alternative**	**No Action Alternative**	**Mitigation Measures**
Socioeconomics and Public Facilities					
• Construction would result in short-term increases in population and demand for temporary housing resources. These impacts would be ***short-term*** and ***low***. • Construction would result in potential benefits to local and regional economies through employment opportunities and purchases of goods and services. This impact, while positive, is expected to be ***short-term*** and ***low***. • Construction would result in an increased demand on local resources. This alternative would have ***no*** impact on law enforcement, medical facilities, and solid waste disposal. Impacts to fire protection, with mitigation in place, and education would be low. • There would be a ***low***, short-term negative impact to local property values.	• Impacts to socioeconomics and public facilities would be similar to those described for the North Alternative.	• Impacts to socioeconomics and public facilities would be similar to those described for the North Alternative.	• Impacts to socioeconomics and public facilities would be similar to those described for the North Alternative.	• The proposed project would not be built under the No Action Alternative and there would be no positive economic impacts due to construction-related expenditures or impacts to housing and other socioeconomic resources. In addition, under the No Action Alternative, BPA would be unable to provide the full amount of firm transmission service that has been requested. Congestion on the existing lines moving power east to west through the area would limit the ability to transfer additional power through the Columbia Gorge area and could make it more difficult for existing or new generation facilities (including wind facilities) to sell their power.	• Compensate landowners at market value for any new land rights required for corridor easements or acquired for new temporary or permanent access roads on private lands. • Initiate discussions with local fire districts prior to construction and work with the districts and other appropriate emergency response to develop a Fire and Emergency Response Plan that addresses potential wildland fires and other emergencies.
Transportation					
• Approximately 33 miles of new access roads would be constructed primarily on private land. • Construction-related traffic impacts with mitigation in place are expected to be ***low*** to ***moderate***. • With mitigation in place, impacts related to potential damage to existing roads would be ***low***. • The proposed project would generate up to an estimated 120 vehicle round trips per day (65 trucks and 55 passenger vehicles) during the peak construction period. • ***No*** new bridges would be required and impacts to existing bridges would be ***none*** to ***low***. • The transmission line would be located about 0.5 mile east and 1.5 miles south of the Lower Monumental and Little Goose airstrips, respectively. These airstrips are used only occasionally and pilots are used to avoiding existing transmission lines; therefore, impacts on air traffic using these airstrips would be ***low***.	• Approximately 35 miles of new access roads would be constructed, primarily on private land. • Construction-related traffic impacts, potential roadway damage, projected peak construction traffic, and impacts to bridges would be similar to those described for the North Alternative. • The transmission line would be located about 2.7 miles south of the Little Goose Airstrip. This airstrip is used only occasionally and pilots are used to avoiding existing transmission lines; therefore, impacts on air traffic using this airstrip would be ***low***.	• Approximately 33 miles of new access roads would be constructed, primarily on private land. • Construction-related traffic impacts, potential roadway damage, projected peak construction traffic, and impacts to bridges would be similar to those described for the North Alternative. • The transmission line would be located about 1.5 miles south of the Little Goose Airstrip. This airstrip is used only occasionally and pilots are used to avoiding existing transmission lines; therefore, impacts on air traffic using this airstrip would be ***low***.	• Approximately 35 miles of new access roads would be constructed, primarily on private land. • Construction-related traffic impacts, potential roadway damage, projected peak construction traffic, and impacts to bridges would be similar to those described for the North Alternative. • The transmission line would be located about 0.5 mile east of the Lower Monumental Airstrip. This airstrip is used only occasionally and pilots are used to avoiding existing transmission lines; therefore, impacts on air traffic using this airstrip would be ***low***.	• Under the No Action Alternative the proposed project would not be built and there would be no impact on transportation.	• Obtain a Haul Road Agreement and any additional permits or approvals from state and local agencies prior to construction. These documents will identify any special conditions to be addressed by BPA and their contractors during construction and operation of the project. • Prepare an erosion control plan which includes measures to stabilize construction entrances and exits to prevent sediments from being transported onto adjacent roadways. • Route traffic around affected intersections if construction vehicles cause temporary traffic blockages on local roadways. • Employ traffic control flaggers and post warning signs of construction activity and merging traffic when necessary. • Comply with applicable seasonal road restrictions for construction traffic, where practicable. • Restore public roadways to their pre-construction condition or better upon completion of project construction activities. • Design and construct new access roads to minimize runoff and soil erosion. • Reclaim any road-related disturbance areas after construction is completed. • Reimburse agricultural landowners for any crop damage that occurs during routine maintenance or emergency situations. • Install gates at the entrances to access roads when required or requested by landowners to reduce unauthorized use. Coordinate gate locks with landowners to ensure that both BPA and the landowner have access. • Work with WDNR concerning a possible cooperative agreement for the control of unauthorized public access and use on state lands that could result from the proposed project. The agreement could address various provisions related to unauthorized access, such as additional measures to be taken to discourage unauthorized use of the project corridor and associated access roads, periodic inspection for unauthorized access and any resulting damage, and repair of any damage from unauthorized access. • Install marker balls on the conductor and lights on towers at the Tucannon River crossing if required by the FAA.

Table 2-4. Summary of Impacts of the Proposed Action Alternatives and the No Action Alternative (continued)

Potential Impacts					
North Alternative	**South Alternative**	**Combination A Alternative**	**Combination B Alternative**	**No Action Alternative**	**Mitigation Measures**
Noise, Public Health, and Safety					
• Construction of access roads, tower site preparation, erection of steel towers, helicopter assistance during tower erection, stringing of conductors, potential blasting, and the potential use of implosive couplers for conductor splicing would create localized noise impacts. • On occasions, a helicopter may be used to assist with construction. This would create noise levels above 65 dBA for a distance of 1 mile, potentially resulting in a ***moderate*** to ***high*** short-term impact to residents in Starbuck. • Blasting may be required in some locations, which would create noises that would be audible for up to 0.5 mile. Implosive fittings would also be used to hook conductors together. This disturbance would be localized to the immediate area. • During construction, there would be a risk of fire and injury associated with the use of heavy equipment, cranes, helicopters, potential bedrock blasting, and other risks associated with working near high-voltage lines. With mitigation in place, these risks would be ***low***. • Impacts from electric and magnetic fields (EMF) would be ***none*** to ***low***. • With mitigation measures in place, impacts associated with the use of hazardous materials, such as fuels, would be ***none*** to ***low***.	• One residence is located within 1,000 feet of this alternative. If construction noise levels exceeded 50 dBA,short-term impacts to this residence would be ***moderate*** to ***high***. • All other impacts would be similar to those described for the North Alternative.	• One residence is located within 1,000 feet of this alternative. If construction noise levels exceeded 50 dBA,short-term impacts to this residence would be ***moderate*** to ***high***. • Impacts would be similar to those described for the North Alternative.	• Impacts would be similar to those described for the North Alternative.	• Under the No Action Alternative the proposed project would not be built and there would be no impact to noise and public health and safety.	• Install sound-control devices on all construction equipment. • Muffled exhaust will be installed on all construction equipment and vehicles except helicopters. • Notify landowners directly impacted along the corridor prior to construction activities, including blasting. • Hold crew safety meetings during construction at the start of each workday to go over potential safety issues and concerns. • Secure the site at the end of each workday to protect equipment and the general public. • Train employees as necessary, in structure climbing, cardiopulmonary resuscitation, first aid, rescue techniques, and safety equipment inspection. • Fuel all highway-authorized vehicles off-site to minimize the risk of fire. Fueling of construction equipment that is transported to the site via truck and is not highway authorized will be done in accordance with regulated construction practices and state and local laws. Helicopters will be fueled and housed at local airfields or at staging areas. • Adhere to BPA's specifications for grounding fences and other objects on and near the existing and proposed rights-of-way during construction. • Construct and operate the new transmission line in accordance with the National Electrical Safety Code, as required by law. • Restore reception quality if radio or television interference occurs as a result of the transmission line. Reception needs to be as good or better than it was before the interference. • Carry fire suppression equipment including (but not limited to) shovels, buckets, and fire extinguishers on all operation and maintenance vehicles. • Use established access roads during routine operation and maintenance activities. • Clear vegetation according to BPA standards to avoid contact with transmission lines. • Contact the appropriate BPA representative if hazardous materials, toxic substances, or petroleum products are discovered within the project area that would pose an immediate threat to human health or the environment. Other conditions such as large dump sites, drums of unknown substances, suspicious odors, stained soil, etc. must also be reported immediately to BPA. • Limit construction activities to daytime hours (i.e., only between 7:00 a.m. and 7:00 p.m.) • Prepare and maintain a safety plan in compliance with Washington requirements. This plan would be kept on-site and would detail how to manage hazardous materials such as fuel, and how to respond to emergency situations. • Ensure that helicopter pilots and contractors take into account public safety during flights. For example, flight paths could be established for transport of project components to avoid flying over populated areas or near schools (Helicopter Association 1993). • Take appropriate safety measures for blasting consistent with state and local codes and regulations. Lock up or remove all explosives from the work site at the end of the workday. • Install implosive fittings used to connect the conductors in a way that minimizes potential health and safety risks. • Stay on established access roads during routine operation and maintenance activities. • Submit final tower locations and conductor heights to the Federal Aviation Administration for review. Install lights or marker balls as required.

Table 2-4. Summary of Impacts of the Proposed Action Alternatives and the No Action Alternative (continued)

Potential Impacts					Mitigation Measures
North Alternative	**South Alternative**	**Combination A Alternative**	**Combination B Alternative**	**No Action Alternative**	
Air Quality					
• Construction activities that could create dust include road building and grading, on-site travel on unpaved surfaces, work area clearing and preparation, and soil disrupting operations. These impacts would be ***short-term*** and ***low*** with mitigation in place. • Operation of the transmission line would result in the production of small, insignificant amounts of ozone and nitrogen oxides, created through the breakdown of air via the line's high electric field. These impacts would be ***low*** to ***none***.	• Impacts to air quality would be similar to those described for the North Alternative.	• Impacts to air quality would be similar to those described for the North Alternative.	• Impacts to air quality would be similar to those described for the North Alternative.	• Under the No Action Alternative the proposed project would not be built and there would be no impact to air quality.	• Use water trucks to control dust during construction operations. • Cover construction materials if they are a source of blowing dust. • Limit the amount of exposed soil, including dirt piles and open pits, to a minimum. • Prevent wind erosion by reseeding disturbed areas with grass or an appropriate seed mixture as soon as reasonably possible following construction activities. • Avoid burning during construction activities. • Ensure construction vehicles travel at low speeds on gravel roads and at the construction sites to minimize dust. • Comply with Washington State tailpipe emission standards for all on-road vehicles. • Ensure all vehicle engines are in good operating condition to minimize exhaust emissions. • Use low sulfur fuel for on-road diesel vehicles.
Greenhouse Gases					
• Construction activities could release greenhouse gases that are currently sequestered within vegetation and soils. • Emissions from vehicle traffic on and off the project corridor could impact atmospheric greenhouse gas concentrations incrementally as gas and diesel motors are primarily used in construction equipment. • Construction would result in an estimated 3,066 metric tons of CO_2 emissions, and an estimated 3,069 metric tons of CO_2 equivalent emissions, per year. This translates roughly to the annual CO_2 emissions of 532 passenger vehicles. This impact would be ***low***. • Operation and maintenance would involve the use of a helicopter twice yearly and approximately four vehicle trips a year. This impact would be ***low***.	• Impacts to current levels of greenhouse gasses would be similar to those described for the North Alternative.	• Impacts to current levels of greenhouse gasses would be similar to those described for the North Alternative.	• Impacts to current levels of greenhouse gasses would be similar to those described for the North Alternative.	• Under the No Action Alternative the proposed project would not be built and there would be no impact to greenhouse gas concentrations.	• During construction, trucks and heavy equipment will limit engine idling time and equipment will be shut down when not in use except when activities occur in cold weather. Provide clear signage that posts this requirement for workers at all entrances to the work sites. • During construction, all vehicles will comply with applicable federal and state air quality regulations for tailpipe emissions. Certification that vehicles meet applicable regulations will be provided to BPA in writing. • Encourage carpooling and the use of shuttle vans among construction workers to minimize construction-related traffic and associated emissions. • Locate all staging areas as close to construction areas as practicable to minimize driving distances between staging areas and construction sites. • Locate staging areas in previously graded or graveled areas to minimize soil and vegetation disturbance where practicable. • Maintain and certify in writing that all construction equipment is in proper working condition according to manufacturer's specifications. • Train equipment operators in the proper use of equipment. • Use the proper size of equipment for the job. • Use alternative fuels for generators at construction sites such as propane or solar, or use electrical power where practicable. • Reduce electricity use in the construction office by using compact fluorescent bulbs, and powering off computers every night. • Submit a plan for approval to recycle or salvage non-hazardous construction and demolition debris where practicable. • Submit a plan for approval to dispose of wood poles locally where practicable. • Use locally sourced rock for road construction.

Chapter 3
Affected Environment, Environmental Consequences, and Mitigation Measures

This chapter describes the existing environment of the project area for each resource and evaluates the environmental consequences of the proposed action alternatives, and the No Action Alternative, on these resources. Mitigation measures to reduce or avoid the impacts of the action alternatives on each resource also are identified. The chapter concludes with discussions of potential cumulative impacts, short-term use and long-term productivity, irreversible and irretrievable commitments of resources, adverse effects that cannot be avoided, and the potential effect of intentional destructive acts to Bonneville Power Administration (BPA) facilities.

3.1 Geology and Soils

3.1.1 Affected Environment

Geology

The project area for the proposed transmission line is located within the eastern margin of the Columbia River plateau. The geology of the Columbia River plateau is dominated by the Columbia River Basalt group, a series of flood basalt flows that were formed between 17.5 and 6 million years ago when massive lava flows poured out onto what are now parts of Washington, Oregon, and Idaho (Washington Department of Natural Resources [WDNR] 2009a, U.S. Geological Survey [USGS] 2009a). Younger geologic units cover the basalt flows; these younger units consist of flood deposits of gravel, sand, and silt, as well as loess and alluvium.

Topography in the project area consists of gently rolling to moderately hilly plateaus incised by rivers and streams. Elevations in the project area generally range from 500 to 1,800 feet above sea level.

No mapped landslides have been identified within the project area. There are no landslides identified within the project area on the Washington State 1:1,000,000 Geologic Map (Washington Division of Geology and Earth Resources [WDGER] 2008a) or the state's landslide GIS data (WDGER 2008b), and the USGS rates the area as having low landslide incidence (Godt 2001).

WDGER, a division of the Washington Department of Natural Resources (DNR), maintains information about existing geology, geologic hazards, and mineral resources in the state of Washington. The state of Washington's State Geologist is housed within this division. WDNR has indicated that there are numerous bedrock hollows and inner gorges in the project vicinity, which may be susceptible to mass wasting (based on slope, saturation, vegetation, and presence of colluvium) (WDNR 2010). A bedrock hollow is typically a concave (spoon-shaped) areas on a hillslope that can store and release accumulated sediment from its headwalls. Release of this stored material may occur as debris slides that begin within the bedrock. Inner gorges are canyon walls created by a combination of stream downcutting/undercutting action and mass movement on the slope walls (such as rock fall).

The USGS Quaternary Fault and Fold Database (part of the Earthquake Hazards Program) was reviewed to indentify potentially hazardous faults near the project area. No hazardous faults were identified. The nearest fault identified in the database is the Central Ferry fault, which is located about 1 mile east of the easternmost extent of the project area (see Figure 3-1). This and other fault zones in the area are considered to have a low to moderate probability of surface rupture.

Liquefaction occurs when soils lose shear strength and deform during an earthquake, acting like quicksand. Liquefaction typically occurs in areas of loose sandy soils that are saturated with water, such as low-lying coastal areas, lakeshores, and river valleys (Palmer et al. 2004). Liquefaction susceptibility maps have been prepared for each county in the state of Washington, including Columbia, Garfield, and Walla Walla counties (WDGER 2008a). These maps provide an estimate of the likelihood that soil will liquefy as a result of earthquake shaking based on the physical characteristics of the soil, (e.g., grain texture, compaction, and depth of groundwater). Liquefaction susceptibility maps depict the relative hazard in terms of high, moderate, low, or very low liquefaction susceptibility (Palmer et al. 2004). Liquefaction susceptibility in the project area is shown in Figure 3-2. The soil survey maps for Columbia, Garfield, and Walla Walla counties show that the project area is generally well-drained loess deposits over bedrock. The risk of liquefaction thus is very low to low throughout most of the project area, with the exception of alluvium in some drainages and outburst flood deposits where small areas of low-to-moderate and moderate-to-high susceptibility occur (Figure 3-2).

WDNR has provided information concerning folds in the project area, which could be recent or active faults, such as a blind thrust fault, and areas vulnerable to liquefaction that may exist in the project vicinity (see Table 3-1a). This table, provided by WDNR, identifies potential areas of concern by township and range. These same data are displayed spatially in Figures 3-1 and 3-2.

Table 3-1a. WDNR-identified Potential Faults and Liquefaction Hazards in the Project Vicinity

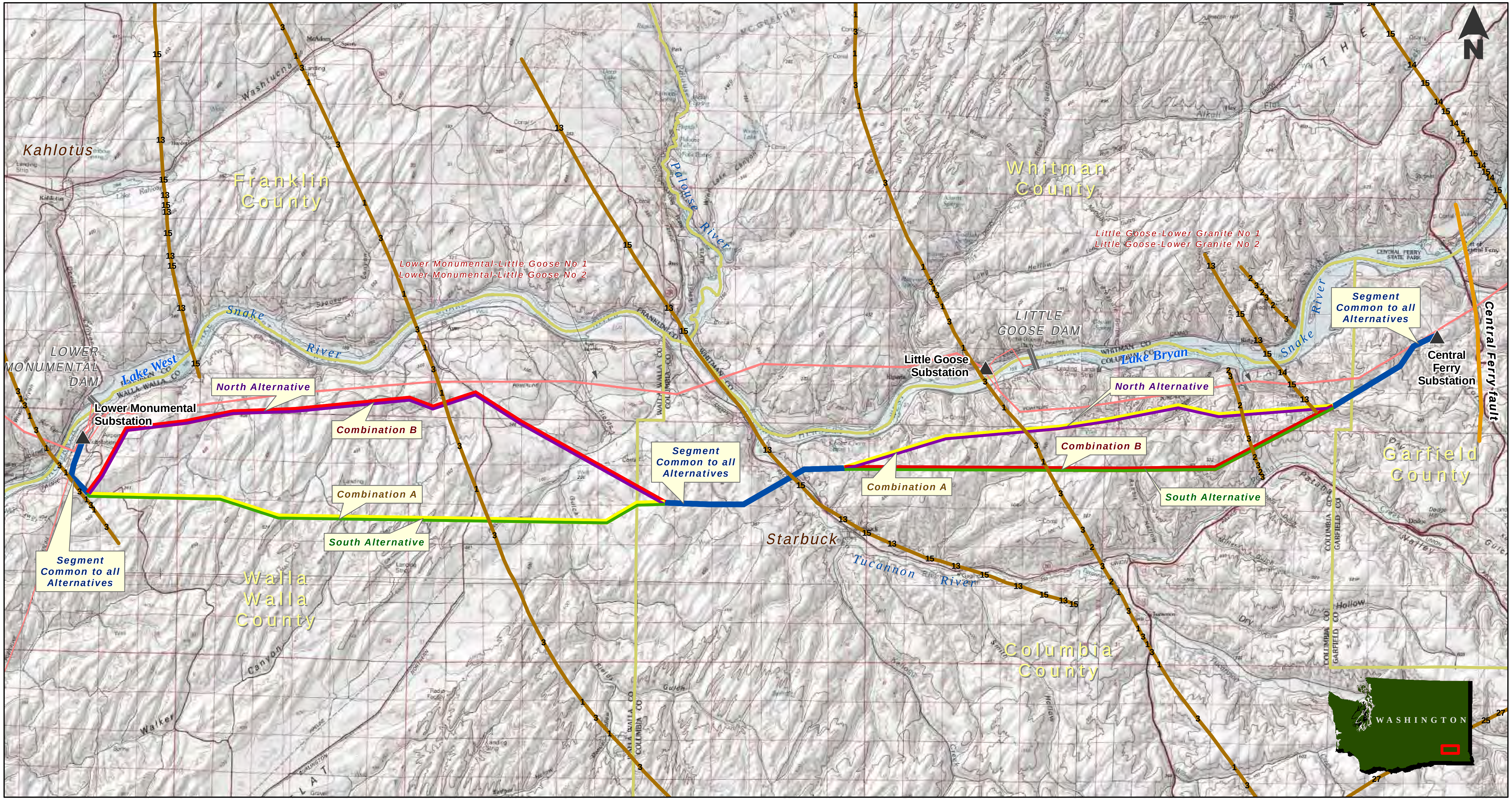
Folds[1/]	
Location[2/]	**Type**
T13R36E S31	Fold
T12R36E S16	Fold
T12R37E S11	Fold
T12R38E S2	Fold
T12R38E S11	Fold
T13R39E S34	Fold
T13R39E S35	Fold
T12R39E S3	Fold
Liquefaction Hazards	
Location[2/]	**Susceptibility**
T12R34E S11	Moderate to High
T13R35E S36	Moderate to High
T13R36E S32,33	Low to Moderate
T12R36E S2,3,4	Low to Moderate
T12R36E S2	Moderate to High
T12R36E S14	Moderate to High
T12R37E S10,11	Moderate to High
T13R40E S29	Moderate to High

Notes:

1/ WDNR has indicated that folds in the project area, which could be recent or active faults, such as a blind thrust fault

2/ Location identified in Township and Range, as provided by WDNR 2010. These same data are displayed spatially in Figures 3-1 and 3-2.

Source: WDNR 2010.



Data Source:
Bonneville Power Administration Regional GIS Database, ESRI,
Geology of Washington State at 1:100,000 Scale -WADNR

Proposed Route Alternatives
(Route sections shown adjacent to one another share the same proposed alignment)

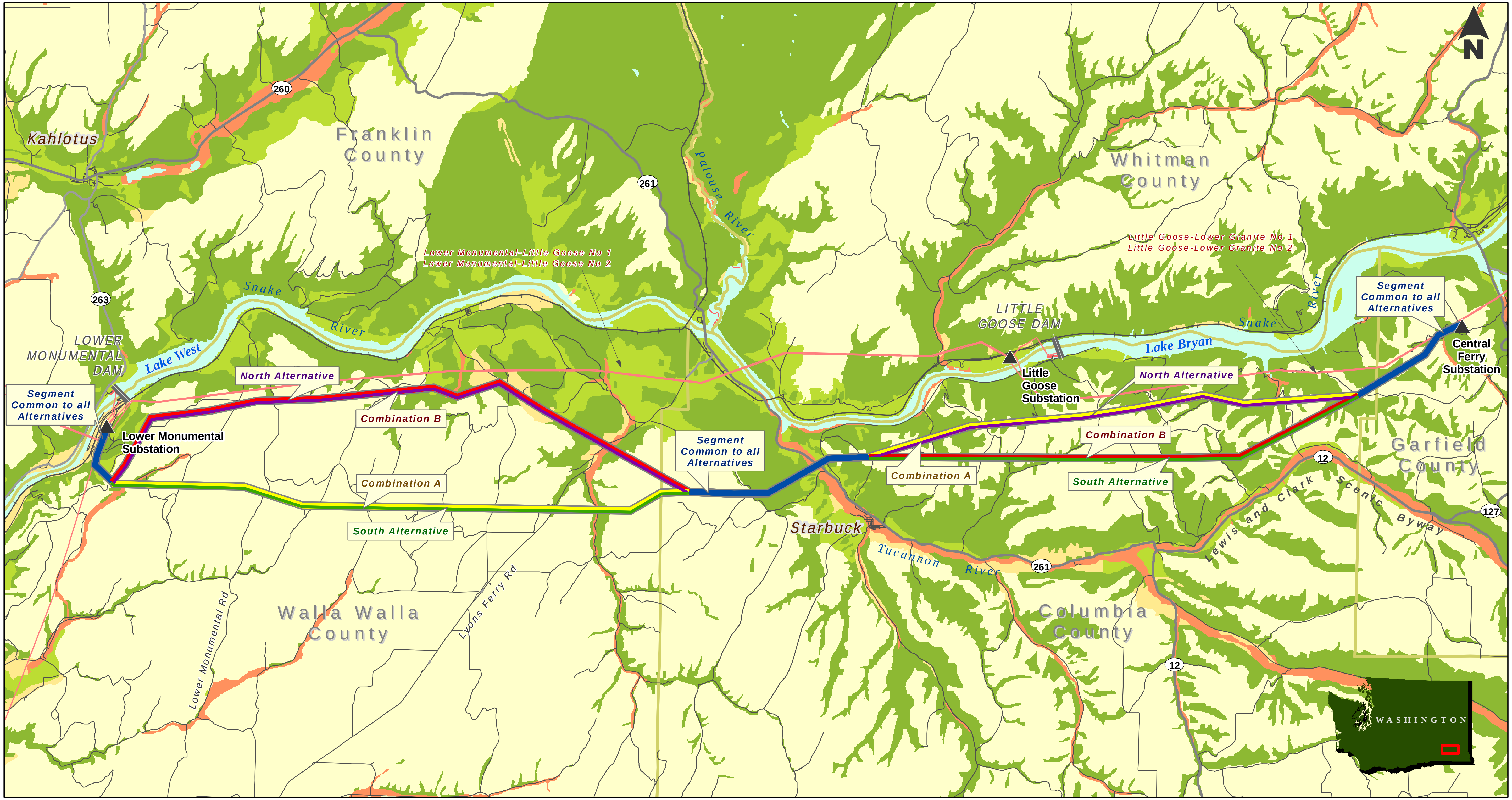
- Segments Common to all Alternatives
- North Alternative
- South Alternative
- Combination A Alternative
- Combination B Alternative

- Substation
- Federal Dam
- Existing BPA Transmission Lines
- County Boundary
- Folds
- Faults Quaternary

Fold Type
1 - Anticline
2 - Anticline, approximately located
3 - Anticline, concealed
13 - Syncline
14 - Syncline, approximately located
15 - Syncline, concealed

Bonneville Power Administration
Central Ferry-Lower Monumental 500-kV Transmission Line Project
Figure 3-1
Mapped Folds and Faults

File Path: \\bud.bpa.gov\wg\gis\gis_data2\work\ryan\PROJECTS_2\09\RDB090006\EIS\FoldsFaults_11x17.mxd, Date: March 19, 2010 9:07:51 AM



BONNEVILLE POWER ADMINISTRATION

Data Source:
Bonneville Power Administration Regional GIS Database, ESRI, Geology of Washington State at 1:100,000 Scale -WADNR

0 2.5 5 10 Miles

Proposed Route Alternatives
(Route sections shown adjacent to one another share the same proposed alignment)

- Segments Common to all Alternatives
- North Alternative
- South Alternative
- Combination A Alternative
- Combination B Alternative

- Substation
- Federal Dam
- Existing BPA Transmission Lines
- County Boundary
- Major Highway
- Roads
- Railroad

Liquefaction Risk

- High
- Moderate to High
- Moderate
- Low to Moderate
- Low
- Very Low to Low
- Very Low
- Bedrock
- Peat
- Ice
- Water

Bonneville Power Administration
Central Ferry-Lower Monumental 500-kV
Transmission Line Project
Figure 3-2
Liquefaction Risk

File Path: \\bud.bpa.gov\wg\gis\gis_data2\work\ryan\PROJECTS_2\09\RDB090006\EIS\Liquefaction_11x17.mxd, Date: March 19, 2010 9:07:51 AM

Soils

Soils in the project area are generally well drained and include silty to sandy loams overlying basalt bedrock with isolated basalt rock outcrops. Most of these soils formed in loess deposits, sometimes overlying glacial outwash deposits. Soils in the area are generally used for rangeland, cropland, recreation, and wildlife habitat.

The Natural Resources Conservation Service (NRCS) considers slope and soil properties such as cohesion, drainage, and organic content in determining soil erosion hazard classes of soils. Generally, coarse-grained soils on level to low-slope ground that are well drained have low erosion hazard potential. Conversely, fine-grained soils on steep slopes that are poorly drained have the greatest erosion hazard potential. Erosion hazard potential is described in this analysis as slight, moderate, or severe. A rating of slight indicates that little or no erosion is likely; moderate indicates that some erosion is likely, that roads or trails may require occasional maintenance, and that simple erosion-control measures are needed; and severe indicates that significant erosion could be expected, that the roads or trails require frequent maintenance, and that erosion-control measures or mitigation are needed for unsurfaced roads and trails (NRCS 2009a, 2009b, 2009c). Slopes in the project area are generally classified as low (less than 15 percent) to moderate (15 to 40 percent). Most soils in the project area have a severe soil erosion potential which means they are susceptible to erosion. This is also the case for soils in the project corridor (Table 3-1b).

Table 3-1b. Soil Erosion Hazard Classes in the Project Corridor (acres)

Soil Classification	Action Alternative[1/]			
	North	South	Combination A	Combination B
Slight	7	4	4	7
Moderate	94	42	58	77
Severe	732	743	726	749
Not Rated	0	0	0	0
Total	**833**	**789**	**788**	**833**

Notes:

1/ The project corridor, as defined here, includes a 150-foot-wide right-of-way that extends 75 feet either side of the proposed centerline of the action alternatives, and areas affected by new access road construction based on an average disturbance width of 40 feet. These acres represent the entire right-of-way and new road footprint for each action alternative, not estimates of soils that would be disturbed under each alternative as a result of this project.

Source: NRCS 2009a, 2009b, 2009c

The NRCS also provides compaction susceptibility ratings for soils in the project area. Review of these ratings indicates that soils in the project area have low to moderate resistance to soil compaction (in other words, they are susceptible to compaction). Soils with a moderate resistance to compaction have features that are favorable to resisting compaction. A low resistance to compaction rating indicates that one or more soil characteristics exist that favor the formation of a compacted layer.

Areas with low resistance to compaction occur along the project corridor for all of the action alternatives, including the alignment common to all alternatives that extends west from the Tucannon River crossing (Figure 3-1). Further west, a larger area identified as having low resistance to soil compaction extends south from the lower Snake River. This area of low resistance is wider closer to the river where it is crossed by the North and Combination B alternatives; this is reflected in the project corridor comparison in Table 3-2.

Table 3-2. Soil Compaction Resistance Classes in the Project Corridor (acres)

Soil Classification	Action Alternative[1/]			
	North	South	Combination A	Combination B
Low	337	206	204	339
Moderate	472	538	565	446
Not Rated[2/]	24	45	19	49
Total	**833**	**789**	**788**	**834**

Notes:
1/ See footnote 1 to Table 3-1.
2/ Some units have not been rated by the NRCS; this is often because the rating is not applicable, such as for bedrock or water.
Source: NRCS 2009a, 2009b, 2009c

3.1.2 Environmental Consequences of Action Alternatives

Impacts Common to All Action Alternatives

Geology

Permanent impacts from construction would include some alterations to local topography, but no sensitive or hazardous geologic resources were identified in the project corridor. There are no mapped landslide risks, no active mines or mineral leases, and seismic hazards are low due to low incidence of earthquakes in the area. Overall, earthquakes can be expected occasionally in the general area and may be felt along the proposed corridors, but there has been low occurrence of large, damaging earthquakes. Additionally, BPA would design the transmission line towers using wind and ice loading criteria that would exceed earthquake induced loads.

No hazardous faults have been identified in the project area. WDNR has indicated that geologic folds in the project area could potentially be faults (Table 3-1a, Figure 3-1). Unless a mapped fault is present or an unmapped surface rupture is visible, efforts to locate towers to avoid all potential surface faults are not considered practicable. Evidence of surface ruptures would be evaluated at the proposed tower locations prior to construction. Tower locations found to be near an identified surface rupture would be relocated away from the fault zone.

WDNR has indicated that bedrock hollows and inner gorges may be present in the vicinity of the project and could pose a mass wasting risk (WDNR 2010). These features are not suitable for construction of the proposed facilities and would be identified during the detailed geologic hazard assessment. The final alignment would be adjusted to avoid such hazards, if identified.

Much of the area is underlain by bedrock or has soil with low susceptibility to liquefaction. In the few areas (about 1 acre for each alternative) where soils are moderately to highly susceptible to liquefaction, the low risk of seismic activity reduces the likelihood of soil liquefaction. Generally, transmission towers are likely to survive settlement associated with liquefaction with only minor structural damage. Liquefaction hazard areas would be identified prior to construction based on anticipated soil and groundwater conditions. Several liquefaction mitigation options are available, including avoiding areas susceptible to liquefaction, soil densification, and deep foundations. Mitigation would be considered on a site by site basis.

While the development of roads has the potential to cause mass wasting (e.g., erosion or landslides), road grades would be varied depending on the erosion potential of the soil and roads would be rocked where needed for dust abatement, stability, load bearing, and seasons of use.

Final design measures would take slopes, soil types, bedrock, the presence of bedrock hollows or inner gorges, and other factors into account based on site specific information.

Soils

Construction of the proposed project would affect soils regardless of the action alternative. Ground disturbance from tower and counterpoise installation, access road improvements and new access road construction, installation of temporary pulling/tensioning sites, and installation of fiber optic wood poles would cause temporary disturbance to soil. Impacts from this disturbance would be greatest during and immediately after construction until revegetation, drainage, and erosion controls are established.

Grading, trenching, and construction traffic and equipment may result in temporary soil erosion because project area soils are susceptible to erosion (see Table 3-3). Clearing of vegetation and soil disturbance would expose soils to erosion by water and wind. Construction-related soil erosion is typically caused by falling and flowing water, including the direct impact of falling rain drops, sheet erosion caused by unconfined runoff, and rill and gully erosion by concentrated runoff (Washington State Department of Ecology [Ecology] 2004). The erosion hazard classes of the soils that would be affected by construction are displayed by project component in Table 3-3; most of the disturbance would occur on soils with severe soil erosion potential.

Table 3-3. Erosion Hazard Classes Potentially Affected by Construction of the Action Alternatives (acres)

Action Alternative/ Project Component	Slight	Moderate	Severe	Total
North Alternative				
Tower Installation	0.0	12.6	79.3	91.9
Counterpoise Installation	0.1	13.1	90.7	103.9
Access Roads	0.7	18.0	124.2	142.9
Pulling/Tensioning Sites	0.0	3.5	12.4	15.8
Total	**0.9**	**47.1**	**306.6**	**354.6**
South Alternative				
Tower Installation	0.0	7.0	78.3	85.2
Counterpoise Installation	0.0	7.5	89.4	97.0
Access Roads	0.4	6.7	138.6	145.7
Pulling/Tensioning Sites	0.1	1.8	13.3	15.2
Total	**0.4**	**23.0**	**319.5**	**343.0**
Combination A Alternative				
Tower Installation	0.0	9.6	76.1	85.7
Counterpoise Installation	0.0	9.8	87.1	97.0
Access Roads	0.4	9.5	128.8	138.6
Pulling/Tensioning Sites	0.1	2.3	12.8	15.2
Total	**0.4**	**31.2**	**304.9**	**336.5**
Combination B Alternative				
Tower Installation	0.0	10.0	81.5	91.4
Counterpoise Installation	0.1	10.8	93.0	103.9
Access Roads	0.7	15.2	134.0	149.9
Pulling/Tensioning Sites	0.0	3.0	12.9	15.8
Total	**0.9**	**39.0**	**321.6**	**361.1**

Source: NRCS 2009a, 2009b, 2009c

Limiting site disturbance is the single most effective method for reducing erosion (Ecology 2004). Preserving vegetative cover to the maximum extent feasible helps shield the soil from the elements, slowing runoff velocity and increasing infiltration time, and holding soils in place. Vegetation removal would be limited to the extent possible during construction. Temporary erosion control measures would be maintained until vegetation reestablished and/or permanent erosion control measures were in place. Mitigation measures proposed for construction would reduce soil disturbance and erosion (see Section 3.1.3 Mitigation Measures). Temporary soil impacts would be ***low*** with the implementation of these erosion limiting mitigation measures, which would include implementing a Stormwater Pollution Prevention Plan (SWPPP), designing roads to control runoff and prevent erosion, constructing during the dry season, and other measures to prevent or limit soil impacts (see Section 3.1.3).

Realignment of three existing transmission lines entering Lower Monumental Substation and placement of one or two temporary staging areas would also temporarily impact soils in the project area. Soil disturbance associated with the line realignment and the staging areas would occur in areas that are already developed or disturbed. In addition, the mitigation measures identified in Section 3.1.3 would be implemented in these areas, and, as a result, the impact on soils from these activities would be ***low.***

Soil compaction occurs when soil particles are pressed together by equipment operation or vehicle traffic. When soils are compacted, the pore spaces between soil particles are reduced, thus restricting infiltration and deep rooting, and reducing the amount of water available for plant growth. When infiltration is reduced, runoff may occur and lead to erosion, nutrient loss, and potential water quality problems (NRCS 1996, 2004). Soil water content influences compaction such that the risk is greatest when soils are moist or wet; dry soils are much more resistant to compaction than moist or wet soils (NRCS 1996, 2004). Other factors affecting compaction include the pressure exerted upon the soils (from heavy equipment or vehicles), soil characteristics (organic matter content, clay content and type, and texture), and the number of passes by equipment or vehicle traffic (NRCS 1996).

Soil compaction would occur if heavy equipment or repeated vehicle traffic press soil particles together, especially if the soils are moist or wet. Soils in the project area generally have low to moderate resistance to soil compaction (Table 3-4). This means that the traffic and equipment operating directly on soils would likely cause soil compaction. Compaction would be expected where equipment operates off access roads, such as during tower construction, counterpoise and fiber optic pole installation, and at pulling/tensioning sites. To limit soil compaction, heavy equipment and vehicles would only be operated on access roads and within approved construction footprints, and off-road construction would be limited during wet conditions. Implementation of mitigation as described in Section 3.1.3 Mitigation Measures would reduce compaction and long-term impacts to soils would be ***low***.

Permanent impacts to soils would occur from placement of towers, access roads, and fiber optic wood poles. Acreages of soils permanently disturbed are discussed below for each action alternative. While the construction of roads has the potential to cause mass wasting along hillsides, road grades would be varied depending on the erosion potential of the soil, and roads would be rocked where needed for dust abatement, stability, load bearing, and seasons of use. Road design would take slopes, soil types, bedrock, and other factors into account based on site specific information. Permanent impacts to soils would be ***low***.

Operation and maintenance activities could increase erosion potential in the affected areas. Maintenance would involve various sized vehicles and equipment traveling on access roads. However, anticipated erosion rates are expected to remain at or near current levels, once revegetation has occurred. Operational mitigation measures, including facility maintenance and monitoring, would limit long term soil erosion. Thus, long-term impacts would be ***low***.

Table 3-4. Compaction Resistance Classes Potentially Affected by Construction of the Action Alternatives (acres)

Action Alternative/ Project Component	Low[1/]	Moderate[2/]	Not Rated[3/]	Total
North Alternative				
Tower Installation	41.9	48.6	1.4	91.9
Counterpoise Installation	45.4	57.0	1.5	103.9
Access Roads	59.8	82.1	1.0	142.9
Pulling/Tensioning Sites	6.0	8.6	1.2	15.8
Total	**153.1**	**196.3**	**5.2**	**354.6**
South Alternative				
Tower Installation	28.4	55.7	1.1	85.2
Counterpoise Installation	32.7	63.0	1.3	97.0
Access Roads	48.2	95.2	2.3	145.7
Pulling/Tensioning Sites	4.7	9.8	0.7	15.2
Total	**114.1**	**223.9**	**5.3**	**343.0**
Combination A Alternative				
Tower Installation	27.7	56.6	1.5	85.7
Counterpoise Installation	31.1	64.6	1.3	97.0
Access Roads	43.0	94.3	1.3	138.7
Pulling/Tensioning Sites	3.9	10.0	1.3	15.2
Total	**105.7**	**225.6**	**5.3**	**336.5**
Combination B Alternative				
Tower Installation	42.6	47.7	1.1	91.4
Counterpoise Installation	47.0	55.3	1.6	103.9
Access Roads	65.0	83.0	2.0	149.9
Pulling/Tensioning Sites	6.9	8.4	0.6	15.8
Total	**161.5**	**194.4**	**5.2**	**361.1**

Notes:

1/ A low resistance to compaction rating indicates that one or more soil characteristics exist that favor the formation of a compacted layer.

2/ Soils with a moderate resistance to compaction have features that are favorable to resisting compaction.

3/ Some units have not been rated by the NRCS; this is often because the rating is not applicable, such as for bedrock or water.

Source: NRCS 2009a, 2009b, 2009c

The following sections describe potential impacts on soils specific to each of the action alternatives. As discussed above, with implementation of mitigation measures, both temporary and permanent impacts to soils would be ***low*** for all of the following action alternatives.

North Alternative

Construction of the North Alternative would result in about 355 acres of temporary ground disturbance (Table 3-3). Approximately 307 acres (86 percent of the affected acres) of the soils that would be affected by construction of the North Alternative are rated as having a severe erosion hazard (Table 3-3). About 153 acres (43 percent of the affected acres) of soils with a low resistance to compaction would be affected by the North Alternative (Table 3-4).

South Alternative

Construction of the North Alternative would result in about 343 acres of temporary ground disturbance (Table 3-3). Approximately 320 acres (93 percent of the affected acres) of the soils that would be affected by construction of the South Alternative are rated as having a severe erosion hazard (Table 3-3). About 114 acres (33 percent of the affected acres) of soils with a low resistance to compaction would be affected by the South Alternative (Table 3-4).

Combination A Alternative

Construction of the Combination A Alternative would result in about 337 acres of ground disturbance (Table 3-3), which is the least of any action alternative. Approximately 305 acres (91 percent of the affected acres) of the soils that would be affected by construction of the Combination A Alternative are rated as having a severe erosion hazard (Table 3-3). About 106 acres (31 percent of the affected acres) of soils with a low resistance to compaction would be affected by the Combination A Alternative (Table 3-4).

Combination B Alternative

Construction of the Combination B Alternative would result in about 361 acres of ground disturbance (Table 3-3), which is the most of any action alternative. Approximately 322 acres (89 percent of the affected acres) of the soils that would be affected by construction of the Combination B Alternative are rated as having a severe erosion hazard (Table 3-3). About 162 acres (45 percent of the affected acres) of soils with a low resistance to compaction would be affected by the Combination B Alternative (Table 3-4).

3.1.3 Mitigation Measures

Potential impacts to soils would be reduced by the installation of runoff and erosion controls and would be further minimized following revegetation. The following mitigation measures and best management practices (BMPs) would minimize or avoid impacts:

- Prior to construction, conduct a detailed geologic hazard assessment for the selected action alternative. This assessment will include a review of geologic maps and aerial photomaps combined with surface condition assessments at each proposed tower location and surrounding terrain. In addition, subsurface information will be obtained from water well logs, material exposed in existing road and stream-cut slopes, and construction/design information from the existing transmission lines in the project area. Particular attention will be given to on-site evaluation of the slope stability of each proposed tower location. Tower or road locations found to be within previously unidentified active slides, bedrock hollows, or other geologic hazard areas will be relocated outside the limits of these areas.
- Prepare and implement a SWPPP to lessen soil erosion and improve water quality of stormwater run-off. SWPPPs are developed to prevent movement of sediment off-site to adjacent water bodies during short term or temporary soil disturbance at construction sites. The SWPPP for this project will address stabilization practices, structural practices and stormwater management.
- Design access roads to control runoff and prevent erosion by using low grades, outsloping, intercepting dips, water bars, or ditch-outs, or a combination of these methods.
- Minimize construction equipment use within 150 feet of a water body (stream or river).
- Surface all permanent access roads with rock to help prevent erosion and rutting of road surfaces and to support vehicle traffic.
- Minimize construction on steep, unstable slopes, if possible.
- Save topsoil removed for structure and new access road construction for onsite restoration activities to promote regrowth from the native seed bank in the topsoil. If contaminated, follow-up weed control would be needed.
- Cover exposed piles of soil with plastic or similar material to reduce erosion potential from rain or wind.

- Cut or crush vegetation, rather than blade, in areas that will remain vegetated in order to maximize the ability of plant roots to keep soil intact and prevent sediment movement offsite.
- Revegetate or reseed all disturbed areas with a native plant/grass seed mixture suited to the site and landowner, to promote vegetation that will hold soil in place.
- Till or scarify compacted soils before reseeding where necessary.
- Monitor erosion control BMPs to ensure proper function and nominal erosion levels.
- Monitor revegetation and site restoration work for adequate growth; implement contingency measures as necessary.
- Mark construction limits within agricultural fields or grasslands to minimize disturbance.
- Inspect and maintain project facilities, including the access roads.
- Inspect and maintain tanks and equipment containing oil, fuel or chemicals for drips or leaks and to prevent spills onto the ground or into state waters.
- Maintain and repair all equipment and vehicles on impervious surfaces away from all sources of surface water.
- Refuel and maintain equipment at least 25 feet from any natural or manmade drainage conveyance including streams, wetlands, ditches, catch basins, ponds, and pipes, and provide spill containment and cleanup. Utilize pumps, funnels and absorbent pads for all equipment fueling and maintenance operations.
- Provide spill prevention kits at designated locations on the project site and at the hazardous material storage areas.
- Minimize the number of road stream crossings.
- Stabilize cut and fill slopes.

3.1.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would, be no impact to geology and soils.

3.2 Land Use

3.2.1 Affected Environment

The proposed project is located in the northern portion of Garfield, Columbia, and Walla Walla counties, Washington. Land use in these counties is largely agricultural, with farmland comprising 71 percent of the total area (U.S. Department of Agriculture [USDA] National Agricultural Statistics Service 2009). Land in the project area is mainly used for crops and livestock grazing. Other land uses in the project vicinity include lands participating in the Conservation Reserve Program (CRP), fallow land, state and county roads, commercial gravel pits, electric transmission lines, and outdoor recreational sports and activities (e.g., hunting and fishing).

Figure 3-3 presents an overview of land use in the project area and vicinity. Land use data are from the USGS National Land Cover Database (NLCD) (2001) and show the general distribution of Agriculture and Grasslands in the area. The Agriculture category consists of areas identified by the USGS as Cultivated Crops and Pasture/Hay. Grassland, as shown here, consists of areas identified by the USGS as Scrub/Shrub and Grassland/Herbaceous. Land use is summarized by project corridor in Table 3-5.

Table 3-5. Land Use in the Project Corridor (acres)

Land Use	Action Alternative[1/]			
	North	South	Combination A	Combination B
Agriculture	207.8	220.9	197.9	230.8
Grassland	607.7	553.3	575.6	585.5
Developed	17.4	14.6	14.6	17.4
Total	**832.9**	**788.8**	**788.0**	**833.7**

Note:
1/ The project corridor, as defined here, includes a 150-foot-wide right-of-way that extends 75 feet either side of the proposed centerline of the action alternatives, and areas affected by new access road construction based on an average disturbance width of 40 feet. These acres represent the entire right-of-way and new road footprint for each action alternative, not estimates of soils that would be disturbed under each alternative as a result of this project.
Source: USGS 2001

Housing in the vicinity of the project corridor is primarily associated with farms scattered along the primary roadways. The small community of Starbuck, with an estimated 2009 population of 130, is the closest community, located approximately 1.5 miles to the south of the project corridor in Columbia County (Washington Office of Financial Management [OFM] 2009a). Land in the project area is primarily in private ownership (Table 3-6). Major highways in the project area include U.S. Highway 12, State Route (SR) 127, SR 261, and SR 263.

Table 3-6. Land Ownership in the Project Corridor (acres)

Ownership	Action Alternative[1/]			
	North	South	Combination A	Combination B
Private	796.2	762.6	762.6	796.2
Federal (USACE)	15.0	15.0	15.0	15.0
State (WDNR)	20.4	9.0	9.0	20.4
Other[2/]	1.3	2.1	1.3	2.1
Total	**832.9**	**788.8**	**788.0**	**833.7**

Notes:
USACE – U.S. Army Corps of Engineers
WDNR – Washington Department of Natural Resources
1/ See footnote 1 to Table 3-5.
2/ “Other” consists primarily of county roads.

Agricultural lands in the project area include prime farmlands. Prime farmlands are defined as those lands that have the best physical and chemical characteristics for producing items such as food, feed, forage, fiber and oilseed crops, which have not already been targeted for urban development or water storage (Code of Federal Regulations [CFR] 730-733 section 657.5). The NRCS identifies soil mapping units within Washington state that qualify as prime based on specific soil criteria. Soil mapping units may be classified as prime farmland under current conditions or as prime farmland given that certain qualifying conditions exist on the site (e.g., "prime farmland if irrigated," "prime farmland when protected from flooding," etc.). In such cases, if the qualifying conditions do not exist, then the unit is considered "not prime."

Land may also be identified as Farmland of Statewide Importance. This is land, in addition to prime farmlands, that is of statewide importance for the production of food, feed, fiber, forage, and oil seed crops. Unlike prime farmland, criteria for defining and delineating this land are determined by the appropriate state agency or agencies. Farmlands of statewide importance typically include land that is nearly prime farmland and has the potential to economically produce high yields of crops (NRCS 2010).

NRCS soil survey data were reviewed for the affected counties. Data is available for all of Walla Walla County and the northern parts of Columbia and Garfield counties, with data available for 71 percent of Columbia County and 78 percent of Garfield County. Prime farmland comprises 5 percent, 8 percent, and 7 percent of total county area for Columbia, Garfield, and Walla Walla counties, respectively, and prime farmland, if irrigated, accounts for 10 percent of Walla Walla County. Farmland of statewide importance accounts for 47 percent and 46 percent of the areas in Columbia and Garfield counties covered by NRCS soil survey information, and 49 percent of Walla Walla County.

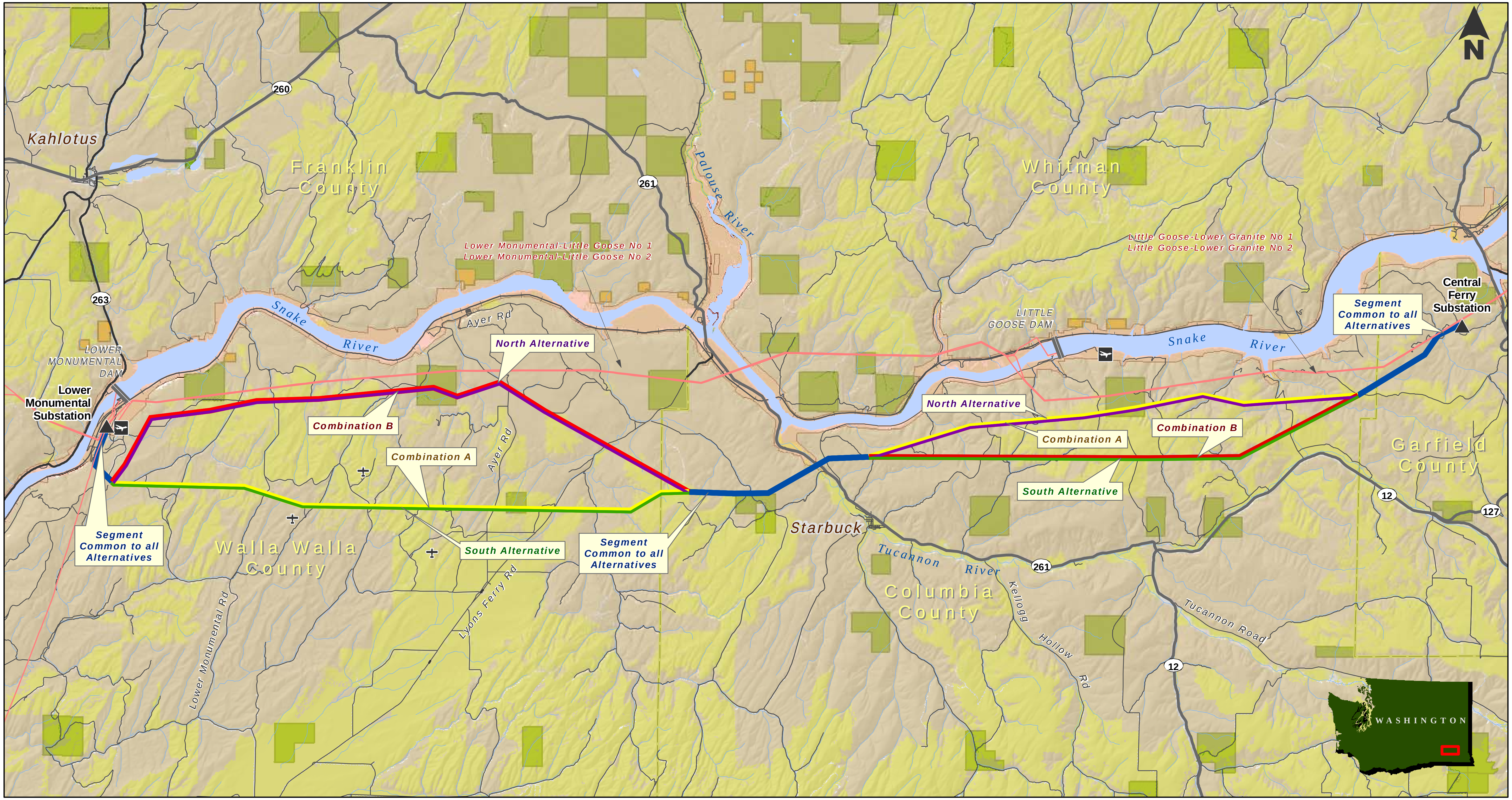
Only a small percentage of the project corridor (3 to 4 percent, depending on the alternative corridor) is designated as prime farmland or prime farmland if irrigated, with the majority of this designation being prime farmland if irrigated (see Table 3-7). More than half of the project corridor is designated as farmland of statewide importance under all four action alternatives, ranging from 55 percent of the area under the Combination A Alternative to 66 percent under the Combination B Alternative (see Table 3-7).

Table 3-7. Prime Farmland in the Project Corridor (acres)

Land Classification	Action Alternative[1/]			
	North	South	Combination A	Combination B
Prime Farmland	0.5	0.5	0.5	0.5
Farmland of Statewide Importance	525.9	452.1	430.7	547.3
Prime Farmland if Irrigated	20.9	33.7	33.7	20.9
Not Prime Farmland	285.6	302.4	323.0	265.0
Total	**832.9**	**788.8**	**788.0**	**833.7**

Note:
1/ See footnote 1 to Table 3-5.
Source: NRCS 2009a, 2009b, 2009c

Many of the agricultural lands and rangelands in the project area are enrolled in the NRCS's CRP. The CRP provides assistance to farmers and ranchers in complying with federal, state, and tribal environmental laws, and encourages environmental enhancement on sensitive lands. By participating in the CRP, farmers are encouraged to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as grasses, wildlife plantings, and trees. Farmers receive an annual rental payment for the term of a multi-year contract. The CRP is administered by the Farm Service Agency (FSA), with NRCS providing technical land eligibility determinations, conservation planning, and practice implementation.



Data Sources:
BPA Regional GIS Database
USGS 2001 National Land Cover Database

0 2.5 5 10 Miles

Proposed Route Alternatives
(Route sections shown adjacent to one another share the same proposed alignment)
- Segments Common to all Alternatives
- North Alternative
- South Alternative
- Combination A Alternative
- Combination B Alternative

Land Use
- Grassland
- Agriculture

Public Lands
- Washington State
- US BLM
- US Army Corps of Engineers

- Federal Dam
- Substation
- Existing BPA Transmission Lines
- Public Airport
- Private Airfield
- County Boundary
- Major Highway
- Road
- Railroad

Bonneville Power Administration
Central Ferry-Lower Monumental 500-kV
Transmission Line Project
Figure 3-3
Land Ownership and Uses

File Path: \\bud.bpa.gov\wg\gis\gis_data2\work\ryan\PROJECTS_2\09\RDB090006\EIS\LandOwnUse11x17.mxd, Date: March 19, 2010 8:50:57 AM

BPA contacted the FSA and requested CRP data for landowners in the project area under the Freedom of Information Act. The 2008 Food, Conservation and Energy Act (Section 1619) prevents disclosure of specific information about individual landowners or the programs they participate in and, as a result, the FSA was only able to indicate whether landowners identified by BPA had received CRP program payments. The results of this review indicate that of the 34 landowners that could be affected by the proposed project, 23 have received CRP payments. However, it cannot be determined if these landowners' CRP holdings are within the project corridor. Lands in the project area enrolled in the CRP were, in general, previously cultivated for crops.

Washington State Department of Natural Resources (WDNR) manages a number of parcels of land in the project vicinity, including lands that would be crossed by the project corridor under all four action alternatives (Figure 3-3). These state-owned lands are leased by WDNR to farmers and ranchers and used for agricultural and grazing purposes (Berndt 2009). The agency manages uplands for many purposes, including protection of state and federal threatened and endangered species, revenue for school construction, and environmental protection. Lands held in trust to support public beneficiaries generate earnings that help build or remodel public schools and universities. These revenues come from timber harvest on state trust lands, as well as from leases to farmers and ranchers and leases for mineral exploration and wind power generation (WDNR 2009b).

Lands along both sides of the Snake River are managed by the U.S. Army Corps of Engineers (USACE) Walla Walla District. The USACE operates and maintains the federal navigation channel from McNary Dam on the Columbia River through the four lower Snake River projects, including Lower Monumental Dam and all of the related operational and recreation facilities in the vicinity of the dam. The USACE's management of the Snake River provides a navigable waterway 400 miles inland to Lewiston, Idaho. Agricultural products, especially wheat from the Inland Empire region, are the most important commodities shipped downstream. Outdoor recreational opportunities on USACE lands and waterways include boating, fishing, hunting, camping, fish viewing, swimming, and walking (USACE 2009a).

3.2.2 Environmental Consequences of Action Alternatives

Impacts Common to All Action Alternatives

Construction of the action alternatives would result in temporary impacts to land use from use of heavy equipment causing soil and crop disturbance, noise, and dust. Construction activities that could cause impacts would include placement of towers, counterpoise installation, access road improvements and new road construction, placement of temporary pulling/tensioning sites, and installation of fiber optic wood structures (see Table 3-8). Realignment of three existing lines entering the Lower Monumental Substation and placement of one or two temporary staging areas would also temporarily impact land use in the project area.

Impacts to agricultural or grazing lands during construction could cause damage to crops and soil compaction resulting in a temporary loss of soil productivity. Temporary construction impacts would depend on the type of crop, the season, and if the land was in use or fallow. While construction would cause localized temporary disturbance, temporary impacts to land uses would be ***low***. These impacts would coincide with the construction period at each location and existing land uses would continue after construction. All temporarily disturbed areas including temporary access roads would be restored to their original condition following construction activities as discussed in Section 3.2.3 Mitigation. Landowners would be reimbursed for impacts related to facility construction through the terms of their private leases.

Table 3-8. Construction Impacts to Land Use (acres)

Action Alternative/ Project Component	Agriculture	Grassland	Developed	Total
North				
Tower Installation	22.5	67.8	1.8	92.0
Counterpoise Installation	25.4	75.5	3.0	103.9
Access Roads	45.6	95.8	1.5	142.9
Pulling/Tensioning Sites	3.1	12.7	0.0	15.8
Total	**96.6**	**251.8**	**6.3**	**354.6**
South				
Tower Installation	24.6	58.8	1.9	85.2
Counterpoise Installation	27.9	67.6	1.5	97.0
Access Roads	44.9	99.6	1.2	145.7
Pulling/Tensioning Sites	3.9	11.3	0.0	15.2
Total	**101.3**	**237.3**	**4.6**	**343.0**
Combination A				
Tower Installation	22.4	61.5	1.9	85.7
Counterpoise Installation	25.8	69.7	1.5	97.0
Access Roads	41.6	95.9	1.2	138.7
Pulling/Tensioning Sites	3.3	11.8	0.0	15.2
Total	**93.1**	**238.9**	**4.6**	**336.5**
Combination B				
Tower Installation	24.7	65.1	1.8	91.4
Counterpoise Installation	27.5	73.4	3.0	103.9
Access Roads	48.9	99.5	1.5	149.9
Pulling/Tensioning Sites	3.7	12.2	0.0	15.8
Total	**104.8**	**250.2**	**6.3**	**361.1**

Soil and vegetation disturbance can encourage the establishment or spread of noxious weeds. Noxious weeds can impact crops and grazing grasses by competing and replacing them. See Section 3.3 Vegetation for more information about noxious weeds.

Construction would result in temporary disturbance to farmlands of statewide importance and prime farmland, if irrigated (see Table 3-9). Impacts could include damage to crops and soil compaction, but would be temporary and localized and, therefore, considered ***low***. There would be no disturbance to prime farmland.

Table 3-9. Construction Impacts to Prime Farmland (acres)

Land Classification	Action Alternative			
	North	South	Combination A	Combination B
Prime Farmland	0	0	0	0
Farmland of Statewide Importance	248.8	209.4	209.3	248.9
Prime Farmland if Irrigated	11.3	16.1	16.1	11.3
Not Prime Farmland	94.6	117.5	111.0	100.9
Total	**354.6**	**343.0**	**336.5**	**361.1**

Source: NRCS 2009a, 2009b, 2009c

Permanent impacts to land use from construction would result from acquisition of a new 150-foot wide right-of-way, transmission tower footings, permanent access roads, and fiber optic wood poles (Table 3-10). These lands would not be available for other uses for the duration of project operation. Although construction of the proposed project would result in the development of a new utility corridor, the permanent impacts from construction would be ***low***. The proposed project would not substantially affect overall land use patterns in the project area. BPA would obtain transmission easements for operation of the proposed project on private lands, and would obtain right-of-way grants to cross federal and state lands. Existing land use or ownership would not change along the majority of the transmission line right-of-way, but the new 150-foot-wide transmission line easement that would be required under all action alternatives would encumber the right-of-way area with some land use limitations. Each transmission line easement would specify the present and future right to clear the right-of-way and to keep it clear of all trees, brush, vegetation, crops, other structures, and fire and electrical hazards. Most of the vegetation along the proposed right-of-way is low growing grasslands or agricultural fields; both are generally compatible with transmission lines.

Table 3-10. Permanent Impacts to Land Use (acres)

Action Alternative/ Project Component	Agricultural	Grassland	Developed	Total
North				
Tower Footings	5.6	17.0	0.4	23.0
Access Roads	51.5	103.4	1.7	156.5
Total	**57.1**	**120.4**	**2.0**	**179.5**
South				
Tower Footings	6.1	14.7	0.5	21.3
Access Roads	52.0	113.3	1.5	166.8
Total	**58.1**	**128.0**	**2.0**	**188.1**
Combination A				
Tower Footings	5.5	15.4	0.5	21.4
Access Roads	49.3	105.9	1.5	156.6
Total	**54.8**	**121.3**	**2.0**	**178.1**
Combination B				
Tower Footings	6.2	16.3	0.4	22.9
Access Roads	54.2	110.8	1.7	166.7
Total	**60.4**	**127.1**	**2.0**	**189.5**

The placement of transmission line towers and permanent access roads through agricultural lands could lead to fragmentation and less efficient harvesting of agricultural crops. New permanent access roads may also have beneficial impacts in cases where a landowner has need for the access. In agricultural areas, new permanent roads could potentially be used by farmers during planting and harvest and for spraying fields.

Lands permanently impacted would include farmlands of statewide importance and prime farmland, if irrigated (see Table 3-11). These lands would be unavailable for agricultural use for the duration of project operation. Impacts to farmlands of statewide importance would range from an estimated 111 acres to 132 acres. As noted in the Affected Environment discussion, almost half of the land in the affected counties (where information is available) is identified as farmland of statewide importance. Impacts under the action alternatives would range from about 0.01 percent to 0.02 percent of the county total, and overall impacts are, therefore, expected to be ***low***. Impacts to prime farmland, if irrigated, would range from 5 to 8 acres, approximately 0.01 percent of land in this classification in the affected counties, and are, as a result, expected to be ***low***.

Table 3-11. Permanent Impacts to Prime Farmland (acres)

Land Classification	Action Alternative			
	North	South	Combination A	Combination B
Prime Farmland	0	0	0	0
Farmland of Statewide Importance	127.9	115.2	111.4	131.7
Prime Farmland if Irrigated	4.6	7.8	7.8	4.6
Not Prime Farmland	47.0	65.1	58.8	53.3
Total	**179.5**	**188.1**	**178.1**	**189.6**

Source: NRCS 2010

As noted above, BPA has submitted a request to the FSA under the Freedom of Information Act to identify CRP lands that would be crossed by the proposed project. BPA plans to consult with the FSA and landowners to determine if construction would affect the CRP status of the land or if special construction or revegetation techniques would be necessary. BPA will provide landowners with any information, including estimated disturbance to ground cover and length of use, if required to obtain prior approval from the FSA for ground disturbance on CRP lands.

It is assumed that no adjustment would be made to CRP enrollees' annual lease payments, despite the potential for a permanent reduction in CRP acres under the action alternatives from the transmission tower footings and access roads. The FSA Handbook Agricultural Resource Conservation Program for State and County Offices (USDA 2008, p. 12-8) states:

> "Following is the procedure for continuing CRP-1 on land being used by public utilities for installing gas lines, pipes, cable, telephone poles, etc., materials used by an entity of the State for road building or Federally funded pipeline projects.
>
> CRP-1's may be continued without reduction in payment if:
>
> - the participant gives COC [the County Committee] details of proposed use, including length of use
> - COC authorizes the use
> - NRCS or TSP [Technical Service Provider] certifies usage will have minimal effect, such as:
> - erosion is kept to a minimum
> - minimum effect on wildlife and wildlife habitat
> - minimum effect on water and air quality
> - the participant restores cover, at the participant's expense, to disturbed land in timeframe set by COC.
>
> Note: No payment reduction will be made for compensation received by the participant from the public agency. NRCS or TSP will determine whether the disturbance will have an adverse effect on the land. If NRCS or TSP determines that public use will have an adverse effect on CRP acreage, affected acreage shall be terminated and refunds assessed."

BPA would use existing access roads where possible, but additional access road easements across private and public ownership would also need to be acquired. Signs would be posted or gates would be installed at the landowners' request to prevent trespassing on private lands.

Operation and maintenance impacts from the action alternatives are expected to be ***low***. During the life of the project, BPA would perform routine, periodic maintenance and emergency repairs to the transmission line. Vegetation would be maintained for safe operation and to allow access to the line. If a tower on agricultural land without permanent access roads needs to be accessed for maintenance or emergency situations, BPA would pay the landowner for any crop damage that would occur.

The following sections describe potential impacts on land use specific to each of the action alternatives.

North Alternative

Construction of the North Alternative would temporarily disturb about 355 acres of land, with approximately 71 percent (252 acres) of this disturbance expected to occur on areas characterized by the USGS as grassland and 27 percent (97 acres) on land used for agriculture (Table 3-8). Approximately 70 percent (249 acres) of construction-related disturbance under this alternative would occur on farmland of statewide importance, with 11 acres of prime farmland, if irrigated, also affected (Table 3-9). As discussed above under Impacts Common to All Action Alternatives, temporary impacts on land use from the North Alternative would be ***low***.

The North Alternative would result in the permanent conversion of approximately 180 acres of land from primarily agricultural and grassland uses to tower footings and access roads. The majority of this land (87 percent) would be associated with permanent access roads. The remaining 13 percent would be associated with the tower footings. Approximately 31 percent of this disturbance would occur on agricultural lands, with the majority of the remainder occurring on grasslands (Table 3-10). Approximately 71 percent (128 acres) of the permanent disturbance under this alternative would occur on farmland of statewide importance, with 5 acres of prime farmland, if irrigated, also affected (Table 3-11). As discussed above under Impacts Common to All Action Alternatives, permanent impacts on land use from the North Alternative would be ***low***.

There are no residences in the vicinity of the North Alternative project corridor. Structures within 1,000 feet of the North Alternative include a water storage tower located to the south of the proposed route in Walla Walla County (Township 13N, Range 35E, Section 36), and several agricultural silos located to the north of the proposed route on Magallon Road (Township 12N, Range 35E, Section 6). There would be ***no*** effect to these structures during construction of the North Alternative.

South Alternative

Temporary and permanent land disturbance impacts for construction of the South Alternative would be similar to those described above for the North Alternative. Construction of the South Alternative would temporarily disturb about 343 acres of land, with approximately 69 percent (237 acres) of this disturbance expected to occur on areas characterized by the USGS as grassland and 30 percent (101 acres) on land used for agriculture (Table 3-8). Approximately 61 percent (209 acres) of construction-related disturbance under this alternative would occur on farmland of statewide importance, with 16 acres of prime farmland, if irrigated, also affected (Table 3-9). As discussed above under Impacts Common to All Action Alternatives, temporary impacts on land use from the South Alternative would be ***low***.

Construction of this alternative would result in the permanent conversion of approximately 188 acres of land from primarily agricultural and grassland uses to tower footings and access roads. The majority of this land (89 percent) would be associated with permanent access roads. The remaining 11 percent would be associated with the tower footings. Approximately 31 percent of this disturbance would occur on agricultural lands, with the majority of the remainder occurring on grasslands (Table 3-10). Approximately 61 percent (115 acres) of the permanent disturbance under this alternative would occur on farmland of statewide importance, with 8 acres of prime farmland, if irrigated, also affected (Table 3-11). As discussed above under Impacts Common to All Action Alternatives, permanent impacts on land use from the South Alternative would be ***low***.

A private residence is located approximately 400 feet to the north of the South Alternative in the vicinity of Lyons Ferry Road in Walla Walla County. Construction-related impacts in the vicinity of this residence would include short-term noise, construction traffic, and dust.

Combination A Alternative

Construction of the Combination A Alternative would temporarily disturb about 337 acres of land, with approximately 71 percent (239 acres) of this disturbance expected to occur on areas characterized by the USGS as grassland and 28 percent (93 acres) on land used for agriculture (Table 3-8). Approximately 62 percent (209 acres) of construction-related disturbance under this alternative would occur on farmland of statewide importance, with 16 acres of prime farmland, if irrigated, also affected (Table 3-9). Similar to the North and South alternatives, temporary impacts on land use from the Combination A Alternative would be ***low***.

Construction of this alternative would result in the permanent conversion of approximately 178 acres of land from primarily agricultural and grassland uses to tower footings and access roads. The majority of this land (88 percent) would be associated with permanent access roads. The remaining 12 percent would be associated with the tower footings. Approximately 31 percent of this disturbance would occur on agricultural lands, with the majority of the remainder occurring on grasslands (Table 3-10). Approximately 63 percent (111 acres) of the permanent disturbance under this alternative would occur on farmland of statewide importance, with 8 acres of prime farmland, if irrigated, also affected (Table 3-11). Similar to the North and South alternatives, permanent impacts on land use from the Combination A Alternative would be ***low***.

A private residence is located approximately 400 feet to the north of the Combination A Alternative in the vicinity of Lyons Ferry Road in Walla Walla County. Construction-related impacts in the vicinity of this residence would include short-term noise, construction traffic, and dust.

Combination B Alternative

Construction of the Combination B Alternative would temporarily disturb about 361 acres of land, with approximately 69 percent (250 acres) of this disturbance expected to occur on grassland and 29 percent (105 acres) on land used for agriculture (Table 3-8). Approximately 69 percent (249 acres) of construction-related disturbance under this alternative would occur on farmland of statewide importance, with 11 acres of prime farmland, if irrigated, also affected (Table 3-9). Similar to the alternatives above, temporary impacts on land use from the Combination B Alternative would be ***low***.

Construction of this alternative would result in the permanent conversion of approximately 190 acres of land from primarily agricultural and grassland uses to tower footings and access roads. The majority of this land (88 percent) would be associated with permanent access roads. The remaining 12 percent would be associated with the tower footings. Approximately 32 percent of this disturbance would occur on agricultural lands, with the majority of the remainder occurring on grasslands (Table 3-10). Approximately 69 percent (132 acres) of the permanent disturbance under this alternative would occur on farmland of statewide importance, with 5 acres of prime farmland, if irrigated, also affected (Table 3-11). Similar to the alternatives above, permanent impacts on land use from the Combination B Alternative would be ***low***.

There are no residences in the vicinity of the Combination B Alternative project corridor. Structures within 1,000 feet of the Combination B Alternative include a water storage tower located to the south of the proposed route in Walla Walla County (Township 13N, Range 35E, Section 36), and several agricultural silos located to the north of the proposed route on Magallon Road (Township 12N, Range 35E, Section 6). There would be ***no*** effect to these structures during construction of the Combination B Alternative.

3.2.3 Mitigation Measures

The following mitigation measures have been identified to reduce or eliminate adverse impacts on land use from the action alternatives:

- Provide a schedule of construction activities to all landowners that could be affected by construction.
- Compensate landowners for any new land rights required for right-of-way easements, or to construct new, temporary or permanent access roads.
- Plan and conduct construction activities to minimize temporary disturbance, displacement of crops, and interference with agricultural activities.
- Use BMPs to limit erosion and the spread of noxious weeds.
- Restore compacted cropland soils to pre-construction conditions.
- Compensate landowners for any damage to property during construction and maintenance activities.
- Minimize or eliminate public access to project facilities through postings and installation of gates and barriers at appropriate access points and, at the landowner’s request, on private property.

3.2.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact on land use.

3.3 Vegetation

3.3.1 Affected Environment

The proposed project lies within the Columbia Plateau Ecoregion, a semi-arid ecoregion that encompasses nearly one-third of the state of Washington (Washington Biodiversity Council [WBC] 2009). Summers are hot and dry and winters are cold and overcast. Prior to human modification, this ecoregion was dominated by native grasslands and shrub-steppe vegetation communities. Native grassland communities consist primarily of bunchgrasses including bluebunch wheatgrass, Sandberg bluegrass, and Idaho fescue. More than half of the shrub-steppe and 70 percent of the native grasslands in this ecoregion have been converted to agriculture (WBC 2009). The landscape in the project area consists of rolling foothills and steep canyons.

Human activities, such as agricultural conversion, ranching, and road construction, have extensively altered the vegetation communities throughout the project area. The open rolling hills are comprised primarily of cultivated agricultural fields, fallow pastures, and native and disturbed grasslands. Although native grassland communities remain in scattered pockets within the project area, invasive species such as cheatgrass, bulbous bluegrass, yellow star-thistle, and rush skeletonweed have displaced native forbs and bunchgrasses in much of the project area. A small amount of riparian and wetland vegetation also occurs in the project area, primarily near the Tucannon River.

General vegetation surveys were conducted along the project corridors in September 2009. The purpose of the field surveys was to determine the distribution and condition of vegetation types within the transmission line rights-of-way for the proposed alternatives and to assess impacts of the proposed alternatives on vegetation communities. All vascular plant species encountered in the survey area are listed in Appendix A to this Environmental Impact Statement (EIS); however, due to the timing of the surveys, it was not possible to identify all species, and other species (primarily annual herbaceous species) had, presumably, completed their life cycle and were no longer present. Additional vegetation field surveys are scheduled for spring/summer of 2010.

Vegetation Communities

Vegetation communities within the project area include cropland, disturbed grassland, native grassland, riparian/wetland, and potential native grassland. Although land enrolled in the CRP likely exists along all the action alternatives, these areas are often difficult to distinguish in the field from disturbed grasslands and/or fallow agricultural fields and information regarding the specific location of CRP lands is not available (see Section 3.2 Land Use). As a result, CRP lands are included in this report in the disturbed grassland category. Table 3-12 lists the acres of cropland, disturbed grassland, native grassland, riparian/wetland, and potential native grassland along the project corridor for all action alternatives. Note that these acres represent the entire corridor (right-of-way and new access roads) for each alternative, not estimates of vegetation that would be disturbed under each alternative as a result of this project.

The communities identified in Table 3-12 are briefly described below. Additionally, although acres of CRP land in the project corridor have not been determined, CRP land is also discussed below.

Cropland

Cropland in the project area is primarily used for dry land wheat and hay production. Areas identified as fallow land are also considered cropland for the purposes of this analysis. Most of the wheat fields are treated with herbicides and fertilizers annually. Hay fields are typically mowed and harvested once a year. Although agricultural fields are generally left fallow every other year, croplands are generally intensively disturbed on an annual basis, and these areas provide little if any habitat for native plant species.

Table 3-12. Vegetation Communities in the Project Corridor (acres)

Vegetation Community[1/]	Action Alternative			
	North[2/]	South[2/]	Combination A[2/]	Combination B[2/]
Cropland	176.7	150.9	130.7	196.9
Disturbed Grassland	489.0	519.2	535.3	473.0
Native Grassland	50.2	28.5	32.7	45.9
Riparian/wetland	3.6	3.2	3.5	3.2
Potential Native Grassland[3/]	113.4	87.0	85.8	114.6
Total	**832.9**	**788.8**	**788.0**	**833.7**

Notes:

1/ Vegetation communities were identified based on field surveys conducted during September 2009 and a review of high-resolution aerial imagery.

2/ The project area, as defined here, includes a 150-foot-wide right-of-way that extends 75 feet either side of the proposed centerline of the action alternatives, and areas affected by new access road construction based on an average disturbance width of 40 feet. These acres represent the entire right-of-way and new road footprint for each alternative, not estimates of vegetation that would be disturbed under each alternative as a result of this project.

3/ Not all areas of the proposed transmission line rights-of-way were accessible by foot during 2009 surveys. Based on binocular surveys and/or aerial map interpretation, areas that appeared to potentially have native grassland communities present were classified as potential native grassland. However, it is possible that these areas may also include disturbed grassland and cropland.

Areas that were fallow in September 2009 and had not obviously been cultivated in the recent past were classified as disturbed grassland. Thus, areas that are not currently, but may be cultivated for agriculture in the future, were classified as disturbed grassland.

Disturbed Grassland

This vegetation type consists of areas degraded due to land use activities, such as grazing and past agricultural practices. These communities are dominated by invasive annual grass and forb species such as cheatgrass, bulbous bluegrass, tall tumblemustard, prickly lettuce, and yellow star-thistle. Native bunchgrasses, such as Idaho fescue and Sandberg bluegrass are rare, although bluebunch wheatgrass and squirreltail were observed to be locally common. Other species commonly observed in disturbed grasslands include branched lagophylla, horseweed, and Russian thistle. Scattered shrubs, primarily gray rabbitbrush, were also often present and locally abundant in disturbed grassland communities. As mentioned above, areas that were fallow in September 2009 and had not obviously been cultivated in the recent past were classified as disturbed grassland.

Additionally, lands presumed to be enrolled in CRP are included in this classification. Land enrolled in the CRP was, in general, previously cultivated for crops. These areas are seeded with a mix of native and non-native grasses and forbs specified by federal agencies managing CRP lands. Although not deliberately seeded in, annual invasive grasses are often very common in these communities. Dominant species observed in potential CRP communities in the project corridor include introduced perennial bunchgrasses, such as crested wheatgrass and tall wheatgrass, invasive annual grasses such as cheatgrass, and native perennial bunchgrasses such as bluebunch wheatgrass and Sandberg bluegrass. Although these areas often include a native component and are more resistant to weed infestations, these areas provide minimal habitat for native plant species. More than half of the land crossed by each of the action alternatives was classified as disturbed grassland, ranging from an estimated 473 acres under the Combination B Alternative to 535 acres under the Combination A Alternative (Table 3-12).

Native Grassland

Patches of native grassland occur along all the action alternative corridors. These areas vary in size and quality, but are generally small, patchy, and isolated with localized areas of weed infestation. These patches generally provide habitat for native plant species, but the quality of the habitat depends on the size and integrity of the community and the species composition of the surrounding vegetation communities. Dominant grass species in native grassland communities include bluebunch wheatgrass, Sandberg bluegrass, and Idaho fescue. Squirreltail was also locally abundant, especially in the northern region of the project corridor. Herbaceous species commonly observed in native grassland communities include hoary aster, woolly plantain, yarrow, and lupine. Invasive species such as cheatgrass and bulbous bluegrass are also commonly found, though in lesser extents, in native grasslands in the project corridor. Scattered shrubs, primarily gray rabbitbrush, and occasionally snow buckwheat, were at times observed in native grassland.

Native grassland, also called eastside steppe, is listed by the Washington Department of Fish and Wildlife (WDFW) as a priority habitat for conservation and management (WDFW 2008). Eastside steppe is defined as a nonforested vegetation community consisting predominantly of native bunchgrasses, such as bluebunch wheatgrass, Sandberg bluegrass, and Idaho fescue, and/or broadleaf herbaceous plant species (WDFW 2008).

Native grassland comprises a slightly larger share of the corridors along the North and Combination B alternatives, approximately 6 percent of the total, versus 4 percent of the total under the South and Combination A alternatives (Table 3-12). During the 2009 survey, one larger, relatively undisturbed area of native grassland was observed in the northwestern quadrant of the project area along the North and Combination B Alternative corridor. This area of native grassland supports a diverse assemblage of native bunchgrass, herbaceous, and shrub species. Non-native species within this area were generally restricted to disturbed areas, such as near an existing BPA access road.

Potential Native Grassland

Either due to lack of permission to enter or due to topography, not all areas of the project corridors were accessible by foot during the 2009 survey. Based on binocular surveys and/or aerial map interpretation, areas with the potential to contain native grassland communities present were classified as “potential native grassland.” Areas assigned this classification comprised approximately 14 percent of the North and Combination B Alternative corridors and 11 percent of the South and Combination A Alternative corridors.

Riparian and Wetland Communities

Small patches of riparian vegetation exist near the perennial Tucannon River, and intermittent streams in the project corridor. Riparian vegetation observed along intermittent streams in the project corridor consists primarily of non-native shrub and herbaceous species including Russian thistle, absinth wormwood, yellow star-thistle, fiddleneck and Canada goldenrod. The only riparian forest habitat observed exists along the Tucannon River. The dominant tree species in this area is white alder. Other common species in this area include black walnut, Russian-olive, and the noxious weeds: false-indigo, reed canary grass, absinth wormwood, and Queen Anne’s Lace. The only wetland area observed during the 2009 field surveys was adjacent to the Tucannon River. Riparian areas and wetlands are discussed further in Section 3.6 Water Resources and Fish.

Threatened, Endangered, and Sensitive Plant Species

In addition to common plant species, there are several special status plant species with the potential to occur in the project area. These species include Threatened, Endangered, and Sensitive (TES) plant species, as well as federal species of concern. Based on review of the Washington Natural Heritage Program’s (WNHP) GIS database (WNHP 2009a) and the U.S. Fish and Wildlife Service (USFWS) endangered species database (USFWS 2009a) one federally listed species—Ute ladies’-tresses (*Spiranthes diluvialis*)—has the potential to occur in the project area. However, the likelihood of occurrence is low because there is little potential habitat (see Table

3-13). Several federal species of concern and Washington State listed species also have the potential to occur in the project area. Table 3-13 lists the federal and state listed TES plant species, as well as species of concern, that are known to occur in or near Walla Walla, Columbia, and Garfield counties, and assesses their likelihood of occurring in the project area.

Table 3-13. TES Plant Species that May Occur in the Project Area

Species	Flowering Period	USFWS Status[1/]	State Status[2/]	Habitat Requirements/ Information[3/]	Potential to Occur in Project Area
Aliciella leptomeria (Great Basin gilia)	May	None	T	Open dry habitats on gravelly bluffs; sandy swales; on caliche; Elevation 470 to 1,140 feet.	Low to moderate; potential habitat exists in the project area; however, it is out of range of known occurrences of this species.
Allium campanulatum (Sierra onion)	June–July	None	T	Generally prefers dry soils at medium to high elevations in the mountains; the one known location in Washington occurs in an intermittent streambed at 5,500 feet.	Low; elevation of the project area too low.
Allium dictuon (Blue Mountain onion)	Variable; generally June–July	SC	T	On steep, gravelly slopes at middle to upper elevations. Elevation 4,200 to 5,200 feet. Known from one small area in the Blue Mountains.	Low; elevation of the project area too low; species is endemic to the Blue Mountains.
Ammania robusta (grand red stem)	May–June	None	T	Riverine emergent wetlands/riparian mudflat communities in free-flowing sections of eastern Washington rivers; may occur in backwater areas along reservoirs.	Low to moderate; little emergent wetland habitat in the project area.
Anagallis minima (chaffweed)	May–September	None	T	Freshwater riparian areas, floodplains, and vernal pools in mud and silty soil. Elevation 400 to 2,340 feet.	Moderate; potential habitat along riparian areas such as near the Tucannon River.
Anthoxanthum hirtum (common northern sweet grass)	April–July	None	R1	Moist slopes, meadows, and streambanks from foothills to sub-alpine elevations. Elevation 325 to 4,420 feet.	Low to moderate; little potential habitat in the project area.
Astragalus riparius (Piper's milk-vetch)	Flowers May–June; Fruits persist through fall	None	E	Dry bluffs, canyon banks and prairies. Regionally endemic and locally plentiful along the lower Snake River and its tributaries between the mouth of the Clear Water and that of the Tucannon River.	Moderate to high; potential habitat occurs near the Tucannon River.
Bergia texana *(Texas bergia)*	June–November	None	R1	Obligate wetland species; found in moist, disturbed soils, margins of vernal pools and sand bars along rivers at elevations below 600 feet.	Low; potential habitat may exist near the Tucannon River; however, known occurrences of this species are only from Whitman and Klickitat counties.

Table 3-13. TES Plant Species that May Occur in the Project Area (continued)

Species	Flowering Period	USFWS Status[1/]	State Status[2/]	Habitat Requirements/ Information[3/]	Potential to Occur in Project Area
Bolandra oregano (Oregon bolandra)	May–early June	None	S	Columbia River drainage mostly at low-elevations; near streams and in moist, rocky places in deep shade, though sometimes this species found in open, rocky areas and steep, grassy semi-open slopes.	Low; project area outside of the known range of this species.
Calochortus macrocarpus var. M*aculosus* (sagebrush lily; mariposa lily)	July–August	None	E	Rocky, basaltic soils and substrates on hillsides, rock outcrops and cliffbands; observed on grasslands on steep slopes. Prefers dry pristine habitats at low to upper elevations.	Moderate; potential habitat exists in the project area; however, areas of pristine habitat are limited.
Calochortus nitidus (broad-fruit mariposa)	Late June–August	SC	E	Endemic to the Palouse grasslands of eastern Washington and adjacent Idaho in the Blue Mountains and Columbia Basin physiographic province. Grasslands and moist swales between adjacent hills. Elevation 1,500 to 6,400 feet.	Low; project area outside of the known range of this species.
Carex comosa (bristly sedge)	May–July	None	S	Marshes, lake shores, and wet meadows. Elevation 50 to 2,000 feet.	Low to moderate; minimal amount of potential habitat in the project area.
Cheilanthes feei (Fee's lip-fern)	Identifiable year round	None	T	Limestone cliff crevices, outcrops and steep slopes. Elevation 850 to 2,650 feet. In Washington only known from Whitman and Asotin counties.	Low; project area outside of the known range of this species.
Cryptantha leucophaea (gray Cryptantha)	May–June	SC	S	Regional endemic known from sandy substrate along the Columbia River within the Columbia Basin physiographic province. Restricted to sand dunes that have not been completely stabilized.	Low; this species is regionally endemic to areas along the Columbia River.
Cryptantha rostellata (beaked Cryptantha)	April–mid June	None	T	Very dry microsites on coarse substate generally in shrub-steppe communities; usually found in scattered patches of a few individuals along dry drainages. Historically known in Walla Walla County.	Moderate; suitable habitat is present in the project area.
Cypripedium fasciculatum (clustered lady's slipper)	Early May–mid June	SC	S	Mid- to late-seral Douglas-fir or ponderosa pine forests mostly on northerly aspects. Elevation 1,200 to 5,000 feet.	Low; absence of suitable forest habitat in the project area.
Hackelia diffusa var. Diffusa (diffuse stickseed)	May–June	None	T	Shaded areas, cliffs, talus, wooded flats and slopes. Associated species include snowberry, Rocky Mountain maple, mock orange, and western sweet-cicely.	Low; absence of suitable habitat with associated species in project area.
Lomatium serpentinum (Snake Canyon desert-parsley)	April–July	None	S	Low elevations in moderately deep sandy or rocky soil; rock crevices or clefts on open moderate to steep slopes. Historically known from Walla Walla County.	Moderate; suitable habitat is present in project area.
Lupinus lepidus var. C*usickii* (prairie lupine)	June–August	SC	R2	Known from the Blue Mountains and Okanogan County.	Low; project area outside of known range of this species.
Lupinus sabinianus (Sabin's lupine)	May–June	None	E	Lower to mid-elevation coniferous forests or transition grassland, primarily on drier sites. Range is blue mountains of WA and OR.	Low; absence of forest habitat; project area outside of known range of this species.

Table 3-13. TES Plant Species that May Occur in the Project Area (continued)

Species	Flowering Period	USFWS Status[1/]	State Status[2/]	Habitat Requirements/ Information[3/]	Potential to Occur in Project Area
Lupinus sericeus var. A*sotinensis* (Asotin silky lupine)	May–August	None	R1	Grasslands, roadsides, and steep breaklands; has also been found in highly disturbed sites. Elevation 800 to 3,600 feet.	Moderate to high; suitable habitat is present in project area.
Mimulus pulsiferae (Pulsifer's monkey-flower)	June–July	None	S	Seasonally moist, open areas, in grass/forb dominated openings in ponderosa pine and Douglas-fir forests; often in exposed mineral soil.	Low; absence of suitable habitat in project area.
Minuartia pusilla var. P*usilla* (annual sandwort)	April–June	None	R1	Plains, open pine forest, chaparral slopes, and dry rock cliffs. Elevation 25 to 7,900 feet.	Moderate; potential habitat occurs in the project area.
Physaria didymocarpa var. D*idymocarpa* (common twinpod)	June–August	None	S	Gravel bars, steep shale outcrops, rocky flats, gravelly prairies, talus slopes, dry hillsides, and road cuts. Elevation 5,200 to 5,400 feet.	Low; elevation of project area to low.
Ranunculus herbecarpus (downy buttercup)	March–May	None	R1	Shaded areas on moist to dry hillsides and in woodland areas at elevations less than 4,300 feet. Historically known from one occurrence in Garfield County.	Low to moderate; potential habitat may exist, but only historically known from counties in the project area.
Ranunculus populago (mountain buttercup)	April–August	None	S	Moist meadows, stream terraces, riparian corridors, open areas along the edge of shrubs, and adjacent to perennial streams and bogs. Elevation 4,480 to 5,920 feet.	Low; elevation of project area to low.
Rubus nigerrimus (northwest raspberry)	May–July	SC	E	Bottom of steep, narrow drainages and somewhat moist areas on adjacent slopes on tributaries to the Snake River in the bluebunch wheatgrass/ Sandberg bluegrass association. Elevation 700 to 2,200 feet.	Moderate; potential habitat exists, but project area out of known range of species.
Spiranthes diluvialis (Ute ladies'-tresses)	Mid July–August	FT	E	Found in low elevation, seasonally flooded, moist habitats. In Washington known from a moist meadow adjacent to Ponderosa Pine/Douglas-fir woodlands and adjacent to the Columbia River on stabilized gravel bars that are moist throughout the growing season. Elevation 720 to 1,500 feet	Low; little potential habitat in the project area.
Trifolium douglassii (Douglas' clover)	June–July	SC	E	Moist wet meadows and forested wetlands, and streambanks. Elevation of the single extant occurrence in Washington is 3,900 feet.	Low; little potential habitat exists. Elevation of project area too low.
Trifolium plumosum var. P*lumosum* (plumed clover)	June–July	None	T	Found in the Blue Mountains of southeast Washington; associated with pine forests.	Low; absence of suitable habitat; out of species range.

Notes:

1/ USFWS Classification: FT=Listed as Threatened, likely to become endangered; SC = Species of Concern (USFWS 2009a).

2/ State Status: WNHP (2009b) provides the following explanation of state status:

- E – Endangered taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree presenting the danger of becoming extinct or extirpated from Washington within the foreseeable future if factors contributing to their decline continue.
- T – Threatened are likely to become Endangered in Washington within the foreseeable future if factors contributing to population decline or habitat degradation or loss continue.
- S – Sensitive taxa are vulnerable or declining and could become Endangered or Threatened in the state without active management or removal of threats.
- R – Review taxa are either R1 = Taxon in need of additional field work before a status can be assigned, or R2 = Taxon with unresolved taxonomic questions.

3/ Habitat requirements are primarily from the WNHP Field Guide to Selected Rare Plants (WNHP 2009a).

The Endangered Species Act (ESA) of 1973 requires federal agencies to consult with the Secretary of Interior whenever an authorized action is likely to affect a species listed as threatened or endangered under the ESA. There are currently no state laws protecting TES plant species in Washington; however, many federal and state land-managing agencies have policies that provide protection for TES plant species. Local jurisdictions may also provide protection for TES species through ordinances, regulations, and permitting requirements.

The closest known occurrence of a TES plant species to the project corridor is one occurrence of grand red stem (*Ammannia robusta*), a state-listed threatened species, which occurs 1.6 miles across the lower Snake River from the project corridor.

No TES plant species were observed during general vegetation surveys conducted in September 2009; however, these surveys occurred outside of the optimal survey period for these species. Additional vegetation surveys, including surveys for TES plant species, will be conducted in all native and potential native grassland areas in the spring/summer of 2010 because this is where, and when, TES plant species are more likely to be identified if present.

Noxious Weeds

Noxious weeds are non-native plant species, designated by federal, state, or county governments. They are highly destructive, competitive, and/or difficult to control and cause ecological and economic damage. Noxious weeds are opportunistic species that often invade and flourish in disturbed areas. Noxious weeds can reduce crop yields, displace native species, and destroy native plant and animal habitat.

The Washington State Noxious Weed Control Board (WSNWCB) identifies three classes of noxious weeds: A, B, and C (WSNWCB 2009). These classes determine the degree of control required for the listed species. Class A weeds are non-native species that have limited distribution in Washington State and are required to be eradicated. Class B weeds are species that are either absent from or in limited distribution in some portions of the state, but are very abundant in other areas of the state. Class B weeds are designated for control in regions where they are not yet widespread. Prevention of new infestations in these areas is the primary goal. In areas where Class B species are widespread, control is decided at the local level and containment is the primary goal. These species are identified as "not designated for control." Class C noxious weeds include non-native plants which are already widespread in Washington State. Control of Class C weeds is decided by individual counties. Individual counties can choose to either enforce control of Class C weeds or educate residents about control of these noxious weeds.

During the 2009 general vegetation surveys along the proposed transmission line corridor, 11 noxious weed species were observed (Table 3-14). Two of these species, false indigo, and Queen Anne's lace are Class B species designated for control in Columbia County, the county in which these two species were observed. The remaining nine species are Class B and Class C species not designated for control in Columbia, Garfield, or Walla Walla counties. No Class A species were observed. Yellow star-thistle and rush skeletonweed were the predominant noxious weeds observed along all action alternative corridors. Although noxious weed species were more common and abundant along roads and other disturbed areas, many species, particularly yellow star-thistle and rush skeletonweed, have become widespread across the entire project corridor. Heavy infestations of yellow star-thistle were common in many of the disturbed grasslands surveyed. Cultivated rye was also locally abundant in many areas along all action alternative corridors. Table 3-14 lists the noxious weed species observed during the 2009 vegetation surveys and their state weed classification.

Table 3-14. Noxious Weed Species Observed during 2009 Field Surveys of the Project Corridor

Scientific Name	Common Name	Designation	Observations
Aegilops cylindrica	jointed goatgrass	Class C	Occasionally observed along all action alternatives.
Amorpha fruticosa	false indigo; river-locust	Class B–designated for control in Walla Walla, Columbia, Garfield counties	Only observed near the Tucannon River where the proposed alternatives share a common alignment.
Artemisia absinthium	absinth wormwood	Class C	Restricted to riparian areas near the Tucannon River and intermittent streams.
Centaurea diffusa	diffuse knapweed	Class B–not designated for control	Occasionally observed along all action alternatives.
Centaurea solstitialis	yellow star-thistle	Class B–not designated for control	Widespread and abundant along all action alternatives.
Chondrilla juncea	rush skeletonweed	Class B–not designated for control	Widespread and abundant along all action alternatives.
Cirsium arvense	Canada thistle	Class C	Occasionally observed along all action alternatives.
Convolvulus arvensis	field bindweed	Class C	Occasionally observed along all action alternatives.
Daucus carota	Queen Anne's lace	Class B–designated for control in Walla Walla, Columbia, Garfield counties	Only observed near the Tucannon River where the proposed alternatives share a common alignment.
Phalaris arundinacea	reed canarygrass	Class C	Only observed near the Tucannon River where the proposed alternatives share a common alignment.
Secale cereale	cultivated rye	Class C	Commonly observed and locally abundant along all action alternatives.

3.3.2 Environmental Consequences of Action Alternatives

Impacts Common to All Action Alternatives

Construction of the action alternatives would result in temporary ground disturbance that could affect vegetation communities, TES plant species, and the spread of noxious weeds. Construction activities that could cause impacts include tower and counterpoise installation, access road improvements and new access road construction, placement of temporary pulling/tensioning sites, and installation of fiber optic wood poles. Realignment of three existing lines entering the Lower Monumental Substation and placement of one or two temporary staging areas could also result in temporary disturbance.

Permanent impacts would result from the tower footings and new access roads. Existing vegetation would not, however, be affected along the majority of the transmission line right-of-way. Tall vegetation would not be allowed to grow within the right-of-way corridor, and tall trees outside the right-of-way with the potential to fall into the line would also be removed. However, most of the vegetation along the proposed transmission line routes is low-growing grassland or cropland and would be compatible with the new transmission line. Vegetation clearing is assumed, for this analysis, to be limited to those areas where other types of ground disturbance would occur. Estimates of permanent disturbance due to new access roads are based on an average disturbance width of 40 feet; however, not all of this area would be maintained as a road surface. Thus, estimates of long-term, road-related impacts likely overestimate the amount of permanent disturbance that would occur.

Vegetation Communities

Construction of the action alternatives would cause direct and indirect impacts to vegetation communities, as shown in Table 3-15. Direct impacts are generally limited to those that would occur within the immediate project corridor and include clearing of vegetation, ground disturbance, alteration of habitat, and spread of noxious weeds. Indirect impacts include the potential spread or introduction of noxious weeds outside the immediate construction area, which can alter the composition of and degrade existing vegetation communities. Another potential indirect impact is habitat fragmentation which can restrict species migration and can leave vegetation communities more susceptible to encroachment by non-native species.

Table 3-15. Construction Impacts to Vegetation Communities (acres)

Action Alternative/Project Component	Cropland	Disturbed Grassland	Native Grassland	Potential Native Grassland	Total[1/]
North					
Tower Installation	20.5	54.6	5.1	11.7	**91.9**
Counterpoise Installation	24.1	60.9	5.1	13.8	**103.9**
Access Roads	35.5	88.5	8.5	10.3	**142.9**
Pulling/Tensioning Sites	3.6	9.5	0.0	2.8	**15.8**
Total	**83.8**	**213.6**	**18.7**	**38.5**	**354.6**
South					
Tower Installation	14.7	56.4	4.1	10.0	**85.2**
Counterpoise Installation	19.0	64.3	3.7	10.0	**97.0**
Access Roads	27.8	101.1	5.9	10.7	**145.7**
Pulling/Tensioning Sites	3.5	10.0	0.3	1.4	**15.2**
Total	**65.0**	**231.8**	**14.0**	**32.1**	**343.0**
Combination A					
Tower Installation	14.0	59.8	3.6	8.3	**85.7**
Counterpoise Installation	17.6	67.0	3.4	9.0	**97.0**
Access Roads	29.4	94.4	7.1	7.8	**138.7**
Pulling/Tensioning Sites	3.1	10.6	0.0	1.4	**15.2**
Total	**64.1**	**231.8**	**14.1**	**26.5**	**336.5**
Combination B					
Tower Installation	21.2	51.2	5.6	13.4	**91.4**
Counterpoise Installation	25.5	58.2	5.3	14.8	**103.9**
Access Roads	34.1	95.4	7.3	13.1	**149.9**
Pulling/Tensioning Sites	4.0	8.8	0.3	2.8	**15.8**
Total	**84.8**	**213.6**	**18.6**	**44.1**	**361.1**

Note:
1/ Numbers are rounded and may not sum exactly.

Potential impacts due to construction can also be classified as short- and long-term impacts. Impacts are considered short-term if they disturb vegetation, but do not prevent the reestablishment of preconstruction vegetation communities within several years. In general, cropland, grassland, and riparian emergent communities are vegetation communities that have the potential to be reestablished within three growing seasons. Impacts to vegetation communities would be minimized, but not eliminated, with implementation of BMPs, weed control, and mitigation (see Section 3.3.3 Mitigation).

Construction-related impacts to vegetation in cropland and disturbed grassland communities, assuming mitigation measures are implemented, would be considered short-term because the vegetation would generally be reestablished within 2 years, resulting in a ***low*** level of impact in these areas.

Impacts to native grassland would also be considered short-term assuming the mitigation measures identified in Section 3.3.3 are implemented. However, clearing of vegetation reduces the future ability of these areas to support native and, potentially, TES plant species, further altering plant diversity and composition. In addition, native grassland communities disturbed by construction could potentially take 5 to 7 years to fully recover due to poor soil and low moisture conditions. Construction-related activities in native grassland would have a ***moderate to high*** level of impact depending on the size and integrity of the community being impacted.

Long-term impacts continue for an extended period of years, or may be permanent (i.e., continue for the life of the project). Long-term vegetation impacts are impacts that prevent the reestablishment of a vegetation community similar to the preconstruction community. Permanent impacts to vegetation communities from the action alternatives are shown in Table 3-16. Long-term impacts would result from placement of transmission tower footings and new permanent access roads.

Table 3-16. Permanent Impacts to Vegetation Communities (acres)

Action Alternative/Project Component	Cropland	Disturbed Grassland	Native Grassland	Potential Native Grassland	Total[1/]
North					
Tower Footings	5.1	13.7	1.3	2.9	23.0
Access Roads	40.3	96.2	8.8	11.2	156.5
Total	**45.4**	**109.8**	**10.1**	**14.1**	**179.5**
South					
Tower Footings	3.6	14.2	1.0	2.5	21.3
Access Roads[2/]	37.8	106.3	7.8	14.8	166.8
Total	**41.4**	**120.5**	**8.8**	**17.3**	**188.1**
Combination A					
Tower Footings	3.4	15.0	0.9	2.1	21.4
Access Roads[2/]	40.3	96.3	8.8	11.2	156.6
Total	**43.7**	**111.3**	**9.7**	**13.3**	**178.0**
Combination B					
Tower Footings	5.3	12.8	1.4	3.3	22.9
Access Roads	37.8	106.2	7.8	14.8	166.7
Total	**43.0**	**118.9**	**9.2**	**18.2**	**189.5**

Note:

1/ Numbers are rounded and may not sum exactly.

2/ New access roads proposed for the South and Combination A alternatives would also cross 0.2 acre of riparian vegetation associated with an intermittent drainage east of the Tucannon River.

Construction activities that cause removal of tree and shrub species in forested and shrub communities would also be considered long-term impacts because of the time required for reestablishment of a vegetation community similar to those existing prior to construction. The only forested area in the project corridor occurs where all action alternatives would share a common corridor and cross the Tucannon River. No transmission towers would be placed within

970 feet of the Tucannon River. West of the river, the closest tower would be approximately 1,610 feet from the river, and the closest tower on the east side would be approximately 970 feet away. The proposed transmission line would span the river and adjacent riparian and forested vegetation. No vegetation removal is anticipated in this area under any of the action alternatives.

Threatened, Endangered, and Sensitive Plant Species

Construction of the action alternatives could cause direct and indirect effects to TES plant species. Potential direct impacts include removal of TES plant species and/or removal or degradation of their habitat, and increased potential for noxious weed colonization. Potential indirect project impacts to TES plant species include the potential spread or introduction of noxious weeds outside the immediate construction area, and habitat fragmentation. Noxious weeds introduced as a result of the project could compete with TES plant species and/or degrade their habitat. Habitat fragmentation can restrict species migration and can leave TES plant populations more susceptible to encroachment by non-native and noxious weed species.

As discussed in Section 3.3.1, no TES plant species were observed during general vegetation surveys conducted for the project in September 2009. Additional surveys will be conducted in the spring/summer of 2010. If any TES plant species are found, potential impacts will be assessed and mitigation measures will be developed, as appropriate.

Noxious Weeds

Noxious weeds can displace native species and negatively impact the composition and function of vegetation communities. Ground disturbance and disturbance to intact vegetation communities increases the risk of noxious weed introduction and spread. In general, habitats with more bare ground, such as grasslands and riparian areas, are more susceptible to invasion than areas with relatively closed canopy, such as dense, moist forests. Disturbance of grassland communities, particularly on drier sites, facilitates the establishment of invasive species, such as cheatgrass and other introduced annual grasses, which outcompete native bunchgrasses and shrubs (Ashley and Stovall 2004).

Two noxious weed species designated for control, false indigo and Queen Anne's lace, were observed along the Tucannon River during the September 2009 field surveys (see Section 3.3.1). Ground disturbing activities are not proposed for the area near the Tucannon River under any action alternative and the project is not expected to facilitate increased distribution of these species under any action alternative. Three noxious weed species—yellow-star thistle, rush skeletonweed, and cultivated rye—are already widespread and abundant along all the action alternative corridors, particularly in disturbed grassland communities. The other six species observed during the September 2009 field surveys (Table 3-14) were occasionally observed along all the action alternative corridors. The mitigation measures described in Section 3.3.3 would help reduce, but would not eliminate, the potential introduction and spread of noxious weeds in the project corridor.

Temporary construction disturbance would result from tower and counterpoise installation, access road improvements and new access road construction, temporary pulling/tensioning sites, and installation of fiber optic wood structures (Table 3-15). The abundance and diversity of non-native and noxious weed species tends to be highest near road edges and movement of vehicles on roads may also contribute to weed spread (Lonsdale and Lane 1994, Sheley and Petroff 1999, Tyser and Worley 1992). Construction of access roads and the movement of construction equipment and other vehicles along these roads would increase the potential for the spread of noxious weeds in the affected areas.

The total number of acres disturbed under each alternative does not indicate that all of these acres would be infested with noxious weeds if the selected alternative were implemented, but the estimated numbers provide a sense of the difference in the potential for infestation under the different alternatives.

Areas of native grassland, including patches of native grassland in areas of potential native grassland, are generally less disturbed and contain a lower abundance of non-native species and noxious weeds than disturbed grasslands. Native grassland communities are important because they provide habitat for a diverse assemblage of native species, and potentially TES plant species. Very few areas of native grassland vegetation exist in the project corridor, and these areas are vulnerable to the effects of noxious weed introduction and proliferation. Construction-related ground disturbance would increase the potential for noxious weed introduction in areas of native grassland, therefore, impacts to these areas are considered ***moderate to high***.

Cropland vegetation communities are highly modified communities; however, noxious weed species can impact cropland by reducing crop and pasture production. Construction-related ground disturbance in croplands could increase the potential for noxious weed introduction and spread in cultivated areas that are free of noxious weeds and, therefore, result in a ***moderate*** level of impact. Disturbed grassland communities are typically characterized by a high abundance of noxious weeds and non-native species. Construction-related ground disturbance in these areas would have a ***low*** level of impact.

Operation and maintenance activities, including vegetation clearing and vehicular travel on access roads, would likely increase the potential for spread and introduction of noxious weeds in the project corridor. Weed seeds and propagules, including seeds from weed species not currently known from the project corridor, could be brought in on maintenance vehicles. Operational activities would have a ***moderate*** impact on the spread of noxious weeds in areas of native grassland under all action alternatives and in cultivated areas that are free of noxious weeds. Operational activities would have a ***low*** impact on the spread of noxious weeds in disturbed grassland.

The following sections describe potential impacts on vegetation resources specific to each of the action alternatives.

North Alternative

The North Alternative would involve construction of approximately 40 miles of new transmission line. This alternative would involve the installation of approximately 178 towers and construction of approximately 33 miles of new access roads. Construction of this alternative would disturb approximately 355 acres of land. More than half (60 percent) of this disturbance would occur in areas classified as disturbed grassland (Table 3-15). Construction would also disturb approximately 84 acres of cropland, 19 acres of native grassland, and 39 acres of potential native grassland. As discussed above under Vegetation Communities, construction-related impacts on vegetation in cropland and disturbed grassland communities, assuming mitigation measures are implemented, would be ***low***. One larger, relatively undisturbed area of native grassland was observed along the North Alternative during the 2009 field survey. Impacts to this area would be ***moderate to high*** because this is one of few relatively intact areas of native grassland in the project area.

Under the North Alternative, approximately 180 acres of land would be permanently occupied by tower footings and new access roads. Permanently disturbed areas would include approximately 110 acres of disturbed grassland, 45 acres of cropland, 10 acres of native grassland, and 14 acres of potential native grassland (Table 3-16). Long-term impacts similar to those described above under Vegetation Communities would occur. Impacts on disturbed grassland and cropland would be ***low.*** Impacts to native grasslands would be ***moderate to high*** if towers and roads are placed within the few intact areas of native grassland in the project area, depending on the size and integrity of the community/area being impacted. The transmission line would be designed to avoid these native grassland areas if possible.

New access roads, which increase the potential for the spread of noxious weeds, account for the majority (87 percent) of the estimated permanent disturbance under this alternative (Table 3-16). The majority of this disturbance related to access road construction and movement of vehicles along these roads would occur in areas classified as disturbed grassland (96 acres), where impacts are considered ***low***. Approximately 40 acres of cropland, 9 acres of native grassland, and 11 acres of potential native grassland would also be impacted by access roads (Table 3-16). Noxious weed impacts to cultivated areas relatively free of noxious weeds would be ***moderate***. Impacts to the few intact areas of native grassland in the project area would be ***moderate*** to ***high***. Patches of native grassland likely exist in areas of potential native grassland; however, as discussed above, a considerable portion of these areas most likely consist of disturbed grassland communities and cropland.

As stated above, no TES plant species were observed during the general vegetation surveys conducted for the project in September 2009. Impacts to TES plant species under this alternative will be evaluated if TES plant species are observed during the additional vegetation surveys scheduled for spring/summer 2010.

South Alternative

The South Alternative would involve construction of approximately 38 miles of new transmission line. This would involve the installation of approximately 167 towers, as well as construction of approximately 35 miles of new access road. Construction of this alternative would disturb about 343 acres of land. Approximately two-thirds (68 percent) of this disturbance would occur in areas classified as disturbed grassland (Table 3-15). Construction would temporarily disturb an estimated 65 acres of cropland, 14 acres of native grassland, and 32 acres of potential native grassland. Areas of native grassland along the South Alternative are generally small and isolated; impacts on these areas during construction would be ***moderate***.

Under the South Alternative, approximately 188 acres of land would be permanently occupied by tower footings and new access roads. Permanently disturbed areas would include approximately 121 acres of disturbed grassland, 41 acres of cropland, 9 acres of native grassland, and 17 acres of potential native grassland (Table 3-16). Impacts to native grassland would be ***moderate*** under the South Alternative.

New access roads, which increase the potential for the spread of noxious weeds, would disturb approximately 167 acres of ground under the South Alternative. The majority of road-related disturbance (i.e., movement of construction equipment and other vehicles) would occur in areas classified as cropland or disturbed grassland, with an estimated 8 acres of native grassland and 15 acres of potential native grassland also disturbed due to new access roads (Table 3-16). Impacts of the potential spread of noxious weeds for cropland and disturbed grassland would be ***low*** to ***moderate*** and ***low***, respectively. Noxious weed impacts to the few intact areas of native grassland potentially affected by this alternative would be ***moderate***.

Impacts to TES plant species under this alternative will be evaluated if TES plant species are observed during the additional vegetation surveys scheduled for spring/summer 2010.

Combination A Alternative

The Combination A Alternative would involve construction of approximately 38 miles of new transmission line. This alternative would involve the installation of approximately 167 towers and construction of approximately 33 miles of new access roads. Construction of this alternative would disturb about 337 acres of land. More than half (69 percent) of this disturbance would occur in areas classified as disturbed grassland (Table 3-15). Construction would disturb an estimated 64 acres of cropland, 14 acres of native grassland, and 27 acres of potential native grassland. The Combination A Alternative would result in less total construction-related disturbance to vegetation than the other action alternatives and would result in less impact to potential native grassland than under the North, South, and Combination B alternatives (Table 3-15). However, viewed in terms of acres, impacts to native grassland due to construction of this alternative would be similar to the South Alternative and only slightly less (approximately 4.6 acres less) than the North or Combination B alternatives (Table 3-15). Impacts to native grassland would be similar to those under the South Alternative (***moderate***).

Under the Combination A Alternative, approximately 178 acres of land would be permanently occupied by tower footings and new access roads. Permanently disturbed areas would include approximately 111 acres of disturbed grassland, 44 acres of cropland, 10 acres of native grassland, and 13 acres of potential native grassland (Table 3-16). Permanent impacts on these areas from the Combination A Alternative would be similar to those discussed under the South Alternative. The Combination A Alternative would result in slightly less permanent disturbance to vegetation than the North, South, and Combination B alternatives (Table 3-16). However, permanent impacts to native grassland would be similar to those under the South Alternative (***moderate***).

New access roads, which increase the potential for the spread of noxious weeds, would disturb approximately 157 acres of ground under the Combination A Alternative. The majority of road-related disturbance (i.e., movement of construction equipment and other vehicles) would occur in areas classified as disturbed grassland, with an estimated 40 acres of cropland, 9 acres of native grassland, and 11 acres of potential native grassland also disturbed due to new access roads (Table 3-16). Impacts of the potential spread of noxious weeds for cropland and disturbed grassland would be ***low*** to ***moderate*** and ***low***, respectively. Noxious weed impacts to the few intact areas of native grassland potentially affected by this alternative would be ***moderate***.

Impacts to TES plant species under this alternative will be evaluated if TES plant species are observed during the additional vegetation surveys scheduled for spring/summer 2010.

Combination B Alternative

The Combination B Alternative would involve construction of approximately 40 miles of new transmission line. This alternative would involve the installation of approximately 178 towers and construction of approximately 35 miles of new access roads. Construction of this alternative would disturb an estimated 361 acres of land. More than half (59 percent) of this disturbance would occur in areas classified as disturbed grassland (Table 3-15). Construction would also disturb an estimated 85 acres of cropland, 19 acres of native grassland, and 44 acres of potential native grassland. The Combination B Alternative would result in more total construction-related disturbance than the other action alternatives (Table 3-15). Acres of impacts to native grassland due to construction of this alternative would be similar to the North Alternative and slightly more (approximately 4.6 acres more) than the South or Combination A alternatives. Construction of the Combination B Alternative would also result in more acres of impact to potential native grassland than under the North, South, and Combination A alternatives. In addition, the Combination B Alternative would cross the larger, relatively undisturbed area of native grassland discussed above under the North Alternative. Impacts to this area would be ***moderate to high*** because this is one of few relatively intact areas of native grassland in the project area.

Under the Combination B Alternative, approximately 190 acres of land would be permanently occupied by tower footings and new access roads. Permanently disturbed areas would also include approximately 119 acres of disturbed grassland, 43 acres of cropland, 9 acres of native grassland, and 18 acres of potential native grassland (Table 3-16). The Combination B

Alternative would also result in more acres of permanent impacts than the other action alternatives; however, permanent impacts to native grassland would be similar under all action alternatives. Acres of permanent impacts to potential native grassland would be slightly more under this alternative than under the North, South, or Combination A alternatives.

New access roads, which increase the potential for the spread of noxious weeds, would disturb approximately 167 acres of ground under the Combination B Alternative. The majority of road-related disturbance (i.e., movement of construction equipment and other vehicles) would occur in areas classified as disturbed grassland, with an estimated 38 acres of cropland, 8 acres of native grassland, and 15 acres of potential native grassland also disturbed due to new access roads (Table 3-16). Impacts of the potential spread of noxious weeds for cropland and disturbed grassland would be ***low*** to ***moderate*** and ***low***, respectively. Noxious weed impacts to the few intact areas of native grassland potentially affected by this alternative would be ***moderate*** to ***high*** because the potentially affected areas include a larger, relatively undisturbed area of native grassland observed along the northwestern section of this alternative where it shares an alignment with the North Alternative.

Impacts to TES plant species under this alternative will be evaluated if TES plant species are observed during the additional vegetation surveys scheduled for spring/summer 2010.

3.3.3 Mitigation Measures

Vegetation Communities

The following mitigation measures have been identified to reduce or eliminate potential impacts on vegetation communities under the action alternatives:

- Limit ground-disturbing activities to tower sites, access roads, and staging areas; stake or flag native grassland or sensitive cropland areas prior to initiating construction.
- Limit road improvements to the minimum amount necessary to safely move equipment, materials, and personnel into and out of the construction area.
- Avoid introduction of non-native seed into areas of native grassland and/or areas where non-native species are not yet well established.
- Use an approved native seed mix to re-vegetate areas of native grassland disturbed during construction activities.
- Use an approved mixture of native and non-native species or seed for re-vegetation in areas were non-native species are already well established (i.e., disturbed grassland).
- Use a seed mix approved by the local FSA to re-vegetate areas of CRP land that are disturbed during construction activities.

Threatened, Endangered, and Sensitive Plant Species

The following mitigation measures have been identified to reduce or eliminate potential impacts on TES plant species under the action alternatives:

- Conduct additional surveys for TES plant species in all areas of native grassland, as well as areas classified as potential habitat, during spring/summer 2010.
- Consult with the USFWS concerning any federally listed TES plant species that are identified and implement any mitigation measures to eliminate or reduce adverse impacts to these species.

Noxious Weeds

The following mitigation measures have been identified to reduce or eliminate the potential for the spread of noxious weeds under the action alternatives:

- Comply with all federal, state, and county noxious weed control regulations and guidelines.
- Wash all equipment using pressure or steam before entering the project area and when leaving discrete patches of noxious weeds.
- Map and flag noxious weed populations for construction crews so these populations can be avoided when possible. Clean vehicles after leaving these areas to avoid the spread of noxious weeds.
- Use seed mixes to revegetate construction areas that meets the requirements of federal, state, and county noxious weed control regulations and guidelines.
- Use certified weed-free straw for erosion control during construction and restoration activities.
- Cooperate with private, county, state, and federal landowners to treat noxious weeds along access roads that will be used to bring construction equipment into the project area to reduce the introduction and spread of noxious weeds and noxious weed seeds.
- Apply herbicides according to labeled rates and recommendations to ensure protection of surface water, ecological integrity, and public health and safety.
- Conduct a post-construction noxious weed survey to determine whether noxious weeds have been spread within the project area. Take corrective action if needed.

3.3.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, construction of the proposed transmission line would not occur and vegetation communities and TES plant species found within the project area would likely remain in their current state. Current ongoing activities, such as farming and grazing, would continue to affect vegetation communities and have the potential to affect TES plant species in the project area under this alternative. Under this alternative, noxious weeds would continue to spread in the project area at current rates, with treatment conducted at landowner discretion.

3.4 Recreation

3.4.1 Affected Environment

The proposed project is located in the lower Snake River area of eastern Washington. Recreational activities in the general vicinity of the project area include boating, fishing, hunting, camping, hiking, wildlife watching, sightseeing, photography, and cultural and historical tourism, such as re-tracing the Lewis and Clark expedition. General day-use activities, including swimming, picnicking, and sports games, also occur in the broader project area. Many of these activities are focused along the banks of the Snake River north and west of the project corridor. Recreation areas located in the general project area and recreation activities that may occur within or near the project area are described below.

Recreation Areas

Lake Bryan at Little Goose Lock and Dam

Construction of Little Goose Dam resulted in the formation of 37-mile-long Lake Bryan, which extends eastward up the lower Snake River to Lower Granite Dam (Figure 3-4). The following recreation sites and activities are available around Lake Bryan:

Central Ferry Park. This park is a 170.5-acre recreation area, located on the north bank of the lower Snake River at River Mile (RM) 83 (National Recreation Reservation Service 2009a, USACE 2009b). Opening and closing dates depend upon use and weather. The park's season of operation runs from mid-March through mid-November, with the campground remaining open 24 hours a day. The park is somewhat isolated and is in the middle of wheatfields and cattle grazing areas. The park has many trees and lawns. Recreation activities include beach interests (such as sunbathing), bird watching, boating, canoeing, fishing, camping, hiking, visiting historic sites, horseshoe pitching, jet skiing, kayaking, photography, sightseeing, wildlife viewing, windsurfing, and day-use activities. Horses and hunting are prohibited.

Little Goose Landing. Little Goose Landing is a 61-acre recreation area that is open year-round with no specific hours of operation (USACE 2009b). It is on the south bank of the Snake River at RM 72. Recreation activities include camping, boating, and day-use activities. Horses and hunting are prohibited.

Little Goose Dam. A 2-acre recreation area is located at Little Goose Dam. This area, located approximately 9 miles northeast of Starbuck, Washington at RM 71 on the lower Snake River, is open year-round during hours of operation (USACE 2009b). Recreation activities include fish viewing, fishing, primitive camping, and day-use activities. Horses and hunting are prohibited.

Lake West at Lower Monumental Lock and Dam

Construction of Lower Monumental Dam resulted in the formation of 28-mile-long Lake West, which extends eastward upriver to Little Goose Dam (Figure 3-4). The following recreation sites and activities are available around Lake West:

Riparia. Riparia is a 32-acre recreation area that is open year-round with no specific hours of operation (USACE 2009c). It is on the north bank of the lower Snake River at RM 67. Recreation activities include camping and day-use activities. Horses and hunting are prohibited.

Texas Rapids. Located on the south bank of the lower Snake River at RM 66, Texas Rapids is a 113-acre recreation area that is open year-round with no specific hours of operation (USACE 2009c). Recreation activities include camping, boating, and day-use activities. Horses and hunting are prohibited.

Tucannon River. The Tucannon River drains into the lower Snake River downstream from Texas Rapids and approximately 4 miles upstream from Lyons Ferry Park. The river and surrounding area are used for boating, fishing, camping, and hiking.

Lyons Ferry Park. Located on the north bank of the lower Snake River at RM 59.5 (USACE 2009c), Lyons Ferry Park is open May 15 through Labor Day. Recreation activities include camping, boating, hiking, canoeing/kayaking, and day-use activities. Various facilities are available, including the Lyons Ferry Historic Site (antique ferry display), Marmes Rockshelter, and Palouse Canyon Natural Area. Horses and hunting are prohibited. An estimated 60,000 to 80,000 vehicles visit Lyons Ferry Park and Marina annually and demand is increasing (Entrix, Inc. 2009).

Lyons Ferry Marina. Lyons Ferry Marina is a 37-acre recreation area that is open year-round (USACE 2009c). It is on the south bank of the lower Snake River at RM 59. Recreation activities include camping, boating, picnicking, and day-use activities. Horses and hunting are prohibited.

Ayer Boat Basin. Located on the south bank of the lower Snake River at RM 51, Ayer Boat Basin is a 170-acre recreation area that is open year-round with no specific hours of operation (USACE 2009c). Recreation activities include camping, boating, and day-use activities. Hunting is prohibited.

Devils Bench. Devils Bench, a 52-acre recreation area located on the north bank of the lower Snake River at RM 42, is open year-round with no specific hours of operation (USACE 2009c). Recreation activities include camping, boating, and day-use activities. Horses and hunting are prohibited.

Lower Monumental Dam. The Lower Monumental Dam recreation area includes 419 acres located on both sides of the lower Snake River at RM 42 (USACE 2009c). Recreation activities include boating and day-use activities. Horses and hunting are prohibited. Crossing the dam is currently closed until further notice.

Lake Sacajawea at Ice Harbor Lock and Dam

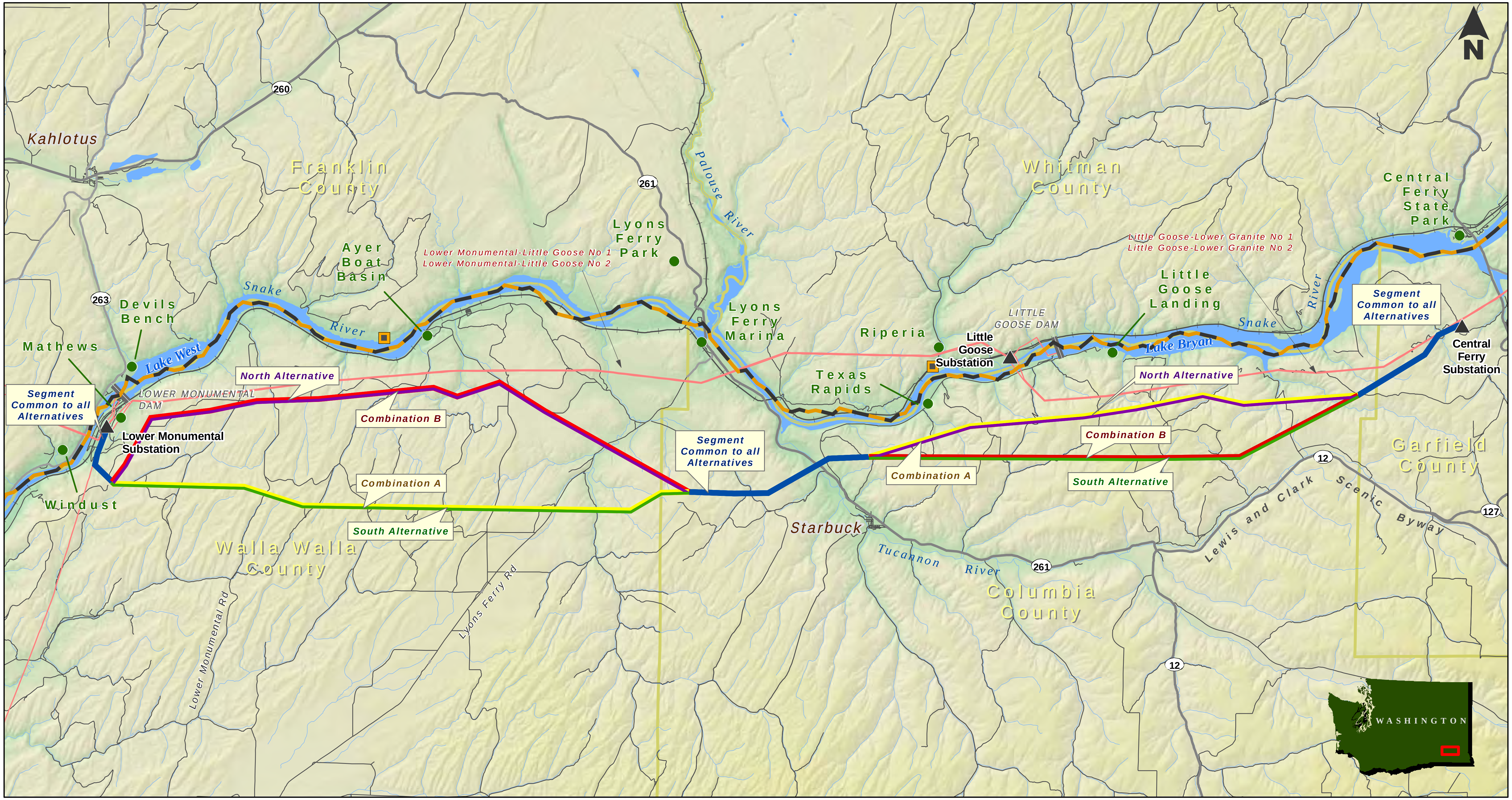
Construction of Ice Harbor Dam resulted in the formation of 35-mile-long Lake Sacajawea, which extends northeastward up the lower Snake River to Lower Monumental Dam (Figure 3-4). The following recreation sites and activities are available around Lake Sacajawea:

Mathews. Located on the south bank of the lower Snake River at RM 41, Mathews is a 15-acre recreation area that is open year-round with no specific hours of operation (USACE 2009d). Recreation activities include camping, boating, and day-use activities. Hunting is prohibited.

Windust. Windust is a 54-acre recreation area located on the north bank of the lower Snake River at RM 39 (National Recreation Reservation Service 2009b, USACE 2009d). Dry camping is available from September 8 through March 31, and camping when restrooms and water are available is from April 1 through September 7. Recreation activities include camping, boating, and day-use activities. Horses and hunting are prohibited. The area is used by boaters, upland game hunters, and anglers. Visitors also watch barge traffic pass through the navigation locks.

Lewis and Clark National Historic Trail

The outbound journey of the Lewis and Clark expedition traveled down the lower Snake River. History enthusiasts re-trace the route of the expedition. SR 127, SR 261, SR 263, Magallon Road, Lower Monumental Road, Little Goose Dam Road, and Ayer Road are the primary travel routes for reaching publicly-accessible locations along the lower Snake River to view the route of the Lewis and Clark expedition. Two Lewis and Clark expedition campsites are located along the



BONNEVILLE POWER ADMINISTRATION

Data Source:
Bonneville Power Administration Regional GIS Database.
All data is best available, 12/15/2009

0 2.5 5 10 Miles

Proposed Route Alternatives
(Route sections shown adjacent to one another share the same proposed alignment)

- Segments Common to all Alternatives
- North Alternative
- South Alternative
- Combination A Alternative
- Combination B Alternative
- Substation
- Federal Dam
- Existing BPA Transmission Lines
- Recreation Site
- Lewis and Clark Campsite
- Lewis and Clark Trail
- Major Highway
- Roads
- Railroad
- County Boundary

Bonneville Power Administration
Central Ferry-Lower Monumental 500-kV
Transmission Line Project
Figure 3-4
Recreation

File Path: W:\work\ryan\PROJECTS_2\09\RDB090006\EIS\Rec_11x17.mxd, Date: March 19, 2010 9:54:34 AM lower Snake River (Figure 3-4). These campsites are accessed via Little Goose Dam Road and Ayer Road, respectively.

Washington State-Owned Lands

None of the action alternatives would cross any WDNR or other Washington state designated recreational facilities or trails. WDNR does, however, allow the use of state lands in the project area for hunting, fishing, and other dispersed recreation. Sightseeing and hunting in the general project area are discussed in the following section.

Recreation Activities

Sightseeing

The Lewis and Clark Trail Scenic Byway is 572 miles long in Washington and extends from Clarkston on the Idaho border to Cape Disappointment on the Pacific Coast (Washington State Department of Transportation [WSDOT] 2009). U.S. Route 12, which passes through the project area, is part of this byway. In this area of Washington, dry-land agriculture on rolling hills between dispersed farms and ranches is the primary scenic attraction along the winding byway. At its closest point U.S. Route 12 is approximately 0.8 mile south of the project corridor (Figure 3-4). The location of this point is identified as Viewpoint 2 in Figure 3-7 in Section 3.7 Visual Resources.

The Palouse is a region that encompasses parts of southeastern Washington and north central Idaho. Traditionally, this region was defined as the hills and prairies north of the Snake River, centered on the Palouse River. Today, the region is sometimes used to refer to the entire wheat growing region, including Walla Walla County, south of the Snake River. This region is typically characterized by rolling hills on deep soils. Most of the native prairie has been converted to agriculture and dry land wheat farming is common. Typical recreation activities in the Palouse include visiting small towns, watching wildlife, photography, and sightseeing. The Palouse Scenic Byway consists of 208 miles of connected highways located in the heart of the Palouse Region, north of the lower Snake River and outside the project area (Pullman Chamber of Commerce 2010).

Hunting

Hunting occurs on private and WDNR-managed lands in the project area. There are three locations in the general project area where private landowners have entered into Hunt by Written Permission or Feel Free to Hunt agreements with the WDFW to allow public access for hunting. None of these areas are located directly within the project corridor of any of the action alternatives. Hunting also occurs on other private lands in the project area, with property owners hosting hunting on their property for family members, friends, or with other people through private agreements. In addition, WDNR allows the public use of the lands it manages for hunting.

Under the terms of the WDFW Hunt by Written Permission or Feel Free to Hunt programs, WDFW hunting access signs must be posted on site for hunters to enter private lands. In order to hunt on property in the WDFW Hunt by Written Permission program hunters must visit the site and contact the landowner to acquire a permission slip (WDFW 2009a). Hunters must have a valid permission slip with them while hunting on the property. Landowner contact information is located on signs posted on the property. In addition, hunters must still obey all posted signs on the property, including safety zone and vehicle restriction signs.

There are no requirements for additional landowner permission for hunters to be able to hunt on property enrolled in the WDFW Feel Free to Hunt program (WDFW 2009a). While additional permission is not needed, hunters must still obey all posted signs on the property, including safety zone and vehicle restriction signs.

The public may hunt under WDFW Hunt by Written Permission or Feel Free to Hunt agreements at the following three locations on private land in the general project area (WDFW 2009a):

- Near New York Gulch Road and SR 127 intersection: The size of the hunting area is 6,106.7 acres. The hunting agreement type is Hunt by Written Permission. The hunting access dates are during hunting season. The public can hunt deer, pheasant, and quail.
- Near SR 127 and U.S. Route 12 intersection: The size of the hunting area is 1,951.8 acres. The hunting agreement type is Feel Free to Hunt. The hunting access dates are during hunting season. The public can hunt pheasant and deer.
- Near Smith Hollow Road and SR 261 intersection: The size of the hunting area is 9,465 acres. The hunting agreement type is Hunt by Written Permission. The hunting access dates are during hunting season. The public can hunt pheasant and deer.

Hunting also occurs on private and WDNR-managed lands elsewhere in the project vicinity. As noted above, private property owners who do not participate in WDFW's Hunt by Written Permission or Feel Free to Hunt agreement programs may host hunting on their property for family members, friends, or others through private agreements. No formal data exists on this type of private hunting, but according to WDFW, the majority of potentially affected property owners likely allow hunting (Schirm 2010). WDNR allows the public use of the lands it manages for hunting, but has no formal data on hunting use of the WDNR-managed lands in the vicinity of the proposed project. Hunted game on lands in the general project area likely includes deer and upland birds.

The Eastern Washington Pheasant Enhancement Program has a pheasant release site in the project area. The John Henley pheasant release site is adjacent to Little Goose Dam Road near the lower Snake River (WDFW no date). Each year thousands of pheasants are released on lands open for public hunting (WDFW 2009b). Pheasants may also be released sporadically on lands open under the Feel Free to Hunt Program.

The hunting season for pheasant, quail, and deer in eastern Washington is as follows (WDFW 2009c):

- Ring-necked pheasant: September 26-27 (youth) and October 24, 2009-January 18, 2010
- Mountain quail: Closed
- California quail: September 26-27 (youth) and October 3, 2009-January 18, 2010
- White-tailed deer: October 17-25 (modern firearms), September 1-20 (archery), September 26-October 4 (muzzleloader)
- Mule deer: October 17-25 (modern firearms), September 1-20 (archery), September 26-October 4 (muzzleloader).

Other game species hunted in the project area include Chukar, Gray partridge, northern bobwhite, Mourning dove, and a number of small game species.

3.4.2 Environmental Consequences of Action Alternatives

Impacts Common to All Action Alternatives

Lake Bryan, Lake West and Lake Sacajawea

Construction, operation, and maintenance of the action alternatives would not occur at or near recreation sites around Lake Bryan, Lake West, or Lake Sacajawea. The proposed project would have ***no*** effect on access to recreation sites around Lake Bryan, Lake West, or Lake Sacajawea. However, transmission towers and conductors would be visible from some of the recreation sites and activities around Lake Bryan, Lake West, and Lake Sacajawea. This could potentially reduce the quality of outdoor recreation experiences due to the visibility of permanent, man-made features. However, this impact would be ***low***, because the visual setting for recreation at these areas is only one aspect of the outdoor recreation experience, and there are already high-voltage transmission lines visible from parts of these areas. Also, these areas are not specifically protected for their visual qualities for outdoor recreation. Impacts on visual resources are discussed in Section 3.7 Visual Resources.

Lewis and Clark National Historic Trail

The outbound journey of the Lewis and Clark expedition traveled down the lower Snake River. At its closest point (the western end of the project area), all four action alternatives would be approximately 0.3 mile from the lower Snake River and the two historic Lewis and Clark expedition campsites located along the lower Snake River. Construction, operation, and maintenance of the proposed project would not occur along the bank of the lower Snake River or at expedition campsites, and would not alter access to the lower Snake River or the expedition campsites. Some transmission towers and conductors would be visible from the lower Snake River and the areas of the expedition campsites. This could potentially reduce recreation experiences related to re-tracing history due to the visibility of towers and conductors that alter the historical setting of the expedition. However, this impact would be ***low***, because the visual setting is only one aspect of re-tracing history, and high-voltage transmission lines and other types of development are already present along the Lewis and Clark National Historic Trail and visible to individuals re-tracing the trail. Also, this area of the lower Snake River is not specifically protected for its visual qualities for this type of recreation. Impacts on visual resources are discussed in Section 3.7 Visual Resources.

Sightseeing

U.S. Route 12, which is part of the Lewis and Clark Trail Scenic Byway, passes through the project area, approximately 0.8 mile south of the project corridor at its closest point (Figure 3-4). Construction, operation, and maintenance of the action alternatives would not occur immediately adjacent to U.S. Route 12 and would not permanently alter access to this route. However, this highway would be used for the movement of vehicles and heavy equipment and materials to construction work areas under all of the action alternatives. Impacts to sightseeing along U.S. Route 12 would be ***moderate*** during construction. Depending on the action alternative selected, following construction, the proposed transmission line would be visible from U.S. Route 12. Potential impacts to sightseeing following construction are discussed below by action alternative.

Construction of the project would involve the movement of vehicles and heavy equipment through Walla Walla County, which is sometimes included in broader definitions of the Palouse region. The action alternatives would not, however, be expected to affect sightseeing from the roads that comprise the Palouse Scenic Byway, which is located north of the Snake River and unlikely to be heavily affected by construction-related traffic.

Hunting

There are three locations where the public may hunt on private land in the general project area, but none are located along any of the action alternatives. Although no formal data exists, hunting is also believed to occur on private lands elsewhere in the project vicinity, with the majority of the potentially affected property owners likely allowing hunting (Schirm 2010). In addition, WDNR allows hunting on the lands it manages in the project area.

During construction, noise from equipment and helicopters could displace wildlife either away or toward hunting areas. The displacement of wildlife from hunting areas would result in less wildlife in those areas, thereby diminishing the hunting experience. In other locations and depending on the construction schedule, wildlife displaced toward hunting areas would result in more wildlife for hunting, thereby enhancing the hunting experience. These adverse and beneficial impacts would be localized and limited to the construction phase of the project, with overall impacts expected to be ***temporary*** and ***low***. Potential impacts on wildlife are described in Section 3.5 Wildlife.

Operation and maintenance of the proposed transmission line would not occur on or alter access to lands that participate in the Hunt by Written Permission or Feel Free to Hunt agreement programs. Impacts to these lands during construction would therefore be ***low***.

The following sections describe potential impacts on recreation resources specific to each of the action alternatives.

North Alternative

The North Alternative would not be visible from U.S. Route 12 and would, therefore, have ***no*** impact on sightseeing from the Lewis and Clark Trail Scenic Byway.

South Alternative

At its closest point, U.S. Route 12 (part of the Lewis and Clark Trail Scenic Byway) is approximately 0.8 mile south of the South Alternative. The proposed towers and conductors would introduce a skyline to the landscape, altering the texture of the horizon. This would diminish the attractiveness of the natural and rural landscape that is characteristic of this segment of the scenic byway. The impacts on sightseeing from this location along U.S. Route 12 after construction of the South Alternative would be ***moderate to high***. These impacts would decrease as the distance between the highway increases in either direction from this point and the intervening landscape and relative positioning of the transmission changes (see Figure 3-4). For more information on visual impacts see Section 3.7 Visual Resources.

Combination A Alternative

The Combination A Alternative would not be visible from U.S. Route 12 and would, therefore, have ***no*** impact on sightseeing from the Lewis and Clark Trail Scenic Byway.

Combination B Alternative

The impacts on sightseeing from the closest point along U.S. Route 12 would be the same as those described for the South Alternative.

3.4.3 Mitigation Measures

Impacts to recreational use would largely be associated with changes in viewsheds and the general recreational experience from the presence of the proposed transmission line. Mitigation measures concerning these potential visual effects are identified in Section 3.7.3 of this EIS.

3.4.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impacts on recreation.

3.5 Wildlife

3.5.1 Affected Environment

Existing Wildlife Habitat and Associated Wildlife Species

Prior to European settlement, the landscape of the lower Snake River region was dominated by large expanses of bunchgrass (i.e., perennial) grasslands interspersed with big sagebrush shrub-steppe (Daubenmire 1988). Today, most of this landscape has been converted to either dry-land wheat farming or disturbed grasslands, dominated by exotic annuals, which have been transformed through past grazing practices and wildfire. What remains of the shrub-steppe community is sparse and patchy, and is now dominated more by invasive gray rabbitbrush than sagebrush.

The vegetation communities that provide wildlife habitat within the project area are primarily cropland (dry-land wheatfields), disturbed and native grasslands, and sparse patches of shrub-steppe community. Additional habitats important to wildlife found within, or very near, the proposed project include rocky features such as cliffs and rock outcrops, and riparian areas found along the Tucannon and Snake Rivers (including shorelines and open water). Habitat types and associated wildlife species found within the project area are discussed below. A summary of the species believed to commonly occur in each habitat type is presented in Table 3-17. Figure 3-5 presents an overview of existing wildlife habitat in the project vicinity. This figure was developed using data from the USGS NLCD (2001) and the WDFW Priority Habitats and Species (PHS) database (WDFW 2009d).

A general wildlife field survey was conducted along the proposed project corridors in September 2009. Information on wildlife resources in the vicinity of the project area, including known and suspected occurrence, was compiled from many sources during a pre-field review. These sources included the WDFW PHS database (WDFW 2009d), National Audubon Society (NAS) Important Bird Area (IBA) database (NAS 2009), North American Breeding Bird Survey database (USGS 2009b), The Nature Conservancy (TNC) list of Places They Protect (TNC 2009), Northwest Regional Gap Analysis Project (ReGap) (USGS 2009c), and Watershed Updates by Water Resource Inventory Area (WRIA) (Ecology 2009a).

The focus of the field survey was to identify and document potential or actual raptor nesting habitat and nest sites, mule and/or whitetail deer sign and habitat locations, although all other species observed were recorded as well. A complete list of species observed during the field survey is presented as Appendix B. The timing of the fall general wildlife field survey did not overlap with the breeding season of most wildlife species, including raptors. As a result, an additional field survey is scheduled for summer 2010. This survey will target potential raptor nesting habitat and nest sites identified during the fall general wildlife survey.

Grassland/Shrub-Steppe

Open grasslands dominated by a mix of native bunchgrasses and exotic annuals are the dominant habitat in the project area. Isolated patches of shrub-steppe can be found mostly in the draw bottoms where moisture regimes are higher, affording some protection from wildfires. For this discussion, grassland/shrub-steppe is considered to be composed of all grassland areas (disturbed grassland, native grassland, and potential native grassland) and all shrub-steppe habitats. Disturbed grassland accounts for the majority of this category in the project corridor (see Section 3.3 Vegetation, Table 3-12). Figure 3-5 shows the general distribution of grassland in the project area. These data are from the USGS NLCD (2001) and include areas identified by the USGS as Schrub/Shrub and Grassland/Herbaceous.

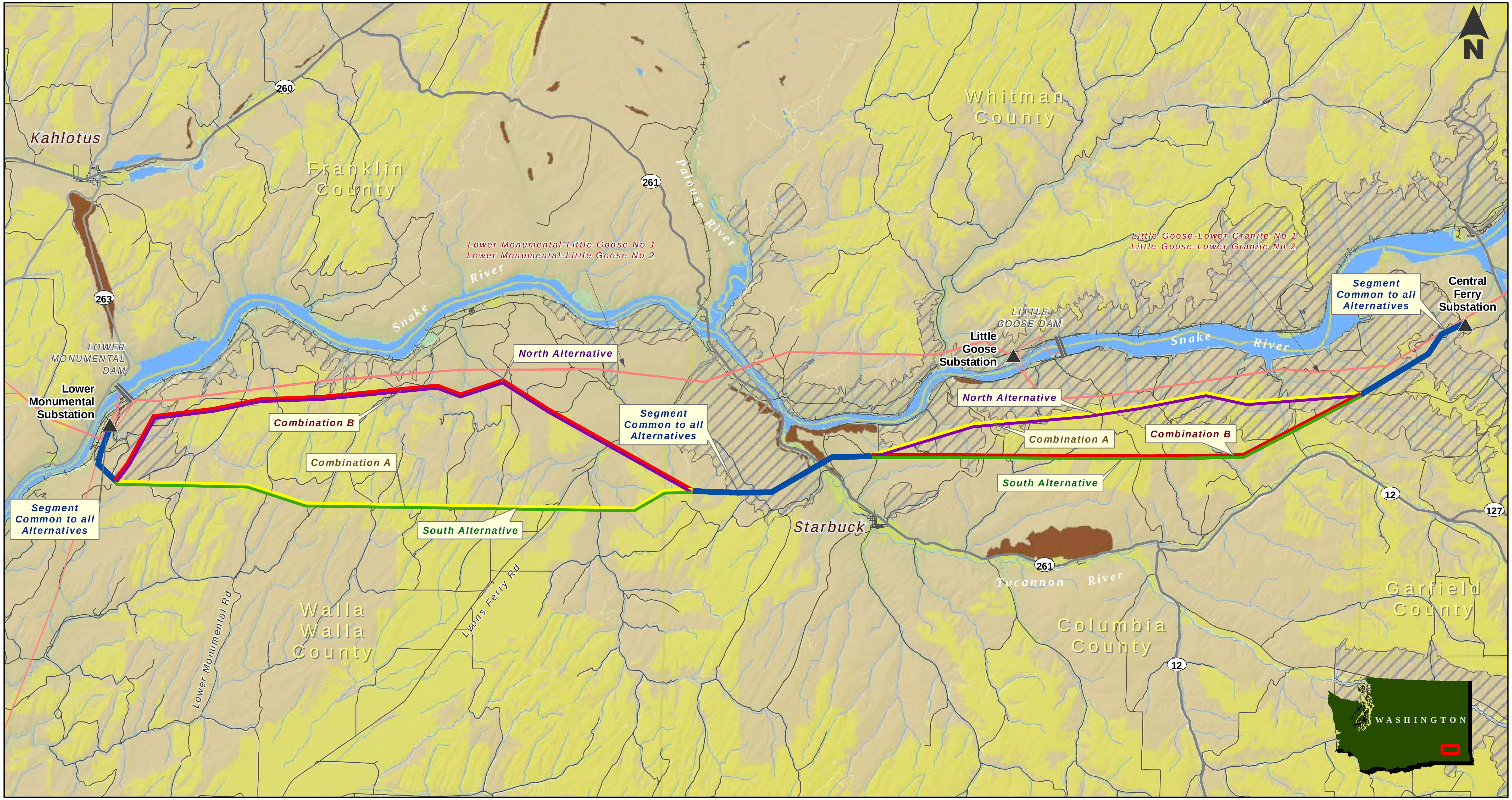
A wide variety of wildlife use these habitats although some species are more common than others. Northern harriers, Swainson's hawks, ferruginous hawks, northern rough-legged hawks, golden eagles, and short-eared owls hunt these grasslands for rodents such as northern pocket

Table 3-17. Habitat Types and Associated Wildlife Species Commonly Found in the Project Area[1/]

Generalists Found Throughout Area	Habitat Type				
			Rock Features		
	Grassland/Shrub-Steppe	Riparian	Cliff Faces	Rock Outcrops	Cropland
Red-tailed Hawk	Northern Harrier	Ring-necked Pheasant	Golden Eagle	Ferruginous Hawk	
American Kestrel	Swainson's Hawk	California Quail	Prairie Falcon	Chukar	Canada Goose
Deer Mouse	Ferruginous Hawk	Killdeer	Rock Dove	Say's Phoebe	Mallard
Coyote	Northern Rough-legged Hawk	Mourning Dove	Barn Owl	Horned Lark	Northern Harrier
Long-tailed Weasel	Golden Eagle	Great Horned Owl	Great Horned Owl	Common Raven	Swainson's Hawk
Bobcat	Ring-necked Pheasant	Long-eared Owl	Cliff Swallow	Rock Wren	Gray Partridge
Mule Deer	Gray Partridge	Northern Flicker	Violet-green Swallow	Western Meadowlark	Chukar
	Chukar	Western Kingbird	Common Raven	Nuttall's Cottontail	Ring-necked Pheasant
	California Quail	Eastern Kingbird	Small-footed Myotis	Yellow-bellied Marmot	California Quail
	Mourning Dove	Black-billed Magpie	Little Brown Bat	Bushy-tailed Woodrat	Mourning Dove
	Short-eared Owl	American Robin	Townsend's Big-eared Bat	Porcupine	Barn Owl
	Common Nighthawk	Brewer's Blackbird	Canyon Bat	American Badger	Great Horned Owl
	Horned Lark	Brown-headed Cowbird	Yellow-bellied Marmot	Striped Skunk	Common Nighthawk
	Black-billed Magpie	Bullock's Oriole	Bushy-tailed Woodrat	Spotted Skunk	Western Kingbird
	Vesper Sparrow	American Goldfinch	Western Rattlesnake	Skink	Horned Lark
	Savannah Sparrow	Vagrant Shrew		Rubber Boa	Barn Swallow
	Western Meadowlark	Big Brown Bat		Racer	Black-billed Magpie
	Brown-headed Cowbird	Little Brown Bat		Nightsnake	Common Raven
	Nuttall's Cottontail	Beaver		Gopher Snake	Western Meadowlark
	Columbia Ground Squirrel	Montane Vole		Western Rattlesnake	Nuttall's Cottontail
	Washington Ground Squirrel	Muskrat			Northern Pocket Gopher
	Northern Pocket Gopher	Raccoon			American Badger
	Great Basin Pocket Mouse	Mink			Striped Skunk
	Northern Grasshopper Mouse	Striped Skunk			Coyote
	Western Harvest Mouse	White-tailed Deer			Gopher Snake
	American Badger	Tiger Salamander			
	Great Basin Spadefoot	Long-toed Salamander			
	Short-horned Lizard	Woodhouse's Toad			
	Sagebrush Lizard	Pacific Treefrog			
	Racer	Western Terrestrial Garter Snake			
	Gopher Snake	Common Garter Snake			

Note:

1/ Habitat and species data compiled during the fall field survey and from the following sources: Leonard et al. (1993), Storm and Leonard (1995), Dvornich et al. (1997), Johnson and Cassidy (1997), Smith et al. (1997), St. John (2002), Wahl et al. (2005).



0 2.5 5 10 Miles

Data Sources:
BPA Regional GIS Database
USGS 2001 National Land Cover Database
WDFW 2009 Priority Habitat and Species Database

Potential Mule Deer Habitat
(These areas mapped by WDFW indicate where mule deer are believed to concentrate based on the presence of suitable habitat)
Cliffs (PHS Database)
Grassland
Agriculture

Proposed Route Alternatives
(Route sections shown adjacent to one another share the same proposed alignment)
Segments Common to all Alternatives
North Alternative
South Alternative
Combination A Alternative
Combination B Alternative

Substation
Federal Dam
Existing BPA Transmission Lines

County Boundary
Major Highway
Road
Railroad

Bonneville Power Administration
Central Ferry-Lower Monumental 500-kV
Transmission Line Project
Figure 3-5
Wildlife Habitat

File Path: W:\work\ryan\PROJECTS_2\09\RDB090006\EIS\Willdlife_11x17.mxd, Date: March 19, 2010 10:06:59 AM gophers, Great Basin pocket mice, and deer mice (Table 3-17). Rabbits are also important prey species with Nuttall's cottontails found predominately in the sagebrush patches. American badgers, racers, and gopher snakes are also commonly found in these habitats where they hunt primarily rodents.

The most common passerines using the local grasslands are western meadowlarks and horned larks, while brown-headed cowbirds can be found in association with grazing cattle when they are present. Great Basin spadefoots, short-horned lizards, and sagebrush lizards are also found in these habitats, although each requires unique micro-habitat conditions that may or may not be present. Finally, the shrub habitats in the draw bottoms are used by a variety of gallinaceous birds for cover. Species common to this area include gray partridge, chukars, ring-necked pheasants, and California quail. Draw bottoms also provide cover for mule deer and denning habitat for coyotes.

Rock Features

Two types of rock features dominate the project area; cliffs and rock outcrops.

Cliffs

Large cliff habitats (large vertical walls of rock) are found in the project area on the east shore of the Tucannon River and on the south shore of the Snake River, near the Lower Monumental Substation (see Figure 3-5). Cliffs are most prevalent outside the project corridor along the south shore of the lower Snake River. Although cliffs are similar to rock outcrops, their tall expansive faces provide unique nesting and roosting habitat not present on smaller rock outcrops. Golden eagles, prairie falcons, red-tailed hawks, American kestrels, rock doves, barn owls, great horned owls, cliff swallows, violet-green swallows, common ravens, and even Canada geese, are all known to nest on Snake River cliffs (Ecology 2009a; see Table 3-17). Crevices and small caves are used by roosting bats, especially small-footed myotis and canyon bats. Small and medium sized mammals such as deer mice, yellow-bellied marmots, and bushy-tailed woodrats also den in these features along with a diversity of reptiles such as snakes and lizards. Large mammals such as mule deer also use cliffs for resting and protection from weather and predators.

Rock Outcrops

Rock outcrops, which range from small rock faces generally less than 20 feet in height to jumbled strings of rocks, are scattered throughout the project area (although few or any are actually bisected by the project corridor). Many of the species that use cliffs also use rock outcrops, especially those that do not require tall vertical cliffs for breeding or roosting, such as marmots, woodrats, and rattlesnakes (Table 3-17). Rock outcrops provide important nesting habitat for ferruginous hawks, Say's phoebes, and rock wrens; and offer protective cover for chukars. Porcupines, Nuttall's cottontails, bobcats, coyotes, and spotted skunks den amongst the rubble, often in abandoned marmot burrows enlarged by pursuing predatory badgers. These rock features are probably the most important for reptiles. Skinks, rubber boas, racers, nightsnakes, gopher snakes, and rattlesnakes use these features year-round, but seek necessary winter denning sites in the cavities they provide. Rock outcrops are prominent features in an otherwise rolling or level landscape, and thus, provide vantage points for perching birds, especially hawks, eagles, ravens, and meadowlarks.

Riparian

Riparian habitat in the project area is located primarily where the project corridor crosses the Tucannon River. Extensive riparian habitat is also found north of the proposed corridor along the Snake River shorelines and in areas of riverside ponds. The riparian habitat found along the Tucannon River is dominated by deciduous trees such as black cottonwood, quaking aspen, white alder, peachleaf and other willows, and a diversity of shrubs (Ashley and Stovall 2004). Although riparian habitat accounts for relatively a small amount of area in the local landscape, it supports a rich assemblage of wildlife. Canopy species include mourning doves, great horned and long-eared owls, northern flickers, both western and eastern kingbirds, American robin, Bullock's oriole, and American goldfinch (Table 3-17). Both little brown and big brown bats forage for insects within the canopy during summer nights. The riparian habitat also provides cover and forage for ground-dwelling wildlife species including ring-necked pheasants, California quail, vagrant shrews, montane voles, deer mice, striped skunks, white-tailed deer, western toads, and western terrestrial garter snakes. The aquatic environment of the Tucannon River riparian habitat supports beavers, muskrats, raccoons, mink, Pacific treefrogs, and common garter snakes. Although, much of the bottomland flanking the Tucannon River has been converted to irrigated alfalfa fields, these fields are still used by species such as northern harriers and short-eared owls for nesting, and by gamebirds seeking additional cover. North of the project corridor, the lower Snake River's more open shoreline supports nesting habitat for killdeer, while the riverside ponds are likely used by Woodhouse's toads and other amphibians for breeding.

Cropland

The dominant crop in the project area is dry-land wheat. Depending on the year and season, wheatfields within the project area are characterized by either dense wheat plants in various stages of growth or post-harvest stubble, or they are fallow. Relative to natural habitats, few wildlife species use the wheatfields because of the effects constant plowing and harvesting have on cover and small mammal habitat. However, wheatfields are readily used by Canada geese, mallards, ring-necked pheasants, and gray partridge, which feed on the waste grain in the fall; and mule deer, which feed on emerging wheat or fall greenup plants in the stubble. Grassland passerines such as horned larks, savanna sparrows, and western meadowlarks also use the wheatfields (Table 3-17). The presence of these avian species draws various predators to areas of cropland, though in lower densities than in more natural habitats. Predators include gopher snakes, northern harriers, Swainson's hawks, red-tailed hawks, American badgers, striped skunks, and coyotes. Farm homesteads associated with cropland also provide important habitat features such as outbuildings and large trees and shrubs planted as ornamentals or wind-breaks. Wildlife typically found at homesteads include Swainson's hawks, American kestrels, California quail, mourning doves, barn owls, great horned owls, western kingbirds, black-billed magpies, Nuttall's cottontails, and gopher snakes.

Figure 3-5 shows the general distribution of agricultural land in the project area. These data are from the USGS NLCD (2001) and include areas identified by the USGS as Cultivated Crops and Pasture/Hay.

Species of Interest

The ESA of 1973, as amended, declares that all federal agencies "…utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act." Section 7 of the ESA requires federal agencies to ensure that any agency action (any action authorized, funded, or carried out by the agency) is not likely to jeopardize the continued existence of any threatened, endangered, or proposed species. Agencies are further required to develop and carry out conservation programs for these species.

Table 3-18 lists 25 wildlife species of interest with the potential to occur in Garfield, Columbia, and Walla Walla counties. These include species identified under the ESA as threatened, candidate, or species of concern (USFWS 2009b) and species on the WDFW Species of Concern list (WAC 232-12-297) designated as threatened, sensitive, or candidate (WDFW 2009e). None of these species are currently designated as endangered. Twelve species are currently listed under the ESA. Nine are listed as species of concern and three listed as threatened or candidate: Canada lynx (threatened), yellow-billed cuckoo (candidate), and Washington ground squirrel (candidate) (Table 3-18). Although not listed under ESA or included on the WDFW Species of Concern list, mule deer, a common species in the area, have been identified by WDFW as a species of interest with the potential to be affected by proposed project activities (Schirm 2009, Schirm and Fowler 2009) and as a result, are also discussed below.

Table 3-18. Wildlife Species of Interest Potentially Occurring in the Project Area

Species	Federal Status[1/]	State Status[2/]	Likely Presence in the Project Area
Amphibian			
Rocky Mountain-tailed frog (*Ascaphus montanus*)	Not Listed	Candidate	Very Unlikely
Reptiles			
Sagebrush lizard (*Sceloporus graciosus*)	Species of Concern[3/]	Candidate	Potentially
Striped whipsnake (*Masticophis taeniatus*)	Not Listed	Candidate	Very Unlikely
Birds			
Bald eagle (*Haliaeetus leucocephalus*)	Species of Concern[3/]	Sensitive	Potentially
Golden eagle (*Aquila chrysaetos*)	Not Listed	Candidate	Potentially
Ferruginous hawk (*Buteo regalis*)	Species of Concern[3/]	Threatened	Confirmed
Merlin (*Falco columbarius*)	Not Listed	Candidate	Confirmed
Peregrine falcon (*Falco peregrinus*)	Not Listed	Sensitive	Unlikely
Greater sage-grouse (*Centrocercus urophasianus*)	Not Listed	Threatened	Very Unlikely
Burrowing owl (*Athene cunicularia*)	Species of Concern[3/]	Candidate	Unlikely
Lewis' woodpecker (*Melanerpes lewis*)	Not Listed	Candidate	Unlikely
Olive-sided flycatcher (*Contopus cooperi*)	Species of Concern[3/]	Not Listed	Very Unlikely
Loggerhead shrike (*Lanius ludovicianus*)	Species of Concern[3/]	Candidate	Potentially
Yellow-billed cuckoo (*Coccyzus americanus*)	Candidate[3]	Candidate	Very Unlikely
Sage thrasher (*Oreoscoptes montanus*)	Not Listed	Candidate	Very Unlikely
Sage sparrow (*Amphispiza belli*)	Not Listed	Candidate	Confirmed
Oregon vesper sparrow (*Pooecetes gramineus affinis*)	Not Listed	Candidate	Very Unlikely
Mammals			
Preble's shrew (*Sorex preblei*)	Species of Concern[4/]	Candidate	Unknown
Long-eared myotis (*Myotis evotis*)	Species of Concern[3/]	Not Listed	Unknown
Pallid Townsend's big-eared bat (*Corynorhinus townsendii pallescens*)	Species of Concern[3/]	Candidate	Unknown
Canada lynx (*Lynx canadensis*)	Threatened[3/]	Threatened	Very Unlikely
Washington ground squirrel (*Spermophilus washingtoni*)	Candidate[5/]	Candidate	Unknown
White-tailed jackrabbit (*Lepus townsendii*)	Not Listed	Candidate	Potentially
Black-tailed jackrabbit (*Lepus californicus*)	Not Listed	Candidate	Potentially
Mule deer (*Odocoileus hemionus*)[6/]	Not Listed	Not Listed	Confirmed

Notes:

NL – Not Listed

1/ Species identified on the federal ESA list of endangered, threatened, proposed candidate, and species of concern for Garfield, Columbia, and Walla Walla counties.

2/ State species were identified using the WDFW Species of Concern list.

3/ Federal status in Garfield, Columbia, and Walla Walla counties.

4/ Federal status in Columbia and Walla Walla counties.

5/ Federal status in Garfield and Columbia counties.

6/ Although they have no federal status, and are not included on the WDFW Species of Concern list, mule deer have been identified as a species of concern in the project area by WDFW (Schirm 2009, Schirm and Fowler 2009).

Sources: USFWS 2009b and WDFW 2009e

Species in this section are discussed according to the primary habitat type where they are likely to occur (see Table 3-19). Some of the species of concern may use more than one of the habitat types. These species are discussed once under the first habitat type they appear and these discussions are referenced in subsequent sections, as appropriate. In addition, several species are considered to be very unlikely to be present in the project area (see Table 3-18). These species of interest are identified in Table 3-19 as "Not Present" and are discussed at the end of the section.

Table 3-19. Potential Species of Interest by Habitat Type

Grassland/Shrub-Steppe	Rock Feature: Cliff Faces	Rock Feature: Rock Outcrops	Riparian	Cropland	Not Present
Sagebrush lizard Golden eagle Ferruginous hawk Merlin Peregrine falcon Loggerhead shrike Sage sparrow Preble's shrew Washington ground squirrel White-tailed jackrabbit Black-tailed jackrabbit Mule deer	Golden eagle Ferruginous hawk Peregrine falcon Long-eared myotis Pallid Townsend's big-eared bat Mule deer	Sagebrush lizard Ferruginous hawk	Bald eagle Peregrine falcon Lewis' woodpecker Long-eared myotis Townsend's big-eared bat	Merlin White-tailed jackrabbit Black-tailed jackrabbit Mule deer	Rocky Mountain-tailed frog Striped whipsnake Greater sage-grouse Burrowing owl Olive-sided flycatcher Yellow-billed cuckoo Sage thrasher Oregon vesper sparrow Canada lynx

Grassland/Shrub-Steppe Associated Species

Sagebrush lizard, golden eagle, ferruginous hawk, merlin, peregrine falcon, loggerhead shrike, sage sparrow, Preble's shrew, Washington ground squirrel, white-tailed jackrabbit, black-tailed jackrabbit, and mule deer are species of interest that do occur, or could potentially occur in grassland/shrub-steppe found in the project area.

Sagebrush lizard (*Sceloporus graciosus*) – State Candidate, Federal Species of Concern

Across its range, the sagebrush lizard inhabits a wide array of dry habitats including desert, forest-conifer, forest-mixed, grassland/herbaceous, sand/dune, shrubland/chaparral, woodland-conifer, woodland-hardwood, and woodland-mixed (NatureServe 2009). However, in the Columbia Basin, this species is strongly associated with stands of big sagebrush or antelope bitterbrush intermixed with sandy bare ground, and avoids habitats dominated by rabbitbrush or dense exotic or native grasslands (Green et al. 2001). While Green et al. (2001) did not observe rock use by sagebrush lizards in the Columbia Basin shrub-steppe, both Rodgers (1953) and Rose (1976) observed this behavior suggesting rocky outcrop habitats in the project area might support this small lizards. The sagebrush lizard is a "sit and wait" predator dashing out over open ground to capture prey and then quickly returning to cover afforded by large shrubs. Snakes, raptors, and shrikes are the most common predators. Columbia Basin sagebrush lizards are active during only the warmer months of the year (NatureServe 2009). No sign of this species was observed during the fall wildlife survey, although it is unlikely that they would have been active during the September survey period.

Golden eagle (*Aquila chrysaetos*) – State Candidate

Golden eagles are currently protected under the federal Bald and Golden Eagle Protection Act (16 U.S. Code [USC] 668(a); 50 CFR 22). They occupy most of western North America (Kochert et al. 2002) and are associated with open, arid sagebrush, ponderosa pine, and grassland habitats near cliffs and plateaus (Watson and Whalem 2003). Golden eagles nest throughout much of Washington State but are most common in the north-central highlands transitional area between montane and shrub-steppe habitats (Watson and Whalen 2003). This species primarily nest on cliffs or in large trees near open habitats such as shrub-steppe and grassland communities that support abundant prey (Marzluff et al. 1997, Kochert et al. 2002). Golden eagles use the same territory annually but may use alternate nests in different years. The migratory status of golden eagles in Washington is poorly understood though in the upper Columbia Basin they are thought to remain through winter (Knight et al. 1979 as cited in Watson and Whalen 2003).

Grassland/shrub-steppe found within the project area provides potential foraging habitat for golden eagles, and cliffs provide potential nesting sites. Small mammals such as rabbits, marmots, and ground squirrels make up the majority of their diet; however, insects, snakes, birds, juvenile ungulates, and carrion are also consumed (see Palmer 1988, NatureServe 2009). Primary threats to this species include habitat loss and disturbance, loss of foraging areas, and direct human-caused mortality (Kochert et al. 2002). Any golden eagle observations in the project area are likely related to either spring migration or foraging activity. No nest sites were identified during the fall wildlife survey or by the pre-field review (WDFW 2009d); however, known nesting habitat is present north of the project area along the cliffs of the lower Snake River near Lyons Ferry. The cliffs found on the east side of the Tucannon River where the action alternatives share the same alignment, provide the only potential nesting habitat within the project area.

Ferruginous hawk (*Buteo regalis*) – Federal Species of Concern, State Threatened

Ferruginous hawk habitat across much of the American west includes plateaus, plains, rolling grasslands, agricultural fields, and shrub-steppe (Bechard and Schmutz 1995). Southeastern Washington forms the northwestern range limit for this species; however, increasing fragmentation of shrub-steppe habitats from agricultural conversion and residential development has contributed to the decline and listing of the ferruginous hawk in Washington state (Watson 2003). Disappearance of shrub-steppe mammals such as black-tailed jackrabbits and Washington ground squirrels, and drought (Watson 2003), have contributed to dietary shifts of ferruginous hawks to smaller mammals, insects, and gulls (Leary et al. 1996, Richardson et al. 2001). Changes in prey-base and increased distance to foraging ranges may be affecting population numbers by reducing hawk survival (Leary et al. 1998, Richardson et al. 2001). Juvenile survival, although less important than adult survival to population maintenance, seems to be most impacted by poor foraging conditions in Washington (Leary et al. 1996, Richardson et al. 2001).

Nesting ferruginous hawks require substantial nest substrate such as isolated large trees, cliffs, or occasionally rock outcrops or bare ground to support their bulky stick nests (Green and Morrison 1983, Bechard and Schmutz 1995). One known nest (WDFW 2009d) and one previously unknown potential cliff nest were identified in the project area during the fall wildlife survey. In addition, moderate quality nesting habitat was documented along the North and Combination A alternative corridor, east of the Tucannon River wherever cliffs were present. Somewhat lower quality nesting habitat was also documented along all alternative alignments wherever rock outcrops were present. No individuals were observed during the fall wildlife survey, an expected outcome since fall migration had already occurred (fall migration occurs from early August to late November; spring migration occurs from late February to mid-June; Bechard and Schmutz 1995). However, individuals have been documented passing through the project area en route to southern wintering grounds or spring breeding grounds (WDFW 1996). Despite the presence of nesting habitat in the project area, densities of prey species are unknown and may be depressed due the highly fragmented habitat found in the area, potentially limiting usage by ferruginous hawks.

Peregrine falcon (*Falco peregrinus*) – State Sensitive

Peregrine falcons occur year-round in Washington, either as nesting or migratory individuals. Potential nesting and roosting habitat for this species usually includes cliffs or high escarpments that dominate the nearby landscape, although office buildings, bridges, and river cutbanks have also been used for nesting (USFWS 1982, Craig 1986). Preferred nesting cliffs are at least 150 feet high, and occur in a wide range of elevations from sea level to 11,000 feet in elevation (USFWS 1982). Foraging habitat for this species includes open areas such as marshes, lakes, river bottoms, and meadows with a high abundance of potential prey (e.g., songbirds, waterfowl, and shorebirds). Past declines in peregrine falcon populations were mainly caused by pesticide pollution (particularly DDT), which led to egg shell-thinning; however, this threat has been largely eradicated (USFWS 1999). Peregrine falcons in Washington are vulnerable though, due to their limited population size, and are sensitive to disturbances which may jeopardize nest occupancy.

The pre-field review did not identify any nesting peregrine falcons in the vicinity of the project area (WDFW 2009d) and no individuals were documented during the fall wildlife survey. Further, Hayes and Buchanan (2001) found no peregrine nesting sites anywhere near the project area. However, the project area does fall within the historic breeding range of this species and the Washington breeding population is currently expanding its range (WDFW 2002). In addition, the cliffs found along the lower Snake River, including near the Lower Monumental Substation in the project area, provide potential nesting habitat. Still, peregrine falcons attempting to nest locally would likely face competition from existing prairie falcon pairs. Presently, it is unlikely that breeding peregrine territories occur in vicinity of the project area.

Merlin (*Falco columbarius*) – State Candidate

Merlins range throughout most of North America wherever there is open to semi-open habitat. Nests are common in conifer woodlands or wooded prairies (including planted shelterbelts) near forest openings and often near water (Warkentin et al. 2005, NatureServe 2009). The bulk of their diet consists of small to medium-sized birds, often flocking species. Large flying insects such as dragonflies may be important for young when learning to hunt. Merlins also eat toads, reptiles, and small mammals (NatureServe 2009). They use inconspicuous perches and a searching flight pattern when hunting. They may cache prey during various seasons (NatureServe 2009). Migration to breeding areas occurs from early February to early May with peak migration occurring in early April. Return migration occurs from early August to early November (Warkentin et al. 2005); migration through the project area is likely. Wintering grounds extend through much of western U.S. (Warkentin et al. 2005).

No known nesting sites or nesting habitat are located in the project area (WDFW 2009d), or anywhere in eastern Washington (Wahl et al. 2005). One adult female was seen during the fall wildlife survey along the North Alternative, east of the Tucannon River. The pre-field review indicated only limited usage in the project area by merlin (WDFW 2009d), primarily as an occasional migrant or winter resident (Wahl et al. 2005).

Loggerhead shrike (*Lanius ludovicianus*) – Federal Species of Concern, State Candidate

The Loggerhead shrike is present throughout much of North America in areas of open fields and grasslands interspersed with shrubs and trees that are used for nesting or the impaling of prey (Vander Haegen 2003a). In Washington, this species is known to breed in the shrub-steppe of the central Columbia Basin (Yosef 1996) and the closest confirmed breeding area is in the Juniper Dunes Wilderness, approximately 20 miles east of the project area (Smith et al. 1997). Although migration patterns of this species are generally poorly understood, it is thought that fall migration occurs from September through November while spring migration occurs in March (Yosef 1996). No shrikes were observed during the fall wildlife survey, and the project area is outside the historic breeding range. Loggerhead shrikes are not expected to be present in the project area although it is possible that migrants may pass through the area on occasion.

Sage sparrow (*Amphispiza belli*) – State Candidate

Sage sparrows are strongly associated with sagebrush for breeding, but are also found in salt-bush brushland, and in areas with rabbitbrush and black greasewood (NatureServe 2009). The preferred habitat characteristics of sage sparrows include semi-open areas interspersed with shrubs 3 to 5 feet tall (Martin and Carlson 1998). Other habitat features associated with this species include the presence of big sagebrush, shrub cover, bare ground, above-average shrub height, and horizontal patchiness. Sage sparrows tend to avoid areas with grass cover (Rotenberry and Wiens 1980, Wiens and Rotenberry 1981, Larson and Bock 1984). These habitat preferences may be driven by the nesting requirements of the sage sparrow, which include healthy older shrubs for building nests with cover (Terres 1980). This species prefers to forage near woody cover where it searches for various grains and invertebrates (NatureServe 2009).

A small mixed flock that included sage sparrows was observed moving through the project area in an area of disturbed grassland near Lyons Ferry Road during the fall wildlife survey. The migratory nature of this flock and direction of travel suggested that it flew across all action alternatives. These birds must be considered migrants as the pre-survey analysis revealed that neither their current breeding nor wintering distributions overlap with the project area (Smith et al. 1997, Vander Haegen 2003c).

Preble's shrew (*Sorex preblei*) – Federal Species of Concern, State Candidate

Although a limited amount of natural history is known about the Preble's shrew, it has been documented in various habitats with arid and semiarid shrub-grass associations, openings in montane coniferous forests dominated by sagebrush (Washington), willow-fringed creeks and marshes (Oregon), bunchgrass associations and sagebrush-aspen associations (California), sagebrush-grass associations (Nevada), and in alkaline shrubland (Utah) (Hoffman et al. 1969, Williams 1984, Cornely et al. 1992, Gitzen et al. 2009). The nearest population apparently occurs about 35 miles southeast of the project area in the high elevation (>5,000 feet) forests of the Blue Mountains (Johnson and Cassidy 1997). This species feeds primarily on insects and other small invertebrates such as worms, molluscs, and centipedes (NatureServe 2009). Preble's shrews are active throughout the year and may be active at any time day or night, but are probably most active during morning and evening hours (NatureServe 2009). Although the Blue Mountain records suggest that the project area does not provide suitable habitat for this species, a recent capture of a Preble's shrew (Gitzen et al. 2009) in native Columbia Basin shrub-steppe (Douglas County) suggests that we may not know enough about this species to discount the possibility of it occurring in the project area.

Washington ground squirrel (*Spermophilus washingtoni*) – Federal Candidate, State Candidate

The Washington ground squirrel occupies shrub-steppe habitat of the Columbia Basin ecosystem (USFWS 2004, WDFW 2007). The species is most abundant in areas of high grass cover on deep soils with low clay and high silt content (Betts 1990, Greene 1999). Individuals live alone or in colonies with densities ranging from 120 to 250 per-hectare in favorable habitat. Adults emerge from hibernation in late January through March and feed throughout spring and into summer to accumulate body fat (NatureServe 2009). Adults are active until late May or early June and juveniles until late June or early July. During hot weather, Washington ground squirrels are the most active in the morning (Dalquest 1948, Rickart and Yensen 1991, WDFW 2007). This species breeds late January to early February, soon after emergence from hibernation. A litter is born in a nest chamber in an underground burrow after a gestation period of 23 to 30 days (NatureServe 2009). Young appear above ground in late March or April and are grown to nearly full-sized by late May (Rickart and Yensen 1991). The American badger is the most important predator of this species.

Washington ground squirrel-sized open burrows were found sporadically in the project area though no individual squirrels were seen or heard during the fall wildlife survey and no fresh diggings were observed. This was not unexpected because the timing of the fall wildlife survey coincided with the period when this and other squirrel species are inactive and underground. The fall wildlife survey also revealed that the majority of potential habitat is low in quality, primarily due to disturbance from agricultural practices and invasion of weedy species. The pre-field review, however, indicated the presence of a Washington ground squirrel colony located above and east of the riparian corridor of the Tucannon River where the action alternatives share the same alignment (WDFW 2009d). However, a thorough investigation of this area during the fall wildlife survey found no sign of their presence (e.g., burrows). Additional field surveys will be performed during summer 2010 when the Washington ground squirrel is active.

White-tailed jackrabbit (*Lepus townsendii*) – State Candidate

White-tailed jackrabbits are most common in open grasslands and sagebrush plains (NatureServe 2009) and are the rabbit most often associated with rabbitbrush habitats. They usually rest by day in shallow depressions or forms at the base of shrubs, or during winter, in cavities in snow. Young are born in a well-concealed depression in the ground or in burrows abandoned by other animals (NatureServe 2009). White-tailed jackrabbits are herbivores that eat grasses, forbs, and grains in summer, and browse on twigs, buds, and bark in winter, and may feed on cultivated crops. They are active throughout the year and are primarily crepuscular (active at dusk and dawn) (Armstrong 1975). Habitat marginally suitable for white-tailed jackrabbits is present throughout the project area wherever grassland or patches of sagebrush or rabbitbrush is present. Johnson and Cassidy (1997) suggest that habitat for this species is still available in the project area although no evidence of white-tailed jackrabbit use was observed during the fall wildlife survey.

Black-tailed jackrabbit (*Lepus californicus*) – State Candidate

Black-tailed jackrabbits inhabit open country such as open plains, fields, and deserts with scattered thickets of shrubs (Caire et al. 1989). This species rests by day in shallow depressions or forms typically located near the cover of large bunchgrasses or forbs (NatureServe 2009). Black-tailed jackrabbits forage on grasses, forbs, crops, and hay in summer, and buds, bark, and leaves of woody plants in winter. The black-tailed jackrabbit is well-adapted to arid landscapes because it is able to obtain water from vegetation, as well as re-ingest soft fecal pellets, extracting nutrients and moisture. This species may be crepuscular or nocturnal, and is active throughout the year (NatureServe 2009). Habitat suitable for black-tailed jackrabbits is present in the project area wherever patches of shrub-steppe are present. However, no sign of this species was observed during the fall wildlife survey and the pre-field review suggested black-tailed jackrabbits may now be uncommon due to the loss of sagebrush shrub-steppe (Smith et al. 1997).

Mule deer (*Odocoileus hemionus)*

Although not listed under ESA or included on the Washington State list of endangered, threatened, sensitive, and candidate species, mule deer have been identified as a potentially affected species of interest by WDFW (Schirm 2009, Schirm and Fowler 2009). Mule deer are common throughout the project area. They are generalists that occur in a broad array of habitats, with shrub-steppe rangeland considered particularly valuable as winter range because of the favorable climatic conditions and forage species it provides (Vander Haegen et al. 2001). Quality and quantity of winter range is the most critical component of mule deer habitat because it largely determines the survival of deer from one year to the next, and hence, the size and persistence of the population (Zeigler 1978, NPCC 2004). During winter months, windblown slopes and ridges remain snow-free, providing mule deer access to forage. Toward the end of winter, vegetation on west and south-facing slopes develops early and provides much-needed nutritious forage at a time when deer are often poorly nourished (Vander Haegen et al. 2001).

Potential threats to mule deer include the removal of winter range habitat, disturbance to wintering deer from human activity, reduced forage quality due to noxious weeds, and increased disturbance as a result of access along roads. Research on the effects that linear recreation routes have on wildlife describes a zone of influence found along access roads where mule deer are often displaced by human activity, experience increased hunting pressure, or are susceptible to vehicle collisions (Lyon 1983, Gaines et al. 2003).

WDFW has identified potential winter range habitat in the project area along the Snake and Tucannon Rivers (WDFW 2009d) (Figure 3-5), with the area located on the east bank of the Tucannon River between the Tucannon Breaks (near the city of Pomeroy, Washington) and the confluence with the lower Snake River believed to host the highest densities of mule deer in WDFW District 3 (the district in which the project area is located) (Schirm 2009, Schirm and Fowler 2009). The project area is also thought to be important for spring fawning; however, the significance and location of fawning grounds remains unstudied (Schirm 2009, Schirm and Fowler 2009).

Although mule deer are distributed throughout the project area, they tend to concentrate in areas within the North and Combination A alternative corridor, east of the Tucannon River, where grassland habitat is interspersed with rock features and draws (WDFW 2009d). Seasonal movements of mule deer in the project area are largely unknown, but they are thought to concentrate near river drainages in the late fall through winter and move into more open rangeland in the spring and summer.

Rock Features Associated Species

Although cliffs and rock outcrops are similar in many ways, they do offer different habitat features important to wildlife. Golden eagle, ferruginous hawk, peregrine falcon, long-eared myotis, pallid Townsend’s big-eared bat, and mule deer (often bedding at the bases of cliffs) are species of interest that are associated with the types of cliffs found in the project area. Sagebrush lizard, ferruginous hawk, and mule deer are wildlife species that could potentially occur within the rock outcrops found in the project area. All of the above species are discussed above under *Grasslands/Shrub-Steppe Associated Species*, except long-eared myotis and Pallid Townsend’s big-eared bat, which are discussed below.

Long-eared myotis (*Myotis evotis*) – Federal Species of Concern

The long-eared myotis is found mostly in forested areas especially those with broken rock outcrops. It has also been observed flying over shrubland, over meadows near tall timber, along wooded streams, and over reservoirs (NatureServe 2009). The long-eared myotis often roosts in buildings, hollow trees, mines, caves, and in fissures. In northeastern Washington, long-eared myotis roosts of reproductive females have been found in crevices in small basalt rock formations (Rancourt et al. 2005). Diet of the long-eared myotis consists almost entirely of insects, which it captures over water or among trees (NatureServe 2009). It usually feeds by picking prey from the surface of foliage, tree trunks, rocks, or ground and may fly slowly around shrubs searching for emerging moths or perhaps non-flying prey (Manning and Jones 1989). Their preferred habitat is uncommon in the project area, with suitable habitat that is present limited to cliffs and larger rock outcrops. Because of their nocturnal habits, confirming the presence of this species along the lower Snake River requires a concerted survey effort using sophisticated technology, which apparently has not happened in the project vicinity. Until such a survey is conducted, the presence of this species in the project area remains a possibility.

Pallid Townsend's big-eared bat (*Corynorhinus townsendii pallescens*) – State Candidate, Federal Species of Concern

A relatively sedentary bat, the longest documented movements of the pallid Townsend's big-eared bat have been on the order of 19 to 40 miles (NatureServe 2009). Throughout much of its known range, the pallid Townsend's big-eared bat commonly occurs in mesic habitats characterized by coniferous and deciduous forests (Kunz and Martin 1982), but may occupy a broad range of habitats (Handley 1959). In Washington, it is known from limestone caves, lava tubes, and human-made structures in coastal lowlands, cultivated valleys, and nearby hills covered with mixed vegetation (Handley 1959). This species tends to avoid grasslands wherever possible, even while commuting to foraging grounds (NatureServe 2009). Caves, buildings, and tree cavities provide night roosts. Flying insects, primarily moths, are captured near the foliage of trees and shrubs (Barbour and Davis 1969).

Suitable habitat in the project area is confined to the Tucannon River riparian corridor and the cliffs on the east side of the Tucannon River where the action alternatives share the same alignment. Like other nocturnal bats, confirming the presence of this species along the lower Snake River requires a concerted survey effort using sophisticated technology. Until such a survey is conducted, the presence of this species in the project area remains a possibility.

Riparian Associated Species

Bald eagle, peregrine falcon, Lewis' woodpecker, long-eared myotis, and pallid Townsend's big-eared bat are species of interest that do occur, or could potentially occur in riparian habitat found in the project area. Peregrine falcons are discussed above under *Grassland/Shrub-Steppe Associated Species.* Long-eared myotis and Pallid Townsend's big-eared bat are discussed above under *Rock Features Associated Species*.

Bald eagle (*Haliaeetus leucocephalus*) – State Candidate, Federal Species of Concern

The bald eagle, a species formerly listed as threatened under the federal ESA, was delisted in July 2007 (50 CFR Part 17). Protection to the species is still afforded by the federal Golden and Bald Eagle Protection Act and the Migratory Bird Treaty Act. In addition, Washington State's bald eagle protection rules of 1986 (WAC 232-12-292) established a legal requirement for private, state, and municipal landowners to reach agreement with WDFW on measures to protect breeding and roosting habitat. Bald eagle nesting habitat consists of large trees among stands near open water for foraging.

In Washington, nearly all bald eagle nests (99 percent) are within 1 mile of a lake, river, or marine shoreline (WDFW 2007). Migration occurs from early March to late May (Buehler 2000). Habitat that could support bald eagles in the project area is limited to where the action alternatives share the same alignment and cross the Tucannon River, and near the Lower Monumental Substation on the south shore of the Snake River. No bald eagles or bald eagle nests were observed in the project area during the fall wildlife survey, and no nests or territories (WDFW 2009d, 2009f) have been documented in the past. However, individuals have been documented in areas near the general project area including the Tucannon Fish Hatchery (see BPA 2000b).

Lewis' woodpecker (*Melanerpes lewis*) – State Candidate

Lewis' woodpecker inhabits open forest and woodland with features remaining from past logging or fire. Preferred habitat includes oaks, coniferous forest, riparian woodland (including black cottonwood), or orchards, and, less commonly, pinyon or juniper species (American Ornithologists' Union [AOU] 1983). Their distribution in North America is closely associated with open ponderosa pine forest, and in particular, areas of fire-maintained old-growth ponderosa pine (Diem and Zeveloff 1980, Tobalske 1997, Saab and Dudley 1998). Important habitat features include an open tree canopy, a brushy understory with ground cover, dead trees for nest cavities, dead or downed woody debris, perch sites, and abundant insects (NatureServe 2009). Lewis' woodpeckers feed on adult emergent insects in summer and ripe fruit and nuts in fall and winter (NatureServe 2009). Unlike other woodpeckers, this species does not bore for insects but will flycatch and glean insects from tree branches or trunks, or drops from perch to capture insects on the ground.

Lewis' woodpecker has been documented along the Tucannon River near the project area and suitable habitat occurs in the cottonwood trees along the river. However, no birds were observed during the fall wildlife survey and the pre-field analysis suggested that Lewis's woodpeckers are rare in the project area.

Cropland Associated Species

Merlin, white-tailed jackrabbit, black-tailed jackrabbit, and mule deer are species of interest that do occur, or could potentially occur, in wheatfields found in the project area. These species are addressed above under *Grassland/Shrub-Steppe Associated Species.*

Wildlife Species of Interest Unlikely to be Present in the Project Area

The following species of interest are not addressed further because they are not known or documented to occur within the project area, the project area is outside the known range of the species, or breeding and/or foraging habitat does not exist within or adjacent to the alternative project corridors. These species include Rocky Mountain-tailed frog, striped whipsnake, greater sage-grouse, burrowing owl, olive-sided flycatcher, yellow-billed cuckoo, sage thrasher, Oregon vesper sparrow, and Canada lynx.

Rocky Mountain-tailed frog (*Ascaphus montanus*) – State Candidate

The Rocky Mountain-tailed frog is found in clear, cold, swift-moving mountain streams with coarse substrate (Leonard et al. 1993, Stebbins 2003, NatureServe 2009). It appears to occur mostly in older forests. This species may be found on land during wet weather, near any water source in humid forests, or in more open habitat (Stebbins 2003, NatureServe 2009). No forests or mountain streams are found within the project area; hence it is very unlikely Rocky Mountain-tailed frogs occur in the project area.

Striped whipsnake (*Masticophis taeniatus*) – State Candidate

The striped whipsnake inhabits dry habitats such as bare rock/talus/scree, desert, grassland/herbaceous, shrubland/chaparral, woodland-conifer, woodland-hardwood, and woodland-mixed and tends to burrow in or use soil, fallen logs, or other debris for cover (NatureServe 2009). According to Dvornich et al. (1997), there is no evidence of striped whipsnakes occurring in Washington as far east as the project area, and neither Storm and Leonard (1995) or St. John (2002) suggested that the range of this species includes the project area. Furthermore, no evidence for the presences of this species was observed during field surveys of the project area. Therefore, it is unlikely this species occurs in the project area.

Greater sage-grouse (Centrocercus urophasianus**)** – State Threatened

Greater sage-grouse are found in habitats such as foothills, plains, and mountain slopes wherever sagebrush is present intermixed with meadows and in close proximity to quaking aspen groves (AOU 1983). Greater sage-grouse use a wide variety of mosaic habitats, including: tall sagebrush types such as big sagebrush, three-tip sagebrush, and silver sagebrush; low sagebrush types such as low sagebrush and black sagebrush; mixes of low and tall sagebrush with abundant forbs; riparian and wet meadows; steppe dominated by native forbs and bunchgrasses; scrub-willow; and sagebrush/woodland mixes with juniper, or ponderosa pine (Schroeder et al. 1999). Limited greater sage-grouse habitat exists in the project area and the pre-survey analysis revealed that their current distribution does not overlap with the project area (see Stinson et al.2004). Therefore, greater sage-grouse are unlikely to occur in the project area.

Burrowing owl (*Athene cunicularia*) – Federal Species of Concern, State Candidate

Burrowing owls inhabit open, dry areas in well-drained grasslands, shrub-steppe, prairies, deserts and often agricultural and suburban lands across much of western North America (Klute et al. 2003, WDFW 2003). In Washington, burrowing owls typically nest in sparse sagebrush or antelope bitterbrush shrub-steppe, or grassland habitats in the central Columbia Basin (Green and Anthony 1989, Wahl et al. 2005). Although the grassland habitats of the project area appear suitable for burrowing owls, especially where badgers or marmots are present, virtually all breeding records for this species in the Columbia Basin occur at lower elevations many miles east of the project area (Smith et al. 1997). Since there is no evidence of burrowing owls inhabiting higher elevations of the Columbia Plateau coincident with the project area, it is unlikely that they occur here.

Olive-sided flycatcher (*Contopus cooperi*) – Federal Species of Concern

The olive-sided flycatcher is considered an indicator species of the coniferous forest biome throughout North America, although this species is occasionally found in mixed deciduous/coniferous forests (NatureServe 2009). In the winter, this species can be found in a variety of forest, woodland, and open situations with scattered trees, especially where tall dead snags are present (AOU 1983, NGS 2006). While it is considered an uncommon or rare forest species in the nearby Blue Mountains of Washington, it is not considered an inhabitant of the lower Snake River area (Smith et al. 1997). Therefore, it is very unlikely that olive-sided flycatchers occur in the project area.

Yellow-billed Cuckoo (*Coccyzus americanus*) – Federal Candidate, State Candidate

The yellow-billed cuckoo resides in open woodland (especially where undergrowth is thick), parks, deciduous riparian woodland, and in the West, it nests in tall cottonwood and willow riparian woodland (Harrison 1979). This species commonly requires a large area (approximately 25 acres) of dense riparian forest with a canopy cover of at least 50 percent in both the understory and overstory (Biosystems Analysis 1989). Habitat for this species is very limited in the project area and poor in quality; only occurring where the action alternatives share the same alignment and cross the Tucannon River. In addition, yellow-billed cuckoos have only rarely been seen in the general area and confirmed observations have not been made for some time; the last confirmed observation in the Tucannon River riparian corridor occurred in 1997 (Aanerud and Mattocks 1997). Finally, mirroring its decline throughout the West, Smith et al. (1997) considered the species extirpated as a Washington State breeder. Evidence suggests that it is very unlikely for yellow-billed cuckoos to be present in the project area, although the Tucannon River riparian zone and similar habitats in southeastern Washington supported the last known populations.

Sage thrasher (*Oreoscoptes montanus*) – State Candidate

Sage thrashers breed from British Columbia to eastern Montana, south to northern Arizona and west to California (NGS 2006). This species is highly dependent on healthy shrub-steppe communities (Rich 1980). In eastern Washington, sage thrashers are found in the Columbia Basin shrub-steppe region where they have been shown to have the strongest association to sagebrush cover of all shrub-steppe bird species (Dobler 1992, Dobler et al. 1996, Vander Haegen 2003a). The pre-survey analysis revealed that their current distribution does not overlap with the project area and no evidence of sage thrashers was observed during the fall wildlife survey (Smith et al. 1997, Vander Haegen 2003b). It is, therefore, very unlikely that sage thrashers occur in the project area.

Oregon vesper sparrow (*Pooecetes gramineus affinis*) – State Candidate

Oregon vesper sparrows breed in the lower valleys and plains west of the Cascade Range in western Washington, western Oregon, and extreme northwestern California (AOU 1957, 1998; King 1968) and are restricted almost entirely to California in winter (Shuford and Gardali 2008). Vesper sparrows were observed in mixed flocks with sage sparrows during the fall survey, but were most certainly western vesper sparrows (a separate species). Evidence suggests Oregon vesper sparrows are highly unlikely to occur in the project area.

Canada lynx (*Lynx canadensis*) – Federal Threatened, State Threatened

Although listed by USFWS as occurring in both Garfield and Columbia counties, Canada lynx in Washington state are primarily found in high-elevation forests of north-central and northeast Washington, including Okanogan, Chelan, Ferry, Stevens, and Pend Oreille counties (NatureServe 2009). Habitat that would normally support this species or snowshoe hare, its preferred prey species, is not present in the project area making their occurrence very unlikely. Furthermore, it is doubtful lynx were ever consistently present in this portion of Washington State (Stinson 2001).

3.5.2 Environmental Consequences of Action Alternatives

Impacts Common to All Action Alternatives

Impacts from construction and operation of the proposed project would vary by wildlife species. General impacts would include changes to or removal of habitat; increased risk of mortality due to collision or increased human access to habitat; disturbance during critical periods, such as nesting or wintering periods; and temporary disturbance and displacement due to construction activities. Construction activities that may cause impacts to wildlife include tower and counterpoise installation, access road improvements and new access road construction, placement of temporary pulling/tensioning sites, installation of fiber optic wood structures, and line realignments near Lower Monumental Substation. With implementation of mitigation measures, impacts during construction would range from ***low to moderate*** depending on the species.

Permanent impacts from construction would result from the transmission tower footings, permanent access roads, and fiber optic wood poles. Wildlife habitat in these areas would be permanently converted to transmission line facilities. Impact levels for permanent impacts to wildlife and habitat are discussed below for the specific habitat types and action alternatives.

Maintenance of the proposed project has the potential to cause wildlife injury or mortality from collisions or interactions with maintenance equipment. Avoidance of habitat during key nesting or wintering periods would reduce the incidence of collisions and disturbance from human interaction; hence impacts would be ***low*** during maintenance of the proposed corridor.

Electrocution of birds normally is not an effect of higher voltage transmission lines, even for birds with the largest wingspans. The main electrical design factor that influences electrocutions is the “physical separation between energized and/or grounded structures, conductors, hardware, or equipment that can be bridged by birds to complete a circuit” (Avian Power Line Interaction Committee [APLIC] 2006). Electrocution is more commonly a problem with lower voltage distribution lines which have conductors that are generally spaced 2 to 6 feet apart. Higher voltage transmission line conductors are generally spaced from 3 to 30 feet apart, with the larger distances greatly reducing the risk of electrocution. Conductor-to-conductor spacing for the lattice steel tower design proposed for all the action alternatives would be at least 23 feet and, as a result, potential impacts to birds from electrocution would be ***low***.

The following sections describe potential impacts on wildlife resources common to all action alternatives for specific habitat types.

Grassland/Shrub-Steppe Associated Species

Construction of the action alternatives would affect similar acreages of grassland/shrub-steppe habitat, ranging from about 271 acres to 278 acres, with most of these acres comprised of disturbed grassland (see Section 3.3, Table 3-15). The acres of cropland permanently impacted under each action alternative would also be very similar, ranging from about 134 to 147 acres (see Section 3.3, Table 3-16). With the exception of mule deer (discussed below by action alternative), there would be very little difference in potential construction and permanent impacts on grassland/shrub-steppe associated species under the four alternatives. Potential impacts to these species common to all action alternatives are discussed below.

Sagebrush Lizard

Current range maps and the presence of preferred habitat suggest that sagebrush lizards are potentially found in the project area (Storm and Leonard 1995, Stebbins 2003, NatureServe 2009). However, based on the best available information on habitat use by sagebrush lizards in the Columbia Basin (Green et al. 2001), lizard use of the project area would be confined to any remaining patches of sagebrush/grasslands near rock outcroppings. This combination of features is extremely rare in the project area and is only present north of the proposed Tucannon River crossing.

If sagebrush lizards are present and active (summer months) during construction, minor impacts might occur from disturbance or displacement, injury or mortality from vehicle strikes and construction equipment, and direct habitat loss or degradation from installation of towers and roads. The spread of weeds from ground disturbing activities could lead to further degradation of already limited habitat for this species. Russian thistle, tall tumblemustard, and cheatgrass are leading among the many species of weeds that grow well in disturbed soils. Implementation of mitigation measures (see Section 3.3.3 Vegetation, Mitigation Measures) to reduce the spread of weeds would lessen the impact on sagebrush lizard habitat. Additionally, the potential impact to sagebrush lizards from the proposed project is likely to be ***low*** because only limited, low quality habitat is available in the project corridor.

Golden Eagle, Ferruginous Hawk, Merlin, Peregrine Falcon, and Loggerhead Shrike

Golden eagles, ferruginous hawks, merlin, peregrine falcons, and loggerhead shrikes all potentially use grassland/shrub-steppe habitat as hunting or wintering habitat, although use by merlin, peregrine falcons, and loggerhead shrikes is most likely rare. Both merlin and ferruginous hawks have been known to be ground nesters (Green and Morrison 1983, Bechard and Schmutz 1995, Warkentin et al. 2005, NatureServe 2009), however this behavior is infrequent and has never been documented in the project area region. Furthermore, only golden eagles and ferruginous hawks are thought to nest in the area. Potential impacts to these species would occur from disturbance during construction activities or from injury or mortality from vehicle strikes or interactions with other equipment used during construction. Noise from construction equipment and general construction activities could disturb and displace individuals using neighboring rock features as hunting or loafing perches, with little impact. Permanent impacts would be related to loss of hunting habitat, reduction in preferred habitat for prey species, and disturbance, injury, or mortality from vehicle strikes or interactions with other equipment used for maintenance.

Restricting active construction to the non-breeding season (from mid August to early March) would reduce potential disturbance to hunting, loafing, and nesting raptors and their nest structures which are usually in close proximity to grassland/shrub-steppe habitat. With implementation of mitigation measures as described in Section 3.5.3, impacts on golden eagles and ferruginous hawks during construction would be ***moderate*** for all action alternatives given the known use of the area by these species and their susceptibility to disturbance. After construction impacts would be ***low*** as potential disturbance would be greatly reduced. Impacts to merlin, peregrine falcons, and loggerhead shrikes would be ***low*** for all action alternatives given their apparent infrequent use of the area.

Sage Sparrow

Primary concerns related to sage sparrows include displacement due to construction activities; injury or mortality from vehicle strikes or interactions with other equipment during construction or maintenance; and permanent and temporary habitat loss. Construction activities in grassland/shrub-steppe habitat could disturb and displace individuals present within the project corridor. However, the window of potential disturbance would be brief given these species are only present during periods of spring and fall migration. Vehicle strikes during active construction or maintenance would most likely result in the highest incidences of injury or mortality to sage sparrows. The installation of towers and roads within grassland habitat would cause permanent loss and degradation of existing habitat and may increase perching habitat for predators such as raptors.

The estimated permanent loss of grassland/shrub-steppe habitat (see Section 3.3, Table 3-16) may not be substantial, especially for birds that would use it only fleetingly during migration. However, the degraded nature of the surrounding ecosystem due to agriculture may increase its significance. Limiting construction activities in grassland/shrub-steppe habitat during fall and spring migration, using proper BMPs, and limiting raptor perch sites on transmission towers may further reduce impacts. Although collision concerns for sparrows are not high given their ability to maneuver compared to larger-bodied birds, all action alternatives would be designed according to APLIC guidelines as discussed above. Because the species would be found in the project area for a limited time period and with the implementation of the mitigation measures identified in Section 3.5.3, the impact to sage sparrow would be ***low*** for all of the action alternatives.

Preble's Shrew

If Preble's shrews are present in the proposed project area, they would be confined to any remaining patches of sagebrush/grasslands. This habitat type is very rare in the project corridor and confined to various draws that are evenly distributed throughout the grassland/shrub-steppe habitat in the project area. If Preble's shrews are present and active during construction, potential impacts during construction would include disturbance or direct interactions with vehicles and equipment. Permanent impacts would result from direct habitat loss associated with tower footings and new access roads. The spread of weeds from ground disturbing activities could leave to further degradation to already limited habitat for this species. Russian thistle, tall tumblemustard, and cheatgrass are leading among the many species of weeds that grow well in disturbed soils. Implementation of mitigation measures (see Section 3.3.3 Vegetation, Mitigation Measures) to reduce the spread of weeds would lessen the impact on Preble's shrew habitat. Additionally, the potential impact to Preble's shrew from the proposed project is likely to be ***low*** because only limited, low quality habitat is available in the project corridor.

Washington Ground Squirrel

Potential impacts to Washington ground squirrel include displacement from construction activities, injury or mortality from vehicle strikes or interactions with other equipment during construction or maintenance, and permanent and temporary loss of grassland/shrub-steppe habitat. While construction activities would disturb individuals, their typical behavioral response to retreat underground would not necessarily cause displacement from the area. Washington ground squirrels do not migrate, but instead move underground to hibernate during winter months. While these behaviors may be beneficial for avoiding dangers from predation, cold ambient temperatures, and lack of forage, construction-related ground disturbance may result in injury or mortality if individuals are underground in the project corridor. The potential for impacts may increase following emergence from hibernation in late January through March and when the young appear above ground in late March or April. It is not known, however, how deep underground these species typically seek cover or hibernate, or whether this depth would overlap with the depth of construction-related ground disturbance. Vehicle strikes during active construction or maintenance would most likely result in the highest incidences of injury or mortality to Washington ground squirrel. In addition, the installation of towers within grassland/shrub-steppe habitat would cause permanent loss of usable acreage, and may increase perching habitat for predators such as raptors.

While the permanent loss of grassland/shrub-steppe habitat would not be substantial, the already degraded nature of the surrounding ecosystem due to agriculture may increase its significance. Injury or mortality may be substantially reduced by moving vehicles and equipment at slow speeds and reducing the depth and frequency of earthmoving activities. In addition, limiting construction activities in grassland/shrub-steppe habitat during periods of Washington ground squirrel activity and limiting raptor perch sites on transmission towers would further reduce impacts. Impacts to Washington ground squirrel from disturbance of grassland/shrub-steppe habitat from construction of the Action Alternatives is likely to be ***low to moderate***; this species was known to be in the project area during the recent past but its current demographics remain unknown, and only poor quality habitat is available.

White-tailed and Black-tailed Jackrabbits

Impacts to white-tailed and black-tailed jackrabbits include displacement due to construction activities, injury or mortality from vehicle strikes or interactions with other equipment during construction or maintenance, and permanent and temporary habitat loss. Construction activities in areas of grassland habitat would disturb and displace any jackrabbits that are present nearby. Vehicle strikes during active construction or maintenance would most likely result in the most incidences of injury or mortality to these species. In addition, the installation of permanent towers and roads within grassland/shrub-steppe habitat would cause permanent loss and degradation of existing habitat and may increase perching habitat for predators such as raptors.

The permanent loss of grassland habitat may not be substantial; however, the degraded nature of the greater ecosystem due to agriculture may increase its significance. Although permanent loss of habitat may not be mitigated, injury or mortality may be substantially reduced by moving vehicles and equipment at slow speeds throughout the project area. Furthermore, restricting public access to current and proposed access roads associated to the proposed project would reduce the chance of vehicle collisions and illegal hunting. Implementation of mitigation measures such as limiting raptor perch sites on towers would reduce impacts to jackrabbits. The overall impact from the action alternatives to white-tailed jackrabbits is likely to be ***low to moderate*** given the greater potential for this species to be present in the action area. For black-tailed rabbits, the impact would be ***low*** because it is less likely that this species would use the project area.

Mule Deer

Mule deer are discussed below under the specific Action Alternatives.

Rock Features Associated Species

Potential impacts to the two species associated with rock outcrops—sagebrush lizards and ferruginous hawks—are discussed below under the specific action alternatives. This section discusses potential impacts to those species associated with cliff face rock features.

Impacts to species that use cliffs in the project area would include disturbance from construction activities or injury or mortality from vehicle strikes or interactions with other equipment used during construction. Noise from construction equipment and general construction activities could disturb and displace these species from cliffs although the impact would be ***low***; the distance from construction to the cliffs would help mitigate noise. Impacts to raptors or bats that are nesting or birthing in the cliffs would be ***low to moderate*** given disturbance can result in the abandonment of young (see NatureServe 2009; summarized in Richardson and Miller 1997). Impacts on raptor prey species may also occur during construction and maintenance in neighboring habitats. Impacts on golden eagles, ferruginous hawks, peregrine falcons, long-eared myotis, and pallid Townsend's big-eared bats also could occur from potential collisions with towers, conductors, the fiber optic cable, or with maintenance equipment.

Mule deer, which only use cliffs for resting and protection from weather and predators, would be minimally impacted by the proposed action alternatives. Potential temporary impacts would ***low*** and ***temporary*** and primarily be related to disturbance and displacement from cliffs by construction activities. Injury or mortality from vehicle strikes or interactions with other equipment used during construction can also occur. ***No*** permanent impacts to mule deer are anticipated from disturbance to cliff habitats.

Restricting active construction to the non-breeding season of cliff-dwelling wildlife (from mid August to early March) would occur if breeding raptors or bats appear to use cliffs in the project area. Limiting construction to this time period also would reduce the potential for disturbance and abandonment of young and displacement of hunting or loafing raptors and roosting bats. Cliffs in the project area would continue to draw raptors after construction with the potential for a ***low*** impact from maintenance activities and potential collisions with conductors. With implementation of mitigation measures as described in Section 3.5.3, impacts to cliff-dwelling species found along the action alternatives are expected to be ***low to moderate*** on golden eagle, ferruginous hawk, and peregrine falcon.

Few raptor nests, individual raptors, or bats were observed during the fall wildlife survey or documented during pre-field analysis. Additional field surveys for golden eagle, ferruginous hawk, and peregrine falcon will be conducted in summer 2010 when these species are more likely to be present. For long-eared myotis and pallid Townsend's big-eared bats, the habitat surrounding the cliffs in the project area is marginal in quality especially in regard to the production of bat prey species such as flying insects. As a result, the action alternatives are, therefore, expected to have a ***low*** impact on long-eared myotis and pallid Townsend's big-eared bat.

Riparian Associated Species

The only riparian habitat found in the project area is located where the action alternatives would cross the Tucannon River. This area is small (i.e., not of sufficient size to list in Section 3.3, Tables 3-15 or 3-16), but remains important because it provides unique features to wildlife species not found anywhere else in the project area. No riparian vegetation would be removed during construction of the action alternatives. Impacts to wildlife species that do occur, or could potentially occur in riparian areas are discussed below.

Bald Eagle and Peregrine Falcon

During construction, bald eagles and peregrine falcons would most likely avoid the riparian area and as a result, injury or mortality is very unlikely to occur. The lack of existing observations of these species in the project area suggests they are locally uncommon. No removal of suitable foraging and roosting perch trees (for bald eagles) would occur along the Tucannon River. Collision with conductors or the fiber optic cable may occur, but this would be reduced by the use of bird diverters on the wires. Mitigation measures limiting disturbance to all breeding raptors would further reduce potential impacts (see Section 3.5.3); impacts on these species would be ***low***.

Lewis' Woodpecker

Impacts on Lewis' woodpeckers would be ***none to low*** because this species is locally uncommon, if present at all, and construction would occur well away from the riparian zone of the Tucannon River.

Long-eared Myotis and Pallid Townsend's Big-eared Bat

Impacts on long-eared myotis and pallid Townsend's big-eared bats would include disturbance from construction activities or from injury or mortality from vehicle strikes or interactions with other equipment used during construction. However, these species would be expected to use the riparian habitat as an evening feeding area and daytime roosting area. Noise from construction equipment and general construction activities could disturb and displace these species from riparian habitat that they are using for roosting. Because construction in this habitat will be very limited and only occur during periods when long-eared myotis and pallid Townsend's big-eared bats are roosting in neighboring habitats, impact from construction would be ***low***.

Cropland Associated Species

Construction of the action alternatives would affect similar acreages of cropland, ranging from about 64 acres to 84 acres (see Section 3.3, Table 3-15). The acres of cropland permanently impacted under each action alternative would also be very similar, ranging from about 43 to 45 acres (see Section 3.3, Table 3-16).

Any differential impacts on wildlife due to differences in acreages would be low because of the poor quality habitat cropland provides. Only a few wildlife species of interest are potentially found in this habitat: merlin, white-tailed jackrabbit, black-tailed jackrabbit, and mule deer (see Table 3-19), and of these species, only mule deer appear to use it regularly. Although one adult female merlin was observed near cropland during the fall 2009 field survey, this species is considered uncommon in the area and more often uses grassland/shrub-steppe habitat. White-tailed and black-tailed jackrabbits, though known to use cropland habitat, would most likely only use cropland for limited foraging, performing all other behaviors in the surrounding grassland/shrub-steppe habitat. Mule deer are habitat generalists that use cropland as foraging habitat. As with jackrabbits, most non-foraging behaviors occur away from cropland in other habitats such as grassland/shrub-steep. Disturbance to cropland from any of the proposed action alternatives would, therefore, be expected to result in a ***low*** level of impact on cropland-associated wildlife species of interest (merlin, white-tailed jackrabbit, black-tailed jackrabbit, and mule deer).

North Alternative

Rock Outcrop Associated Species

Approximately 72 rock outcrops are located within 0.5 mile of the North Alternative, with two-thirds of the total (48) occurring east of the Tucannon River. This relatively high density of rock outcrops suggests the potential for high use by associated species. Approximately one-quarter (17) of these rock outcrops are found where the action alternatives share the same alignment across the Tucannon River and near the Lower Monument Substation.

Potential temporary impacts to both sagebrush lizards and ferruginous hawks would be primarily related to disturbance from construction activities. Sagebrush lizards, if present, would typically respond by retreating into rock crevices and impacts are expected to be temporary and ***low***.

Construction disturbance of ferruginous hawks nesting in the area could have substantial impacts because disturbance commonly results in nest abandonment (Richardson and Miller 1997). Impacts on ferruginous hawks prey species may also occur during construction and maintenance. Permanent impacts on ferruginous hawks associated with rock outcrops would result from potential collisions with towers, conductors, the fiber optic cable, or with maintenance equipment.

Mitigation would reduce the potential impacts of the North Alternative on ferruginous hawks (see Section 3.5.3). Restricting active construction to the non-breeding season (from mid August to early March) would reduce the potential of disturbance to hunting, loafing, and nesting ferruginous hawks and their nest structures. In addition, the North Alternative would be built according to the suggested practices identified by APLIC (2006) and the USFWS-approved Avian Protection Plan Guidelines (2005) to reduce potential avian collision concerns.

The confirmed use of the project area by ferruginous hawks and the relatively high densities of rock outcrops located along the North Alternative right-of-way suggest a ***moderate to high*** potential for impacts to these species from this alternative. The rock outcrops within the North Alternative right-of-way would continue to attract these species and other wildlife both during and after construction. Although few nests or individuals were observed during the fall wildlife survey or documented during pre-field analysis, additional field surveys are scheduled for summer 2010 to further investigate the presence of this species in the project area.

Grassland/Shrub-Steppe Associated Species

Mule Deer

Only mule deer would potentially experience a difference in impact between action alternatives with regards to disturbance of grassland/shrub-steppe habitat. Seasonal movements of mule deer in the project area are largely unknown, but mule deer are thought to concentrate near river drainages in the late fall through winter and move into more open rangeland in the spring and summer. As a result, the grassland/shrub-steppe habitat found along the North Alternative, east of the Tucannon River, has been identified by WDFW as a PHS habitat important to this species (see Figure 3-5) (Schirm 2009, Schirm and Fowler 2009).

Primary concerns related to mule deer include removal of winter range habitat, disturbance and displacement due to construction and maintenance, potential vehicle collision, increased human access due to project roads, and reduced forage quality. Approximately 214 acres of disturbed grassland, 19 acres of native grassland, and 39 acres of potential habitat (likely a combination of disturbed and native grassland) would be disturbed during construction of the North Alternative (see Section 3.3, Table 3-15), with an estimated 110 acres of already disturbed grassland, 10 acres of native grassland, and 14 acres of potential habitat permanently affected by the installation of tower footings and new access roads (see Section 3.3, Table 3-16). Areas of winter range have not been explicitly defined in the project area although WDFW has indicated that the majority could be considered winter range and also year-round winter range, with the areas closest to the Snake River being most critical. As a result, it is difficult to estimate the acres of winter range that could be potentially affected.

Human activity along access roads during construction and maintenance would be the most likely disturbance to mule deer. This activity could reduce the effectiveness of winter range or migration routes, resulting in displacement from or avoidance of otherwise suitable habitat, increased hunting or pressure, and increased risk of collisions with vehicles. Although existing public and private access roads would be used during construction and maintenance to the extent possible, an estimated 157 acres of land (about 33 miles of road) would be permanently disturbed by the construction of access roads under this alternative (see Section 3.3, Table 3-16). Efforts would be made to limit construction activities during periods of deer migration or when they are presence in their winter range, and the potential for vehicle collisions would be reduced by maintaining slow speeds both within and outside the project area (see Section 3.3.5).

Ground disturbance associated with installed infrastructure could result in the establishment of noxious weeds. These weeds would reduce forage quality by competing with higher-quality, native vegetation. To minimize adverse impacts on mule deer forage, surface disturbance in temporary work areas would be re-vegetated using seed mixes approved by the appropriate land managing agency or landowner. Other mitigation measures proposed to reduce the potential for the North Alternative to increase the spread of noxious weeds in the project area are described in Section 3.3.3.

Little is known about mule deer demographics in the project area, except that mule deer are found seasonally in high densities along the North Alternative, and as a result, are potentially susceptible to impacts. However, much of the existing deer habitat in the project area is already disturbed and construction would occur outside the high-use seasons when deer concentrate or migrate. The construction of approximately 33 miles of new roads could allow more access to humans, potentially increasing the frequency of disturbance although mitigation measures designed to regulate access should help to reduce this impact. Overall, impacts from the North Alternative on mule deer using grassland/shrub-steppe habitat would be ***low to moderate*** with implementation of mitigation.

South Alternative

Rock Outcrop Associated Species

Fewer rock outcrops are found along the South Alternative relative to the North Alternative or Combination A Alternative, particularly in the area east of the Tucannon River. As a result, species of interest that are associated with, or could potentially be associated with, the rock outcrops in the project area, such as sagebrush lizards and ferruginous hawks, are expected to be present only in low densities where this habitat is found along the South Alternative. Any impact to rock outcrops found in the South Alternative due to the proposed project would, therefore, have a ***low*** level of impact on sagebrush lizards and ferruginous hawks.

Grassland/Shrub-Steppe Associated Species

Mule Deer

Although mule deer are known to use all grassland/shrub-steppe habitat in the project area, no winter range or PHS habitat important to this species has been identified by WDFW along the South Alternative (Schirm 2009, Schirm and Fowler 2009). Much of the existing deer habitat in the project area is disturbed, particularly along the South Alternative where extensive cropland exists. Proposed construction would most likely occur outside any high-use seasons when deer are present. Similar to the North Alternative, construction of approximately 35 miles of new roads could allow more access by humans, potentially increasing the frequency of disturbance; however, mitigation measures designed to regulate access should help to reduce this impact. Overall, impacts from the South Alternative would be ***low*** given that deer densities are relatively low to moderate in this area and with implementation of mitigation.

Combination A Alternative

Rock Outcrop Associated Species

Approximately 63 rock outcrops are located within 0.5 mile of the Combination A Alternative, with three-quarters of the total (48) occurring east of the Tucannon River. Impacts would be similar to those discussed under the North Alternative: ***low*** on sagebrush lizards and ***moderate to high*** on ferruginous hawks.

Grassland/Shrub-Steppe Associated Species

Mule Deer

Impacts from the Combination A Alternative on mule deer are similar to those discussed under the North Alternative because both alternatives cross PHS habitat east of the Tucannon River that is important to mule deer.

Combination B Alternative

Rock Outcrop Associated Species

Similar to the South Alternative, much fewer rock outcrops are found along the Combination B Alternative (relative to the North Alternative or Combination A Alternative), particularly in the area east of the Tucannon River. As a result, species of interest that are associated (or potentially associated) with, the rock outcrops in the project area—sagebrush lizards and ferruginous hawks—are expected to be present only in low densities where this habitat is found along the Combination B Alternative; impacts would be ***low***.

Grassland/Shrub-Steppe Associated Species

Mule Deer

Impacts from the Combination B Alternative are similar to those discussed under the South Alternative: some mule deer are expected to inhabit areas along this alternate route, but there is no associated winter range or other PHS habitat important to this species present (Schirm 2009, Schirm and Fowler 2009). The Combination B Alternative route is dominated by wheatfields rather than grassland/shrub-steppe. Following proper mitigation measures, as discussed for the South Alternative, impacts would be ***low***.

3.5.3 Mitigation Measures

Mitigation measures listed in Section 3.3.3 Vegetation and Section 3.1.3 Geology and Soils would minimize impacts to wildlife species and their habitat. Additionally, the following mitigation measures would minimize or reduce impacts:

- Install bird flight diverters where the project corridor crosses the riparian corridor of the Tucannon River.

- Avoid construction activities within 0.6 mile of any active raptor nest during the raptor nesting season (e.g., March 1 to August 15 for ferruginous hawks, February 15 to July 15 for golden eagles), if possible.
- Avoid construction activities within PHS-designated mule deer winter range during the mule deer winter range period from November 1 through March 31, if possible.
- If identified, confirmed Washington ground squirrel colonies will be avoided during peak above-ground activity in the spring
- Maintain all existing BPA gates. Wherever permitted by landowners or land managing agencies, gates will be installed to limit vehicular use of new access roads.
- Use slow speeds when operating vehicles or equipment during construction activities located in grasslands or croplands.

3.5.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to wildlife.

3.6 Water Resources and Fish

3.6.1 Affected Environment

Water Resources

Watersheds

The proposed project is located in the Lower Snake-Tucannon and the Lower Snake subbasins (see Figure 3-6). The Lower Snake-Tucannon watershed is further divided into three smaller watersheds within the project area including Deadman Creek, Penawawa Creek-Snake River, and Lower Tucannon River watersheds. Within the Lower Snake subbasin, the project corridor crosses the Walker Creek-Snake River watershed.

Floodplains

Based on a review of 100-year floodplain mapping information available from WDNR, the only floodplain occurring within the project corridor is adjacent to each bank of the Tucannon River.

Wetlands

Based on a review of wetland maps available from the National Wetlands Inventory, the only wetlands occurring within the project corridor are adjacent to each bank of the Tucannon River. General vegetation field surveys conducted in the fall of 2009 confirmed the presence of wetlands adjacent to the Tucannon River and did not identify any other potential wetlands in the project corridor (see Section 3.3 Vegetation).

Precipitation

The proposed project is located in the southwestern corner of the Columbia Plateau Ecoregion, lying in the rain shadow of the Cascade Mountains to the west. As westward moving air masses pass over the Cascade Mountains, warming and drying of the air occurs as it descends along the eastern slopes of the Cascades, resulting in the hot and dry summers and cold winters that characterize the general project area (Western Regional Climate Center [WRCC] 2009a). To the east and northeast, the Rocky Mountains usually block the dry continental air masses from the interior United States and Canada. When infrequent, dry continental air masses enter the region from the north or east, relative humidity decreases and, in the summer, temperatures increase, while in winter, clear, cold weather prevails. Extremes in both summer and winter temperatures generally occur when the inland basin is under the influence of air from over the continent. Weeks may pass with only a few scattered showers. A few thunderstorms per month commonly occur from April through September. In warmer months, these thunderstorms generally occur as isolated cells covering only a few square miles. Annual precipitation is between 10 to 20 inches (WRCC 2009a).

Surface Water

Only two perennial waterbodies exist in the vicinity of the project area: the lower Snake River and the Tucannon River. The Tucannon River flows north into the Snake River through the project corridor near the Town of Starbuck. The lower Snake River flows from east to west north of most of the project corridor, flowing southward to the west of the existing Lower Monumental Substation. The section of the river in the vicinity of the project area has been dammed. Lake West extends east upriver from Lower Monumental Dam; Lake Bryan extends upriver from Little Goose Dam.

Numerous named and unnamed intermittent streams are located within the project corridor including New York Gulch, Dry Gulch, Hanger Gulch, to the east of the Tucannon River and Cow Bar Canyon and Fields Gulch to the west of the Tucannon River.

Water Quality

Section 303(d) of the federal Clean Water Act (CWA) requires Washington State to periodically prepare a list (commonly known as the 303(d) list) of all surface waters in the state for which beneficial uses, such as drinking, recreation, aquatic habitat, and industrial use, are impaired by pollutants. This list encompasses water quality limited estuaries, lakes, and streams that fall short of state surface water quality standards, and are not expected to improve within the next 2 years (Ecology 2009b).

Ecology completed and submitted Washington State's Water Quality Assessment for 2006/2008 to the U.S. Environmental Protection Agency (EPA) in June 2008, as an "integrated report" to meet the CWA requirements of sections 305(b) and 303(d). EPA approved the Water Quality Assessment in January 2009. Review of this list indicates that the Tucannon River, which all action alternatives would span at the same location, is listed as impaired for temperature, pH, and turbidity near the proposed crossing.

The Tucannon River has been included on the 303(d) list since 1993 for elevated temperature. Elevated temperatures were recorded by Ecology in 2001, showing a 7-day mean temperature of 26° Celsius in August 2001. The river has been listed for turbidity since 2004, based on samples collected in 2002. High pH levels were recorded between 1993 and 2001, and reported again in 2004, resulting in the continued 303(d) listing since 2004; however, subsequent monitoring in 2004 has not detected any pH exceedances.

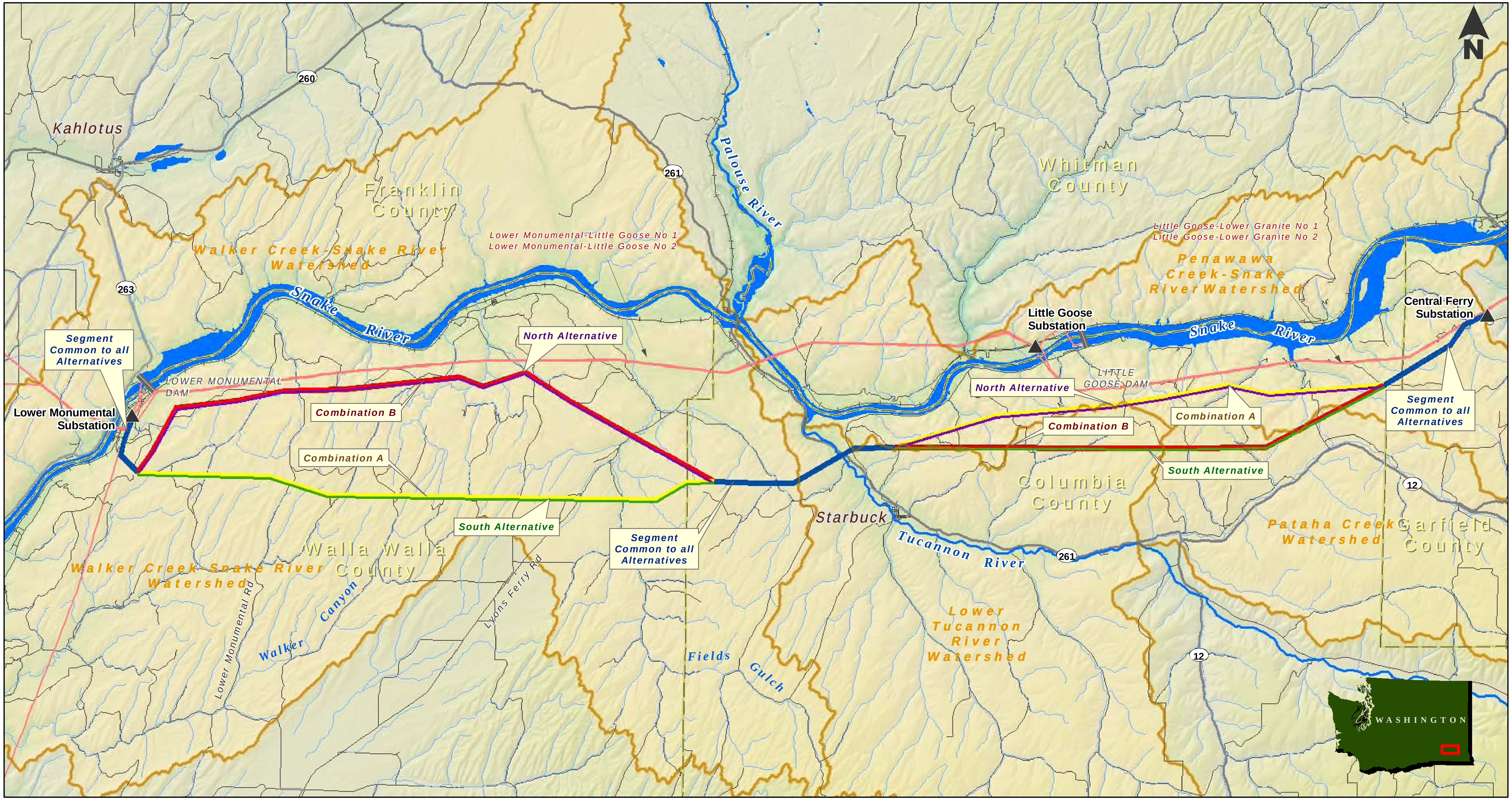
Groundwater

The project area lies within the Columbia Plateau Regional Aquifer System, which occurs in unconsolidated deposits and Pliocence age and younger basaltic-rocks. This aquifer system is an extensive set of aquifers and confining units that might locally be discontinuous but function hydrologically as a single aquifer system on a regional scale.

Unconsolidated deposit aquifers consist of alluvial, glacial, outburst flood, eolian (wind), and volcanic deposits that fill large to small basins, occupying ancestral stream valleys and lowlands. These aquifers can be important sources of water for domestic and commercial, agricultural, and industrial needs because of their location in generally flat lowlands where human activities may be concentrated.

Aquifers in Pliocene and younger basaltic rocks generally occur in thin, basaltic lava flows and beds of volcanic materials. Numerous extensive flows of basaltic lava have spread out from vents in and near the Snake River Plain. Most of the interconnected open space in which groundwater passes occurs in interflow zones (between individual lava flows). These interflow zones can yield large volumes of water.

Maps from the Washington State Department of Health, Office of Drinking Water, were reviewed to identify any wellhead protection areas: none are located within the project corridor. The nearest wellhead protection areas occur along the lower Snake River and include groundwater wells for the Little Goose Dam and Lower Monumental Dam water systems (further downstream where the Snake River joins the Columbia River; Tyson Fresh Meats, Inc. and Boise Cascade Corp water systems also rely on water from the Snake River). All of these are non-transient, non-community systems.



Proposed Route Alternatives
(Route sections shown adjacent to one another share the same proposed alignment)
- Segments Common to all Alternatives
- North Alternative
- South Alternative
- Combination A Alternative
- Combination B Alternative

- Watershed
- Substation
- Federal Dam
- Existing BPA Transmission Lines
- County Boundary
- Major Highway
- Roads
- Railroad

BONNEVILLE POWER ADMINISTRATION

Data Source:
Bonneville Power Administration Regional GIS Database.
All data is best available, 12/15/2009

0 2.5 5 10
Miles

Bonneville Power Administration
Central Ferry-Lower Monumental 500-kV
Transmission Line Project
Figure 3-6
Water Resources

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Fish

Aquatic resources and habitat within the project corridor are limited to the Tucannon River. The regional habitat of the lower 33 miles of the Tucannon River is primarily agricultural lands. Riparian vegetation along the river includes brushy understory with some cottonwood and mostly alder tree overstory (Mendel et al. 2006). The habitat at the proposed transmission line crossing site consists of large trees of white alder, black walnut, and Russian olive, with bushy and tall grass understory. As mentioned above, the Tucannon River near the proposed crossing is a 303(d) listed waterbody (for temperature, pH, and turbidity) with primary aquatic habitat limiting factors for salmon and steelhead being sediment load, habitat diversity, and low abundance of key habitat components such as large woody debris and large holding pools for adult salmonids (Columbia Conservation District [CCD] 2004). Elevated temperature in the lower Tucannon River is considered a secondary aquatic habitat limiting factor.

The remaining streams within the project corridor have seasonal flow (i.e., primarily spring snow melt and high rainfall runoff), and riparian vegetative cover is mostly non-native brush and herbaceous plants and no trees, resulting in low organic input from stream side vegetation. The project area generally has erosive soils (see Section 3.1 Geology and Soils), which tend to fill substrate with fines reducing use by aquatic organisms that may be present in these seasonal streams.

The Tucannon River drainage contains varied commercially and recreationally important salmonid species including Chinook salmon, steelhead trout and rainbow trout. Additionally several of the species present in the Tucannon River have special status (Table 3-20). Four of the species have federal ESA status including bull trout, spring/summer Chinook salmon, fall Chinook salmon, and summer steelhead. A summary of each of these species relative to the Tucannon River is provided below.

Table 3-20. Fish Species Found in the Tucannon River System with Federal or Washington State Status

Species	Federal Status	State Status
Bull trout (*Salvelinus confluentus*)	Threatened	Candidate
Snake River Spring/Summer-run Chinook Salmon (*Oncorhynchus tshawytscha*)	Threatened	Candidate
Snake River Fall-run Chinook Salmon (*O. tshawytscha*)	Threatened	Candidate
Snake River Basin Steelhead (*O. mykiss*)	Threatened	Candidate
Redband trout (*O. mykiss*)	Species of Concern	None
Pacific Lamprey (*Lampetra tridentata*)	Species of Concern	Monitor Species
River Lamprey (*L. ayresi*)	Species of Concern	Candidate
Margined Sculpin (*Cottus marginatus*)	Species of Concern	Sensitive

Sources: Bassett et al. 2002, National Marine Fisheries Service (NMFS) 2009, USFWS 2009b, WDFW 2009e

Bull trout, among all local salmonid species, prefer the coolest and clearest water conditions. They use the lower portion of the Tucannon River as a migration corridor, with no spawning or rearing occurring in this reach (StreamNet accessed November 11, 2009). Some overwintering may occur in the lower reach or within the lower Snake River (Faler et al. 2005, 2008). Spawning and rearing occurs upstream in this system (Mendel et al 2006), and upstream of the proposed transmission line crossing. Spawning occurs in the fall with migration to spawning areas beginning in spring to mid summer in this system (Faler et al. 2005, 2008). Spawning occurs in stream regions with primarily clean low fines gravel conditions. Bull trout in this portion of their range would not be anadromous, completing their life within the freshwater system, which may include the Snake River.

Spring Chinook salmon of the Tucannon River are anadromous entering this system as adults likely in the spring (late April through June) when temperatures are cool (Bassett et al. 2002, CCD 2004). Like Bull Trout, these fish use the lower reaches only as a migration corridor (Streamnet accessed November 11, 2009), using regions upstream for spawning and rearing. Similar to bull trout, these fish use clean gravel/cobble substrate for spawning, which typically occurs in the mainstem upstream of RM 24 from late August to early October (Hatchery Scientific Review Group 2009a, CCD 2004). Tucannon juvenile spring Chinook salmon spend their first summer in the stream system before outmigrating, primarily during the spring, although subyearling outmigration also occurs (CCD 2004). Recent estimate of adults entering the system has ranged from 11 to 897 fish (Hatchery Scientific Review Group 2009a).

Fall Chinook salmon are also anadromous and have recently begun using the lower portion of the Tucannon River in larger numbers. Many of these fish are strays from regions outside of the Snake River basin or of Lyons Ferry Hatchery origin (Milks et al. 2007, 2009). Stream entry time is early October to early December (CCD 2004). Spawning occurs primarily in October and November. Recent escapement (the number of fish reaching freshwater spawning grounds) (2002-2006) has ranged from 205 to 630 fish, with nearly all spawning occurring in the lower 18 miles of the mainstem Tucannon River. Like all salmon, Chinook salmon prefer gravel and cobble substrate clear of excessive fines for spawning. Juvenile fall Chinook salmon outmigrate from the river primarily from late winter to early summer as subyearlings, but may rear in the reservoirs for a year prior to outmigrating to the ocean the following spring (Milks et al. 2009).

Summer steelhead also use the Tucannon River. The lower river from near Starbuck downstream is a migration corridor, but spawning and rearing begins just upstream of Starbuck extending into headwater tributaries (RM 3 to RM 52). Adults enter the system in early July and may extend migration into April the following year, spawning from mid-February through mid-May (CCD 2004). Most juveniles leave at age 1 or 2 in the spring (Hatchery Scientific Review Group 2009b). Clean gravel/cobble substrate is the preferred spawning habitat. Approximate escapement to the whole river system averaged about 445 fish from 1990 to 2007 (Hatchery Scientific Review Group 2009b).

Other major fish species of special concern in the Tucannon River basin include redband trout, river lamprey, Pacific lamprey, and margined sculpin. Redband trout have a similar life history and habitat requirements to steelhead but are not anadromous and would complete their life cycle within the river system. Pacific lamprey are an anadromous species present in the system in low numbers with a life history similar to salmon. Little is known of their use of the Tucannon system, although juvenile lamprey are captured in smolt traps in the lower river (RM 1.9) (Bassett et al. 2002, CCD 2004). They enter the system in the spring, and spawn over typically fine gravel with some sand substrate in the spring and summer. Their ammocoetes (larval stage) juveniles rear in fine sediment from 4 to 7 years before metamorphosing into a juvenile form (with physical characteristics similar to adults) that outmigrate during the spring and summer (Wydoski and Whitney 2003). The species is of special interest to the Confederated Tribes of the Umatilla Indian Reservation and Nez Perce Tribe locally. Little is known of the use of the Tucannon River system by river lamprey, which is smaller than Pacific lamprey at the adult stage. But river lamprey is also anadromous and has similar habitat requirements during their freshwater phase to Pacific lamprey. Margined sculpin, a small fish typically less than 3 inches in size, are locally common. They are a bottom dwelling fish, spawning in the late spring under rocks where eggs are guarded by the adults. Common habitat is small gravel with some silt, in pools and glides, with little seasonal variation in location (Bassett et al. 2002). Within the Tucannon River system they are present in the headwaters well away from the lower river reaches (Wydoski and Whitney 2003).

3.6.2 Environmental Consequences of the Action Alternatives

Water Resources

Impacts Common to All Action Alternatives

Impact to water resources from construction of any of the action alternatives could be caused by the introduction of sediment into waterbodies through soil erosion and transport. Some intermittent waterbodies also could be affected by use and construction of access roads (Table 3-21). Where seasonal flow may occur, culverts of adequate size would be installed to pass water and protect the roadbed from erosion, as well as maintain the natural drainage pattern. During construction, stormwater and sedimentation, along with other potential contaminants, would be controlled by implementation of the SWPPP (see Section 3.1.3 Geology and Soils). If project-generated sediment were to reach an intermittent stream, it would have little affect, if any, and likely be indiscernible from existing conditions within a few hundred feet. Therefore, impacts on intermittent waterbodies would be ***none to low***. Fine sediments would be transported downstream during seasonal or episodic flow while most coarse sediments would be stored in the intermittent channel indefinitely (Duncan et al. 1987).

Table 3-21 displays the intermittent drainages crossed by proposed access roads for the action alternatives.

Table 3-21. Intermittent Drainages Crossed by Proposed Access Roads

Action Alternative	Named Drainages	Total Drainages Crossed
North Alternative	Fields Gulch, Rabbit Hollow	8
South Alternative	Rabbit Hollow, Walker Canyon	15
Combination A Alternative	Walker Canyon	10
Combination B Alternative	Fields Gulch, Rabbit Hollow	13

The only perennial waterbody that would be crossed by the action alternatives is the Tucannon River. The conductor would be strung high above the Tucannon River (and associated floodplains and wetlands) with the steel lattice towers located high on the bluffs above the river valley. The nearest tower would be constructed about 970 feet east of the Tucannon River. There would be ***no*** direct impact to any perennial waterbody, wetland, or floodplain from the proposed project.

As noted in the affected environment section, the Tucannon River is considered impaired due to elevated temperatures, pH, and sediment and is on the state's 303(d) list at the proposed crossing location. The action alternatives would have ***no*** effect on these parameters in the Tucannon River. The nearest construction disturbance to the Tucannon River would be approximately 970 feet away.

As surface water is extremely limited in the project corridor, water for dust control or other construction activities, as necessary, would have to be brought onto the site by the construction contractor. Application of water applied for dust control would be controlled to prevent erosion and puddling and would not be allowed to leave the site as runoff. Dust abatement may be achieved by other standard measures, such as the use of magnesium chloride, which would reduce water application needs.

Groundwater may be encountered during project excavations, but due to the semi-arid conditions and well-drained nature of site soils, it would not be in sufficient quantities to affect surface resources (such as by causing erosion or increased runoff). If groundwater is encountered, it could be pumped from the excavation at a controlled rate to re-infiltrate into the soil at a nearby upland site. There would ***no*** impact to wellhead protection areas or source water protection areas from the proposed project.

Surface water and groundwater could be contaminated by spills of fuel, oils, hydraulic fluid, or other substances. Implementation of mitigation as described in Sections 3.1.3 and 3.6.3 would limit impacts from potential spills; impacts from spills to surface and groundwater would be ***none to low***.

The following sections describe potential impacts on water resources specific to each of the action alternatives.

North Alternative

As described above, the North Alternative would have ***no*** impacts on water resources in the Tucannon River. There could be a ***low*** impact on the 8 intermittent waterbodies, including Fields Gulch, crossed by this alternative from construction of new access roads or improvement of existing access roads.

South Alternative

Impacts to water resources from the South Alternative would be similar to those described above for the North Alternative except that access roads for this alternative would cross 15 intermittent waterbodies, including Rabbit Hollow and Walker Canyon.

Combination A Alternative

Impacts to water resources from Combination A Alternative would be similar to those described above for the North Alternative except that access roads for this alternative would cross 10 intermittent waterbodies, including Walker Canyon.

Combination B Alternative

Impacts to water resources from Combination B Alternative would be similar to those described above for the North Alternative except that access roads for this alternative would cross 13 intermittent waterbodies, including Fields Gulch and Rabbit Hollow.

Fish

Impacts Common to All Action Alternatives

Factors that could potentially affect aquatic resources and habitat from construction and operation of the action alternatives include: increased sediment and turbidity in streams; loss of stream side vegetation and input of large woody debris input; impeded fish passage and increased stream sediment from culvert installation on streams at road crossings; toxic effects from petroleum product spills into streams, and increased herbicide toxicity in streams from vegetation clearing and maintenance.

The land area crossed by the action alternatives is arid with few water bodies or riparian vegetation near any crossing (see Section 3.3 Vegetation). The action alternatives would cross about 40 drainages; all but one of these drainages, the Tucannon River, are intermittent streams with little or no riparian vegetation and no trees. However while all new proposed access roads would generally follow the proposed routes, they avoid many of the drainages and only cross 8 to 15 drainages, depending on the alternative (Table 3-21)

Construction of the action alternatives would result in temporary ground disturbance with the potential to affect aquatic habitat and fish resources during tower and counterpoise installation, access road improvements and new access road construction, placement and use of temporary pulling/tensioning sites, installation of fiber optic wood poles and realignment of lines entering the Lower Monumental Substation. Construction of the action alternatives would disturb between 337 and 361 acres (Table 3-3) that could increase surface erosion and possible sedimentation of stream channels. Increased sediment to streams can have several adverse effects for aquatic resources. Even moderate levels could cause direct salmonid mortality in the short term, possibly a few days (Stober et al. 1981). Salmonids may simply avoid areas with suspended sediment and increased turbidity (Newcombe and Jensen 1996), but such levels may also impede feeding success of salmonids on drifting insects. Increased fine sediment to salmonid spawning areas reduces egg survival, and often reduces benthic organism's abundance, diversity and survival as well (Robertson et al. 2006, Chapman 1988, Platts et al. 1989, Lloyd et al. 1987). Other than the Tucannon River the stream channels crossed by the action alternatives and their access roads are all intermittent channels well upstream of streams that may contain fish. Any local slight sediment increases to intermittent streams would be dispersed and settle before reaching any potential downstream streams that may contain fish.

Construction near the Tucannon River would be limited with tower sites located 970 feet and 1,610 feet from the stream (east and west side of the river, respectively) and no new access roads constructed near or crossing the river for all action alternatives. As a result, the chance of eroded sediment reaching the Tucannon River would be remote and no increases in suspended sediment are anticipated. Also aquatic resources in the Tucannon River below the proposed crossing location are generally limited, with most species of concern either not present or only present during migration, although some spawning (fall Chinook salmon) and overwintering (possibly bull trout) may occur in this region. Adverse impacts to aquatic resources would not occur in this reach from sediment runoff related to project construction or operation activities. Overall ***none to low*** impacts to aquatic resources would occur from clearing and construction of towers and roads.

Operation of the project would not result in the loss of stream side vegetation and there would be no input of large woody debris. Vegetation along streams supplies shade to maintain cool temperatures and organic input (e.g., leaves, terrestrial insects) that aid aquatic production, and large woody debris, an important habitat component in streams (Beechie and Sibley 1997, Lisle 1986, Bilby and Bisson 1992, Piccolo and Wipfli 2002). With the exception of the Tucannon River, vegetation near streams along the proposed action alternatives is limited to low brush. No true riparian vegetation would be removed from any construction actions. The Tucannon River has riparian trees and vegetation, but this riparian area would be spanned by the proposed transmission line, and no new road crossings would be constructed in this area. As a result, operation of the proposed project would have ***no*** impact on fish or fish habitat, including streamside vegetation or large woody debris input to the Tucannon River.

Culvert installation may occur at some locations where new access roads would cross intermittent streams. The need for new culverts would be determined during field verification of the proposed road locations, but could cause some short term increase in sediment during periods when flow occurs on these intermittent streams. This potential increase in sediment would have ***no*** effect on fish because it would not enter perennial streams where fish may be present because increased sediment in the short term flowing water would settle out in the normally dry channel before reaching fish bearing streams (see Water Resource section above). Culverts would not be installed in fish bearing streams and would, therefore, have ***no*** impact on fish passage.

Petroleum entering streams can have toxic effects to fish and other aquatic organisms in low concentrations. As noted above project facilities would be well away from flowing streams so vehicles or fuel trucks would rarely be near fish streams. Also, BMPs would require storage of transported fuel and filling of vehicles to be away from streams and drainages (see Section 3.6.3 Mitigation Measures below). Other than unanticipated spills near water bodies, ***no*** impacts would occur to aquatic organisms from petroleum products.

Herbicides may be toxic to fish and other aquatic organisms, depending on type used and concentration, should they enter streams (Tu et al. 2001). They can also reduce stream primary production by killing aquatic plants. Generally impacts to streams occur from overspray or drift (aerial applications) and additionally from leaching through soils into groundwater or by surface/subsurface runoff. BPA would use an integrated vegetation management strategy (BPA 2000a) to control vegetation along the transmission line corridor that may involve a number of different methods, including manual (hand-pulling, clippers, chainsaws), mechanical (roller-choppers, brush-hogs), biological (insects or fungus for attacking noxious weeds), and the application of herbicides. If used, herbicide application would be limited to hand spraying at least 100 feet from all fish-bearing stream channels and only EPA-approved herbicides that are non-toxic to aquatic resources would be used (see Section 3.6.3). As a result, potential effects to aquatic resources, including fish, would be ***none to low***.

The following sections describe potential impacts on fish specific to each of the action alternatives.

North Alternative

Impacts to aquatic resources and habitat from the North Alternative would be similar to those discussed for impacts common to all action alternatives (***none to low*** impacts). The only differences among the action alternatives that may relate to potential effects to aquatic resources is the amount of ground disturbance and number of dry drainages that new roads would cross (see Section 3.1 Geology and Soils, Table 3-3). The lowest number of drainages crossed (eight) among the action alternatives would occur for this alternative.

South Alternative

Impacts to aquatic resources and habitat from the South Alternative would be similar to those discussed for impacts common to all action alternatives (***none to low*** impacts). The only differences among the action alternatives that may relate to potential effects to aquatic resources is the amount of ground disturbance and number of dry drainages that new roads would cross (see Section 3.1 Geology and Soils, Table 3-3). The highest number of drainages crossed (15) among the alternatives, would occur for this alternative.

Combination A Alternative

Impacts to aquatic resources and habitat from the Combination A Alternative would be similar to those discussed for impacts common to all action alternatives (***none to low*** impacts). The only differences among the action alternatives that may relate to potential effects to aquatic resources is the amount of ground disturbance and number of dry drainages that new roads would cross (see Section 3.1 Geology and Soils, Table 3-3). An intermediate number of drainages crossed (ten) among the alternatives, would occur for this alternative.

Combination B Alternative

Impacts to aquatic resources and habitat from the Combination B Alternative would be similar to those discussed for impacts common to all action alternatives (***none to low*** impacts). The only differences among the action alternatives that may relate to potential effects to aquatic resources is the amount of ground disturbance and number of dry drainages that new roads would cross (see Section 3.1 Geology and Soils, Table 3-3). An intermediate number of drainages crossed (13) among the alternatives, would occur for this alternative.

3.6.3 Mitigation Measures

Mitigation measures listed in Section 3.1.3 Geology and Soils, would minimize impacts to water resources and fish. Additionally, the following mitigation measures would minimize or avoid impacts:

- Design culverts and drainage controls placed in non-fish bearing streams to preserve natural drainage patterns.
- Maintain unobstructed passage for water at all culverts placed in non-fish bearing streams and promptly remove any blockages to protect the roadbed and prevent sedimentation of downstream waterbodies.
- Install and maintain water and sediment control measures at all waterbodies (including dry waterbodies) crossed by access roads or otherwise impacted by surface disturbance.
- Regularly inspect and maintain the condition of access roads, culverts, and sediment control measures to prevent long-term impacts during operation and maintenance.
- Avoid storing, transferring, or mixing of oils, fuels, or other hazardous materials where accidental spills could enter surface or groundwater. Have spill response and clean-up materials onsite and clean-up all spills immediately.
- Maintain, fuel, and repair heavy equipment and vehicles using spill prevention and control measures. Contaminated surfaces will be cleaned immediately following any spill incident.
- Use secondary containment for on-site fueling tanks.
- Limit fuel tank and truck storage to at least 100 feet from all streams, dry or flowing. Limit vehicle fueling to 25 feet from all streams, dry or flowing.
- Limit herbicide application to hand spraying at least 100 feet from all fish-bearing stream channels and use only EPA-approved herbicides that are non-toxic to aquatic resources.

3.6.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to water resources and fish.

3.7 Visual Resources

3.7.1 Affected Environment

This section describes the existing visual setting in the region, as well as three specific areas in the project vicinity: 1) the Lewis and Clark National Historic Trail, which follows the lower Snake River and forms the northern boundary of the project area; 2) the section of the Lewis and Clark Trail Scenic Byway that passes through the project area (U.S. Route 12); and 3) and the town of Starbuck, which is the only town in the vicinity of the project corridor.

Regional Setting

The project area is characterized by rolling hills that generally exhibit smooth rounded lines and varying shades of muted tans and greens. The area was historically dominated by native grasslands and shrub-steppe vegetation communities, but much of the area has been converted to agricultural uses. The open rolling hills create a uniform topographic pattern of cultivated dry land agricultural fields, fallow pastures, and native and disturbed grasslands. This low vegetative cover is generally tan brown interspersed with patches of green, depending on the season. Roadways curve and undulate along the hillsides with wide vistas of the Snake River and countryside visible from hilltops. The area is sparsely populated with development mainly limited to rural homes, ranches, and farms. Existing BPA 500-kV transmission lines run in an east-to-west direction to the north of the project corridor.

The lower Snake River flows north of the project corridor from east to west and forms the northern boundary of the project area. This stretch of the river is flanked by basalt cliffs and represents a distinct departure from the uniform rolling hills on either side of the river. The Tucannon River, the other perennial waterbody in the project area, flows north through the project corridor to its confluence with the Snake River. North of the project area, the Palouse River flows into the Snake River near Lyons Ferry Park. These rivers stand out as unique visual resources. The water in the rivers is a distinct source of color that contrasts with the surrounding tans and muted greens, and also supports riparian vegetation. Vegetation along the river corridors ranges from grasses and shrubs to clusters of trees.

Lewis and Clark National Historic Trail and Lower Snake River

The outbound journey of the Lewis and Clark expedition traveled down the lower Snake River. Two historic Lewis and Clark camp sites (used during the expedition) are located along the river in the vicinity of the project area (Figure 3-7). Roads in the project area providing access to the river and these historic sites include SRs 127, 261, and 263, Magallon Road, Lower Monumental Road, Little Goose Dam Road, and Ayer Road.

Four multi-purpose dams (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor) built and operated by USACE have dramatically modified the lower Snake River, transforming the free-flowing river into a series of lakes. Near the east side of the proposed project, the 37-mile-long Lake Bryan extends from Little Goose Dam upriver to Lower Granite Dam. The 28-mile-long Lake West extends from Lower Monumental Dam to Little Goose Dam along the north side of the proposed project area. Lake Sacajawea is located along the west side of the project area extending upriver from Ice Harbor Dam to Lower Monumental Dam.

Transmission towers and conductors are visible entering and exiting each of the lower Snake River dams. The primary activities visible in the lower Snake River corridor include recreation (such as fishing and boating) and the transportation of goods by barge and rail. Developed recreation sites are concentrated around the dams, and along the banks of the lakes (see Section 3.4 Recreation).

Views north and west from the lower Snake River toward the project area are generally characterized by steep basalt cliffs, interspersed by steep canyons, in the foreground, rising and giving way to smooth rounded hills. Vegetation is low and the landscape consists of tans and muted greens.

Lewis and Clark Trail Scenic Byway (U.S. Route 12)

The Lewis and Clark Trail Scenic Byway is 572 miles long in Washington and extends from Clarkston on the Idaho border to Cape Disappointment on the Pacific Coast (WSDOT 2009). U.S. Route 12, which passes through the project area, is part of this byway. At its closest point U.S. Route 12 is approximately 0.8 mile south of the project corridor (Figure 3-7, Viewpoint 2). Views from this area are broadly representative of the regional setting, characterized by low rolling hills with low vegetative cover consisting of dry land agriculture, fallow pasture, and grasslands, and the occasional rural home or farm.

Starbuck

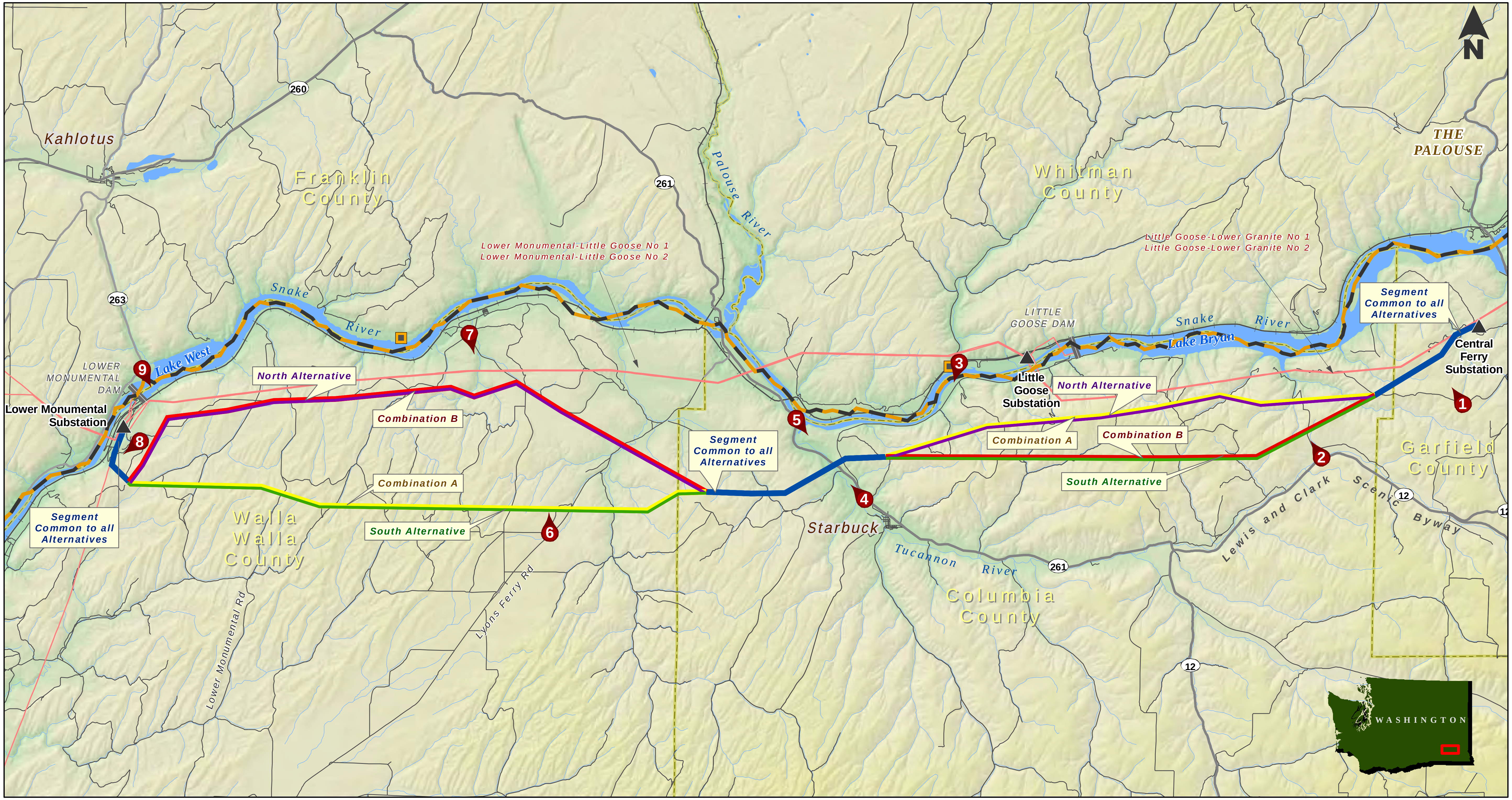
The project area is sparsely populated. Garfield and Columbia counties are the least densely populated counties in Washington. The overall population density in Walla Walla County is higher due to the communities in the south part of the county, but this is not reflected in the part of the county in the project area, which is as sparsely populated as Garfield and Columbia counties (see Section 3.9 Socioeconomics). Residential development in the project area is mainly limited to rural homes and farms. The largest community in the project area is the town of Starbuck in Columbia County, which had an estimated population of 130 in 2009 (Washington OFM 2009a). The project corridor passes approximately 1.2 miles northwest of the town at its closest point (Figure 3-7). Views from the town of Starbuck are broadly representative of the regional setting, characterized by low rolling hills and a mixture of cultivated land, fallow pasture, and grassland.

3.7.2 Environmental Consequences of Action Alternatives

Construction, operation, and maintenance of transmission facilities can affect visual resources in the short- and long-term. Any part of the facility can contribute to visual impacts, including towers, conductors, insulators, and aeronautical safety markings. Access roads, clearing at structure sites, and temporary construction disturbance such as pulling and tensioning sites for the conductors can also cause short- and long-term impacts.

The key evaluation criteria used in the following visual impact assessment are as follows:

- Visibility: Visual impacts are influenced by the estimated degree of project visibility, the distance from which the facility is viewed, and the location of the project in the seen landscape. Degree of visibility pertains to the estimated amount of transmission structures and associated facilities that would be visible. Visibility can be influenced by a proposed facility’s proximity and relationship to existing facilities. Where there are high concentrations of dissimilar structure types, or if similar structure types are not located side by side (not synchronized), there is the potential for a higher degree of visibility. As the distance between viewer and proposed transmission facilities increases, the potential for visual impact decreases. Location in the seen landscape may consider silhouetting, extended views, break in an established landscape pattern or edge, inappropriate scale and the position of the viewer.



BONNEVILLE POWER ADMINISTRATION

Data Source:
Bonneville Power Administration Regional GIS Database.
All data is best available, 12/15/2009

0 2.5 5 10 Miles

Proposed Route Alternatives
(Route sections shown adjacent to one another share the same proposed alignment)

- Segments Common to all Alternatives
- North Alternative
- South Alternative
- Combination A Alternative
- Combination B Alternative

- Viewpoint
- Substation
- Federal Dam
- Existing BPA Transmission Lines

- County Boundary
- Major Highway
- Roads
- Railroad
- Lewis and Clark Campsite
- Lewis and Clark Trail

Bonneville Power Administration
Central Ferry-Lower Monumental 500-kV
Transmission Line Project
Figure 3-7
Viewpoints

- Visual compatibility with the landscape: Visual impacts are also influenced by the compatibility between the proposed project and the landscape in which it is located. Compatibility may be considered in terms of the form, line, color, and texture of the proposed facilities and their relationship to the landforms and vegetation of the surrounding landscape.
- Viewer sensitivity: The potential for visual impact is influenced by the number and type of viewers. As the number of viewers increases, the potential for visual impact also increases. Residents are usually sensitive to changes in their surrounding environments and views, as are some recreational users of particular areas. Highway travelers might not be as sensitive because the lines and associated facilities are in view for only a short time while travelers are en route to other locations. This may not, however, be the case with travelers on a scenic highway where viewers might be sensitive to the presence of man-made structures.

The following visual analysis considers impacts to views in the project area based on an analysis of the potential visual impacts from selected viewpoints (Figure 3-7). The use of these viewpoints allows the actual viewer experience with the landscape to be considered. A total of nine viewpoints were selected to represent the general regional setting and the three specific areas discussed above in the Affected Environment section: the Lewis and Clark National Historic Trail and lower Snake River; the Lewis and Clark Trail Scenic Byway (U.S. Route 12); and the town of Starbuck. Each viewpoint was selected as representative of a series of similar views in each area. These existing views and visual simulations of the proposed facilities superimposed over the existing views are presented in Appendix C.

The selected viewpoints are summarized by landscape setting and area in Table 3-22. This table also identifies the action alternatives that would be visible from each viewpoint and summarizes the permanent impacts for those alternatives from that location. There would also be potential visual impacts during construction. These potential impacts are discussed in the following sections.

Impacts Common to All Action Alternatives

Construction activities that would cause temporary impacts on visual resources include tower and counterpoise installation, access road improvements and new access road construction, temporary pulling/tensioning sites, and installation of fiber optic wood poles. Realignment of three existing lines entering the Lower Monumental Substation and placement of one or two temporary staging areas could also result in temporary disturbance.

These activities would disturb the ground surface by removing low-growing vegetation, moving soil, and temporarily altering drainage patterns. They would also contribute to fugitive dust from the movement of vehicles, from excavation work, and from wind blowing across exposed soil. Surface disturbances would affect visual resources by creating patches of soil across the landscape with a different texture and color when compared to surrounding lands and creating land barren of low-growing vegetation when compared to surrounding lands. Fugitive dust would affect visual resources by diminishing atmospheric clarity. Impacts on visuals resources from surface disturbances and fugitive dust would be adverse, but temporary, because they would be limited to the duration of construction activities. Also, temporary structure-related disturbance, temporary roads, construction staging areas, counterpoise sites, and pulling/tensioning sites would be reclaimed after construction, returning the landscape to pre-disturbance condition. Visual impacts as a result of construction, therefore, are expected to be ***low***.

Table 3-22. Summary of Visual Impacts

Landscape Setting and Area	Viewpoint Number[1/]	Direction of View and Viewshed Description	Action Alternative Simulated[2/]	Permanent Impact Level
Regional Setting	1	Northwest from west of SR 127. Most of the transmission route for the action alternatives would cross landscape similar to the agriculture land in this viewshed.	Common	Low
	6	Northeast from Lyons Ferry Road. Most of the transmission route for the action alternatives would cross landscape similar to the agriculture land in this viewshed.	North	Low
			South	Moderate
			Combination A	Moderate
			Combination B	Low
	7	South from Ayer Road and Casey Road Intersection. Most of the transmission route for the action alternatives would cross landscape similar to the agriculture land in this viewshed.	North	Low
			Combination B	Low
	8	Southwest from Lower Monumental Road. Shows the action alternatives in relation to the Snake River.	Common	Low
Lewis and Clark National Historic Trail and lower Snake River	3	Southwest from Riparia Road. Typical view of the lower Snake River and a general view from the easternmost Lewis and Clark Expedition campsite in the study area.	North	High
			South	High
			Combination A	High
			Combination B	High
	5	South from Snake River and Tucannon River confluence. View from the Snake River up the Tucannon River.	Common	High
	9	South from SR 263. Shows views near the Snake River at Lower Monumental Dam.	North	Moderate
			South	Low
			Combination A	Low
			Combination B	Moderate
Lewis and Clark Trail Scenic Byway (U.S. Route 12)	2	Northwest from U.S. Route 12. Typical view of rolling hills and rural landscape adjacent to scenic byway.	South	High
			Combination B	High
Starbuck, WA	4	Northwest from SR 261 northwest of Starbuck. View from the area north of Starbuck.	Common	High

Notes:

1/ Viewpoints are shown on Figure 3-7. Existing views and visual simulations of the proposed facilities superimposed over the existing views are presented for each viewpoint in Appendix C to this EIS.

2/ This alternative column indicates the alternative or alternatives that would be visible from each viewpoint. "Common" indicates that the action alternatives share a common alignment that would be visible from this location.

Operation and maintenance of the transmission line would occur intermittently and in discrete locations and would not involve erecting new structures or constructing new roads. Also, they would not involve new sources of light. Consequently, permanent impacts from operation and maintenance activities on visual resources would be ***low***.

Permanent impacts on visual resources would result from acquisition of a new 150-foot-wide right-of-way, and the placement of transmission tower footings, new permanent access roads, and fiber optic wood poles. These activities would result in permanent modifications to the visual landscape. All four action alternatives share common alignments where the proposed transmission line originates from the proposed Central Ferry Substation, crosses the Tucannon River, and terminates at the existing Lower Monumental Substation (Figure 3-7). Four of the selected viewpoints provide views of these common alignments and represent the general regional setting, the Lewis and Clark National Historic Trail and lower Snake River, and the town of Starbuck (see Table 3-22). These four viewpoints are used to characterize potential visual impacts to these areas for all action alternatives below. Views from the remaining five viewpoints would vary by alternative and visual impacts from these locations are discussed by action alternative in the following sections. Potential visual impacts are summarized by action alternative in Table 3-23.

Table 3-23. Permanent Visual Impact by Viewpoint and Action Alternative

Landscape Setting and Area	Action Alternative				
	Viewpoint	North	South	Combination A	Combination B
Regional	1[1/]	Low	Low	Low	Low
	6	Low	Moderate	Moderate	Low
	7	Low	None	None	Low
	8	Low	Low	Low	Low
Historic Trail and Lower Snake River	3	High	High	High	High
	5[1/]	High	High	High	High
	9	Moderate	Low	Low	Moderate
Scenic Byway and U.S. Route 12	2	None	High	None	High
Starbuck	4[1/]	High	High	High	High

Note:
None – The action alternative would not be visible from this viewpoint.
1/ Impacts from these viewpoints are common to all action alternatives.

Regional Setting

Viewpoint 1 represents the regional setting common to all action alternatives near the proposed Central Ferry Substation. Viewpoint 8 represents the regional setting common to all action alternatives near the existing Lower Monumental Substations. Impacts from these viewpoints are discussed below.

Viewpoints 6 and 7 represent views from locations south and north of the project corridor, respectively, in the west portion of the project area. Impacts from these locations would not be common by action alternative and are, therefore, discussed by action alternative in the following sections.

Viewpoint 1. The viewpoint used to represent the regional setting common to all action alternatives near the proposed Central Ferry Substation is from Hagen Road, west of SR 127 (see Figure 3-7). This view was selected to be broadly representative of views from south of the corridor and is one of a limited number of publicly accessible points where the proposed project would be visible in this area. Based on the intervening topography, the project corridor and proposed transmission line would not be visible from SR 127 in this area.

The view from this viewpoint is also broadly representative of the rolling hills and agricultural lands that characterize the general regional setting (see Figure C-1a in Appendix C). The existing Little Goose-Lower Granite No. 1 and 2 transmission lines cross the middle of the viewshed approximately 1.6 miles northwest of Viewpoint 1 (Figure C-1a). The proposed transmission line under all action alternatives would be located approximately 1.3 miles northwest of Viewpoint 1 at its closest point. Figure C-1b shows the simulated view of the action alternatives from Viewpoint 1.

The proposed project would mirror the existing transmission line in the landscape by paralleling the existing transmission line (Figure C-1b). The proposed towers would be similar in color, size, and shape to the existing transmission line and would not create a skyline from Viewpoint 1. The color of the proposed towers would mimic the muted colors of the surrounding landscape. As noted above, based on the intervening topography, the proposed transmission line would not be visible from the more heavily travelled SR 127 to the east. The number of viewers from this viewpoint is expected to be limited and infrequent, because Hagen Road is not heavily traveled and the viewpoint is surrounded by agricultural lands. Therefore, permanent impacts on the landscape would be ***low***.

Viewpoint 8. This viewpoint is used to represent views southwest from Lower Monumental Road near the lower Snake River and Lower Monumental Substation at the west end of the project area (Figure C-8a in Appendix C). The proposed transmission line under all action alternatives would be located approximately 0.7 mile south of this viewpoint at its closest point (Figure 3-7). Figure C-8b shows the simulated view of the action alternatives from Viewpoint 8.

The proposed towers and conductors would not create a skyline from Viewpoint 8. The color of the proposed towers would mimic the muted colors of the surrounding landscape and relatively little of the towers and conductors would actually visible from this viewpoint (Figure C-8b). Also, with respect to viewer sensitivity, the duration of views from this viewpoint is expected to be short, because the bends in the road in this area do not permit views of relatively long duration and there are few places to stop for longer views. Therefore, permanent visual impacts on the landscape from this viewpoint would be adverse and ***low***.

Lewis and Clark National Historic Trail and Lower Snake River

All four action alternatives would be visible from the three viewpoints along the Lewis and Clark National Historic Trail and lower Snake River corridor (Viewpoints 3, 5, and 9), but impacts would be common to all action alternatives from just one of them (Viewpoint 5). Impacts from this viewpoint are discussed here; views from Viewpoints 3 and 9 are discussed by action alternative below.

Viewpoint 5. This viewpoint is used to represent views from the lower Snake River common to all action alternatives from near the confluence of the lower Snake and Tucannon rivers (Figure 3-7). This view looks toward the project corridor from the relatively heavily traveled SR 261, which is shown in the foreground (Figure C-5a in Appendix C). The proposed transmission line under all action alternatives would be located approximately 1.6 miles south of this viewpoint at its closest point. Figure C-5b shows the simulated view of the action alternatives from Viewpoint 5.

The proposed towers and conductors would introduce a skyline to the landscape, altering the texture of the hills (Figure C-5b). This would noticeably diminish the smooth landscape of the hills and reduce the openness of the terrain. The proposed towers and conductors would be industrial structures in an area with no other similar structures. The proposed towers and conductors would be a conspicuous change to the relatively natural and rural landscape and would disrupt the continuity of visual resources in the landscape.

With respect to viewer sensitivity, the action alternatives would be visible from popular recreation areas and a frequently travelled roadway. The proposed towers and conductors would be clearly visible from SR 261 and the Tucannon River because there are no structures or vegetation to screen views of the proposed towers and conductors. This would diminish the attractiveness of the natural and rural landscape of the area around the Tucannon River, which would be seen by people recreating outdoors. Permanent impacts on the landscape would be ***high***.

Lewis and Clark Trail Scenic Byway (U.S. Route 12)

One viewpoint (Viewpoint 2) was selected to represent views from the Lewis and Clark Trail Scenic Byway (U.S. Route 12) (Figure 3-7). Impacts from this viewpoint would not be common by action alternative and are, therefore, discussed by action alternative in the following sections.

Starbuck

The viewpoint (Viewpoint 4) used to represent the view from the town of Starbuck looks northwest from the relatively heavily traveled SR 261 (Figure 3-7). This viewpoint is located northwest of the town because field review indicated that trees bordering the town would screen northward views (and views of the project corridor) from initially identified locations on the north part of the town itself.

Viewpoint 4. The existing view from this viewpoint is shown in Figure C-4a in Appendix C. SR 261 is shown in the right of the picture. The proposed transmission line under all action alternatives would be approximately 1.2 miles northwest of Viewpoint 4. Figure C-4b shows the simulated view of the section of the project corridor common to all action alternatives from this viewpoint.

The proposed towers and conductors would introduce a skyline to the landscape, altering the texture of the hills. This would noticeably diminish the smooth landscape of the hills and reduce the openness of the terrain. The proposed towers and conductors would be industrial structures in an area with no other similar structures (Figure C-4b). The proposed towers and conductors would be a conspicuous change to the relatively natural and rural landscape. This would disrupt the continuity of visual resources in the landscape. With respect to viewer sensitivity, the proposed towers and conductors would be clearly visible from the relatively heavily traveled SR 261, as well as a nearby stretch of the Tucannon River. As a result, permanent adverse visual impacts on the landscape from this viewpoint would be ***high***.

North Alternative

Regional Setting

Visual impacts from Viewpoints 1 and 8 are common to all action alternatives and discussed above. Visual impacts from Viewpoints 6 and 7 would vary by alternative and are discussed here for the North Alternative.

Viewpoint 6. This viewpoint is broadly representative of views northeast from Lyons Ferry Road. The view from this viewpoint is also representative of the agricultural lands and rolling hills that characterize the general regional setting (see Figure C-6a in Appendix C). The proposed transmission line under the North Alternative would be located approximately 3 miles northeast of Viewpoint 6 at its closest point. Figure C-6b shows the simulated view of the North Alternative from this viewpoint.

The proposed towers would not create a skyline from Viewpoint 6. The proposed towers and conductors would introduce industrial structures to an area with no other similar structures and represent a change to the relatively natural and rural landscape (Figure C-6b). However, the color of the proposed towers would mimic the muted colors of the surrounding landscape and potential impacts would be reduced due to the distance between Viewpoint 6 and the North Alternative (approximately 3 miles). Also, with respect to viewer sensitivity, the number of viewers from this viewpoint is expected to be relatively limited and infrequent, because the viewpoint is surrounded by agricultural lands and Lyons Ferry Road receives relatively low daily use, with average traffic volumes of 259 vehicles per day (see Section 3.10 Transportation). Therefore, permanent visual impacts under the North Alternative would be ***low*** from this viewpoint.

Viewpoint 7. The viewpoint is broadly representative of views south from Ayer and Casey roads (Figure 3-7). This view from the Ayer Road and Casey Road intersection is also representative of the general regional setting, with Casey Road shown curving away toward the right (Figure C-7a in Appendix C). The existing Little Goose-Lower Granite No. 1 and 2 transmission lines cross the middle of the viewshed approximately 1 mile south of Viewpoint 7. Smaller electric distribution lines and wooden poles parallel this section of Casey Road (Figure C-7a). The proposed transmission line under the North Alternative would be located approximately 1.5 miles south of Viewpoint 7 at its closest point. Figure C-7b shows a simulated view of the north alternative from this viewpoint.

The North Alternative would mirror the existing transmission line in the landscape by paralleling the existing transmission line. The towers would be similar in color, size, and shape to the existing transmission line. Also, with respect to viewer sensitivity, the number of viewers from this viewpoint is expected to be limited and infrequent, because the viewpoint is surrounded by agricultural lands, and Ayer and Casey roads are not heavily traveled. Although the proposed towers would add to the skyline from Viewpoint 7, they would not add a new form or shape to the skyline. The color of the proposed towers would mimic the muted colors of the surrounding landscape. Therefore, permanent visual impacts under the North Alternative would be ***low*** from this viewpoint.

Lewis and Clark National Historic Trail and Lower Snake River

Three viewpoints represent views from the Lewis and Clark National Historic Trail and lower Snake River corridor (Viewpoints 3, 5, and 9) (Figure 3-7). Visual impacts from Viewpoint 5 are common to all action alternatives and discussed above. Visual impacts from Viewpoints 3 and 9 would vary by alternative and are discussed here for the North Alternative.

Viewpoint 3. The view from this viewpoint represents a typical view south across the lower Snake River, as well as a view from the easternmost Lewis and Clark Expedition historic camp site in the project area (Figure C-3a). This viewpoint and the Lewis and Clark campsite are located on the north side of the lower Snake River. The proposed transmission line under the North Alternative would be located approximately 2.1 miles southwest of Viewpoint 3 at its closest point. Figure C-3b shows the simulated view of the North Alternative from this viewpoint.

The proposed towers and conductors would introduce a skyline to the landscape, altering the texture of the horizon. This would noticeably diminish the smooth landscape of the horizon and reduce the openness of the terrain. The proposed towers and conductors would be industrial structures in an area with no other similar structures. They would be a conspicuous change to the relatively natural and rural landscape on the south side of the lower Snake River. This would disrupt the continuity of visual resources in the landscape.

With respect to viewer sensitivity, the proposed towers and conductors would be clearly visible from the lower Snake River and the historic Lewis and Clark campsite near this viewpoint (Figure 3-7). There are no structures or vegetation to screen views of the proposed towers and conductors from the river. The proposed transmission line would diminish the attractiveness of the natural and rural landscape of areas popular with people recreating outdoors permanent visual impacts under the North Alternative would be ***high*** from this viewpoint.

Viewpoint 9. Viewpoint 9 represents views southeast across the lower Snake River toward Lower Monumental Substation at the west end of the project area (Figure C-9a in Appendix C).

The view from this location encompasses a small section of the project corridor that is common to all alternatives (described below under the South Alternative), as well as a section that is common to the North and Combination B alternatives only (see Figure 3-7). The Lower Monumental Substation is shown to the right of the curve in the road. Existing transmission lines entering this substation are visible on the opposite shore of the lower Snake River. Figure C-9b shows the simulated view of the North Alternative, as well as the segment that is common to all action alternatives (compare with Figure C-9c).

The section of the proposed transmission line unique to the North and Combination B alternatives in this area would be located approximately 1.4 miles south of Viewpoint 9 at its closest point. The proposed towers would create a skyline from this viewpoint, thereby diminishing the smooth landscape of the hills and reducing the openness of the terrain across portions of the area in view. The proposed transmission towers and conductors would be similar in color, size, and shape to the existing transmission lines shown in the foreground. In addition, the color of the proposed towers would mimic the muted colors of the surrounding landscape. Also, with respect to viewer sensitivity, the duration of views from this viewpoint is expected to be short, because the curves in the road do not permit views of relatively long duration and there are few places to stop for longer views. Permanent impacts on visual resources from this representative viewpoint would be ***moderate***.

Lewis and Clark Trail Scenic Byway (U.S. Route 12)

One viewpoint (Viewpoint 2) was selected to represent views from the Lewis and Clark Trail Scenic Byway (U.S. Route 12) (Figure 3-7). The North Alternative would not be visible from this viewpoint (Figure 3-7).

Starbuck

One viewpoint (Viewpoint 4) used to represent the view from the town of Starbuck looks northwest from the relatively heavily traveled SR 261 (Figure 3-7). Potential visual impacts at this location would be common to all action alternatives. These potential impacts are discussed in the Impacts Common to All Action Alternatives section above.

South Alternative

Regional Setting

Four viewpoints were selected to represent the regional setting (Viewpoints 1, 6, 7, and 8) (Figure 3-7). Visual impacts from Viewpoints 1 and 8 are common to all action alternatives and discussed above. Visual impacts from Viewpoints 6 and 7 would vary by alternative and are discussed here for the South Alternative.

Viewpoint 6. As discussed with respect to the North Alternative, this viewpoint is broadly representative of views northeast from Lyons Ferry Road (Figure 3-7). The proposed transmission line under the South Alternative would be located approximately 0.9 mile northeast Viewpoint 6 at its closest point. Figure C-6c shows the simulated view of the South Alternative from this viewpoint.

The color of the proposed towers would mimic the muted colors of the surrounding landscape and the number of viewers from this viewpoint is expected to be limited and infrequent, because the viewpoint is surrounded by agricultural lands and Lyons Ferry Road receives relatively low daily use. However, the South Alternative would introduce industrial structures to an area with no other similar structures and the proposed towers and conductors would be a conspicuous change to the relatively natural and rural landscape. This would disrupt the continuity of visual resources in the landscape. Also, the proposed towers would begin to create a skyline from Viewpoint 6, thereby diminishing the smooth landscape of the horizon and reducing the openness of the terrain. Permanent visual impacts under the South Alternative would be ***moderate*** from this viewpoint.

Viewpoint 7. The South Alternative would not be visible from this viewpoint (Figure 3-7).

Lewis and Clark National Historic Trail and Lower Snake River

Three viewpoints were selected to represent views from the Lewis and Clark National Historic Trail and lower Snake River corridor (Viewpoints 3, 5, and 9) (Figure 3-7). Visual impacts from Viewpoint 5 common to all action alternatives are discussed above. Visual impacts from Viewpoints 3 and 9 would vary by alternative and are discussed here for the South Alternative.

Viewpoint 3. The South Alternative would not be visible from this viewpoint (Figure 3-7).

Viewpoint 9. As discussed with respect to the North Alternative, this viewpoint represents views southeast across the lower Snake River toward Lower Monumental Substation at the west end of the project area. This view is from the relatively heavily traveled SR 263, which is shown in the foreground (Figure C-9a in Appendix C). The view from this location encompasses a section of the project corridor that is common to all alternatives, as well as a section that is common to the North and Combination B alternatives only (see Figure 3-7).

The section of the proposed transmission line common to all action alternatives in this area would be located approximately 1.6 miles south of Viewpoint 9 at its closest point. Figure C-9c shows the simulated view of the section of the project corridor common to all action alternatives from this viewpoint. This section of the proposed transmission line would enter the existing substation from the south. The color of the proposed towers would mimic the muted colors of the surrounding landscape. The proposed towers would begin to create a skyline when viewed from this location that could diminish the smooth landscape of the hills and slightly reducing the openness of the terrain. However, this impact would be **low** because only part of one tower would be visible on the skyline (Figure C-9b). Also, with respect to viewer sensitivity, the duration of views from this viewpoint is expected to be short, because the curves in the road do not permit views of relatively long duration and there are few places to stop for longer views. Therefore, overall permanent impacts on visual resources from this representative viewpoint would be ***low***.

Lewis and Clark Trail Scenic Byway (U.S. Route 12)

Viewpoint 2. The viewpoint used to represent views from the Lewis and Clark Trail Scenic Byway (U.S. Route 12) in the project area looks north from U.S. Route 12 (Figure 3-7). This view was selected to be broadly representative of views from this highway and is one of a limited number of locations along the highway where the proposed transmission line would be most visible (Figure C-2a). Based on the intervening topography, the project corridor and proposed transmission line would not be visible from most of U.S. Route 12. The proposed transmission line under the South Alternative would be located approximately 0.8 mile northwest of Viewpoint 2 at its closest point. Figure C-2b shows the simulated view of this alternative from Viewpoint 2.

The proposed towers and conductors would introduce a skyline to the landscape, altering the texture of the horizon. This would noticeably diminish the smooth landscape of the horizon and reduce the openness of the terrain. The proposed towers and conductors would be industrial structures in an area with no other similar structures. Although wooden utility poles with lines are already present, the proposed towers would be larger, a different shape, a different form, and a different color. The proposed towers would also run roughly perpendicular to the existing wooden utility poles. The proposed towers would become the tallest structures on the landscape and disrupt the continuity of visual resources in the landscape.

With respect to viewer sensitivity, proposed towers and conductors would be clearly visible from U.S. Route 12 because there are no structures or vegetation to screen views of the proposed towers and conductors from the road. This would diminish the attractiveness of the natural and rural landscape that is characteristic of this segment of the scenic byway, which is a highly travelled road. Permanent visual impacts under the South Alternative would be ***high*** from this viewpoint.

Starbuck

One viewpoint (Viewpoint 4) used to represent the view from the town of Starbuck looks northwest from the relatively heavily traveled SR 261 (Figure 3-7). Potential visual impacts at this location would be common to all action alternatives. These potential impacts are discussed in the Impacts Common to All Action Alternatives section above.

Combination A Alternative

The Combination A Alternative shares common alignments with the North Alternative east of the Tucannon River, and with the South Alternative west of the Tucannon River (Figure 3-7). Visual impacts under this alternative would, therefore, be a combination of those described above for the North and South alternatives.

Regional Setting

Four viewpoints were selected to represent the regional setting (Viewpoints 1, 6, 7, and 8) (Figure 3-7). Visual impacts from Viewpoints 1 and 8 are common to all action alternatives and discussed above. Visual impacts from Viewpoints 6 and 7 under the Combination A Alternative would be the same as those described above for the South Alternative.

Lewis and Clark National Historic Trail and Lower Snake River

Three viewpoints were selected to represent views from the Lewis and Clark National Historic Trail and lower Snake River corridor (Viewpoints 3, 5, and 9) (Figure 3-7). Visual impacts from Viewpoint 5 common to all action alternatives are discussed above. Visual impacts from Viewpoint 3 under the Combination A Alternative would be the same as those described above for the North Alternative. Visual impacts from Viewpoint 9 would be the same as those described above for the South Alternative.

Lewis and Clark Trail Scenic Byway (U.S. Route 12)

One viewpoint (Viewpoint 2) was selected to represent views from the Lewis and Clark Trail Scenic Byway (U.S. Route 12) (Figure 3-7). The Combination A Alternative would not be visible from this viewpoint (Figure 3-7).

Starbuck

One viewpoint (Viewpoint 4) used to represent the view from the town of Starbuck looks northwest from the relatively heavily traveled SR 261 (Figure 3-7). Potential visual impacts at this location would be common to all action alternatives. These potential impacts are discussed in the Impacts Common to All Action Alternatives section above.

Combination B Alternative

The Combination B Alternative shares common alignments with the South Alternative east of the Tucannon River and with the North Alternative west of the Tucannon River (Figure 3-7). Visual impacts under this alternative would, therefore, be a combination of those described above for the North and South alternatives.

Regional Setting

Four viewpoints were selected to represent the regional setting (Viewpoints 1, 6, 7, and 8) (Figure 3-7). Visual impacts from Viewpoints 1 and 8 are common to all action alternatives and discussed above. Visual impacts from Viewpoints 6 and 7 under the Combination A Alternative would be the same as those described above for the North Alternative.

Lewis and Clark National Historic Trail and Lower Snake River

Three viewpoints were selected to represent views from the Lewis and Clark National Historic Trail and lower Snake River corridor (Viewpoints 3, 5, and 9) (Figure 3-7). Visual impacts from Viewpoint 5 common to all action alternatives are discussed above. The Combination B Alternative would not be visible from Viewpoint 3. Visual impacts from Viewpoint 9 under this alternative would be the same as those described above for the North Alternative.

Lewis and Clark Trail Scenic Byway (U.S. Route 12)

One viewpoint (Viewpoint 2) was selected to represent views from the Lewis and Clark Trail Scenic Byway (U.S. Route 12) (Figure 3-7). Visual impacts from Viewpoint 9 under the Combination B Alternative would be the same as those described above for the South Alternative.

Starbuck

One viewpoint (Viewpoint 4) used to represent the view from the town of Starbuck looks northwest from the relatively heavily traveled SR 261 (Figure 3-7). Potential visual impacts at this location would be common to all action alternatives. These potential impacts are discussed in the Impacts Common to All Action Alternatives section above.

3.7.3 Mitigation Measures

The following mitigation measures have been identified to reduce or eliminate adverse impacts on visual resources from the project alternatives:

- Preserve vegetation within the 150-foot-wide right-of-way that would not interfere with the conductor or maintenance access needs. Most of the vegetation along the proposed transmission line routes is low-growing sagebrush or agricultural crops, both of which are compatible with transmission line safety and operations.
- Locate construction staging areas away from visually sensitive locations. The contractor hired to construct the transmission line would be responsible for determining appropriate staging locations, but potential staging locations include parking lots in Starbuck and Dayton, and possibly Pomeroy.
- Use non-reflective conductors.
- Use non-reflective insulators (i.e., non-ceramic or porcelain).
- Locate new access roads within previously disturbed areas wherever possible.
- Revegetate disturbed areas with approved species.
- Require that contractors maintain a clean construction site and all related equipment, materials, and litter be removed following completion of construction.

3.7.4 Environmental Consequences of the No Action Alternative

There would be no impacts on visual resources from the No Action Alternative because there would be no new structures or activities.

3.8 Cultural Resources

Cultural resources are nonrenewable places of human occupation or activity related to American history, architecture, anthropology, and engineering. Historic properties, a subset of cultural resources, consist of any district, site, building, structure, artifact, ruin, object, work of art, or natural feature important in human history at the national, state, or local level. Historic properties include “prehistoric” resources that pre-date European settlement. Traditional Cultural Properties (TCPs) are another category of property evaluated in this section; these properties are identified by an existing community as being important to that community’s cultural identity and traditional knowledge.

The National Environmental Policy Act’s (NEPA’s) concern is with the “human environment,” defined as including the natural and physical (e.g., built) environment and the relationships of people to that environment. Culturally valued aspects of the environment generally include historic properties, other culturally valued pieces of real property, cultural use of the biophysical environment, and such “intangible” sociocultural attributes as social cohesion, social institutions, lifeways, religious practices, and other cultural institutions.

Please see Chapter 4 – Consultation, Review, and Permit Requirements, for a list of the various laws and regulations applicable to cultural resources.

3.8.1 Affected Environment

The proposed project is located in the Columbia Plateau physiographic region, which has been occupied by human populations for at least 10,000 years. Indigenous oral history information holds that Native people have lived in the project area since the beginning of time. Several tribes occupied portions of the landscape in and around the project area including the Walla Walla, Nez Perce, Palouse, Cayuse, and Umatilla.

In the late eighteenth to early nineteenth centuries, Europeans and Euro-Americans began to explore the Columbia Plateau area. Disease, traders, missionaries, and new technology had considerable impacts on the Native American people living in the region. Native Americans within or near the project area were forced by the U.S. Government to relocate their settlements to reservations in the later half of the nineteenth century, opening up lands for Euro-American settlement.

The earliest documented Euro-Americans to enter the project vicinity were members of the Lewis and Clark Expedition in 1805. The Expedition traveled through the general project area on the Snake River and inland through what would become Columbia and Garfield counties.

The area of potential effect (APE) for the proposed project includes the four proposed 150-foot-wide action alternative rights-of-way, and the proposed new and improved access roads for those alternatives. BPA will consult with the Washington Department of Archaeology and Historic Preservation (DAHP) on the final definition of the APE following completion of a cultural resources inventory scheduled for the summer of 2010 and completion of final project design.

A background search of the Washington DAHP cultural resources database documented 19 cultural resources studies within 0.5 mile of the proposed project. Five of these studies were conducted over areas within portions of the current APE; however, none of the surveys identified cultural resources within the APE. The background research revealed that no previously recorded archaeological sites or historic structures are located directly within the APE. Within an approximate 0.5-mile radius, the review documented six historic and pre-contact archaeological sites and isolates.

Prehistoric Resources

While numerous archaeological sites have been recorded in the project vicinity, they are largely concentrated along the Snake River (and outside the 0.5-mile radius). Three of the six resources identified are located southwest of the Lower Monumental Substation, within 300 meters of the shoreline. All six are situated on terraces, below 600 feet mean sea level, and include two historic-period sites, two pre-contact sites, one pre-contact isolate, and one site with historic and pre-contact components. Cultural materials identified at pre-contact archaeological sites in close proximity to the project area include chipped stone tools, associated debris, varying quantities of fire-modified rock, mussel shell, and bone.

Historic Resources

Historic Euro-American sites identified are related to the railroad industry and late nineteenth century to early twentieth century farming and homesteading. Features and artifacts observed include a railroad grade and one historic debris concentration consisting of sheet metal fragments, tin cans, glass fragments, evaporated milk cans, one ceramic bowl fragment, a wood cookstove, and several pieces of farming equipment.

Traditional Cultural Properties

A Traditional Cultural Property or "TCP" is a property type that can be listed on the National Register of Historic Places (NRHP). Like other potentially eligible property types, the significance and eligibility of a TCP must be evaluated. "The traditional cultural significance of a historic property is significance derived from the role the property plays in a community's historically rooted beliefs, customs and practices" (Parker and King 1998). These sites are important in maintaining a community's historic identity and help preserve and perpetuate traditional knowledge and culture. The nature of a TCP depends on the meaning given to it by the living cultural community, and that community must play a central role in the identification, evaluation and treatment of the property (Hutt 2006).

Traditional cultural properties may be a single site, a district, or a cultural landscape. They may be archaeological, historic or ethnographic in nature. Their setting is variable and may include urban neighborhoods, rural communities, natural settings, or prominent landform features. Communities like a German village in Columbus, Ohio, Chinatown in Honolulu, Hawaii and a range of community resources important to ethnic communities throughout the United States are considered TCPs. In the Pacific Northwest, much of the focus of TCP evaluation has been on American Indian communities, and the 1992 amendment to the NRHP specifically notes that properties of religious and cultural significance to Indian tribes may be determined to be eligible for listing on the NRHP (16 USC 470a(d)(6)(A)).

Many Native American communities who have been displaced from their traditional homelands by European settlement maintain ongoing cultural links with their historic traditional use areas. They recognize traditional cultural properties that are often outside of their modern reservation settings based on pre-European contact settlement and subsistence activities. These include traditional hunting areas, plant gathering and fishing sites, village locations, archaeological sites, rock image sites, places of historical importance, places that feature in tribal legends, historic trails, burial grounds, ceremonial use areas, and sacred landscapes. Many variables can contribute to a sacred landscape, such as myth time stories attached to the location. These stories detail creation beliefs for the tribes and therefore hold religious significance. Sacred landscapes have a strong socio-cultural connection to tribal people. It is the responsibility of federal agencies under the NHPA to work with tribal and other cultural communities to identify TCPs that may be affected by federal undertakings.

The Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation are in the process of preparing TCP studies for this project to determine if areas, including sacred and traditional sites within the project vicinity, could be affected. The Confederated Tribes of the Umatilla Indian Reservation have indicated that the APE for their studies will include the project corridor, and also areas near the project corridor, from which the proposed project would be visible. The laws and regulations related to Native American traditional and sacred sites are summarized in Section 4.4 of this EIS.

3.8.2 Environmental Consequences of Action Alternatives

Impacts Common to All Action Alternatives

Construction of towers, placement of temporary pulling/tensioning sites, counterpoise installation, access road improvements and new road construction, and installation of fiber optic wood poles can damage or destroy cultural resources. Visual elements that alter the character or setting of cultural resource sites are forms of disturbance, as are direct physical impacts to site integrity. Increased access to cultural resources due to project construction, operation, and maintenance can increase vandalism and looting.

Based on the results of the background search that has been conducted for the proposed project, there would be ***no*** expected impacts to previously identified cultural resources. A cultural resources inventory of the action alternatives will be conducted in the summer of 2010 to confirm these results, and field surveys will be undertaken as needed.

The project corridor transects the ancient lands of many Columbia River basin tribes. Impacts are expected to be ***none to low*** to unknown sites with appropriate procedures in place to stop construction activities and determine appropriate protective measures (e.g., avoidance) if artifacts are found (see Section 3.8.3 Mitigation).

No impacts to cultural resources are anticipated during operation and maintenance of the proposed transmission line. The towers and access roads would be sited to avoid sensitive areas, so maintenance to the towers or access roads would not affect known resources. The vegetation within the right-of-way is not dense, so it is not expected that any ground disturbing mechanical type vegetation clearing would be required. If any maintenance activities need to occur outside of the tower locations or off the access roads, a review of the sensitive areas would be required in order to avoid impacting resources.

Possible impacts to TCPs will not be known until the Nez Perce Tribes and the Confederated Tribes of the Umatilla Indian Reservation complete their TCP studies for this project. Following preparation of the studies, appropriate protective measures would be implemented if necessary, and could include avoidance, minimization, or mitigation.

3.8.3 Mitigation Measures

The following mitigation measures would minimize impacts to cultural resources:

- Design the transmission line so that tower sites are placed to avoid cultural resources.
- Design new access roads to avoid cultural resources, and minimize the potential for trespassing access, where possible.
- Improve the existing road system in a manner that minimizes new roads and avoids cultural resource sites. If improvements are needed on existing roads that cross through cultural resources sites, such improvements would be constructed in a manner to

avoid/minimize impacts, such as using fabric and rock or other mitigation agreed to during the consultation process.

- Consult with the Washington DAHP, the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation regarding NRHP eligibility of cultural sites and TCPs.
- Develop an Inadvertent Discovery Plan that details crew member responsibilities for reporting in the event of a discovery during construction.
- Ensure tribal monitors from the Nez Perce Tribe and/or the Confederated Tribes of the Umatilla Indian Reservation are present if work within prehistoric sites or TCPs cannot be avoided.
- Prevent unauthorized collection of cultural materials by ensuring a professional archaeologist and tribal monitor are present during any excavation within known sites.
- Prepare a Mitigation Plan to protect sites in-situ if final placement of project elements results in unavoidable adverse impacts to a significant cultural resource.
- Stop work immediately and notify local law enforcement officials, appropriate BPA personnel, Washington DAHP, the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, and WDNR, if on state lands, if cultural resources, either archaeological or historical materials, are discovered during construction activities.

3.8.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impacts to cultural resources.

3.9 Socioeconomics and Public Facilities

3.9.1 Affected Environment

The proposed project is located in Garfield, Columbia, and Walla Walla counties in southeastern Washington. The town of Starbuck is the closest community to the proposed project. Other communities in the general vicinity include Pomeroy, Dayton, Prescott, Waitsburg, and Walla Walla. Communities further away but still within the affected environment include the Tri-Cities of Kennewick, Pasco, and Richland, Washington located west of Walla Walla County in Franklin and Benton counties. Garfield, Columbia, and Walla Walla counties comprise the primary area of effect for this analysis because they would be directly affected by construction of the project. Franklin and Benton counties are included as a secondary area of analysis because workers may reside or stay temporarily in those counties, and the Tri-Cities—the closest regional economic center to the project corridors—are located in these counties.

Demographic Characteristics and Trends

Population

The five counties mentioned above had an estimated total population of 307,550, with 79 percent of this total in Benton and Franklin counties (Table 3-24). The three counties that comprise the primary area of effect for this analysis (Columbia, Garfield, and Walla Walla counties) had a combined estimated population of 65,550 in 2009, with the majority (90 percent) of this population located in Walla Walla County (Table 3-24). The three counties are sparsely populated and predominantly rural, with the majority of the land used for agriculture. The primary population center in the three counties is the city of Walla Walla, which accounts for almost half of the total population (Table 3-24). The Tri-Cities is the closest regional economic center with a combined estimated population of 169,080 in 2009, more than five times as large as the population in the city of Walla Walla (Table 3-24).

Table 3-24. Population, 1990 to 2009

Geographic Area	1990	2000	2009	1990 to 2000 Absolute Change	1990 to 2000 Percent Change	2000 to 2009 Absolute Change	2000 to 2009 Percent Change
Benton County	112,560	142,475	169,300	29,915	27%	26,825	19%
Kennewick	42,152	54,751	67,180	12,599	30%	12,429	23%
Richland	32,315	38,708	47,410	6,393	20%	8,702	22%
Columbia County	4,024	4,064	4,100	40	1%	36	1%
Dayton	2,468	2,655	2,735	187	8%	80	3%
Starbuck	170	130	130	-40	-24%	0	0%
Franklin County	37,473	49,347	72,700	11,874	32%	23,353	47%
Pasco	20,337	32,066	54,490	11,729	58%	22,424	70%
Garfield County	2,248	2,397	2,250	149	7%	-147	-6%
Pomeroy	1,393	1,517	1,525	124	9%	8	1%
Walla Walla County	48,439	55,180	59,200	6,741	14%	4,020	7%
Prescott	275	314	320	39	14%	6	2%
Waitsburg	990	1,212	1,245	222	22%	33	3%
Walla Walla	26,482	29,686	31,610	3,204	12%	1,924	6%
County Total[1/]	**204,744**	**253,463**	**307,550**	**48,719**	**24%**	**54,087**	**21%**
Washington State	4,866,663	5,894,143	6,668,200	1,027,480	21%	774,057	13%

Note:
1/ These totals are for the five above counties: Benton, Columbia, Franklin, Garfield, and Walla Walla counties.
Source: Washington OFM 2009a

Columbia County had an estimated population of 4,100 in 2009. The city of Dayton is the county seat and accounted for about 67 percent of the total county population. Starbuck, the only other incorporated community in the county, accounted for 3 percent of the population, with an estimated 130 residents in 2009. Population in Columbia County increased slightly in the 1990s and since 2000, with total population gains equivalent to about 1 percent of the total population over both periods, compared to statewide increases of 21 percent in the 1990s and 13 percent since 2000 (Table 3-24).

The county is sparsely populated with the second lowest population density in the state: 4.7 persons per square mile compared to a statewide average of 100.2 persons per square mile (Washington OFM 2009b).

Garfield County had an estimated population of 2,250 in 2009. Pomeroy, the county seat, is the only incorporated community in the county, and accounted for 68 percent of the total county population in 2009 (Table 3-24). Garfield County is the least densely populated county in Washington state, with an average population density in 2009 of 3.2 persons per square mile compared to a statewide average of 100.2 persons per square mile (Washington OFM 2009b). The county experienced modest population gains in the 1990s, that have since reversed, with the estimated population in 2009 almost exactly the same as it was in 1990 (Table 3-24).

Walla Walla County had an estimated population of 59,200 in 2009. Population increased in this county in the 1990s and has continued to increase since 2000 (Table 3-24). The incorporated communities in this county are located in the south portion of the county. Walla Walla County is more densely populated than Columbia and Garfield counties, with approximately 46.6 persons per square mile, which is still less than half the state average (Washington OFM 2009b). This higher density is largely due to the city of Walla Walla, located in the south part of the county. Net in-migration accounted for approximately 67 percent of the population increase in this county since 2000, compared to 56 percent statewide (Washington OFM 2009c).

Two of the Tri-Cities (Kennewick and Richland) are located in Benton County, which had an estimated population of 169,300 in 2009 (Table 3-24). Benton County is relatively densely populated with a 2009 population density of 99.4 persons per square mile compared to a statewide average of 100.2 persons per square mile, and approximately 68 percent of the total population concentrated in the cities of Kennewick and Richland (Washington OFM 2009b). Population growth in Benton County outpaced the state average in the 1990s and from 2000 to 2009 (Table 3-24).

The city of Pasco, the third of the Tri-Cities, is located in Franklin County, which had an estimated population of 72,700 in 2009, with approximately 75 percent of the total concentrated in Pasco (Table 3-24). Franklin County had a population density of 58.5 persons per square mile in 2009, just over half the statewide average of 100.2 persons per square mile (Washington OFM 2009b). Population growth in Franklin County outpaced the state average in the 1990s and increased at almost three times the state average from 2000 to 2009 (Table 3-24).

The Washington OFM prepares three series (low, medium, and high) of 20 year population projections every 5 years. Population projections (medium series) prepared by the Washington OFM in 2007 expect population to continue to increase statewide, with total population expected to increase by 22 percent from 2009 to 2025. Smaller total increases are projected for Garfield and Walla Walla counties over this period, 17 percent and 15 percent, respectively, with population in Columbia County expected to remain at its current level. Population in Benton County is projected to increase at the state average (22 percent), with a much larger increase (66 percent) projected for Franklin County (Washington OFM 2007)

Race and Ethnicity

The majority of the population in Washington state (79 percent) identified as White in the 2000 Census (Table 3-25). The populations of Columbia and Garfield counties were less diverse than the state as a whole, with 91 percent and 96 percent of their respective populations identifying as

White in 2000. The share of the population identified as White has decreased slightly in these counties since 2000, but was still well above the state average in 2009 (Table 3-26). Approximately 79 percent of the population in Walla Walla County identified as White in 2000. People identifying as Hispanic or Latino were the largest minority group in Walla Walla County, accounting for 16 percent of the total population in 2000, and 20 percent of the total in 2009 (Tables 3-25 and 3-26).

Table 3-25. Race and Ethnicity, 2000

Geographic Area	Total Population	Percent of Total Population				
		White[1/]	Hispanic or Latino	American Indian and Alaska Native[1/]	Other Race[1/2/]	Two or more races[1/]
Columbia County	4,064	91	6	1	1	1
Dayton	2,655	89	8	1	1	2
Starbuck	130	97	2	1	0	0
Garfield County	2,397	96	2	0	1	1
Pomeroy	1,517	96	2	1	0	1
Walla Walla County	55,180	79	16	1	3	2
Prescott	314	93	4	1	0	1
Waitsburg	1,212	93	3	0	1	2
Walla Walla	29,686	76	17	1	4	2
Washington State	5,894,121	79	7	1	9	3

Notes:

1/ Non-Hispanic only. The federal government considers race and Hispanic/Latino origin (ethnicity) to be two separate and distinct concepts. People identifying as Hispanic or Latino origin may be of any race. The data summarized in this table present Hispanic/Latino as a separate category.

2/ The “Other Race” category presented here includes census respondents identifying as Black or African American, Asian, Native Hawaiian and Other Pacific Islander, or Some Other Race.

Source: U.S. Census Bureau 2000a

Table 3-26. Race and Ethnicity, 2008

Geographic Area[1/]	Total Population	Percent of Total Population				
		White[2/]	Hispanic or Latino	American Indian and Alaska Native[2/]	Other Race[2/3/]	Two or more races[2/]
Columbia	4,100	89	8	1	1	1
Garfield	2,300	95	3	0	1	1
Walla Walla	58,600	75	20	1	3	1
Washington State	6,587,600	76	9	1	10	3

Notes:

1/ Data are not available at the community level in this series.

2/ See Table 3-25, Note 1.

3/ See Table 3-25, Note 2.

Source: Washington OFM 2008

In Benton and Franklin counties, the share of the population identifying as White in 2009 was 78 percent and 37 percent, respectively. People identifying as Hispanic or Latino were the largest minority group in both counties, accounting for 16 percent of the total population in 2009 in Benton County and 59 percent in Franklin County. The share of the population identifying as Hispanic or Latino has increased in both counties since 2000, especially in Franklin County where Hispanic/Latino people increased from 47 percent of the total population in 2000 to an estimated 59 percent of the total in 2009 (Washington OFM 2008).

Housing

Housing estimates are presented for the five potentially affected counties and the state of Washington in Table 3-27. These estimates suggest that limited housing is available for rent in Columbia and Garfield counties, with estimates of just 33 and 16 units, respectively. An estimated 431 units are available for rent in Walla Walla County. In addition, an estimated 1,562 units are available for rent in neighboring Benton and Franklin counties, with 1,342 of these units located in the Tri-Cities (Kennewick, Richland, and Pasco). These estimates were derived from 2009 housing unit counts, ratios of rental to owner-occupied units for each area from the 2000 Census, and the annual statewide rental housing vacancy rate for 2008. In 2000, the statewide rental vacancy rate was lower than the corresponding rates in the affected counties and nearby communities identified in Table 3-27. As a result, Table 3-27 may underestimate the number of units available for rent in each community.

Table 3-27. Housing Estimates

Geographic Area	Housing Units 2009	Percent Change in Number of Units 2000 to 2009	Estimated Number of Rental Housing Units[1/]	Estimated Units Available for Rent[2/]
Benton County	66,602	19%	21,351	1,132
Kennewick	26,945	22%	11,149	591
Richland	20,221	96%	8,133	431
Columbia County	2,183	8%	623	33
Dayton	1,243	5%	415	22
Starbuck	88	2%	23	1
Franklin	23,544	46%	8,120	430
Pasco	17,657	7%	6,046	320
Garfield County	1,326	3%	293	16
Pomeroy	743	0%	161	9
Walla Walla County	23,442	11%	8,125	431
Prescott	154	1%	51	3
Waitsburg	550	5%	118	6
Walla Walla	12,522	10%	5,159	273
Washington State	**2,837,528**	**16%**	**990,125**	**52,477**

Notes:

1/ Numbers of rental housing units are estimated using the ratio of rental to owner-occupied units identified for each area in the 2000 Census.

2/ Housing units available for rent were estimated using the annual statewide rental vacancy rate for 2008 and the total estimated number of rental units for each area. This may underestimate the availability of rental housing because vacancy rates identified for each area in 2000 were all above the statewide average.

Source: U.S. Census Bureau 2000b, 2009a, Washington OFM 2009d

Temporary accommodation in the form of hotels and motels is limited in the communities located near the proposed routes. Three motels with a total of 54 rooms are located in Dayton and one motel with 13 rooms is located in Pomeroy (Table 3-28). There are also several small bed and breakfast inns (B&Bs), with less than 10 rooms each, located in Pomeroy and the surrounding area.

Data compiled by Smith Travel Research for hotels, motels, and B&Bs with 15 or more rooms identified 14 hotels with a total of 876 rooms in Walla Walla, which is about 60 miles and 70 minutes drive from Starbuck. Smith Travel Research identified 39 hotels, motels, and B&Bs with 15 or more rooms in the Tri-Cities (Kennewick, Pasco, and Richland) area in Benton and Franklin counties (Table 3-28). Pasco, the closest of the Tri-Cities to the proposed project, is about 56 miles and 70 minutes drive from Lower Monumental Dam.

Table 3-28. Motels and Hotels

Geographic Area	Number of Motels and Hotels[1/]	Total Number of Rooms[1/]	Average Number of Available Rooms[2/]
Pomeroy	1	13	5
Dayton	3	54	22
Walla Walla	14	876	350
Tri-Cities[3/]	39	3,348	1,363
Kennewick	15	1,241	496
Pasco	13	979	392
Richland	11	1,128	451

Notes:

1/ Data for Walla Walla and the Tri-Cities were compiled by Smith Travel Research and include hotels, motels, and B&Bs with 15 or more rooms. Data for Pomeroy and Dayton are also from Smith Travel Research, with additional information from Ecology and Environment (2009a) and online research. Totals do not include B&Bs with fewer than 15 rooms.

2/ Average number of rooms are estimated based on the average hotel occupancy rate for Walla Walla County from 2003 to 2008 (57 percent) and the average hotel occupancy rate for the Tri-Cities (60 percent) (Port of Walla Walla and Eastern Washington University 2009, Shugart 2009).

3/ The Tri-Cities are Kennewick, Pasco, and Richland.

Sources: Ecology and Environment 2009a, Smith Travel Research 2009, Port of Walla Walla and Eastern Washington University 2009

Assuming an average annual hotel occupancy rate of 60 percent suggests that 27 unoccupied motel and hotel rooms are on average available for rent in Pomeroy or Dayton, 350 rooms are available for rent in Walla Walla, and more than 1,350 rooms are on average available for rent in the Tri-Cities area (Table 3-28). This is an average vacancy rate and does not account for seasonal or daily fluctuations in occupancy rates. In the Tri-Cities, for example, hotels tend to be busy on mid-week nights with rooms occupied by business travelers, and weekend occupancy rates tend to be higher during the tourist season (Schugart 2009).

Temporary accommodation in the vicinity of the proposed project also includes recreational vehicle (RV) parks and campsites. RV parks in the vicinity include two near Pomeroy and two near Dayton, with three RV parks located further south in Walla Walla.

Economic Conditions

Employment

Employment in all five counties that comprise the primary and secondary areas of effect for this analysis is concentrated in agriculture, which accounts for a much larger share of total employment in each county than it does statewide, with, for example, almost 20 percent of employment in Garfield County in agriculture compared to just 1.8 percent statewide (Table 3-29). Columbia and Garfield counties also have a larger share of total employment concentrated in government. The government sector in Garfield County in 2007, for example, accounted for about 38 percent of total employment compared to about 15 percent statewide (Table 3-29).

Unemployment rates in four of the five counties were lower than the state average (9.1 percent) in November 2009 (Table 3-30). The unemployment rate in Columbia County was higher than the state average (10.2 percent versus 9.1 percent), and the unemployment rates in all five counties were noticeably higher than they were one year earlier, in November 2008, reflecting the ongoing downturn in the economy.

Table 3-29. Employment by Sector, 2007

Economic Sector	Benton	Columbia	Franklin	Garfield	Walla Walla	State of Washington
Total employment[1/]	91,625	2,014	31,474	1,269	34,420	3,948,743
Percent of Total[2/]						
Farm Employment	4.1	15.7	12.3	19.7	7.7	1.8
Mining, forestry, and other	0.0	0.0	0.0	0	0	1.4
Utilities	0.1	0.0	0.0	0	0.3	0.1
Construction	7.0	9.0	6.6	3.4	5.5	7.1
Manufacturing	5.1	3.7	6.8	0.9	10.5	7.9
Wholesale trade	1.4	4.6	5.8	11	2.6	3.6
Retail trade	12.0	8.0	9.4	9.1	10.2	10.5
Transportation and warehousing	1.3	0.0	0.0	0	1.5	3
Real Estate	3.6	0.0	3.0	1.4	3.1	4.9
Consumer Services	12.7	8.1	11.8	4	12.3	13.9
Producer Services	27.2	5.6	8.1	3.2	7	19.3
Social Services	10.0	0.0	9.2	0	16.6	11
Government	13.1	23.6	16.1	37.5	15.7	15.4

Notes:

1/ Full- and part-time employment includes self-employed individuals. Employment data are by place of work, not place of residence, and, therefore, include people who work in the area but do not live there. Employment is measured as the average annual number of jobs, both full- and part-time, with each job that a person holds counted at full weight.

2/ Percentages for the counties do not sum to 100 because employment counts are not provided for sectors with less than 10 jobs or for sectors where counts would disclose confidential information. These numbers are, however, included in the totals.

Source: U.S. Bureau of Economic Analysis 2009

Table 3-30. Employment Overview, August 2009

Geographic Area	November 2009 Labor Force			Unemployment Rate	
	Total Labor Force	Employed	Unemployed	November 2009	August 2008
Benton	93,390	87,070	6,310	6.8	5.5
Columbia	1,490	1,340	150	10.2	8.6
Franklin	35,500	32,330	3,170	8.9	6.9
Garfield	1,010	940	70	6.9	5.8
Walla Walla	31,770	28,850	1,920	6.1	5.1
Washington	**3,518,980**	**3,197,700**	**321,280**	**9.1**	**6.2**

Source: Washington State Employment Security Department 2009

Agriculture

Land use in the three counties that comprise the primary area of analysis (Columbia, Garfield, and Walla Walla counties) is largely agricultural, with farmlands comprising 71 percent of the total area (Table 3-31). The 2007 Census of Agriculture identified 1,451 farms in these three counties, with an average farm size of 899 acres that varied by county, ranging from 734 acres in Walla Walla County to 1,290 acres in Garfield County (Table 3-31). The overall market value of agricultural products sold in these counties in 2007 was about $411 million. Crops accounted for 91 percent and 88 percent of total market value in Columbia and Garfield counties, compared to 70 percent statewide. Agriculture in these two counties was dominated by the grains, oilseeds, dry beans, and dry peas commodity group, which accounted for 86 percent of agricultural products sold by market value in both counties (Table 3-31). This commodity group played a smaller role in Walla Walla County (24 percent of market value) and statewide (14 percent of market value) in 2007.

Table 3-31. Summary of Agriculture by County, 2007

Summary Item	Columbia	Garfield	Walla Walla	County Total[1/]	State of Washington
Number of Farms	283	239	929	1,451	39,284
Land in Farms (acres)	313,307	308,212	682,350	1,303,869	14,972,789
Percent of Total Area	56	68	84	71	35
Average Farm Size (acres)	1,107	1,290	734	899	381
Total Market Value of Agricultural Products Sold ($000)	39,819	26,440	344,489	410,748	6,792,856
Percent of Total Market Value					
Crops	91	88	(D)	(D)	70
Grains, oilseeds, dry beans, and dry peas	86	86	24	34	14
Livestock, poultry, and products	9	12	(D)	(D)	30

Note:
(D) Not disclosed.
1/ This total includes Columbia, Garfield, and Walla Walla counties.
Source: USDA National Agricultural Statistics Service 2009

Recreation and Tourism

Recreation and tourism is not classified or measured as a standard industrial category and, therefore, employment and income data are not specifically collected for this sector. Components of recreation and tourism activities are instead captured in other industrial sectors, primarily the retail sales and services sectors. Estimates of travel-related spending and associated employment for 2007 prepared for the Washington State Community, Trade and Economic Development Tourism Office found that travel-related employment in Columbia County accounted for a larger share of total employment than in the state as a whole, and travel-related employment in Garfield and Walla Walla counties accounted for a smaller than statewide share (Table 3-32). These estimates are primarily based on travel-related spending on accommodation, food and beverages, local transportation, recreation and entertainment, and shopping. While these estimates include business travel, as well as recreation and tourism-related travel, they provide a useful indication of the relative importance of recreation and tourism to the local economies of the counties in the project vicinity.

Table 3-32. Travel-Related Economic Impacts, 2007

Geographic Area	Travel Spending ($million)	Travel-Related Employment	Percent of Total Employment	Tax Receipts	
				Local ($million)	State ($million)
Columbia	7.8	120	5.6	0.1	0.4
Garfield	1.7	20	1.7	0.0	0.1
Walla Walla	84.0	1,230	3.6	1.3	4.5
Washington	**14,850**	**149,830**	**3.8**	**307.2**	**665.9**

Source: Dean Runyan Associates 2009a, 2009b

Income and Poverty

Median household income in the affected counties ranged from 73 percent of the state median in 1999 (the most recent data available for the cities and towns near the proposed alternatives) in Columbia and Garfield counties to 103 percent of the state median in Benton County (Table 3-33). Viewed at the community level, median household income ranged from less than half the state median in Starbuck (40 percent) to 116 percent of the state median in Richland.

Table 3-33. Income and Poverty, 1999

Geographic Area	Median Household Income ($)[1/2/]	Percent of State Average	Percent of Population Below the Poverty Level[2/]
Benton County	47,044	103	10.3
Kennewick	41,213	90	12.9
Richland	53,092	116	8.2
Columbia County	33,500	73	12.6
Dayton	31,409	69	13.3
Starbuck	18,125	40	24.3
Franklin County	38,991	85	19.2
Pasco	34,540	75	23.3
Garfield County	33,398	73	14.2
Pomeroy	28,958	63	15.1
Walla Walla County	35,900	78	15.1
Prescott	39,500	86	18.4
Waitsburg	33,527	73	14.0
Walla Walla	31,855	70	18.0
Washington State	45,776	100	10.6

Notes:
1/ Median incomes are presented in 1999 dollars unadjusted for inflation.
2/ These data compiled as part of the 2000 Census are the most recent available data for the cities and towns in the vicinity of the proposed alternatives.
Source: U.S. Census Bureau 2000c

The percent of the population below the poverty line in 1999 was higher than the state average in all five counties and nearby communities, with the exceptions of Benton County and the city of Richland (Table 3-33). For the counties above the state average, this percentage ranged from 12.6 percent in Columbia County to 19.2 percent in Franklin County, compared to a statewide average of 10.6 percent. For the communities above the state average, the percentage of the population below the poverty level ranged from 13.3 percent in Dayton to 24.3 percent in Starbuck (Table 3-33).

Data are available for 2007 at the state and county level (Table 3-34). These data indicate that median household income in Columbia and Garfield counties declined as a share of the state median between 1999 and 2007, decreasing in both cases from 73 percent of the state median in 1999 to 71 percent in 2007. Median household income in Walla Walla County as a share of the state median increased slightly over this period, from 78 percent in 1999 to 79 percent in 2007. Median household incomes in Benton and Franklin counties decreased from 103 percent of the state median to 96 percent and stayed constant at 85 percent, respectively. The percent of the population above the poverty level increased in three of the five counties and statewide from 1999 to 2007, and was above the state average in 2007 in four of the five counties, ranging from 14 percent in Garfield County to 17.4 percent in Walla Walla County, compared to a statewide average of 11.4 percent (Table 3-34).

Table 3-34. Income and Poverty, 2007

Geographic Area	Median Household Income ($)[1/]	Percent of State Average	Percent of Population Below the Poverty Level
Benton	53,129	96	10.9
Columbia	39,699	71	14.3
Franklin	47,041	85	15.5
Garfield	39,649	71	14.0
Walla Walla	44,167	79	17.4
Washington State	**55,628**	**100**	**11.4**

Note:
1/ Median incomes are presented in 2007 dollars unadjusted for inflation.
Source: U.S. Census Bureau 2008

Community Services

Law Enforcement

The proposed routes both cross through a sparsely populated section of Garfield, Columbia, and Walla Walla counties. The closest community to both proposed routes is the town of Starbuck, with an estimated population of 130 in 2009 (Table 3-24). Law enforcement in the project area falls under the jurisdiction of the respective County Sheriff's Departments and the Washington State Highway Patrol.

The Garfield County Sheriff's Department currently employs 12 deputies (8 full-time and 4 part-time). At any given time the county has one deputy patrolling the city of Pomeroy and one patrolling other parts of the county, including the area near the project area. Maximum response time to the portion of the project area located within Garfield County would be approximately 20 minutes. Special units of the Garfield County Sheriff's Department include patrol units and a Search and Rescue Unit (Boyd 2009).

The Columbia County Sheriff's Department currently employs 19 deputies (9 full-time and 10 part-time). Deputies regularly patrol the northern portion of the county, which encompasses the project area. Maximum response time to the portion of the project area located in Columbia County would be approximately 20 minutes. Special units of the Columbia County Sheriff's Department include patrol units, a Search and Rescue Unit, a Snowmobile Patrol/Rescue Unit (with two snowmobiles, one snow-cat, and two quad-runner motorcycles), and a Dive Rescue/Boat Patrol Unit (Sleemon 2009).

The Walla Walla County Sheriff's Department currently employs 21 deputies (all full-time). The project area is located in a relatively sparsely populated part of the county, and few patrols occur in the area. The closest Sheriff's Department office in this county is located in the city of Waitsburg. This station is staffed by one deputy and the response time from this station to the project area would be approximately one hour (White 2009).

The proposed routes would all cross State Highway 261, north of the town of Starbuck. Other state and federal highways that are located relatively close to the proposed routes and would likely be used by construction workers traveling to and from the project include State Highway 127 and U.S. Highway 12. These highways both fall under the jurisdiction of the Washington State Highway Patrol. The Highway Patrol has one trooper assigned to Garfield County, one assigned to Columbia County, and six assigned to Walla Walla County, with two troopers typically on patrol at any one time in Walla Walla County (Cabezuela 2009). Few patrols occur along the stretches of highway near the project area because traffic in these areas is limited and highway incidents are uncommon. Response times to the stretches of highway near the project area could range from ten minutes to an hour, depending on the starting location of the state trooper (Cabezuela 2009).

Fire Protection

Primary response to fires in the project area is provided by the county fire district with jurisdiction over the affected area. In Garfield County, the proposed routes cross land that falls under the jurisdiction of Garfield County Fire Department District 1. The fire station for District 1 is located in Pomeroy, and is staffed with 21 volunteer firefighters and 14 First Response Emergency Medical Technicians. This District has two structural fire engines, seven brush trucks, and two Basic Life Support ambulances. The District does not have their own water hauling trucks to haul water to rural fires. Instead they use trucks from local fertilizer companies and are also able to draft water from local rivers, when needed (Bunch 2009).

Garfield County Fire Department District 1 stations brush trucks in locations throughout the county. Brush trucks are often stationed at Central Ferry and near agricultural fields in the north part of the county. Response time from these locations to the project area would be approximately 18 minutes, and approximately 12 fire fighters could be expected to respond to a fire emergency at any given time (Bunch 2009).

In Columbia County, the proposed routes cross land that falls under the jurisdiction of Columbia County Fire Department District 1. The fire station for District 1 is located in Starbuck, and is staffed with 25 volunteer firefighters, as well as a paid fire chief and secretary. The number of volunteer firefighters available to respond to a fire in the portion of the project area in Columbia County would depend on the time of day, week, and year, but, on average, six firefighters would be available to respond to a fire. Some of the volunteer firefighters are farmers and may be unavailable to respond to a fire during peak harvest periods (July to August) (Hawks 2009). Response times to fires would vary depending on the remoteness of the fire and the availability of fire fighters, and could range from 20 minutes to an hour. Columbia County Fire Department's District 1 has three all-terrain grass trucks, and two water tender trucks: one 3,800 gallon truck and one 1,300 gallon truck (Hawks 2009). The Garfield and Columbia County Fire Departments have a mutual aid agreement and resources from both counties could be potentially available to respond to a fire in either county (Bunch 2009).

In Walla Walla County, the proposed routes cross land that falls under the jurisdiction of the Walla Walla County Fire Department District 1. The fire station for District 1 is located in Pleasant View. District 1 employs eight volunteer fire fighters, and has five brush trucks and two water tender trucks (one 3,000 gallon water truck and one 5,000 gallon water truck). Two of the brush trucks are stationed at the Pleasant View station: one is stationed near the Lower Monumental Substation, and two in agricultural fields near the northern border of the county. Response times to the project area would be approximately 15 minutes, and all eight fire fighters could be expected to respond to a fire emergency at any given time. In addition, the Walla Walla County Fire Department District 1 has a mutual aid agreement with the Columbia County Fire Department District 2 and Walla Walla Districts 3 and 7, and these districts could also aid in fire suppression in the portion of the project area in Walla Walla County (Heart 2009).

The closest hazmat team to the project area is located in the Tri-Cities area. Response times to the project area would likely be approximately 1.5 hours. Tide Water Barge has a river response team located at Little Goose Dam that can respond to hazardous spills in the Snake River (Hawks 2009).

Medical Facilities

The Dayton General Hospital, located in the city of Dayton, Washington is the closest hospital to the project area. An ambulance would take approximately 20 to 30 minutes to drive from Starbuck, which is located approximately midway along both proposed routes, to the hospital. However, if an accident were to occur, injured workers would most likely need to be transported by helicopter. Helicopter services to the Dayton General Hospital are provided by Medstar. A helicopter would likely take less than 10 minutes to transport an injured party from the project area to Dayton General Hospital (Jorgensen 2009).

The Dayton General Hospital is a 25 bed, Level 5 critical assess hospital. The medical staff at the hospital currently includes four doctors, a nurse practitioner, physician's assistant, and 28 nurses. There are no specialists employed at this hospital, and major injuries requiring critical care or surgery are not treated at this hospital. The closest hospital with critical care capabilities is St. Mary Medical Center in Walla Walla, approximately 7 minutes from the Dayton General Hospital by helicopter (Jorgensen 2009). Total helicopter flight time to and from St. Mary Medical Center to the project area would be just under an hour (Medstar 2009).

St. Mary Medical Center, located in Walla Walla, is a 141 bed, Level 3 trauma hospital. The medical staff at this hospital currently includes approximately 140 doctors and 200 nurses. This hospital is capable of treating most construction-related injuries, but certain types of injuries, such as limb reattachment, severe cardio needs, and major burns, are treated at larger regional hospitals, such as Harbor View Medical Center in Seattle. Patients with these types of injuries are stabilized at St. Mary Medical Center before being transferred to Harbor View Medical Center. Total helicopter flight time from St. Mary Medical Center to Harbor View Medical Center is just under an hour (Obenland 2009).

Education

The proposed routes would all cross land within the jurisdiction of four school districts. In order from east to west, these are the Pomeroy School District in Garfield County, the Dayton and Starbuck Districts in Columbia County, and the Prescott School District in Walla Walla County.

The Pomeroy School District serves all of Garfield County. There are two schools in this district: one elementary school and one high school. Both schools are located in the city of Pomeroy, which is approximately 20 miles and a 30 minute drive east of BPA's Central Ferry Substation location. A total of 333 students were enrolled in this district during the 2009/2010 school year, with a student teacher ratio of 14.8 to 1. Student enrollment at the Pomeroy School District has declined slightly over the last few years, with enrollment currently below capacity (Ruchert 2009).

The Dayton and Starbuck School Districts are the only districts in Columbia County. Together, they operate four schools (one in the Starbuck District and three in the Dayton District). The three schools in the Dayton District (elementary, middle, and high schools) are all located in the city of Dayton, which is approximately 22 miles and a 35 minute drive southeast of Starbuck. A total of 498 students were enrolled in the Dayton School District in the 2009/2010 school year, with a student teacher ratio of approximately 17.0 to 1 (Eaton 2009). In the Starbuck School District, 27 students were enrolled in Starbuck School in the 2009/2010 school year, with a student teacher ratio of 6.7 (Rupenser 2009). Student enrollment at both districts has remained steady over the last few years, with enrollment currently below capacity (Eaton 2009, Rupenser 2009)

The Prescott School District in Walla Walla County operates two schools: one elementary school and one high school. Both schools are located in the city of Prescott, which is approximately 27 miles and a 50 minute drive southwest of Starbuck. A total of 250 students were enrolled in this district during the 2009/2010 school year, with a student teacher ratio of 11.9 to 1 (Prescott School District 2009). Student enrollment at the Prescott School District has remained stable over the last few years, with enrollment currently below capacity (Prescott School District 2009).

The city of Walla Walla, located approximately 54 miles south of Starbuck, is the main population center in the three counties that comprise the primary area of analysis (Columbia, Garfield, and Walla Walla counties), accounting for almost half (48 percent) of the total population in these counties in 2009 (Table 3-24). The Walla Walla School District includes six elementary schools, two middle schools, one high school, and an alternative high school. The District had a total of 6,194 enrolled students in the 2009/2010 school year, with a student teacher ratio of 18.3 to 1. Student enrollment in the district has remained steady to slightly increasing over the last five years. Most of the schools within the Walla Walla School District are at capacity, with some of the schools, such as the Walla Walla High School, above student capacity (Higgins 2009).

Solid Waste Disposal

The Sudbury Road Landfill, located in the city of Walla Walla, is the closest landfill to the project area. Solid waste generated during project construction would likely be disposed of at this landfill, which encompasses approximately 900 acres (including potential expansion areas), and is capable of accommodating approximately 1 million tons of waste. There is no permitting limit on the amount of waste that can be accepted per day or year; however, on average the landfill receives approximately 55,000 tons of solid waste per year, with approximately 150 tons received each day. At the current rate of waste collection, the landfill has available capacity for the next 40 years (Rackstraw 2009).

Fiscal Resources

Total revenues by county in 2008 ranged from $5.4 million in Garfield County to $80.1 million in Benton County (Table 3-35). Revenues in Columbia, Franklin, and Walla Walla counties were $8.2 million, $35.7 million, and $49.2 million, respectively. Sales and use tax accounted for 3 percent, 2 percent, and 12 percent of total revenue in Columbia, Garfield, and Walla Walla counties, respectively (Table 3-35). The total value of taxable retail sales in Columbia, Garfield, and Walla Walla counties in 2008 was $37.4 million, $16.5 million, and $760.7 million, respectively. In Benton and Franklin counties, the respective total values of taxable retail sales were $2.6 billion and $1.05 billion (Washington State Department of Revenue 2009a).

Table 3-35. County Revenues and Expenditures, 2008

Resources/County	Benton	Columbia	Franklin	Garfield	Walla Walla
Total Revenues	**80,077**	**8,242**	**35,694**	**5,380**	**49,225**
General Property Taxes	21,788	1,435	9,960	481	13,161
Sales & Use Taxes	14,255	214	5,343	88	5,670
Other Local Taxes	1,155	100	1,124	66	978
Other Revenue[1/]	17,575	895	10,102	686	7,255
Intergovernmental Revenues	25,305	5,598	9,165	4,060	22,161
Total Expenditures	**75,387**	**8,449**	**37,992**	**6,122**	**48,389**
Law & Justice Services	29,711	1,486	11,705	1,093	9,231
Fire & Emergency Services	1,191	484	775	512	2,890
Health & Human Services	7,388	512	392	385	3,670
Transportation	6,291	2,390	4,308	2,269	6,691
Natural Resources	5,201	778	4,445	166	3,908
Other Expenditures[2/]	25,605	2,799	16,368	1,698	21,999

Notes:

1/ Other revenue includes licenses and permits, charges and fees for services, fines and forfeits, interest and investment earnings, rents, debt proceeds, and operating transfers-in.

2/ Other expenditures include general government, utilities, debt service payments, and operating transfers-out.

Source: Washington State Auditor 2009

Sales and use tax rates in Columbia and Garfield counties and in unincorporated areas of Walla Walla County are 7.9 percent, 7.5 percent, and 8 percent, respectively. The rate in the city of Walla Walla is 8.3 percent. Sales and use tax rates in unincorporated and incorporated places in Benton County are 7.7 percent and 8.3 percent, respectively. Rates in Franklin County also range from 7.7 percent to 8.3 percent. These rates include the 6.5 percent state rate, local rates, and the Regional Transit Authority rate (Washington State Department of Revenue 2009b). The state portion of the sales tax is deposited in the state general fund; the county portion is returned to the county where the purchase occurred (Washington State Department of Revenue 2008).

3.9.2 Environmental Consequences of Action Alternatives

Impacts Common to All Action Alternatives

The following assessment addresses the impacts of the action alternatives. Impacts to socioeconomic and public facilities would be the same under all four action alternatives unless otherwise noted.

Population

Construction would be spread over a two year period, which is currently proposed to extend from July 2011 to July 2013. Transmission line construction is expected to take 12 months and would begin following acquisition of easements, access road construction and improvements. Employment over this period would follow a bell-shaped pattern, ranging from an initial workforce of about 40 workers to a peak of 170 workers at about six months, and then declining to 40 workers and fewer as construction comes to a close. The last part of the construction period would include any additional acquisition of easements, substation work, including work to connect the new line and other existing lines into the substations, and tower site restoration work.

During peak construction periods approximately 25 percent of the workforce would be local (i.e., normally reside within commuting distance of the job sites), and would likely commute to and from their homes to work each day. Local workers would likely be drawn from the communities of Dayton, Pomeroy, and Walla Walla. The remaining 75 percent of the workforce would either temporarily relocate to nearby communities or commute in from their permanent residences on Sunday night and stay in overnight lodging on weekdays, returning home on Fridays. Very few, if any, of the workers employed during the construction phase of the project would be expected to permanently relocate to the area.

Less than 10 percent of the workers temporarily relocating to the area would be expected to be accompanied by their families. Some workers (such as the construction foremen and inspectors) would stay for the length of the project, but many workers would be employed for four to six months and would, therefore, not be expected to bring children with them. Although it is considered unlikely, for the purposes of analysis, 10 percent of the workers temporarily relocating to the area are assumed to be accompanied by their families, including school age children. Based on data compiled by the U.S. Census Bureau (2009b) as part of the 2008 American Community Survey, the average relocating family is assumed to consist of two adults and one school age child (Table 3-36). Comparison of the projected temporary peak increase in employment with the total population in 2009 suggests that the projected increase would be equivalent to approximately 0.2 percent of the total existing population in the three counties (Table 3-36). This impact would be ***low*** and ***temporary***.

Existing BPA staff would be responsible for operation and maintenance of the new transmission line and associated facilities. No existing employees would be required to relocate to the five potentially affected counties.

Table 3-36. Projected Workers and Population Change during Peak Construction

Workers	
Commute to Job Site Daily [1/]	43
Move to the Project Vicinity alone [2/]	115
Move to the Project Vicinity with family [2/]	13
Total	170
Population	
2009 Population [3/]	65,550
Number of People Temporarily Relocating [4/]	153
As a Percent of 2008 Population	0.2%

Notes:

1/ 25 percent of the average and peak workforce is expected to commute to and from the job site each day.

2/ 75 percent of the average and peak workforce is expected to temporarily relocate to the area. 10 percent of workers temporarily relocating are assumed to be accompanied by their families for the purposes of analysis.

3/ Population data are for Columbia, Garfield, and Walla Walla counties and are from the 2009 estimates prepared by the Washington OFM (2009a). These data are provided by county in Table 3-24.

4/ The number of people temporarily relocating assumes that 75 percent of the projected peak construction workforce would temporarily relocate to the area, with 10 percent of that total accompanied by their families (assuming an average family size of two adults and one child) (U.S. Census Bureau 2009b).

Housing

A recent assessment of the economic impact of wind energy projects in southeast Washington found that construction of the Hopkins Ridge and Marengo wind farms near the city of Dayton in Columbia County employed an estimated annual average of 170 construction workers from 2005 to 2007, with 150 temporarily relocating to the area (Entrix 2009). According to a recent socioeconomic study prepared for the Lower Snake Wind Energy Project, contact with the Port of Columbia in Dayton indicated that some of these workers lived in area hotels and others rented apartments. Local hotels/motels, RV parks, and campgrounds reportedly experienced record demand during this period and workers temporarily resided as far away as Walla Walla and commuted to and from the job site each day (Ecology & Environment 2009b). A representative of the Walla Walla Chamber of Commerce indicated that the Chamber was not aware of a shortage of housing resources in the Walla Walla area as a result of these projects and that construction workers employed in the project area would most likely temporarily reside in Walla Walla or the Tri-Cities area (Saylor 2009).

Assuming that approximately 75 percent of the peak construction workforce would temporarily relocate to areas in the vicinity of the proposed project and 10 percent of these workers would be accompanied by their families, an estimated total of 153 people would temporarily relocate to the area (Table 3-36).

Temporary housing resources are discussed in the Affected Environment part of this section and summarized in Tables 3-27 and 3-28. This analysis indicates that temporary housing resources in the immediate vicinity of the project area include four RV parks, two in Columbia County and two in Garfield County, with three additional RV parks located further afield in the city of Walla Walla. Review of the rental housing units and hotel and motel rooms that would normally be vacant and available for rent suggests that there would be insufficient temporary housing in Columbia and Garfield counties to accommodate the total number of construction workers expected to temporarily relocate to the project vicinity for the duration of their employment on the project. Additional temporary housing resources do, however, exist in the larger communities of Walla Walla and the Tri-Cities, and workers unable to find temporary accommodation in Dayton or Pomeroy would likely temporarily reside in one of these areas, and commute to and from the job site each day.

This would be consistent with other recent large energy construction projects in the area (Ecology & Environment 2009b, Saylor 2009). This temporary influx of workers would generate income for motels and hotels and RV parks. There may be temporary shortages in available temporary housing resources in Dayton and Pomeroy, but regional resources would be more than sufficient to accommodate the estimated project-related demand for temporary housing. Hotel and motel resources in Walla Walla, for example, include at least 876 rooms, and 350 of these rooms are, on average, vacant and available for rent (Table 3-28). In addition, an estimated 431 housing units in Walla Walla County are currently vacant and available for rent (Table 3-27). Additional housing resources in the Tri-Cities include at least 39 motels and hotels with a total of 3,348 rooms and an estimated 1,342 housing units that are currently vacant and available for rent, with additional housing resources available elsewhere in Benton and Franklin counties (Tables 3-27 and 3-28). Therefore, impacts to housing would be ***short-term*** and, when viewed in a regional context, ***low*** because sufficient housing would be available within the five county area.

Economic Conditions

Employment and the Economy

The proposed project would have a ***positive*** impact on the regional economy during construction through the local procurement of materials and equipment and spending by construction workers. These direct expenditures generate economic activity in other parts of the economy through what is known as the *multiplier* effect, with direct spending generating indirect and induced economic impacts. Indirect impacts consist of spending on goods and services by industries that produce the items purchased as part of the project. Induced impacts include expenditures made by the households of workers involved either directly or indirectly in the construction process.

The construction cost is expected to be approximately $19 million under all of the action alternatives. Local purchases under all of the action alternatives would likely include fuel for vehicles and equipment, some equipment rentals, staging area rental, and other incidental materials and supplies. Local purchases, employment of local residents, and the temporary relocation of construction workers to the project area would have small, but positive impacts on local businesses.

Construction employment would follow a bell-shaped pattern, peaking at approximately 170 workers, with approximately 25 percent of this total hired locally, most likely from the nearby communities of Dayton, Pomeroy, and Walla Walla, with other workers coming from further afield, including the Tri-Cities. There were approximately 37,700 full- and part-time jobs in Columbia, Garfield, and Walla Walla counties in 2007, including about 2,120 construction jobs (Table 3-28). Unemployment rates in the three counties in August 2009 ranged from 5.5 percent in Garfield County to 9.1 percent in Columbia County (Table 3-29).

The total labor construction payroll, including per diem payments and other allowances, is expected to be approximately $14 million over the life of the project. Approximately 25 percent of this total (about $3.5 million) would be earned by local residents (normally resident in Columbia, Garfield, and Walla Walla counties), which is equivalent to about 0.2 percent of total personal income in these three counties in 2007 and would be spread over two years (U.S. Bureau of Economic Analysis 2009b). The remaining 75 percent (about $10.5 million) would be earned by non-local workers, who would temporarily relocate to the three directly affected counties and adjacent counties, specifically Benton and Franklin counties.

As the preceding discussion indicates, estimated local project-related expenditures, employment, and construction-related earnings are small relative to the total amount of economic activity, employment, and income in the three potentially affected counties, and are short-term in nature.

As a result, the overall impact of construction-related activities on the local and regional economies, while positive, is expected to be ***short-term*** and ***low***.

Operation of the project would have limited direct impacts in the local area under all of the action alternatives. Existing BPA staff would be responsible for operation and maintenance of the new transmission line and associated facilities. No existing employees would be required to relocate to the three potentially affected counties. Local expenditures on project-related goods and services would be limited.

Agriculture

Land use in the three directly affected counties (Columbia, Garfield, and Walla Walla counties) is largely agricultural, with farmlands comprising 71 percent of the total area (Table 3-31). The project area is rural and is generally characterized by rolling grasslands, agricultural areas, and some livestock grazing. As discussed in Section 3.2 Land Use, temporary construction-related disturbance to agricultural land under the action alternatives would range from approximately 93 acres (Combination A Alternative) to 105 acres (Combination B Alternative). These estimates include disturbance from transmission tower and counterpoise installation, new access road construction, and pulling/tensioning sites. Permanent disturbance to agricultural land from construction, primarily the transmission tower footings and new access road construction would range from approximately 55 acres (Combination A Alternative) to 60 acres (Combination B Alternative). These totals represent a very small share of agricultural land in the three potentially affected counties (1.3 million acres in 2007, see Table 3-31) and the potential impact on the agricultural industry would be ***low***.

The introduction of a new transmission line could, however, have detrimental impacts on individual farm operations by reducing the acreage available for cultivation and in some cases disrupting existing harvest patterns, with new transmission line structures affecting the farmer's ability to maneuver equipment in the vicinity of the immediately affected area. BPA would work with individual landowners to try to coordinate the timing of construction to minimize short-term impacts to agriculture.

Recreation and Tourism

Recreation activities in the project area include boating, fishing, hunting, camping, hiking, wildlife watching, sightseeing, photography, and visiting historic sites. Construction of the proposed project under any of the action alternatives would not alter access to existing recreation sites in the vicinity of the project area. Once constructed and in place along any of the action alternatives, the transmission structures and wires would be visible from some recreation sites and features, but long-term adverse impacts to recreation sites would be expected to be low under all of the action alternatives and, therefore, impacts to the recreation and tourism industry in the three potentially affected counties are expected to be ***low***. Potential impacts to recreation are discussed in detail in Section 3.4 Recreation.

Community Services

Law Enforcement

Construction of the proposed project would result in a temporary increase in traffic levels near the project area due to construction workers commuting to and from work and the transportation of project-related materials. However, the Sheriff's Departments and the State Highway Patrol office with jurisdiction over the project area have all stated that they do not expect construction or operation of the project to adversely affect their departments, which are well staffed and have adequate resources (Boyd 2009, Cabezuela 2009, Sleemon 2009, White 2009). The Columbia

County Sheriff's Department and the State Highway Patrol both indicated that the recent wind farm construction projects in Columbia County, which involved a comparable number of workers as this project for a longer period of time, had ***no*** adverse impacts on their respective department's resources (Cabezuela 2009, Sleemon 2009).

Fire Protection

Construction of the project under all of the action alternatives would occur in the northern portions of Columbia, Garfield, and Walla Walla counties, in areas that fall under the jurisdiction of the respective county fire departments. These areas are sparsely populated and locations where minimal fire and emergency response has been required in the past. Construction under all action alternative would occur on lands, primarily dry grassland and agricultural fields, that are susceptible to wildfire, and would result in an increased potential for emergency calls in these areas. Representatives from the Garfield and Walla Walla county fire departments with jurisdiction over parts of the project area stated that, while fire is a concern in these areas, they do not anticipate any adverse impacts to their departments as a result of the project (Bunch 2009, Heart 2009).

Columbia County Fire Department District 1 indicated that a lack of water could reduce their effectiveness in combating fires along the proposed routes (Hawks 2009). The combined capacity of the District's two water tender trucks is 5,300 gallons, which would not be adequate to respond to a large fire, and, as a result, the District may need to partner with additional resources or purchase additional water supplies. BPA proposes to mitigate this potential adverse impact (see Section 3.9.3), which is, therefore, considered to be ***low***.

Medical Facilities

The Dayton General Hospital would be able to treat minor injuries that could occur during project construction, without an increase in resources (Jorgenson 2009). Major injuries that might occur during project construction would be treated at St. Mary Medical Center in Walla Walla. For injuries such as loss of limb or major burns, St. Mary Medical Center would attempt to stabilize the patient prior to transferring them via helicopter to Harbor View Medical Center in Seattle (Obenland 2009). The project area and broader region are served by medical facilities that are capable of handling minor or major injuries and, therefore, it is not expected that project construction would result in a need for additional medical facilities or personnel, and therefore, ***no*** impacts are expected.

Education

Of the estimated peak work force of 170 workers, approximately 75 percent (128 workers) would likely consist of non-local workers who would temporarily relocate to the project area during construction. Approximately 10 percent of the non-local workers (13 workers) temporarily relocating are assumed for the purposes of analysis to be accompanied by their families (Table 3-36). Depending on the length of time these families stay in the project area, up to 13 children would need to be enrolled in local schools.

The addition of this number of students would be unlikely to affect the school districts in the three potentially affected counties. Schools in the Walla Walla School District are for the most part at capacity, with some the schools, including Walla Walla High School, above capacity (Higgins 2009). Student enrollment in the four school districts (Pomeroy, Dayton, Starbuck, and Prescott) crossed by the proposed alternatives is below capacity and schools in these districts could easily accommodate the small numbers of students that could temporarily relocate to the project area during the construction phase of the project (Eaton 2009, Prescott School District 2009, Ruchert 2009, Rupenser 2009). Impacts to education facilities in these counties are, therefore, expected to be ***low***.

Solid Waste Disposal

Transmission line construction would generate various types of solid waste, including packing material such as crates, pallets, and paper wrapping used to protect equipment during shipping. All waste and scrap material that is unable to be recycled would be removed from the site and deposited in local permitted landfills, most likely the Sudbury Road Landfill in Walla Walla, in accordance with local ordinances.

Project-related excavation would generate solid waste that could potentially be used as fill. Very little of the soil excavated during foundation installation would be waste product. However, some excavated material may need to be removed for disposal. Excavated material that is clean and dry would be spread along the right-of-way.

Based on the existing capacity of the Sudbury Road Landfill (approximately 40 years at current disposal rates) and the relatively small amount of waste expected to be generated during project construction, the project is not expected to have an impact on the Sudbury Road Landfill and its ability to handle other current and future waste streams.

Fiscal Resources

The federal government is exempt from state sales tax, as well as local property taxes. Expenditures by workers employed during project construction would, however, generate sales and use tax revenues in the five potentially affected counties (Benton, Columbia, Franklin, Garfield, and Walla Walla counties).

The total labor construction payroll, including per diem payments and other allowances, is expected to be approximately $14 million over the life of the project. Approximately 25 percent of this total (about $3.5 million) would be earned by local residents. The remaining 75 percent (about $10.5 million) would be earned by non-local workers, who would temporarily relocate to the vicinity of the project and adjacent counties. For the purposes of this analysis, income received by local workers was initially adjusted to exclude payments for housing (mortgage or rent payments), based on the median share for Washington State in 2008 (U.S. Census Bureau 2009c), and the remaining total was adjusted based on the average share of total income used for personal consumption expenditures in the state in 2007 (U.S. Bureau of Economic Analysis 2008). The remaining local income was assumed to be spent in the five potentially affected counties, with non-local workers assumed to spend 60 percent of their income in this area.

Based on the preceding assumptions, the project could generate up to an estimated $8.5 million in taxable retail sales spread over 2 years. This amount would be equivalent to 0.2 percent of total taxable retail sales in the five counties in 2008 (Washington State Department of Revenue 2009a). Assuming a sales and use tax rate of 8 percent, the project could generate up to $680,000 in sales tax spread over five counties. Although the actual amount of these revenues is uncertain, whatever amount is generated would be a beneficial effect of the proposed project.

Community Values and Concerns

Residents in the vicinity of the project area expressed a number of concerns during the public scoping process. The comments that addressed potential socioeconomic impacts were mainly concerned with potential impacts to the local economy, with comments noting the positive economic benefits of improving existing infrastructure and providing a means for renewable energy projects in the area to transfer the power they generate to more populated areas. This issue is discussed further in Section 3.13 Cumulative Impacts Analysis. Others asked about the ability of the town of Starbuck to accommodate a temporary influx of workers and noted that the Columbia County Fair is held in Dayton every Labor Day weekend. Housing and temporary accommodation is discussed above.

Potentially affected parties expressed their preferences with respect to the proposed alternatives and potential impacts to their property. The following sections address general property impacts and potential impacts to property values.

General Property Impacts and Compensation

BPA would acquire new right-of-way for the construction and maintenance of the new transmission line. BPA would use existing access roads where possible, but additional access road easements would also need to be acquired.

BPA would pay market value to nonfederal landowners, as established through the appraisal process, for any new land rights required for this project. 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 support their conclusions. The strength of any appraisal depends on the individual analysis of the property, using neighborhood-specific market data in order to determine market value.

The easements required may encumber the right-of-way area with land use limitations. Each transmission line easement will specify the present and future right to clear the right-of-way and to keep it 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 impact of introducing a new right-of-way for transmission structures and lines can vary dramatically depending on the placement of the right-of-way in relation to the property's size, shape, and the 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. 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.

Where BPA needs to acquire easements on roads that already exist and the landowner is the only other user, market compensation is generally 50 percent of full fee value. If other landowners share the access road, compensation is usually something less than 50 percent. 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 percent of full fee value; if the landowner has little or no use for the new access road, market compensation for the easement is generally close to full fee value.

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 about the effect the change may have on property values nearby. Zoning is the primary means by which most local governments 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. Nonetheless, the presence of transmission lines in residential areas is fairly common.

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 the 1990s, 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. Study results showed that the subjects in King County were worth approximately 1 percent less than their matched comps, while the Portland/Vancouver area subjects were worth almost 1.5 percent more (Cowger et al. 1996).

BPA updated this study in 2000 using 1994/95 sales data. The sales of 260 pairs of residential properties in the 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 analysis did, however, identify a small but negative impact from 0 to 2 percent 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 (Bottemiller 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.

Some impacts on property values (and salability) might occur on an individual basis as a result of the new transmission line. However, these impacts would be highly variable, individualized, and unpredictable. Constructing the transmission line is not expected to cause long-term negative impacts to property values along the proposed routes 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. As a result, negative impacts are expected to be ***low*** and ***short-term***.

Property Tax Impacts

The proposed action alternatives would have no impact on local taxing districts.

Eminent Domain

As a government agency, BPA has the power of eminent domain, or the power to condemn land rights needed to support its projects. If, after good faith negotiations, BPA and a landowner are not able to agree on terms of a purchase, BPA would ask the U.S. Department of Justice to begin condemnation proceedings in the U.S. District Court on its behalf. A landowner may request that the condemnation process be used if they are not willing to negotiate.

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires each federal agency to make the achievement of environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low income populations. The Order further stipulates that the agencies conduct their programs and activities in a manner that does not have the effect of excluding persons from participation in, denying persons the benefits of, or subjecting persons to discrimination because of their race, color, or national origin.

Environmental Justice Screening Analysis

Evaluating whether a proposed action has the potential to have disproportionately high and adverse impacts on minority and/or low income populations typically involves: 1) identifying any potential high and adverse environmental or human health impacts, 2) identifying any minority or low income communities within the potential high and adverse impact areas, and 3) examining the spatial distribution of any minority or low income communities to determine if they would be disproportionately affected by these impacts.

Guidelines provided by the Council on Environmental Quality (CEQ) (1997) and EPA (1998) indicate that a minority community may be defined where either: 1) the minority population comprises more than 50 percent of the total population, or 2) the minority population of the affected area is meaningfully greater than the minority population in the general population of an appropriate benchmark region used for comparison. Minority communities may consist of a group of individuals living in geographic proximity to one another, or a geographically dispersed set of individuals who experience common conditions of environmental effect. Further, a minority population exists if there is "more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds" (CEQ 1997, p. 26).

The CEQ and EPA guidelines indicate that low income populations should be identified based on the annual statistical poverty thresholds established by the U.S. Census Bureau. Like minority populations, low income communities may consist of individuals living in geographic proximity to one another, or a geographically dispersed set of individuals who would be similarly affected by the proposed action or program. The U.S. Census Bureau defines a poverty area as a census tract or other area where at least 20 percent of residents are below the poverty level (U.S. Census Bureau 2009d).

Data on race and ethnicity from 2000 and 2008 are summarized for the three counties that would be crossed by the proposed alternatives in Tables 3-25 and 3-26, respectively. Data are also presented for nearby communities in Table 3-25. These data indicate that none of these counties or communities have minority populations that exceed 50 percent of their respective total populations or have minority populations that are meaningfully greater than the state average (Tables 3-25 and 3-26).

Data on income and poverty from 1999 and 2007 are summarized for the three counties that would be crossed by the proposed alternatives in Tables 3-37 and 3-38, respectively. Data are also presented for nearby communities in Table 3-33. These data suggest that Starbuck may be considered a low income community, based on the most recent available data (1999), with 24.3 percent of the population above the poverty level and median household income equivalent to just 40 percent of the state median (Table 3-33). None of the other nearby communities or the counties had 20 percent or more of residents below the poverty level and median household income in the three counties in 2007 ranged from 71 percent to 79 percent of the state average (Tables 3-37 and 3-38).

Both the CEQ and EPA guidelines note that larger and more populated geographic areas may have the effect of "masking" or "diluting" the presence of concentrations of minority and low income populations (CEQ 1997, EPA 1998). The three potentially affected counties (Columbia, Garfield, and Walla Walla counties) are not heavily populated but encompass large areas, ranging in size from 711 square miles to 1,271 square miles. The potential existence of "high concentration pockets" of minority and low income communities in the vicinity of the alternatives was evaluated by reviewing 2000 Census data at the census tract block group level. A census block group is a smaller geographic subdivision of a census tract and typically contain between

3,000 and 6,000 people. Analysis at this level allows a review of the characteristics of surrounding populations at a finer geographic resolution than analysis at the census tract level.

Race and ethnicity data are presented for the census block groups that would be crossed by the proposed alternatives in Table 3-37. These data indicate that the block groups in Columbia and Garfield counties that would be crossed by the action alternatives have populations that are very similar to their respective county totals, and less diverse than the state average. The census block group in Walla Walla County that would be crossed by the action alternatives had a minority population greater than 50 percent in 2000, with just 44 percent of the population identifying as White alone in the 2000 Census, with 53 percent identifying as Hispanic or Latino.

Table 3-37. Race and Ethnicity Block Group Comparison

Geographic Area	Total Population 2000[1/]	Percent of Total Population 2000[1/]				
		White[2/]	Hispanic or Latino	American Indian and Alaska Native[2/]	Other Race[2/3/]	Two or more races[2/]
Columbia County	4,064	91	6	1	1	1
Block Group 5, Census Tract 9602	471	93	4	1	0	2
Garfield County	2,397	96	2	0	1	1
Block Group 1, Census Tract 9702	425	96	1	0	1	1
Walla Walla County	55,180	79	16	1	3	2
Block Group 4, Census Tract 9200	1,671	44	53	1	1	1
Washington State	5,894,121	79	7	1	9	3

Notes:

1/ These data compiled as part of the 2000 Census are the most recent available data at the census block group and block levels.

2/ Non-Hispanic only. The federal government considers race and Hispanic/Latino origin (ethnicity) to be two separate and distinct concepts. People identifying as Hispanic or Latino origin may be of any race. The data summarized in this table present Hispanic/Latino as a separate category.

3/ The “Other Race” category presented here includes census respondents identifying as Black or African American, Asian, Native Hawaiian and Other Pacific Islander, or Some Other Race.

Source: U.S. Census Bureau 2000a

Income and poverty data are presented for the census block groups that would be crossed by the proposed alternatives in Table 3-38. The census block group that would be crossed in Columbia County had a lower median household income and a higher percent of its population below the poverty level than Columbia County and the state as a whole in 1999. The census block group that would be crossed in Garfield County had a higher median household income and a lower percent of its population below the poverty level than Garfield County as a whole, with numbers very similar to the state average. In Walla Walla County, the census block group that would be crossed had a similar median household income to the county as a whole, but a higher percent of the population below the poverty level, 20.4 percent versus 15.1 percent.

These data suggest the potential presence of communities that could be considered minority and low income in the general vicinity of the proposed action alternatives. Construction and operation of the proposed project is not, however, expected to have high and adverse human health or environmental effects on nearby communities, and ***no*** environmental justice impacts are anticipated.

Table 3-38. Income and Poverty Block Group Comparison

Geographic Area	Total Population 1999	Median Household Income ($)[1/2/]	Percent of State Average	Percent of Population Below the Poverty Level[2/]
Columbia County	4,064	33,500	73	12.6
Block Group 5, Census Tract 9602	471	26,016	57	17.7
Garfield County	2,397	33,398	73	14.2
Block Group 1, Census Tract 9702	425	45,833	100	9.2
Walla Walla County	55,180	35,900	78	15.1
Block Group 4, Census Tract 9200	1,671	35,046	77	20.4
Washington State	5,894,121	45,776	100	10.6

Notes:
1/ Median incomes are presented in 1999 dollars unadjusted for inflation.
2/ These data compiled as part of the 2000 Census are the most recent available data at the census block group level.
Source: U.S. Census Bureau, 2000c

Public Participation

BPA has considered all input from persons or groups regardless of race, income status, or other social and economic characteristics. Public scoping was held for the project with the associated public comment period extending from June 6 through August 3, 2009. A public scoping meeting was held at the Starbuck School Gymnasium on July 13, 2009. Interested parties were also encouraged to provide written input via the project web site, U.S. mail, or fax, as well as by telephone. All comments received as part of the scoping process were posted on the project web site: http://www.efw.bpa.gov/environmental_services/Document_Library/Central_Ferry-Lower_Monumental/. Comments were also accepted following conclusion of the scoping period and other opportunities to comment will be provided as the NEPA process continues.

Potentially affected minority populations include American Indian tribes in the general vicinity of the project area. BPA has initiated discussions with the Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes and Bands of the Yakama Indian Nation, Confederated Tribes of the Colville Reservation, the Wanapum Tribe, the Coeur d'Alene Tribe, and the Spokane Tribe of Indians.

3.9.3 Mitigation Measures

The following mitigation measures have been identified to reduce or eliminate adverse effects on socioeconomic resources and public facilities from the project alternatives.

- Compensate landowners at market value for any new land rights required for corridor easements or acquired for new temporary or permanent access roads on private lands.
- Initiate discussions with local fire districts prior to construction and work with the districts and other appropriate emergency response to develop a Fire and Emergency Response Plan that addresses potential wildland fires and other emergencies.

3.9.4 Environmental Consequences of the No Action Alternative

The proposed project would not be built under the No Action Alternative and there would be no positive economic impacts due to construction-related expenditures or impacts to housing and other socioeconomic resources. In addition, under the No Action Alternative, BPA would be unable to provide the full amount of firm transmission service that has been requested. Congestion on the existing lines moving power east to west through the area would limit the ability to transfer additional power through the Columbia Gorge area and could make it more difficult for existing or new generation facilities (including wind facilities) to sell their power. Some or all of those who have requested firm transmission service would need to accept other types of transmission service from BPA, pursue transmission service on other lines (if any capacity is available), or fund their own high-voltage lines and substations. For any firm transmission service requested for new generation, the lack of additional firm transmission capacity under the No Action Alternative also could lead some developers to ultimately modify or even cancel their projects if alternative transmission service could not be found.

3.10 Transportation

3.10.1 Affected Environment

The affected environment for transportation includes roads, railroads, airports, and waterways in or near the project area in Garfield, Columbia, and Walla Walla counties.

Roads

Roads in the project area include a combination of paved and highway system roads, as well as improved and unimproved roads. Primary transportation corridors in the project area include U.S. Route 12, State Route (SR) 127, SR 261, and SR 263. There are many miles of county roads in Garfield and Columbia counties that provide access to the project corridors including Lower Deadman Road (Garfield County, east of SR 127), Meadow Creek Road (Garfield County, east of SR 127), Tucannon Road (Columbia County, east of U.S. Route 12), and Kellogg Hollow Road (Columbia County, south of Starbuck and SR 261). County roads in Walla Walla County that provide access to the project corridors include Lyons Ferry Road, Lower Monumental Road, and Ayer Road.

Local access roads make up the balance of the road system in the project area (Benton-Franklin Council of Governments [BFCOG] 2006). These roads are generally not graveled or paved, and many are closed during the winter unless they provide access to a residence. Figure 3-3 shows the major regional and local transportation routes in the project area. Vehicle use on these roads includes rural residential, recreational, agricultural and commercial vehicles. Table 3-39 shows traffic volumes for the U.S., state, and county highways identified above for the segments in the vicinity of the proposed project area. Traffic volumes for federal, state, and county highways are characterized by Average Daily Traffic (ADT) data for distinct roadway segments.

Table 3-39. Average Daily Traffic Volumes[1/]

Road	ADT
U.S. Route 12 (Garfield County, east of SR 127)	1,700
U.S. Route 12 (Columbia County, east of SR 261)	2,100
SR 127 (Garfield County, south of Meadow Creek Road)	660
SR 127 (Garfield County, north of Meadow Creek Road)	760
SR 261 (Columbia County, west of U.S. Route 12	480
SR 263 (Franklin County, across Snake River from Lower Monumental Road)	133
Lower Deadman Road (Garfield County, east of SR 127)	390
Meadow Creek Road (Garfield County, east of SR 127)	230
Tucannon Road (Columbia County, east of U.S. Route 12)	170
Kellogg Hollow Road (Columbia County, south of Starbuck and SR 261)	250
Lyons Ferry Road (Walla Walla County)	259
Lower Monumental Road (Walla Walla County)	N/A
Ayer Road (Walla Walla County)	N/A

Notes:
N/A – not available
1/ Garfield and Columbia County ADT data are from the Palouse Regional Transportation Plan 2004; Walla Walla County ADT data from the Benton-Franklin Council of Governments Regional Transportation Programs Office, Walla Walla County traffic count databases.

Level of service (LOS) standards represent the minimum performance level desired for transportation facilities and systems. LOS for highway segments, intersections, and arterial street segments are categorized by the Transportation Research Board as ratings “A” through “F”, based on the volume of traffic and the available capacity of the roadway. LOS A represents the best operating conditions and LOS F represents the worst. Washington state standards establish LOS C as the standard for all rural facilities (Palouse Regional Transportation Planning Organization [PRTPO] 2004). All of the Garfield County roadways in the project area currently operate at a LOS A (Ecology and Environment 2009). Kellogg Hollow Road and Tucannon Road in Columbia County are rural roadways and, although Columbia County does not assign LOS values, would generally have a LOS A rating (Yates 2009). According to the BFCOG Transportation Programs Office, the rural roadways in Walla Walla County in the vicinity of the proposed project area are generally LOS A (Kushner 2009). The BFCOG Regional Transportation Plan (2006) defines LOS A as a condition of free flow with low volumes and high speeds. These ratings are generally supported by the ADT data presented in Table 3-39, which indicate that the roads in the vicinity of the project area receive low levels of use.

Bridges

A bridge spans the Tucannon River where SR 261 crosses the river to the northwest of Starbuck. Other minor stream crossings are located throughout the project area.

Railroads

A Union Pacific rail line follows along the north side of the Snake River in Garfield and Columbia counties before crossing the river between the Tucannon River and Lyons Ferry to follow the south side of the river in Walla Walla County. This rail line is approximately 0.2 mile east across the Snake River from the existing Lower Monumental Substation and the project corridor (Figure 3-3). An abandoned rail line follows U.S. Route 12 in Garfield and Columbia counties, and another abandoned line follows the north side of the Snake River near the Lower Monumental Dam in Walla Walla County.

Air Traffic

Commercial airports serving the region are located in the Tri-Cities and Walla Walla, Washington and Lewiston, Idaho. Garfield County has no public airports but is served by the Lewiston Nez Perce County Airport.

Little Goose State Airport is the only public airport in Columbia County. This gravel-surfaced airstrip is managed by the WSDOT and leased from USACE. Originally built to support construction of Little Goose Lock and Dam, this airport is now very popular with recreational users who fly in to the area for fishing, boating, and camping. The Little Goose Airport is generally open from June 1 to October 1 (WSDOT 2009a).

The Lower Monumental airport is a gravel surfaced airstrip in Walla Walla County, located approximately 0.25 mile east of the existing Lower Monumental Substation and the project corridor (Figure 3-3). This airstrip is managed by WSDOT and is leased from USACE. It is the most primitive of three airstrips managed by the state on the lower Snake River, and is not used on a regular basis. The airport is generally open from June 1 to October 1. Agricultural spraying operators occasionally use this facility. The adjacent terrain rises quickly east and south of the airstrip, and two existing power transmission lines are located in close proximity to this facility; one 2,300 feet to the north of the airstrip, and another paralleling it 500 feet to the west.

Numerous smaller landing strips are available in the area for agriculture-related operations such as aerial applications and access to remote recreational areas (WSDOT 2009b).

Waterways

The lower Snake River is used to transport significant amounts of grain and other commodities that are produced in the region. The construction of four major dams on the lower Snake River from the 1950s through the 1970s allows ocean going vessels to travel inland as far as Lewiston, Idaho. Two of these dams, Lower Monumental and Little Goose, are located in the project vicinity.

Port facilities located along the lower Snake River are operated by Port Districts in each county. Ports in the project vicinity include the Port of Columbia, Port of Garfield, and Port of Central Ferry. Grain shipments are a major part of the ports' freight activities, accounting, for example, for 85 percent to 90 percent of total shipments from the Ports of Garfield and Central Ferry. The grain shipped from these sites is trucked in from local farms, as well as from Montana, Oregon, Colorado, the Dakotas, Idaho, and the Great Plains states (PRTPO 2004).

3.10.2 Environmental Consequences of Action Alternatives

Impacts Common to All Action Alternatives

Roads – Construction Impacts

Temporary impacts during construction of the action alternatives would include increased traffic and damage to existing roadways, traffic delays as a result of heavy and light vehicles accessing the project corridor, improvements to existing access roads, and construction of new temporary access roads.

Construction equipment, materials, and personnel would be transported to the corridor using new access roads; existing access roads; and county, state, and private roads. Construction activity and movement of heavy construction vehicles would be ***short-term*** (construction traffic would occur over a two-year period). Deliveries would generally occur during normal construction hours; however, truck traffic could also occur during nighttime hours.

Construction of the proposed project, regardless of the action alternative, could generate approximately 65 truck trips to and from the right-of-way per day during the peak construction period, and an average of 27 truck trips per day over the duration of project construction. During the peak construction period, approximately 170 construction personnel would be working onsite. Construction workers would generally meet at a convenient meeting place at the start of the work day and carpool in groups of 3 to 5 to construction locations. These workforce trips would consist of light-duty vehicles traveling on existing state highways, county roads, and access roads to the project corridor. There would most likely be two meeting areas for the proposed project, one towards each end of the proposed transmission line to save commuting time for the construction crews. Overall, the proposed project would generate up to an estimated 120 vehicle round trips per day (65 trucks and 55 passenger vehicles) during the peak construction period.

The proposed project would not likely require any road closures during construction for all action alternatives. Construction vehicles would temporarily increase traffic and could lead to short-term traffic delays on existing roads used to access the project corridor. The primary transportation corridors in the project area (US 12, SR 127, SR 261, and SR 263) would be used for the duration of the construction phase of the project. A traffic analysis prepared for the Lower Snake River Wind Energy Project (LSRWEP) compared projected construction traffic volumes with estimated vehicle capacities for US 12, SR 127, and SR 261, and found that the addition of LSRWEP construction traffic to these roads (an estimated 159 peak vehicle trips) would result in very small changes to existing volume to capacity ratios on the affected highways, would be less than significant, and would not cause any section of road to fall below its applicable LOS (Ecology and Environment 2009). The addition of the construction-related traffic for the proposed project to existing volumes (Table 3-39) would be expected to have similar or lower impacts, given that fewer vehicles would be added.

Use of county and local roads for construction traffic would be limited to those roads necessary to gain access to the project corridor. Based on the relatively low average daily traffic counts on these roads, and the relatively short-term use any one road is likely to receive, temporary traffic delays are likely to occur at localized spots, but would only occur while construction is taking place in adjacent or nearby areas. If construction vehicles cause temporary traffic blockages on local roadways, traffic would be routed around affected intersections. Construction-related traffic impacts are, therefore, with mitigation measures in place, expected to be ***low to moderate***.

Trucks carrying heavy construction materials and equipment to the project corridor could damage existing roadways and cause localized traffic delays. All loads transported on state and county roads would be within legal size and load limits, or have valid oversize and/or weight permits. Project vehicles could track dust, soils, and other materials from the project site onto public roads. An erosion control plan would be prepared and include measures to stabilize construction entrances and exits to prevent sediments from being transported onto adjacent roadways. With implementation of mitigation and permit requirements, impacts to existing roadways would be ***low***.

Local roads including Fletcher Road, Powers Road, Tucker Road, Riveria Road, Ferrell Road, Archer Road, Hagen Road, Scot Station Road, Whitetail Road, Canyon Bottom Way, and New York Gulch Road, and any other unimproved roads would be improved under all action alternatives. In areas where the proposed alternatives would parallel existing transmission lines, existing access roads would be improved as necessary for use during construction and operation of the project. Improvements may include: widening; upgrading road surfaces from gravel to aggregate; adding ditches, culverts, rolling dips and waterbars; smoothing out curves; and clearing brush. If towers are placed in agricultural fields, BPA would build temporary access roads to these tower sites to construct the transmission line. Once construction is complete, these roads would be removed and the soil would be restored for continuing agricultural use. Impacts from access road improvement and use of temporary roads would be ***low***.

Permanent impacts from construction of the proposed project would include construction of new access roads. In areas where existing roads do not provide access to the project corridor, new gravel access roads would be constructed and maintained. Most of the access road construction would likely occur from late spring to early fall. Any temporary disturbance areas would be reclaimed after construction is completed. Road-related impacts to other resources, such as agricultural use, vegetation, and wildlife, are discussed in the resource-specific sections elsewhere in this EIS. See below for a discussion of specific miles of new access roads required under the action alternatives.

Roads –Impacts From Operation

Operation and maintenance impacts would include use of state, county, and access roads by heavy and light vehicles to perform routine and emergency maintenance to project facilities under all action alternatives. Vehicles would also use access roads to maintain vegetation along the project corridor for safe operation and to allow access to the transmission line corridor. However, the project corridor needs little vegetation maintenance because it includes primarily sagebrush and other low-growing vegetation. If a tower located in an agricultural area would need to be accessed for maintenance or emergency situations, BPA would pay the landowner for any crop damage that occurs. BPA would, when requested by a landowner, place gates at the entrances to access roads to prevent public access to the landowner’s property and the project corridor. Gate locks would be coordinated with landowners to ensure that both BPA and the landowner can unlock these gates. Impacts to existing and new access roads would be ***low*** during operation and maintenance, as vehicles would only access the project corridor periodically and would not be expected to affect local traffic conditions.

Roads –Unauthorized Public Access and Use

As stated above, at the request of any landowners whose land would be crossed by access roads for the proposed project, BPA would place gates at the entrances to these access roads to prevent public access to these lands and the project corridor. However, there is the potential that even with gates, unauthorized access and use of the project corridor, and adjacent properties, could occur. WDNR, which manages state lands in the project vicinity that would be crossed by all of the alternative project corridors (see Figure 3-3), has raised concerns about potential impacts to state lands from this unauthorized access and use. Because transmission line corridors are linear facilities that typically can be accessed fairly easily by the general public, WDNR is concerned that the presence of these corridors can contribute to unauthorized use and damage to state lands and public resources on these lands. DNR also is concerned that gates, by themselves, are not sufficient to prevent unauthorized access and use to its lands where the project corridor and associated roads would be present.

In general, potential impacts from unauthorized public access and use include increased soil erosion, fire danger, and introduction of noxious weeds, as well as disturbance of vegetation, wildlife and their habitat, and cultural resources. Increased soil erosion can occur from unauthorized uses such as off-road vehicles accessing areas and disturbing the soils that are present, which can lead to erosion of these soils from rainfall and other events. Over time, unauthorized uses of gravel or dirt roads in the vicinity of the project corridor also could lead to accelerated deterioration of these roads through disturbance and erosion. Increased fire danger can result from activities by unauthorized users on or near the project corridor from a variety of means, such as campfires, unextinguished cigarettes, and vehicle exhaust systems coming into contact with vegetation. Potential impacts associated with soil erosion and increased fire danger are discussed in Sections 3.1 and 3.11, respectively, of this EIS.

The potential introduction of noxious weeds from unauthorized public access and use can primarily occur from unauthorized vehicles inadvertently transporting and spreading seeds of noxious weeds into the project corridor and adjacent lands. Soil disturbance from these vehicles increases the potential for the introduced noxious weeds to become established in these disturbed areas. Impacts associated with noxious weeds are discussed in Section 3.3 of this EIS.

Unauthorized access and use also can potentially disturb vegetation, wildlife and their habitat, and cultural resources. Vegetation and wildlife habitat can be disturbed by unauthorized vehicles driving over and crushing or uprooting plants, as well as by any vegetation clearance associated with an unauthorized use. Wildlife can be disturbed or displaced by the presence of and noise from unauthorized uses, and these uses can increase stress, disruption of normal foraging and reproductive habits, abandonment of unique habitat features, and energy expenditure of wildlife species in the area. Cultural resources can be disturbed by the damaging of known or previously undiscovered cultural resource sites or the unauthorized collection of artifacts or other cultural resources. Potential impacts associated with disturbance of vegetation, wildlife and their habitat, and cultural resources are discussed in Sections 3.3, 3.5 and 3.8, respectively, of this EIS.

To address WDNR's concerns about unauthorized access to its lands as a result of the project corridor and associated access roads, BPA intends to work with WDNR concerning possible avenues for controlling or minimizing the potential for unauthorized public access and use on state lands that could result from the proposed project. Because mitigation measures would be taken to decrease the potential for unauthorized public access and use and occurrences of this type of activity would generally be expected to be infrequent, impacts from unauthorized public access and use would be ***low***.

Bridges

The bridge where SR 261 crosses the Tucannon River would be used during project construction and operation to transport materials and equipment to the project corridor. Impacts are expected to be ***none to low*** on existing project area bridges from all action alternatives. No new bridges would be required under all action alternatives.

Railroads

No materials would be delivered to the project corridor by local railroad lines; therefore ***no*** impact is expected on railroad operations during project construction and operation under all action alternatives.

Air Traffic

Construction and operation of the project could affect local air traffic in the vicinity of the project corridor. Overhead transmission conductors, towers, and overhead groundwires could pose a slight hazard to low flying aircraft under all action alternatives. Small airplanes utilize the Little Goose and Lower Monumental airstrips, both within 3 miles of the project corridor. A segment of the transmission line corridor common to all action alternatives would be approximately 0.25 mile to the west of the Lower Monumental airstrip. Two existing transmission lines are located in close proximity to this airstrip; one 2,300 feet to the north of the airstrip, and another paralleling it 500 feet to the west. WSDOT warns potential users of this facility of the existing power lines, in addition to the existence of steep terrain adjacent to the airstrip (WSDOT 2009b). These airstrips are used occasionally and pilots are used to avoiding existing transmission lines; therefore, impacts on air traffic using these airstrips would be ***low***.

Flashing lights on the towers or spherical balls on the conductors are required if towers or conductors would be taller than 200 feet from the ground, or if the transmission line would be within the plane elevation of an airport. The maximum height of the towers for all action alternatives is approximately 189 feet. However, across the Tucannon River and possibly above Dry Gulch, the proposed conductor height would be greater than 200 feet, although the towers on each side of this span may only be about 150 feet for all action alternatives. BPA would consult with the Federal Aviation Administration (FAA) regarding the installation of flashing lights on towers or spherical balls on the conductor.

A helicopter would be used during construction and may be used during project operations for periodic aerial inspections regardless of the action alternative. Any helicopter flights would be coordinated with other local flight plans.

Waterways

All action alternatives would cross the Tucannon River to the northwest of Starbuck in the same corridor. Additionally, all action alternatives would be in the same corridor approximately 0.3 mile to the east of the Snake River adjacent to Lower Monumental Substation. No materials would be delivered to the project corridor by barge, resulting in no impact on barge operations or other water-dependent transportation during project construction and operation under all action alternatives.

The following sections describe potential impacts on transportation resources specific to each of the action alternatives.

North Alternative

The North Alternative would require construction of approximately 33 miles of new access roads and about 5 miles of improvements to existing roads located primarily on private land. Existing roads needed to access this action alternative would require varying degrees of improvement, and easements would be acquired if necessary. Similar to the discussion for all action alternatives, the North Alternative would have ***low to moderate*** impacts on transportation resources during construction, operation, and maintenance of the proposed transmission line.

A segment of the North Alternative would be located approximately 0.55 mile to the east of the Lower Monumental airstrip and approximately 1.5 miles south of the Little Goose Airport at its closest point. Similar to the discussion for all action alternatives, impacts to these airstrips would be ***low***.

South Alternative

The South Alternative would require construction of an estimated 35 miles of new access roads and about 13 miles of improvements to existing roads located primarily on private land. Existing roads needed to access this action alternative would require varying degrees of improvement, and easements would be acquired if necessary. Similar to the discussion for all action alternatives, the South Alternative would have ***low to moderate*** impacts on transportation resources during construction, operation, and maintenance of the proposed transmission line.

The South Alternative would be approximately 2.7 miles south of the Little Goose Airport at its closest point. Similar to the discussion for all action alternatives, impacts to these airstrips would be ***low***.

Combination A Alternative

The Combination A Alternative would require construction of approximately 33 miles of new access roads and about 9 miles of improvements to existing roads located primarily on private land. Existing roads needed to access this action alternative would require varying degrees of improvement, and easements would be acquired if necessary. Similar to the discussion for all action alternatives, the Combination A Alternative would have ***low to moderate*** impacts on transportation resources during construction, operation, and maintenance of the proposed transmission line.

The Combination A Alternative would be approximately 1.5 miles south of the Little Goose Airport at its closest point. Similar to the discussion for all action alternatives, impacts to these airstrips would be ***low***.

Combination B Alternative

The Combination B Alternative would require construction of approximately 35 miles of new access roads and about 10 miles of road improvements to existing roads located primarily on private land. Existing roads needed to access this action alternative would require varying degrees of improvement, and easements would be acquired if necessary. Similar to the discussion for all action alternatives, the Combination B Alternative would have ***low to moderate*** impacts on transportation resources during construction, operation, and maintenance of the proposed transmission line.

A segment of the Combination B Alternative would be located approximately 0.55 mile to the east of the Lower Monumental airstrip. The Combination B Alternative would be approximately 2.7 miles south of the Little Goose Airport at its closest point. Similar to the discussion for all action alternatives, impacts to these airstrips would be ***low***.

3.10.3 Mitigation Measures

The following mitigation measures have been identified to minimize or eliminate transportation impacts from the action alternatives:

- Obtain a Haul Road Agreement and any additional permits or approvals from state and local agencies prior to construction. These documents will identify any special conditions to be addressed by BPA and their contractors during construction and operation of the project.
- Prepare an erosion control plan that includes measures to stabilize construction entrances and exits to prevent sediments from being transported onto adjacent roadways.
- Route traffic around affected intersections if construction vehicles cause temporary traffic blockages on local roadways.
- Employ traffic control flaggers and post warning signs of construction activity and merging traffic when necessary.
- Comply with applicable seasonal road restrictions for construction traffic, where practicable.
- Restore public roadways to their pre-construction conditions or better upon completion of project construction activities.
- Design and construct new access roads to minimize runoff and soil erosion.
- Reclaim any road-related disturbance areas after construction is completed.
- Install gates at the entrances to access roads when required or requested by landowners to reduce unauthorized use. Coordinate gate locks with landowners to ensure that both BPA and the landowner have access.
- Work with WDNR concerning a possible cooperative agreement for the control of unauthorized public access and use on state lands that could result from the proposed project. The agreement could address various provisions related to unauthorized access, such as additional measures to be taken to discourage unauthorized use of the project corridor and associated access roads, periodic inspection for unauthorized access and any resulting damage, and repair of any damage from unauthorized access.
- Install marker balls on the conductor and lights on towers at the Tucannon River crossing if required by the FAA.

3.10.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to transportation.

3.11 Noise, Public Health and Safety

3.11.1 Affected Environment

Noise

Noise is commonly defined as unwanted sound that disrupts normal human activities or diminishes the quality of the human environment. Transient noise sources, such as passing aircraft or motor vehicles, produce noise usually of short duration excluded from regulation. Stationary sources such as a substation can emit noise over a longer period. Ambient noise is all noise generated in the vicinity of a site by typical noise sources such as traffic, wind, neighboring industries, and aircraft. The total ambient noise level is a typical mix of noise from distant and nearby sources.

Sources of noise associated with electrical transmission systems include construction and maintenance equipment, transmission line corona, and electrical transformer "hum." Corona is the partial electrical breakdown of the insulating properties of air around the conductors of a transmission line. Corona-generated noise can be characterized as a hissing, crackling sound that is accompanied by a 120 Hertz (Hz) hum under certain conditions.

Noise from transmission lines generally occurs in foul or wet weather. Conductors can be wet during periods of rain, fog, snow, or icing. Such conditions are expected to occur infrequently (less than a few percent of the time) in the project area.

Environmental noise, including transmission line noise, is usually measured in decibels on the A-weighted scale (dBA). This scale models sound as it corresponds to human perception. Table 3-40 shows typical noise levels for common sources expressed in dBA. Noise exposure depends on how much time an individual spends in different locations.

Table 3-40. Common Noise Levels

Sound Level, dBA[1/]	Noise Source or Effect
110	Rock-and-roll band
80	Truck at 50 feet
70	Gas lawnmower at 100 feet
60	Normal conversation indoors
50	Moderate rainfall on foliage
40	Refrigerator
25	Bedroom at night

Note:
1/ Decibels (A-weighted)
Sources: Adapted from BPA 1986, 1996.

Noise levels and, in particular, corona-generated noise vary over time. 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 during a specified period. Thus, L_{50} refers to a particular sound level that is exceeded 50 percent of the time. L_5 refers to the sound level exceeded 5 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.

Along the corridor of the proposed 500-kV transmission line, existing noise levels vary with the proximity to agricultural activities, other transmission lines, and roadway traffic. Most of the proposed corridor crosses undeveloped, rural agricultural lands. Noise levels in this area are generally very low. During foul weather, noise from the existing lines are a source of background noise, along with wind and rain hitting vegetation. In the more developed areas, traffic and noise associated with human activity are major contributors to background noise.

The EPA has established a guideline of 55 dBA for the average day-night noise level (Ldn) 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 p.m. and 7 a.m. BPA has established a design criterion for corona-generated audible noise from transmission lines of 50 dBA for L_{50} (foul weather) at the edge of the right-of-way. The Washington Administrative Code (WAC 173-60) specifies noise limitations by class of property: residential, commercial, or industrial. Transmission lines are classified as industrial and may cause a maximum permissible noise level of 60 dBA to intrude into residential property. There are very few residences in the project area; one residence has been identified within 1,000 feet of the edge of the proposed transmission line.

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, fires, and electric and magnetic fields (EMF) related to transmission facilities or construction activities.

Potential hazards along the corridor include fire, both natural and human-caused. The FAA establishes requirements for towers and other tall structures that would potentially interfere with aircraft safety. Structures taller than 200 feet may require flashing warning lights for aircraft safety.

Transmission lines, like all electric devices and equipment, produce EMF. Current, the flow of electric charge in a wire, produces the magnetic field. Voltage, the force that drives the current, is the source of the electric field. The strength of EMF depends on the design of the line and on distance from the line. Field strength decreases rapidly over a short distance. Field strengths from electric fields are also reduced in strength by structures and vegetation.

EMF is found around any electrical wiring, including household wiring and wiring in electrical appliances and equipment. Electric fields are measured in volts per meter (V/m) or kilovolts per meter (kV/m). 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 electrical appliances.

There are no national (United States) guidelines or standards for electric fields from transmission lines. Washington has no electric-field limit. BPA designs new transmission lines to meet its electric-field guideline of 9 kV/m maximum on the right-of-way and 5 kV/m maximum at the edge of the right-of-way. The National Electric Safety Code (NESC) does specify a maximum 5-milliampere (mA) criterion for maximum permissible induced shock current from large vehicles under transmission lines with voltages 230 kV or greater. BPA complies with the NESC specifications.

Magnetic fields are measured in units of gauss (G) or milligauss (mG). Average magnetic field strength in most homes (away from electrical appliances and home wiring) is typically less than 2 mG. Very close to appliances carrying high current, fields of tens or hundreds of mG are present. Unlike electric fields, magnetic fields from outside power lines are not reduced in strength by trees and building material. So, transmission lines and distribution lines (the lines feeding a neighborhood or home) can be a major source of magnetic field exposure throughout a home located close to the line.

There are no national United States guidelines or standards for magnetic fields, and Washington does not have a limit for magnetic fields from transmission lines. BPA does not have a guideline for magnetic field exposures. The guidelines that do exist for public and occupational magnetic-field exposures are intended for measuring short-term magnetic field exposures, and are not applicable to determining the effects of long-term exposures.

Toxic and Hazardous Substances

Several common construction materials (e.g., concrete, paint and wood-pole preservatives) and petroleum products (e.g., fuels, lubricants, and hydraulic fluids) would be used during construction.

3.11.2 Environmental Consequences of Action Alternatives

Impacts Common to All Action Alternatives

Construction of the action alternatives would generate noise in the project vicinity during the construction period. This noise would have the potential to affect nearby residences, recreational users, and other receptors. During operation and maintenance, noise levels also may periodically increase from these activities. Potential health and safety impacts associated with the proposed project include those that could affect construction workers, operation and maintenance personnel, the public, and others who have occasion to enter the project corridor.

Construction Noise

Construction activities would create noise that would be intermittent and short term during the construction period. Sources of noise include construction of access roads, tower site preparation, erection of steel towers at each tower site, helicopter assistance during tower erection and stringing of conductors, potential blasting, and use of implosive fittings for conductor splicing.

Access roads and tower site preparation would be completed using conventional construction equipment. Table 3-41 summarizes noise levels produced by typical construction equipment that would likely be used for the proposed project.

Table 3-41. Noise Levels Produced by Typical Construction Equipment

Type of Equipment	Maximum Level (dBA) at 50 Feet
Road Grader	85
Bulldozers	85
Heavy Trucks	88
Backhoe	80
Pneumatic Tools	85
Crane	85
Combined Equipment	89

Source: Thalheimer 1996

To account for fluctuating sound levels, statistical descriptors have been developed for environmental noise. The equivalent sound level (L_{eq}) is generally accepted as the average sound level. The overall noise caused by the conventional equipment involved in construction is estimated to be 89 dB L_{eq} at a reference distance of 50 feet. Noise produced by construction equipment would decrease with distance at a rate of about 6 dB per doubling of distance from the site. Based on that assumed attenuation rate, Table 3-42 shows the estimated construction noise levels at various distances from the construction site.

Table 3-42. Estimated Construction Noise Levels at Various Distances

Distance from Construction Site (feet)	Hourly Leq (dBA)
50	89
100	83
200	77
400	71
800	65
1,600	59

Note:
1/ The following assumptions were used:
Equipment used: (1) each- grader, bulldozer, heavy truck, backhoe, Pneumatic tools, concrete pump, crane
Reference noise level: 89 dBA (L_{eq})
Distance for the reference noise level: 50 feet
Noise attenuation rate: 6 dBA/doubling of distance
This calculation does not include the effects, if any, of local shielding or atmospheric attenuation.

Although daytime construction activities are excluded from noise regulations, these regulations can serve as a useful guideline for assessing noise impacts to individuals or residences located in the vicinity of the project area. For the purposes of this evaluation, it was assumed that construction noise levels equal to or less than 50 dBA would be considered a ***low*** impact. If construction noise levels exceed 50 dBA, this would be considered a ***moderate to high*** although ***short-term*** impact.

Residential land use within 1,000 feet of the project corridor is low. The project corridor consists mainly of open range, undeveloped land, and agricultural land with few residences that could be affected by noise from construction activity. One residence was identified within 1,000 feet of the proposed transmission line alignments, approximately 400 feet north of the South and Combination A alternatives in the vicinity of Lyons Ferry Road in Walla Walla County. If construction noise levels exceed 50 dBA at this residence, the impact would be considered ***moderate to high***, although ***short-term***.

Other residences are concentrated in the city of Starbuck, approximately 1.5 miles south of the project corridor at its closest point. The level of noise impacts to those residents from most construction activities and project related traffic would be ***low***. Helicopter use could increase noise and affect residents living in Starbuck; this impact also would be ***moderate to high*** although ***short-term***. Homes within roughly 1 mile of the helicopters would be exposed to temporary noise levels above 65 dBA.

Noise levels generated during erection of each tower would depend on the type of method used. If conventional construction methods were used to erect the towers, then the noise levels would be comparable to those listed in Tables 3-41 and 3-42. However, BPA's construction contractor may elect to use a large helicopter (such as the Sikorsky S-64 Sky-Crane) to assist with tower erection. In that case, all of the towers would be preassembled at one or more central staging areas, then a helicopter would transfer the assembled towers from the staging area to the remote tower sites. The helicopter would hover at each tower site for a total of 2 to 10 minutes during a 1-hour period while the tower sections are placed on the foundation. In addition, the helicopter would hover at the central staging area for 2 to 5 minutes per tower as it picked up each tower section. Assuming helicopters were used to erect all 360 towers, a total of 12 to 60 hours of hover time would be required, spread over several weeks and several sites.

Possible occasional midday blasting might be required at some tower sites in rocky areas where conventional excavation of tower footings would not be practical. Blasting would produce a short noise like a thunderclap that could be audible for 0.5 mile or more from the site. Implosive fittings would also be used to hook conductors together. This disturbance would be localized to the immediate area.

Operation and Maintenance Noise

Noise impacts during operation and maintenance of the proposed project would be ***none to low***. Maintenance noise would primarily involve noise generated by occasional maintenance and repair activities for the transmission line. In addition, periodic vegetation maintenance activities could occur along the right-of-way.

Routine helicopter inspection patrols of the transmission line would be conducted. About every 5 to 6 months, inspectors in a helicopter would fly over the line to look for any problems or repair needs. Because these flights would be infrequent and would result in extremely short periods of noise (likely 30 seconds or less) to any individual noise receptor, this impact is considered ***low***. When and if repair or maintenance needs arise along any portion of the line, field vehicles would be used to access the trouble spots.

The proposed line would increase the corona-generated foul weather audible noise level at the edge of the right-of-way. For all of the proposed corridor (38 to 40 miles) the edge of right-of-way foul-weather noise levels would meet or be below 50 dBA (BPA's standard).

During fair-weather conditions, which occur most of the time, audible noise levels would be about 20 dBA below the foul weather levels and comparable with current background levels. These lower levels could be masked by ambient noise on and off the right-of-way.

Noise from the existing substation equipment and transmission lines would remain the primary source of environmental noise at the Central Ferry and Lower Monumental substations. The large-diameter tubular conductors in the station do not generate corona noise during fair weather and any noise generated during foul weather would be masked by noise from the transmission lines entering and leaving the station. During foul weather the noise from the proposed and existing lines would mask the substation noise at the outer edges of the rights-of-way.

If the proposed transmission line is found to be the source of radio or television interference in areas with reasonably good reception, measures would be taken to restore the reception to a quality as good or better than before the interference (see Section 4.24 Federal Communications Commission for further discussion).

General Safety Issues

During construction and installation of the towers and conductor/ground wires for the proposed action alternatives, there is a risk of fire and injury associated with the use of heavy equipment, hazardous materials such as fuels, cranes, helicopters, potential bedrock blasting for structures, and other risks associated with working near high-voltage lines. There is potential for fire during refueling of hot equipment, such as trackhoes and bulldozers, that cannot be taken off-site for refueling. In addition, there are potential safety issues with more traffic on the highways and roads in the project area during construction. Impacts from operation and maintenance of the line would be ***negligible***, but would include additional risk for fire and injuries as maintenance workers and vehicles travel along the corridor to perform required maintenance.

Electrical Safety

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 distance between the lines and the ground or other objects. These requirements, in addition to BPA standards, determine the edge of the right-of-way and the height of the line, that is, the closest point that houses, other buildings, and vehicles are allowed to the line.

People must also take certain precautions when working or playing near power lines. It is extremely important that a person not bring anything, such as a TV antenna, irrigation pipe or water streams from an irrigation sprinkler, too close to the lines. BPA provides a free booklet that describes safety precautions for people who line or work near transmission lines (see Appendix D, Living and Working Safely Around High Voltage Power Lines). In addition, BPA does not permit any use of the rights-of-way that are unsafe or might interfere with constructing, operating, or maintaining the transmission facilities. These restrictions are part of the legal rights BPA acquires for its transmission line corridors. Landowners might incur delays and redesign or removal costs if they fail to contact BPA for concurrence before planting, digging, or constructing within the transmission corridor.

Electrical and Magnetic Fields

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.

Short-term and long-term effects and the levels of EMF near the proposed transmission line are discussed below and in detail in Appendix E, *Electrical Effects*. A review of recent studies and their implications for health-related effects is provided in a separate technical report, Appendix F, *Health Effects*. In addition, the Department of Energy provides a booklet on this topic (Questions and Answers about EMF, published in 1995).

The issue of whether there are long-term health effects associated with exposure to fields from transmission lines and other sources has been investigated for several decades. There is little evidence that electric fields cause long-term health effects. Estimates of magnetic-field exposures have been associated with certain health effects in studies of residential and occupational populations. Research in this area is continuing to determine whether such associations might reflect a causal relationship. See Appendix F of this EIS for more detailed information on this research.

Short-term Electric fields

Electric fields from high-voltage transmission lines can cause nuisance shocks when a grounded person touches an ungrounded object under a line or when an ungrounded person touches a grounded object. Such effects occur in the fields associated with transmission lines that have voltages of 230 kV or higher. However, these effects would occur infrequently. Transmission lines are designed so that the electric field would be below levels where primary shocks could occur from even the largest (ungrounded) vehicles expected under the line. Fences and other metal structures on and near the right-of-way would be grounded during construction to limit the potential for nuisance shocks. Questions about grounding or reports of nuisance shock received under a line should be directed to BPA.

The electric fields from the proposed 500-kV line would be comparable to those from existing 500-kV lines in the project area and elsewhere. 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.

The calculated peak electric field expected on the right-of-way of the action alternatives with steel lattice towers would be 8.9 kV/m. For average conductor clearance, the peak field would be 4.6 kV/m. As shown in Figure 3-8, 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. The largest value expected at the edge of the 150-foot wide right-of-way would be 2.4 kV/m. These field levels would be comparable with those found for other steel lattice lines. For all action alternatives, the calculated electric field would meet BPA's electric-field guideline of 5 kV/m at the edge of the right-of-way; the level of impact would be ***low***.

Short-term Magnetic fields

Magnetic fields from transmission lines can induce currents and voltages on long conducting objects parallel to the lines. These voltages can also serve as a source of nuisance shocks. However, the effects are well understood and can be mitigated by grounding and other measures. Magnetic fields from transmission lines and distribution lines can interfere with certain electronic equipment, such as older style computer monitors and televisions. The threshold for interference depends on the type and size of monitor. Historically, this phenomenon is reported at magnetic-field levels at or above 10 mG, but some more sensitive monitors may exhibit image distortion at lower levels. Display devices using flat-panel technologies, such as liquid-crystal or plasma displays are not affected.

For the action alternatives, the maximum calculated 60-Hz magnetic field on the right-of-way at 3.28 feet (1 meter) above ground would be 279 mG for a minimum conductor height of 35 feet. The maximum field would decrease for increased conductor clearance. For the average conductor height over a span of 30 feet, the maximum field would be 54 mG.

At the edge of the right-of-way of the proposed line, the calculated maximum magnetic field would be 74 mG (Figure 3-9). The magnetic field falls off rapidly as distance from the line increases. At a distance of 200 feet from centerline of the proposed line, the field would be 11 mG for maximum current conditions. The average field at this location would be about 4 mG.

It is anticipated that the impacts from magnetic fields would be ***none*** to ***low*** from those present on and near the existing line.

Long-term Health Effects

Scientific reviews of the research on EMF and health have stated that there is insufficient evidence to conclude that EMF exposures lead to long-term health effects, such as adult cancer, or adverse effects on reproduction, pregnancy, or growth and development of the embryo. Based on epidemiology studies, some uncertainty remains about the possible effect of magnetic-field exposure above 3-4 mG on the risk of childhood leukemia and short-term exposures to magnetic fields greater than 16 mG on an increased risk of miscarriage. However, as the scientific reviews also indicate, animal or cellular studies provide little support for the idea that the statistical associations reflect a causal relationship, i.e., that magnetic-field exposure increases the risk of childhood or adult cancer or miscarriage. Furthermore, national and international organizations have established public and occupational EMF exposure guidelines on the basis of short-term stimulation effects, rather than long-term health effects. In so doing, these organizations did not find data sufficient to justify the setting of a standard to restrict long-term exposures to electric or magnetic fields.

Electric and Magnetic Field Levels

An increase in public exposure to magnetic fields could occur if field levels increase and if residences or other structures draw people to these areas. The predicted field levels are only indicators of how the proposed project may affect the magnetic-field environment. They are not measures of risk or impacts on health. The approximately 40-mile-long corridor in which the proposed line would be built is sparsely populated.

The proposed line, regardless of routing alternative, would be built entirely on new right-of-way. Sections of the action alternatives to the north would parallel existing 500-kV lines in the area, but would have a separation of at least 1,200 feet to meet reliability criteria established by the Federal Energy Regulatory Commission (FERC). At a separation distance of 1,200 feet, the electrical effects from a transmission line would not be discernable. The proposed routes would be closer to existing transmission lines only for short distances (< 1 mile) where the line would terminate at the Central Ferry and Lower Monumental substations. Electrical effects analysis was not performed for these sections because of their short lengths and the lack of any dwellings or other areas frequented by the public at these locations. Therefore, there is only a single line configuration for field analysis of the proposed line.

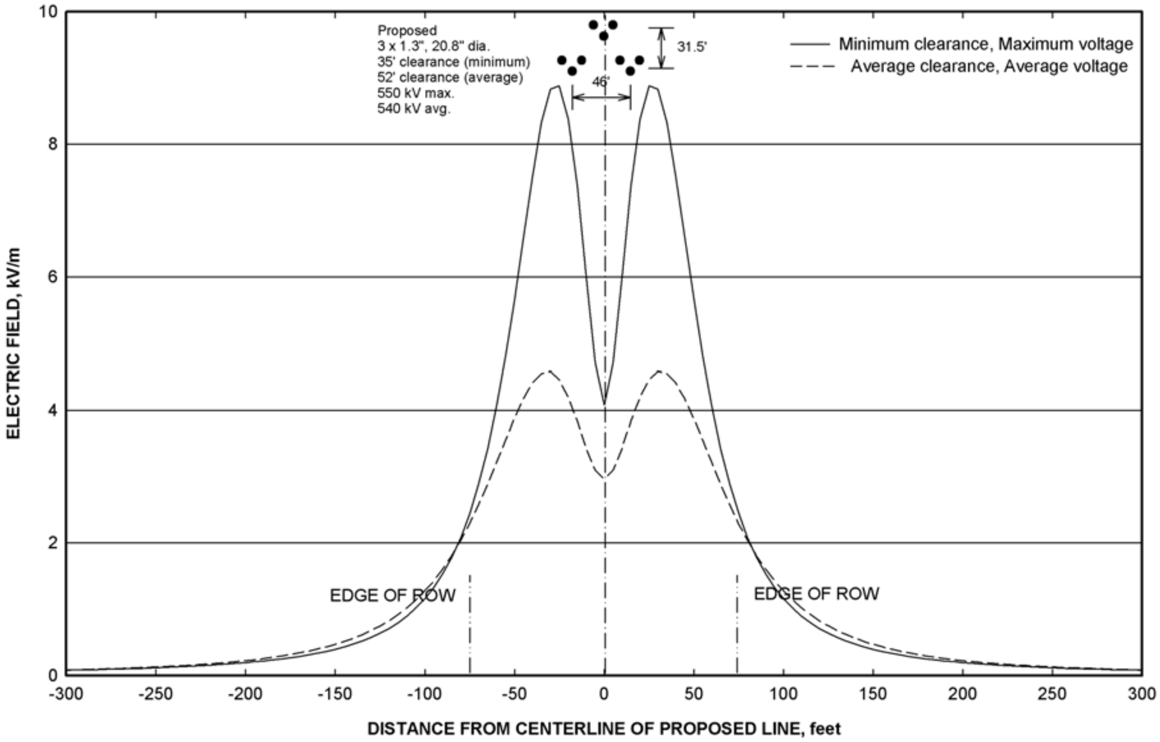


Figure 3-8. Electrical Fields for all Right-of-way Configurations

Note: Fields for maximum voltage with minimum and average clearances are shown.

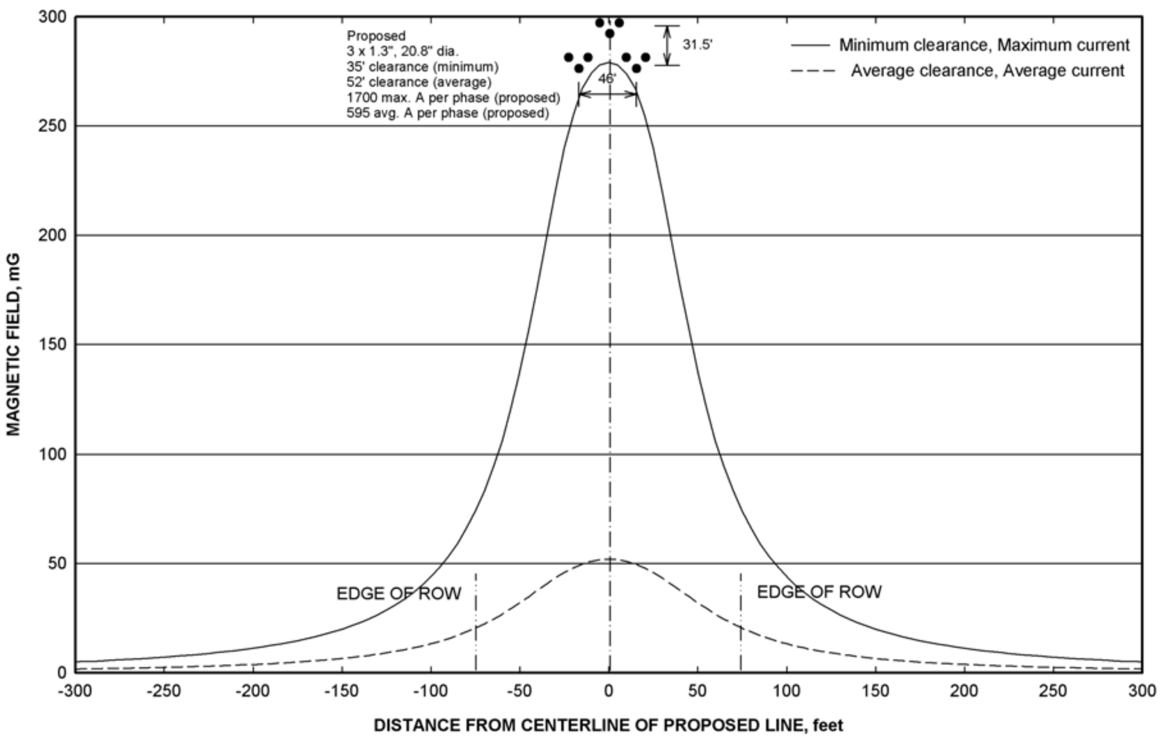


Figure 3-9. Magnetic Fields for all Right-of-way Configurations

Note: Fields for maximum current with minimum clearance and for average current with average clearance are shown

BPA has predicted the annual peak EMF levels for the configuration along the proposed transmission line corridor. This allows for a comparison of the fields from the proposed action alternatives and the No Action Alternative. The predicted levels for EMF are maximum levels that would occur under maximum voltage conditions for electric fields and annual peak current conditions for magnetic fields. Magnetic fields averaged over a year would be half, or less than half, of the estimated maximum values reported in Appendix E.

Toxic and Hazardous Substances

While there are no known occurrences of hazardous materials or contaminated media (soil, surface water or groundwater) in the proposed corridor, if unexpectedly encountered during construction of the project they 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. BPA would follow strict procedures for disposal of these or any other hazardous materials.

Should contaminated media be unexpectedly encountered during construction of the project, work would be stopped, and an environmental specialist would be called in to characterize the nature and extent of the contamination and to determine how the work may safely be completed. Work would proceed only after measures approved by Ecology and BPA are put in place to prevent the spread of contaminated materials and protect the health and safety of workers. Impacts would be ***none to low*** with implementation of mitigation measures, if necessary.

3.11.3 Mitigation Measures

The following mitigation measures would help to reduce the potential for temporary, adverse noise during construction and would help minimize potential health and safety risks:

- Install sound-control devices on all construction equipment.
- Muffled exhaust will be installed on all construction equipment and vehicles except helicopters.
- Notify landowners directly impacted along the corridor prior to construction activities, including blasting.
- Hold crew safety meetings during construction at the start of each workday to go over potential safety issues and concerns.
- Secure the site at the end of each workday to protect equipment and the general public.
- Train employees as necessary, in structure climbing, cardiopulmonary resuscitation, first aid, rescue techniques, and safety equipment inspection.
- Fuel all highway-authorized vehicles off-site to minimize the risk of fire. Fueling of construction equipment that is transported to the site via truck and is not highway authorized will be done in accordance with regulated construction practices and state and local laws. Helicopters will be fueled and housed at local airfields or at staging areas.
- Adhere to BPA's specifications for grounding fences and other objects on and near the existing and proposed rights-of-way during construction.
- Construct and operate the new transmission line in accordance with the National Electrical Safety Code, as required by law.
- Restore reception quality if radio or television interference occurs as a result of the transmission line. Reception needs to be as good or better than before the interference.

- Carry fire suppression equipment including (but not limited to) shovels, buckets, and fire extinguishers on all operation and maintenance vehicles.
- Use established access roads during routine operation and maintenance activities.
- Clear vegetation according to BPA standards to avoid contact with transmission lines.
- Contact the appropriate BPA representative if hazardous materials, toxic substances, or petroleum products are discovered within the project area that would pose an immediate threat to human health or the environment. Other conditions such as large dump sites, drums of unknown substances, suspicious odors, stained soil, etc. must also be reported immediately to BPA.
- Limit construction activities to daytime hours (i.e., only between 7:00 a.m. and 7:00 p.m.)
- Prepare and maintain a safety plan in compliance with Washington requirements. This plan would be kept on-site and would detail how to manage hazardous materials such as fuel, and how to respond to emergency situations.
- Ensure that helicopter pilots and contractors take into account public safety during flights. For example, flight paths could be established for transport of project components to avoid flying over populated areas or near schools (Helicopter Association 1993).
- Take appropriate safety measures for blasting consistent with state and local codes and regulations. Lock up or remove all explosives from the work site at the end of the workday.
- Install implosive fittings used to connect the conductors in a way that minimizes potential health and safety risks.
- Stay on established access roads during routine operation and maintenance activities.
- Submit final tower locations and conductor heights to the FAA for review. Install lights or marker balls as required.

3.11.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to noise and public health and safety.

3.12 Air Quality

3.12.1 Affected Environment

Air quality in the general project area is regulated by the Eastern Region of Ecology. This agency has regulations minimizing windblown fugitive dust from all industrial activities including construction projects. The operation of electrical transmission lines or electrical transformers is not regulated.

While there are no major industrial facilities in the vicinity of the project corridor and no significant existing air quality problems in the project area, the southwest corner of Walla Walla County does have an isolated maintenance area for particulate matter. However, the proposed project is located in the northeastern area of Walla Walla County. Local air pollutant emissions are limited mainly to windblown dust from agricultural operations and tailpipe emissions from traffic along state highways and local roads.

Ecology operates a limited number of ambient air quality monitoring stations throughout Washington. Monitoring stations are generally placed where there is the potential for air quality problems. The nearest monitoring stations are in Wallula and Kennewick, Washington. Based on available data from those monitoring stations, the Ecology Eastern Regional Office acknowledges that air quality along the project corridor complies with all regulatory limits for ambient air concentrations. The general project area has been designated by Ecology as having "attainment" status.

Air quality permitting requirements for attainment areas are relatively straightforward compared to the requirements for nonattainment areas. For this project BPA would not be required to conduct a "conformity analysis" to quantify emissions during construction and operation, and BPA would not be required to offset emissions generated during operation and maintenance.

Air quality does have an effect on visibility. Section 106 of the Clean Air Act 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 areas, and there are eight mandatory Class 1 areas in Washington State where the protection of visibility is required (Ecology 2010). In these areas, there are restrictions on the use of the land and resources in order to avoid damaging visibility, plants and other resources. There are no Class 1 areas in the general project area.

3.12.2 Environmental Consequences of Action Alternatives

Impacts Common to All Action Alternatives

Construction

Air quality impacts associated with the construction of the action alternatives would be the same regardless of action alternative. Air quality impacts associated with the construction of the proposed transmission line and associated facilities would be ***low***. The primary types of air pollution during construction would be combustion pollutants from equipment exhaust and fugitive dust particles from disturbed soils becoming airborne.

Two or three construction crews would most likely be working simultaneously on separate sections of the line. A typical transmission line construction crew (40 to 60 workers) could construct about 10 miles of line in 3 months. Construction equipment would consist of vehicles (pickups, vans), three bucket trucks, one conductor reel machine, three large excavators, one line tensioner, and one helicopter.

Construction activities that could create dust include road building and grading, on-site travel on unpaved surfaces, work area clearing and preparation, and soil disrupting operations. Most access roads would be on the native surface (dirt roads or sparse vegetation), but air quality impacts are expected to be localized, temporary, and controlled as practicable. Wind erosion of disturbed areas would also contribute to fugitive dust. The air quality impacts are expected to be ***short term*** and ***low***, and mitigation measures would be implemented to minimize impacts.

Heavy equipment and vehicles, including those with diesel internal combustion engines, would emit pollutants such as carbon monoxide, carbon dioxide, sulfur oxides, PM-2.5, oxides of nitrogen, volatile organic hydrocarbons, aldehydes, and polycyclic aromatic hydrocarbons. The amount of pollutants emitted from construction vehicles and equipment would be relatively small and comparable to current conditions with the operation of agricultural equipment in the project site and vicinity. Such short-term emissions from construction sites are exempt from air quality permitting requirements.

Operation and Maintenance

Air quality impacts during operation and maintenance of the proposed project would be ***none to low***. Operation and maintenance vehicles would mainly use access roads with native or rocked surfaces, causing fugitive dust to be stirred up. Quantities of potential emissions would be very small, temporary, and localized.

The transmission lines themselves cause limited air emissions. The high electric field strength of transmission lines causes a breakdown of air at the surface of the conductors called corona. Corona has a popping sound that is most easily heard during rainstorms. When corona occurs, small amounts of ozone and nitrogen oxides are released in such small quantities that they are generally too small to be measured or to have any significant effect on humans, plants, or animals. (See Section 3.11.1 for more detailed information about corona.)

3.12.3 Mitigation Measures

The following mitigation measures would be used to minimize impacts to air quality:

- Use water trucks to control dust during construction operations.
- Cover construction materials if they are a source of blowing dust.
- Limit the amount of exposed soil, including dirt piles and open pits, to a minimum.
- Prevent wind erosion by reseeding disturbed areas with grass or an appropriate seed mixture as soon as reasonably possible following construction activities.
- Avoid burning during construction activities.
- Ensure construction vehicles travel at low speeds on gravel roads and at the construction sites to minimize dust.
- Comply with Washington State tailpipe emission standards for all on-road vehicles.
- Ensure all vehicle engines are in good operating condition to minimize exhaust emissions.
- Use low sulfur fuel for on-road diesel vehicles.

3.12.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to air quality.

3.13 Greenhouse Gases

3.13.1 Affected Environment

Greenhouse gases are chemical compounds found in the earth's atmosphere that absorb and trap infrared radiation, or heat, re-radiated from the surface of the earth. The trapping and build-up of heat in the atmosphere increases the earth's temperature, warming the planet and creating a greenhouse-like effect (Energy Information Administration [EIA] 2009a). Anthropogenic activities are increasing atmospheric concentrations to levels that could increase the earth's temperature up to 7.2 degrees Fahrenheit (F) by the end of the twenty-first century (EPA 2009a).

The principal greenhouse gases emitted into the atmosphere through human activities are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_20), and fluorinated gases (EPA 2010). Of these four gases, CO_2 is the major greenhouse gas emitted (EPA 2010, Houghton 2010). For example, CO_2 emissions resulting from the combustion of coal, oil, and gas constitute 81 percent of all U.S. greenhouse gas emissions (EIA 2009a). Carbon dioxide enters the atmosphere primarily through the burning of fossil fuels coal, natural, gas and oil, and wood products, as a result of land use changes, and the manufacturing of cement. Prior to the industrial revolution, concentrations were roughly stable at 280 parts per million (ppm) but have increased 36 percent to 379 ppm in 2005, all of which is attributed to human activities (Intergovernmental Panel on Climate Change [IPCC] 2007).

Of the remaining three principal greenhouse gases, methane is emitted during the production and transport of fossil fuels, through intensive animal farming, and by the decay of organic waste in landfills. Methane concentrations have increased 148 percent above pre-industrial levels (EPA 2009a, 2010). Nitrous oxide is emitted during agricultural and industrial activities, and during the combustion of fossil fuels and solid waste. Nitrous oxide atmospheric levels have increased 18 percent since the beginning of industrial activities (EPA 2009a, 2010). Fluorinated gases, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), are synthetic compounds emitted through industrial processes and now are being used to replace ozone-depleting compounds such as chlorofluorocarbons in insulating foams, refrigeration, and air conditioning. Although they are emitted in small quantities, these gases have the ability to trap more heat than CO_2 and are considered High Global Warming Potential gases. Atmospheric concentrations of fluorinated gases have been increasing over the last two decades and are expected to continue (EPA 2009a, 2010).

Global atmospheric greenhouse gas concentrations are a product of emissions and removal over time. Through the process of photosynthesis, atmospheric carbon is captured and stored as biomass in vegetation, especially forests. Soils also store carbon in the form of decomposing plant materials and constitute the largest carbon reservoir on land. The stored carbon can be released back into the atmosphere when biomass is burned (EOE 2010). In addition, CO_2, N_20, and CH_4 emissions increase in areas where soil disturbance occurs (Kessavalou et al. 1998). Models predict atmospheric concentrations of all greenhouse gases are to increase over the next century, but the extent and rate of change is difficult to predict, especially on a global scale.

The Clean Air Act is a federal law that establishes regulations to control emissions from large generation sources such as power plants. The EPA has issued the Final Mandatory Reporting of Greenhouse Gases Rule that requires reporting of greenhouse gas emissions from large sources. Under the rule, suppliers of fossil fuels or industrial greenhouse gases, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of greenhouse gases, are required to submit annual reports to the EPA (EPA 2010). Executive Orders 13423 and 13514 require federal agencies to measure, manage, and reduce greenhouse gas emissions by agency-defined target amounts and dates (The White House 2009). In the state of Washington, Executive

Orders 07-02 and 09-05 direct state agencies to work with western states and Canadian provinces to develop a regional emissions reduction program designed to reduce greenhouse gas emissions to 1990 levels by 2020 (Ecology 2010).

3.13.2 Environmental Consequences of Action Alternatives

Potential impacts related to greenhouse gases would generally be the same under all four action alternatives. Implementation of any of the action alternatives would contribute to greenhouse gas concentrations in several different ways. Carbon dioxide, methane, and N_20 emission levels would incrementally increase as vegetation and soils are removed and/or disturbed during construction of the transmission line (Kessavalou et al. 1998). Carbon that would be stored in removed vegetation would be offset in time by the growth and accumulation of carbon in soils and new vegetation. While no trees would be removed as part of the proposed project, soil disturbance would occur throughout the project area, as holes are excavated for tower footings and access roads are constructed. Recognized as a contribution to overall green house gas emissions, measurement of emissions from soil disturbance is difficult. However, research has shown that emissions as a result of soil disturbance are short-lived and return to background levels after several hours (Kessavalou et al. 1998). Based on the conservative methodology used to estimate vehicle emissions, the emissions related to soil disruption and vegetation decay are considered to be accounted for in the overall construction emission rates discussed below.

Emissions from construction, operations, and maintenance-related vehicles on and off the project corridor also would impact atmospheric greenhouse gas concentrations incrementally because construction equipment and vehicles would be fueled by gasoline and diesel combustion motors.

Greenhouse gas emissions were estimated for all action alternatives based on the approximate number of vehicles to be used during project construction and the approximate distance those vehicles would travel during the construction period. For the proposed project, an estimated 120 vehicle round trips per day would occur during the peak construction period for all action alternatives (see Sections 3.10 and 3.12 for more information on vehicle use during construction). Construction would take about 2 years, with peak construction activity occurring during a 1-year period (see Figure 3-10). During the 1-year peak construction period, road and tower pad construction usually takes approximately 3 to 5 months including close-out repairs of any roads damaged during construction. Non-peak construction activities would include acquisition of easements, work to connect the new line and other existing lines into the substations, and tower site restoration work (see Section 2.2 for the proposed construction schedule).

In order to provide a conservative analysis and ensure that the proposed project’s potential contribution to greenhouse gas concentrations is adequately considered, greenhouse gas emissions were calculated for the 1-year peak construction period using the estimate of 120 vehicle round trips per day. A round trip on the proposed project was considered to be from one end of the project to the other (about 40 miles). The greenhouse gas emission estimates are therefore artificially high in order to ensure that potential greenhouse gas emissions are fully described.

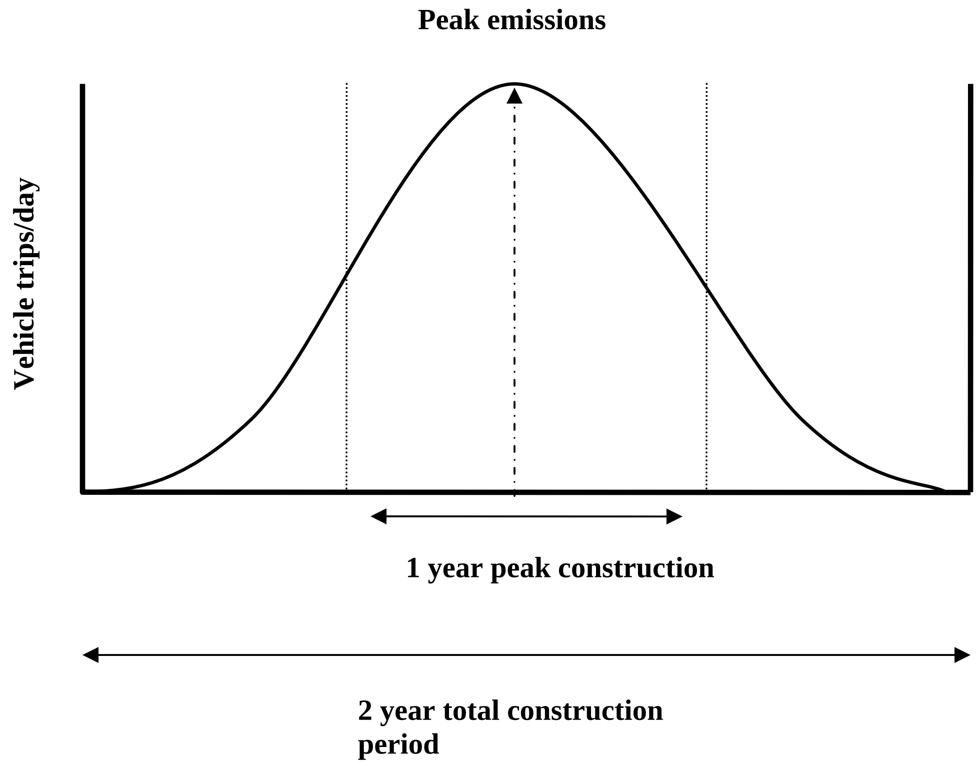


Figure 3-10. Typical Construction Schedule and Illustrative Emission Rates Example Based on Daily Vehicle Trips

Table 3-43 displays the estimated greenhouse gas emissions for the 1-year peak construction period. While all emissions of greenhouse gases are significant in that they contribute to global greenhouse gas concentrations and climate change, the total CO_2 emissions from the proposed project would be very low compared to emissions from other contributors.

Table 3-43. Estimated Greenhouse Gas Emissions from Construction of the Action Alternatives

CO_2 Emissions in metric tons per year	CH_4 (CO_2e[1/] emissions in metric tons per year)	N_2O (CO_2e emissions in metric tons per year)	Total CO_2 Emissions in metric tons per year
3,066	0.19	2.61	**3,069**

1/ CH_4 and N_2O emissions have been converted into units of CO_2 equivalent using the IPCC global warming potential (GWP) factors of 21 GWP for CH_4 and 310 GWP for N_2O. See Appendix I for calculations used in determining emissions.

To provide context for these emission rates, the U.S. Environmental Protection Agency's mandatory reporting threshold for annual CO_2 emissions is 25,000 metric tons of $C0_2$ equivalent. This threshold is roughly the amount of CO_2 generated by 4,336 passenger vehicles per year. This threshold requires federal reporting of greenhouse gas emissions, but does not require any other action (EPA [2009b] 40 CFR Parts 86, 87, 89 et al.).

As shown in Table 3-43, construction of the proposed project would result in an estimated 3,066 metric tons of CO_2 emissions, and an estimated 3,069 metric tons of CO_2 equivalent emissions, per year. The project's estimated CO_2 equivalent emissions translate roughly to the annual CO_2

emissions of 532 passenger vehicles. This emission rate is approximately eight times lower than what is required to trigger EPA emissions reporting. Given this extremely low amount of contribution, the project's impact on greenhouse gas concentrations during construction would be considered ***low***.

During operation and maintenance of the transmission line, a helicopter would be used twice a year for aerial inspections and approximately four vehicle round trips per year would occur. The helicopter and vehicles would most likely access the transmission line corridor from Pasco, WA. A round trip would be from Pasco, to the project and back again, a flying distance of about 130 miles and a driving distance of 140 miles. It is expected that no trees would be removed during operation and maintenance. The only trees located within the corridor are along the Tucannon River with total heights far below the height of the proposed conductor crossing of the river.

Table 3-44 displays the estimated annual greenhouse gas emissions that would be expected to occur during operation and maintenance of the transmission line. As shown in this table, operation and maintenance of the proposed project would result in an estimated 1.54 metric tons of CO_2 equivalent emissions per year, which translate to the annual CO_2 emissions of less than one passenger vehicle. This emission rate is approximately 0.006 percent of the rate that is required to trigger EPA emissions reporting. Given this extremely low amount of contribution, the project's impact on greenhouse gas concentrations during operation and maintenance would be considered ***low***.

Table 3-44. Estimated Greenhouse Gas Emissions from Operation and Maintenance of the Action Alternatives per Year

CO_2 Emissions in metric tons per year	CH_4 (CO_2e[1/] emissions in metric tons per year)	N_2O (CO_2e emissions in metric tons per year)	Total CO_2 Emissions in metric tons per year
1.5	0.002	0.03	**1.54**

1/ CH_4 and N_2O emissions have been converted into units of CO_2 equivalent using the IPCC global warming potential (GWP) factors of 21 GWP for CH_4 and 310 GWP for N_2O. See Appendix I for calculations used in determining emissions.

3.13.3 Mitigation Measures

The following mitigation measures would reduce greenhouse gas emissions during construction, operation, and maintenance of the transmission line:

- During construction, trucks and heavy equipment will limit engine idling time and equipment will be shut down when not in use except when activities occur in cold weather. Provide clear signage that posts this requirement for workers at all entrances to the work sites.
- During construction, all vehicles will comply with applicable federal and state air quality regulations for tailpipe emissions. Certification that vehicles meet applicable regulations will be provided to BPA in writing.
- Encourage carpooling and the use of shuttle vans among construction workers to minimize construction-related traffic and associated emissions.
- Locate all staging areas as close to construction areas as practicable to minimize driving distances between staging areas and construction sites.
- Locate staging areas in previously graded or graveled areas to minimize soil and vegetation disturbance where practicable.
- Maintain and certify in writing that all construction equipment is in proper working condition according to manufacturer's specifications.

- Train equipment operators in the proper use of equipment.
- Use the proper size of equipment for the job.
- Use alternative fuels such as propane or solar for generators at construction sites, or use electrical power where practicable.
- Reduce electricity use in the construction office by using compact fluorescent bulbs, and powering off computers every night.
- Submit a plan for approval to recycle or salvage non-hazardous construction and demolition debris where practicable.
- Submit a plan for approval to dispose of wood poles locally where practicable.
- Use locally sourced rock for road construction.

3.13.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and there would be no impact to greenhouse gas concentrations.

3.14 Cumulative Impacts Analysis

This section describes the potential cumulative impacts of the proposed action. The proposed action, in combination with past, present, and reasonably foreseeable actions identified in the above sections, could potentially result in cumulative impacts to the natural, physical, and socioeconomic resources described in Sections 3.1 through 3.13 of this EIS. The following sections describe the cumulative impact analysis methodology used, actions considered, and the cumulative impact analysis for each affected resource.

3.14.1 Cumulative Impacts Analysis Methodology

The CEQ regulations to implement NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). As stated in the CEQ handbook, "Considering Cumulative Effects" (CEQ 1997), cumulative impacts need to be analyzed in terms of the specific resource, ecosystem, and human community being affected and should focus on effects that are truly meaningful.

The analysis of cumulative impacts was accomplished using four steps:

Step 1 — Identify Resources Affected

In this step, each resource affected by any of the alternatives is identified. These are the same resources as described in the affected resources section in Chapter 3.

Step 2 — Establish Boundaries

In order to identify the past, present, and reasonably foreseeable actions to consider in the cumulative impact analysis, affected resource-specific spatial and temporal boundaries must be identified. The spatial boundary is the area where past, present, and reasonably future actions have, are, or could take place and result in cumulative impacts to the affected resource when combined with the impacts of the proposed action. As stated above, this boundary is defined by the affected resource and may be a different size than the proposed project area. The temporal boundary describes how far into the past and forward into the future actions should be considered in the impact analysis. Appropriate spatial and temporal boundaries may vary for each resource.

Step 3 — Identify Cumulative Action Scenario

In this step, the past, present, and reasonably foreseeable future actions to be included in the impact analysis for each specific affected resource are identified. These actions fall within the spatial and temporal boundaries established in Step 2.

Step 4 — Cumulative Impact Analysis

This final step involves the analysis of the impacts of the actions identified in Step 3 in addition to the impacts of the proposed action. This will result in the total cumulative impact for each resource.

3.14.2 Cumulative Action Scenario

The determination of what past, present, and reasonably foreseeable future actions to consider in the impact analysis is based on the resources being affected by the proposed action. Guidance on determining what actions to consider in the cumulative impact analysis comes from a variety of sources. The Council on Environmental Quality has produced several guidance documents, including a document entitled "Guidance on Consideration of Past Actions in Cumulative Effects Analysis." This document states that consideration of past actions is only necessary in so far as it informs agency decision-making. Typically the only types of past actions considered are those that continue to have present effects on the affected resources. This present effect will dictate how far in the past actions are considered and the impacts of these past actions are largely captured in the discussion of the affected environment chapter for each resource. The guidance states that "[a]gencies are not required to list or analyze the effects of individual past actions unless such information is necessary to describe the cumulative effect of all past actions." Agencies are allowed to aggregate the effects of past actions without "delving into the historical details of individual past actions".

Present actions are those that are currently occurring and also result in impacts to the same resources as would be affected by the proposed action. Reasonably foreseeable future actions are those actions that are likely to occur and affect the same resource as the proposed action. The determination of what future actions should be considered requires a level of certainty that they will occur. This level of certainty is typically met by the completion of permit application, the subject of approved proposals or planning documents, or other similar evidence. Determining how far into the future to consider actions is based on the impact of the proposed action. Once the impacts are no longer experienced by the affected resource, future actions beyond that need would not be considered. For the purposes of this EIS, the future actions being considered are those that will occur over the time it takes temporary impacts to be mitigated or eliminated. The life of a transmission line is approximately fifty years; however, except for TCPs and visual resources, this is not an appropriate time horizon in which to consider future actions because the impacts from construction of the transmission line are greatly reduced if not eliminated, the impacts from operation and maintenance are minimal, and future actions over that period are speculative in nature. For TCPs and visual resources, consideration of future actions would be for the life of the line because while the line is present, impacts to these resources would potentially be occurring.

Table 3-45 summarizes the actions that could affect the various resources, and those requiring additional explanation are discussed in the following narrative.

Past and Present actions include:

- Construction and operation of the lower Snake River dams—The lower Snake River dams, including Lower Granite, Little Goose, and Lower Monumental, were constructed and became operational between 1961 and 1975. All four of these dams are multiple-use facilities that provide navigation, hydropower, irrigation, recreation, and fish and wildlife conservation benefits. While construction of the dams is a past action, operation of the dams would be considered present and reasonably foreseeable actions.
- Agricultural use—Much of the land in the project area has been converted from native grasslands and shrub-steppe to agricultural and grazing. Use of ports along the lower Snake River and the presence of locks at the dams made shipping of wheat and other products possible. This conversion is ongoing and would most likely continue as a reasonable foreseeable action.

Table 3-45. Catalogue of Past, Present, and Reasonably Foreseeable Future Actions by Affected Resource

Affected Resource	Past Actions	Present Actions	Reasonably Foreseeable Future Actions
Geology and Soils	Agricultural activities; highway and railroad construction; construction and operation of existing BPA transmission lines and the Lower Monumental Substation; commercial and residential development.	Agricultural activities and other ongoing land uses and practices; and existing wind energy facilities.	Ongoing agricultural activities; construction of Central Ferry Substation; and development of wind energy facilities and associated power transmission infrastructure.
Land Use	Construction and operation of the lower Snake River dams; agricultural activities; highway and railroad construction; construction and operation of existing BPA transmission lines and the Lower Monumental Substation; commercial and residential development.	Agricultural activities and other ongoing land uses and practices; and existing wind energy facilities.	Ongoing agricultural activities; construction of Central Ferry Substation; and development of wind energy facilities and associated power transmission infrastructure.
Vegetation	Agricultural conversion; ranching; road construction; and construction and operation of existing BPA transmission lines and Lower Monumental Substation.	Agricultural activities and other ongoing land uses and practices; and existing wind energy facilities.	Ongoing agricultural activities; construction of Central Ferry Substation; and development of wind energy facilities and associated power transmission infrastructure.
Recreation	Construction and operation of the lower Snake River dams; past agricultural activities; highway and railroad construction; and limited commercial and residential development	Agricultural activities and other ongoing land uses and practices.	Ongoing agricultural activities; grazing permits and leases on state and private lands; construction of Central Ferry Substation; and development of wind energy facilities and associated power transmission infrastructure.
Wildlife	Agricultural conversion; ranching; road construction; and construction and operation of existing BPA transmission lines and Lower Monumental Substation.	Agricultural activities and other ongoing land uses and practices.	Ongoing agricultural activities; construction of Central Ferry Substation; and development of wind energy facilities and associated power transmission infrastructure.
Water Resources and Fish	Timber harvest and agricultural development within Tucannon River Basin; hydroelectric development in the Snake and Columbia River Basins; fish harvest within and outside the Tucannon River Basin.	Continuing hydroelectric operations; fish harvest; and agricultural activities.	Continuing hydroelectric operations; fish harvest; and agricultural activities.
Visual Resources	Construction and operation of the lower Snake River dams; past agricultural activities; highway and railroad construction; construction and operation of existing BPA transmission lines and Lower Monumental Substation; and limited commercial and residential development.	Agricultural activities and existing wind energy facilities.	Residential and commercial development; ongoing agricultural activities; construction of Central Ferry Substation; and development of wind energy facilities and associated power transmission infrastructure.
Cultural Resources	Construction and operation of the lower Snake River dams; past agricultural activities; highway and railroad construction; construction and operation of existing BPA transmission lines and Lower Monumental Substation; and limited commercial and residential development.	Agricultural activities and existing wind energy facilities.	Ongoing agricultural activities; construction of Central Ferry Substation; and development of wind energy facilities and associated power transmission infrastructure.

Table 3-45. Catalogue of Past, Present, and Reasonably Foreseeable Future Actions by Affected Resource (continued)

Affected Resource	Past Actions	Present Actions	Reasonably Foreseeable Future Actions
Socioeconomics and Public Facilities	Construction and operation of the lower Snake River dams; agricultural activities; highway and railroad construction; construction and operation of existing BPA transmission lines and the Lower Monumental Substation; commercial and residential development.	Agricultural activities and other ongoing land uses and practices.	Residential and commercial development consistent with the comprehensive plans of Garfield, Columbia, and Walla Walla counties; ongoing agricultural activities; grazing permits and leases approved on state and private lands; construction of Central Ferry Substation; and development of wind energy facilities and associated power transmission infrastructure.
Transportation	Highway, local road, and railroad construction; construction and operation of the lower Snake River dams and locks; construction of the Little-Goose and Lower Monumental airstrips; and residential and commercial development.	Ongoing road maintenance projects; transportation of freight by railroad and by barge through the Lower Snake River dams; and operation of the two local airstrips for small aircraft.	Road maintenance activities and construction of residential, commercial, and wind energy facilities that would generate increased traffic volumes on local roads.
Noise, Public Health and Safety	Highway, local road, and railroad construction; agricultural activities; construction of the lower Snake River dams and locks; construction and operation of existing BPA transmission lines and the Lower Monumental Substation.	Agricultural activities; ongoing road maintenance projects; and operation of existing BPA transmission lines and the Lower Monumental Substation.	Ongoing agricultural activities; construction of Central Ferry Substation; operation of existing BPA transmission lines and the Lower Monumental Substation; and development of wind energy facilities and associated power transmission infrastructure.
Air Quality and Greenhouse Gases	Construction of the lower Snake River dams; agricultural activities; highway and railroad construction; construction of existing BPA transmission lines and the Lower Monumental Substation.	Agricultural activities and ongoing road maintenance projects.	Ongoing agricultural activities; construction of Central Ferry Substation; and development of wind energy facilities and associated power transmission infrastructure.

- Commercial and residential development—Commercial development occurred as people moved into the southeastern part of Washington to farm. Homes are primarily located within a few communities such as Dayton, Pomeroy, Starbuck, and Waitsburg. Rural homes and farm development are scattered outside these areas. As population increases, commercial and residential development would be considered present and reasonably foreseeable actions as well as past actions.
- Road construction—Construction of local and state highways bisected native grasslands, shrub-steppe habitat and agricultural lands. As population grows or additional lands are converted to agricultural use, construction and maintenance would be considered present and reasonably foreseeable actions as well as past actions.
- Transmission line construction—BPA constructed the existing transmission lines between the Lower Granite, Little Goose, and Lower Monumental dams in the 1970s. Operation and maintenance of these lines would be considered present and reasonably foreseeable actions as well as past actions.

- Hopkins Ridge Wind Energy Project—This project, completed in 2005 and operated by Puget Sound Energy, is located in Columbia County, approximately 12 miles east of the proposed project. The Hopkins Ridge project consists of 87 wind turbines on 11,000 acres, with an estimated 108 acres permanently impacted (Ecology and Environment 2009).
- Marengo I Wind Energy Project—This project, completed in 2007 and operated by PacifiCorp, is also located in Columbia County, approximately 15 miles east of the proposed project. The Marengo I project consists of 78 turbines on 2,500 acres of land, with an estimated 140 acres permanently impacted (Ecology and Environment 2009).
- Marengo II Wind Energy Project—The second phase of the Marengo Wind Energy Project was completed in 2008 and is also operated by PacifiCorp. Marengo II is adjacent to Marengo I, approximately 15 miles east of the proposed project and consists of 39 turbines on 4,300 acres, with an estimated 70 acres permanently impacted (Ecology and Environment 2009).

Reasonably foreseeable actions include:

- Central Ferry Substation—BPA is in the process of constructing a new substation, referred to as the Central Ferry Substation, at a point along BPA's existing Little Goose-Lower Monumental 500-kV transmission lines; located approximately 2 miles southeast of the Snake River near the Port of Central Ferry in Garfield County, Washington. This substation occupies about 25 acres of a 60 acre parcel of land and will serve as one end for the proposed Central Ferry-Lower Monumental transmission line project. Construction of the substation is expected to be completed in fall 2011 (BPA 2010). Once constructed, operation and maintenance of this substation is expected to continue for the foreseeable future.
- Lower Snake River Wind Energy Project—Construction of this project is expected to begin in 2010. The project, located in Garfield and Columbia counties, is adjacent to the proposed Central Ferry Substation and, as proposed, will consist of 795 turbines on 124,000 acres and an estimated 120 miles of new permanent roads (Ecology and Environment 2009). The project will be operated by Puget Sound Energy.
- Blue Mountain Station—The Port of Columbia is planning to build Blue Mountain Station, a natural and organic eco-food processing park to be located on 28 acres of newly acquired Port of Columbia property at the west end of Dayton, approximately 16 miles south of the proposed project. As of January 2010, site plans for Blue Mountain Station were in the development stage (Port of Columbia 2010).

In addition, based on a review of the queue of interconnection requests that have been submitted to BPA, the following wind project was identified as reasonably foreseeable, to the extent that the developer has submitted requests for transmission line capacity:

- Pomeroy Wind Energy Project—BPA has received a request to interconnect three lines (for a total of 620 megawatts [MW]) into BPA's Little Goose-Lower Granite transmission line. Location information for this project is currently limited to the county it would be located in (Garfield County) and the transmission line with which it would interconnect. However, given the project name, it is reasonable to assume it would be located near the city of Pomeroy, approximately 20 miles southeast of the proposed Central Ferry Substation.

3.14.3 Cumulative Impacts Analysis

This section provides the analysis of any cumulative impacts when potential impacts from the proposed project are combined with past, present, and reasonably foreseeable actions, as listed in Table 3-45 and described above. The following analysis describes these potential cumulative impacts, in the order that the affected resources are presented in Sections 3.1 through 3.12 of this EIS. For each resource a spatial boundary and temporal boundary are described in order to properly analyze the potential impacts. The past temporal boundary is based on the conversion of the area to agriculture. The future boundary is described for each resource as it varies among resources.

Geology and Soils

The spatial boundary for the following evaluation is the project corridor (the proposed rights-of-way and new access roads for the action alternatives), because project-related impacts to this resource would primarily occur within this corridor. The temporal boundary is one year following completion of construction, because project-related impacts would be mitigated and not expected to extend beyond this timeframe.

Past and present actions that have affected soils in the project corridor and resulted in soil disturbance, compaction, and erosion include agricultural activities, highway and railroad construction, construction and operation of existing BPA transmission lines and the Lower Monumental Substation, and commercial and residential development. Present activities that continue to affect soils include agricultural land uses, primarily crop production and livestock grazing, and operation of existing wind energy facilities. Reasonably foreseeable actions with the potential to impact soils from disturbance, compaction, and erosion include the Central Ferry Substation and Lower Snake River Wind Energy Project. The proposed project would originate at the proposed Central Ferry Substation, and approximately 3 miles of the proposed line would coincide spatially with the project area identified for the Lower Snake River Wind Energy Project (Ecology and Environment 2009).

The proposed project would result in minor alterations to topography within the project corridor, associated with grading and construction of towers and roads. These effects would be localized and limited to the construction footprint of the transmission line. Additionally, soil erosion associated with the proposed project would largely be mitigated by implementation of BMPs during and following construction. The proposed project thus would contribute incrementally, though in a relatively minor way, to this cumulative impact.

Land Use

The spatial boundary for the following evaluation consists of the area in the vicinity of the proposed project and more broadly the three counties that would be crossed by the action alternatives (Columbia, Garfield, and Walla Walla counties). The temporal boundary is three to five years based on the general planning timeframes established for the affected counties under their respective county plans.

Past actions that have affected land use in the vicinity of the proposed project include construction and operation of the lower Snake River dams, agricultural activities, highway and railroad construction, construction and operation of the existing BPA transmission lines and Lower Monumental Substation, commercial and residential development, and, more recently, construction of the Hopkins Ridge and Marengo (I and II) wind energy facilities. Present and ongoing activities in the immediate vicinity of the proposed project include agricultural land uses, primarily crop production and livestock grazing.

Land use within the project corridor and surrounding area is primarily agricultural, with land used mainly for crops and livestock grazing. Residential development near the project corridor is primarily limited to farms and rural residences, with commercial activities primarily related to agriculture. Zoning regulations established for the parts of each county crossed by the project corridor are designed to maintain this rural, agricultural character by only allowing land uses that are consistent with agricultural use (Columbia County 2007b, Garfield County 2008b, Walla Walla County 2008). This suggests that future development that is not consistent with agriculture is likely to be concentrated in existing communities and other areas zoned for these types of uses. In Columbia County, future development is expected to occur in Dayton and Starbuck (Columbia County 2007a); in Garfield County this type of development is expected to occur in and around Pomeroy (Garfield County 2008a). Development of the proposed project is not expected to add incrementally to the land use impacts of this type of future residential and commercial development.

Reasonably foreseeable projects in the area include the Blue Mountain Station eco-food processing plant in Dayton, proposed by the Port of Columbia. The project is expected to be developed on the 28-acre Bell Farm and will represent a change in land use, but overall represents a minor potential impact on overall land use in Columbia County and would, therefore, not result in significant cumulative impacts when viewed in conjunction with the proposed project.

Construction of the Lower Snake River Wind Energy Project would coincide spatially with approximately 3 miles of the proposed project, and could occur during the same general timeframe. Construction of this wind project would involve temporary land use disturbance from the installation of project facilities and could temporarily interrupt agricultural production in affected areas on an intermittent basis. The EIS prepared for the Lower Snake River Wind Energy states that all temporarily disturbed areas would be restored to their original condition following construction (Ecology and Environment 2009). This project would also result in the permanent conversion of approximately 600 acres of agricultural land to an energy production use. Estimated permanent disturbance under the proposed action alternatives for the Central Ferry-Lower Monumental Project would range from an estimated 178 acres to 190 acres, depending on the alternative. Cumulative temporary and permanent impacts of the proposed project and the Lower Snake River Wind Energy Project would not, however, alter overall land use patterns in the vicinity of the proposed project and are relatively minor when compared to the amount of available agricultural and grazing land in Garfield, Columbia, and Walla Walla counties. Construction of the Central Ferry Substation would also result in temporary and permanent impacts to agricultural land use, but the incremental addition of these impacts would not affect overall land use patterns in the county and vicinity of the project corridor.

One other wind energy project, the Pomeroy Wind Energy Project, is proposed in Garfield County. Very little information is currently available on this project, which suggests that construction is unlikely to coincide in time with the proposed project. While the exact location of this potential wind energy project is unknown, it is most likely located approximately 20 miles from the proposed Central Ferry-Lower Monumental transmission line, and is likely to have similar temporary and permanent impacts on land use as the Lower Snake River Wind Energy Project. The incremental addition of the permanent disturbance to agricultural land that would occur, under the proposed project, to the cumulative permanent disturbance associated with this potential wind project and the Lower Snake River Wind Energy Project would not result in a significant impact to overall land use in the affected counties.

All these projects—the proposed transmission line project and the two reasonably foreseeable wind energy projects—would likely affect CRP lands and agricultural lands of statewide importance. However, given the extent of these types of land classifications in the affected counties the incremental additional of permanent impacts under the proposed action alternatives to the likely impacts of these reasonably foreseeable projects would have a relatively minor impact on these types of land use.

BPA would obtain transmission easements for operation of the proposed project on private lands, and would obtain right-of-way grants to cross federal and state lands. Existing land use or ownership would not change along the majority of the transmission line right-of-way. The proposed project thus would contribute incrementally, though in a relatively minor way, to potential cumulative land use impacts.

Vegetation

The spatial boundary for the following evaluation is the project corridor (the proposed rights-of-way and new access roads), because project-related impacts to this resource would primarily occur within this corridor. The temporal boundary for temporary impacts is three years, because that is the time that would be required for most species to re-establish.

Past and present actions have resulted in extensive changes to vegetative communities within the project corridor. Native vegetative communities in the project corridor and general vicinity have been substantially altered by agricultural conversion, ranching, road construction, and construction of the existing BPA transmission lines and Lower Monumental Substation. These actions have resulted in the removal and permanent conversion of vegetation communities.

Ongoing agricultural activities are expected to continue within the project corridor in the future. Reasonably foreseeable actions with the potential to overlap spatially with the project corridor include the Central Ferry Substation and the Lower Snake River Wind Energy Project. These ongoing and reasonably foreseeable actions have the potential to result in the continuing loss and degradation of native grassland habitat within the project corridor and in the immediate vicinity. The proposed project would primarily impact disturbed grassland and cropland and would result in a minimal contribution to cumulative impacts to native grassland habitat.

Surveys will be conducted for TES plant species along the project corridor in the spring/summer of 2010. If species are identified, mitigation measures will be developed to address potential impacts. As a result, the proposed project would not be expected to add cumulatively to any adverse TES plant species impacts resulting from other past, present, or reasonably foreseeable actions.

Past and present activities, such as ranching, agriculture, and road construction have resulted in the substantial introduction and spread of noxious weeds in the project corridor and general vicinity. The spread of noxious weeds will continue as a result of ongoing and reasonably foreseeable actions and construction of the proposed project would contribute to this cumulative impact. Operation and maintenance activities also have the potential to contribute to this cumulative impact. The potential contribution of the proposed project would, however, be minimized by project-related mitigation measures designed to minimize the acres of new noxious weed infestations and minimize the contribution to cumulative effects of noxious weed colonization in the project area. The proposed project thus would contribute incrementally, though in a relatively minor way, to potential cumulative impacts to vegetation.

Recreation

The spatial boundary for the following evaluation is the area within 8 miles of the proposed project; this boundary was selected to be consistent with the cumulative impact analysis for visual resources (below) and allow the assessment of cumulative impacts in all directions from areas approximately 4 miles from the alternatives. The temporal boundary is three to five years based on the general planning timeframes established for the affected counties under their respective county plans.

Past actions that have affected recreation in the project vicinity include construction and operation of the lower Snake River dams, development of recreation areas and sites in the project area, primarily along the lower Snake River, as well as designation of the historic Lewis and Clark campsites and the Lewis and Clark Trail, also along the lower Snake River, and designation of U.S. Route 12 in the project area as part of the Lewis and Clark Trail Scenic Byway. More generally, agricultural activities, highway and railroad construction, construction and operation of the existing BPA transmission lines and the Lower Monumental Substation, and limited commercial and residential development have also affected recreation in the area, particularly with respect to providing access to the area for recreation. Present and ongoing activities in the immediate project vicinity include agricultural land uses, primarily crop production and livestock grazing.

Reasonably foreseeable actions within 8 miles of the action alternatives include ongoing agricultural activities, and construction and operation of the Central Ferry Substation and Lower Snake River Wind Energy Project. Construction of the Central Ferry Substation and Lower Snake River Wind Energy Project would be likely to affect sightseeing from U.S. Route 12 (the Lewis and Clark Trail Scenic Byway) in the project area, primarily because construction traffic would likely use this route to access the area. The Lower Snake River Wind Energy Project has the potential to affect sightseeing in the area with the introduction of wind turbines that would be visible from U.S. Route 12. These projects could also affect hunting by temporarily disturbing wildlife and, in the case of the Lower Snake River Wind Energy Project restricting future access for hunting. The proposed project could add incrementally to these impacts, if construction were to take place at the same time. Permanent visual impacts would coincide in space with the Lower Snake River Wind Energy Project, and could affect sightseeing. These potential impacts are discussed under Visual Resources below.

Operation of the proposed project is not expected to affect hunting or access to existing hunting areas. New access roads would be gated to prevent hunting on private lands unless authorized by the landowner. The proposed project thus would contribute incrementally, though in a relatively minor way, to potential cumulative impacts.

Wildlife

The spatial boundary for the following evaluation is the project corridor (the proposed rights-of-way and new access roads), because project-related impacts to this resource would primarily occur within this corridor. The temporal boundary is one year following completion of construction, because project-related impacts to wildlife are not expected to extend beyond this timeframe.

Past and present actions have resulted in the degradation of wildlife habitat in the project corridor. Agricultural operations have resulted in disturbed grasslands and cropland dominating the area. Existing roads in the project corridor and vicinity have led to increased disturbance from human activity, increased landscape fragmentation and the presence of wildlife travel barriers, lost habitat, and spread of noxious weeds. In its current state, the habitat in the proposed project area is moderate to poor in quality and supports depressed wildlife populations.

The highest quality habitat in the proposed project area, though still degraded, is found along the North and Combination A alternatives, east of the Tucannon River where mule deer habitat and high densities of rock outcrops have been identified. Although construction in this area would have a greater impact on mule deer and rock outcrop associated species (sagebrush lizard and ferruginous hawk) than the east portion of the South and Combination B alternatives, mitigation measures such as minimizing disturbance and timing construction to avoid periods of reproduction and peak densities would substantially reduce most impacts. Maintenance would occur for the life of the proposed project, but would be minimal and only negligibly increase the current level of disturbance. Access to wildlife habitat through new or existing roads would be controlled and limited, further reducing disturbance in these areas. Mitigation measures designed to reduce the spread of noxious weeds would also reduce potential impacts. None of the action alternatives, including the North and Combination A alternatives, would add substantially to current conditions found within the project area.

Reasonably foreseeable actions that coincide with the project corridor include the Central Ferry Substation and Lower Snake River Wind Energy Project. The additional disturbance and new roads associated with the Central Ferry Substation and Lower Snake River Wind Energy Project could result in cumulative impacts, but it is assumed that potential impacts from the other projects would be mitigated with proper planning and construction strategies, similar to those identified for the proposed project. Furthermore, these reasonably foreseeable projects would only overlap spatially with the east edge of the project corridor and, therefore, the potential for cumulative impacts would, for the most part, likely be limited to wide-ranging resident species such as mule deer.

Little is known about mule deer demographics in the proposed project area except that they are found seasonally in high densities along the lower Snake River, east of the Tucannon River (e.g., near the North and Combination A alternatives) making them susceptible to impacts from construction. Construction of the proposed project in this area under the North or Combination A alternatives would not coincide spatially with other reasonably foreseeable projects proposed in the vicinity and construction in this area would take place outside the high use seasons when deer concentrate. The proposed project thus would contribute incrementally, though in a relatively minor way, to potential cumulative impacts on mule deer and other wildlife populations in this area.

Water Resources and Fish

The spatial boundary for the following evaluation is the Tucannon River basin, because the only known fish resources within the project corridor are in the Tucannon River. The temporal boundary is one year following completion of construction, because project-related impacts to water resources and fish are not expected to extend beyond this timeframe.

Past and present actions that have affected water resources and fish include timber harvest in the Tucannon basin, which has reduced habitat quality for fish through the reduction of in-stream and riparian habitat and the addition of sediment to streams. Agricultural practices in the vicinity of the proposed Tucannon River crossing (common to all action alternatives) have resulted in the loss of streamside riparian cover, the loss of large woody debris sources, and the addition of sediment. In addition, development of the hydroelectric system in the Snake and Columbia Rivers has adversely affected both downstream and upstream survival of fish originating in the Tucannon River system. Harvest of these fish resources, in the ocean, the Columbia and Snake Rivers, and in the Tucannon River, has further impacted these resources. In recent years these conditions have all been improving with better passage conditions, directed harvest management, and improved timber harvest procedures.

None of the action alternatives are expected to have adverse effects on water quality or fisheries resources. Thus the proposed project would not contribute to potential cumulative impacts.

Visual Resources

The spatial boundary for the following evaluation is the area within 8 miles of the proposed project; this boundary was selected to allow the assessment of cumulative impacts in all directions from areas approximately 4 miles from the alternatives. The temporal boundary is expected to be the life of the line.

Past actions that have affected visual resources in the project vicinity include construction and operation of the lower Snake River dams, agricultural activities, highway and railroad construction, construction and operation of the existing BPA transmission lines and the Lower Monumental Substation, and limited commercial and residential development. Present and ongoing activities in the immediate project vicinity include agricultural land uses, primarily crop production and livestock grazing.

Reasonably foreseeable actions within 8 miles of the action alternatives include ongoing agricultural activities, and construction and operation of the Central Ferry Substation and Lower Snake River Wind Energy Project. The proposed Central Ferry Substation and new transmission facilities associated with the Lower Snake River Wind Energy Project would likely mimic the muted colors of the surrounding landscape in most locations. However, the wind turbines would be white and would likely stand out in contrast to the surrounding landscape. This proposed wind energy project would involve placement of industrial structures in an area with no other similar structures and represent a conspicuous change to the relatively natural and rural landscape. This would disrupt the continuity of visual resources in the landscape. The wind projects would involve structures that would create a skyline on the landscape, altering the texture of the horizon. This would noticeably diminish the smooth landscape of the horizon and reduce the openness of the terrain. The visual impact analysis prepared for the Lower Snake River Wind Energy Project concluded that the project would likely have unavoidable significant adverse impacts on visual resources (Ecology and Environment 2009).

The visual impact analysis prepared for the proposed project includes one visual simulation that shows the area where the proposed project and the Lower Snake River Wind Energy Project would coincide spatially. This simulation from Viewpoint 1 shows the view looking north from State Route 127. The proposed project would mimic the muted colors of the surrounding landscape and would not create a skyline from this viewpoint; therefore, permanent adverse impacts on the landscape from this viewpoint would be low. The proposed project when viewed by itself would contribute incrementally, though in a relatively minor way, to potential cumulative impacts. However, when combined with views of wind turbines for the Lower Snake River Wind Energy Project, lower Snake River dams, and existing BPA lines, the proposed project would contribute incrementally to the adverse cumulative impact to visual resources in the area.

Cultural Resources

The spatial boundary for the following evaluation of cultural resources (archaeological and traditional cultural properties) is the area within 8 miles of the proposed project; this boundary was selected to allow the assessment of cumulative impacts in all directions from areas approximately 4 miles from the alternatives. The temporal boundary for archaeological resources is expected to be limited to project construction; mitigation for new access roads would be completed and operation and maintenance of the line would most likely not entail construction of new roads. The temporal boundary for traditional cultural properties is expected to be the life of the line.

Past actions that have affected cultural resources in the project vicinity include construction and operation of the lower Snake River dams, agricultural activities, highway and railroad construction, construction and operation of the existing BPA transmission lines and the Lower Monumental Substation, and commercial and residential development. Many archaeological resources and traditional cultural properties are present along the lower Snake River; many more were indundated when the reservoirs behind the dams were filled. Past actions have also caused disturbance of cultural sites, reduction of the cultural integrity of certain sites, and removal of cultural artifacts. Construction of the dams, transmission lines, and substations created manmade structures within the viewshed of traditional cultural properties and archaeological sites in the lower Snake River area. Agricultural activities have converted native vegetation to cropland potentially affecting subsistence farming or gathering practices within traditional cultural properties.

Present and ongoing activities in the immediate project vicinity include agricultural activities and existing wind energy facilities. Placement of wind turbines within the viewshed of traditional cultural properties may negatively affect the use of these areas by local area tribes. Continued conversion of native vegetation to cropland lessens the amount of lands available to tribes for native plant gathering.

Reasonably foreseeable actions within 8 miles of the action alternatives include ongoing agricultural activities, construction and operation of the Central Ferry Substation, and development of wind energy facilities and associated power transmission infrastructure including the Lower Snake River Wind Energy Project. As discussed for visual resources, approximately 3 miles of the proposed line would coincide spatially with the Lower Snake River Wind Energy Project area.

There is the potential for archaeological resources to be impacted during construction of the Central Ferry Substation site and Lower Snake River Wind Energy Project. While none were identified within the substation site, implementation of mitigation measures would lessen or avoid the potential for this impact. Field surveys of the Lower Snake River Wind Energy Project would identify sites and similar mitigation would be implemented. For traditional cultural properties, placement of the substation, turbines and associated lines would possibly impact the viewshed of traditional cultural properties.

During construction of the proposed project, there is also the potential for archaeological resources to be impacted. Implementation of mitigation measures as described in Section 3.8.3 would lessen or avoid the potential for impacts to archaeological resources. However, if the proposed project does impact previously undiscovered archaeological resources, it also would contribute incrementally to the adverse cumulative impact to cultural resources in the area.

Because the proposed action alternatives could also potentially impact the viewshed of traditional cultural properties, it would contribute incrementally to the adverse cumulative impacts to those properties.

Socioeconomics and Public Facilities

The spatial boundary for the following evaluation consists of the three counties that would be crossed by the action alternatives (Columbia, Garfield, and Walla Walla counties), because this is the area where the majority of the potential socioeconomic and public facility impacts are expected to occur. The temporal boundary is three to five years based on the general planning timeframes established for the affected counties under their respective county plans.

Past actions that have affected socioeconomic in the project vicinity include construction and operation of the lower Snake River dams, agricultural activities, highway and railroad construction, construction and operation of the existing BPA transmission lines and the Lower Monumental Substation, commercial and residential development, and, more recently, construction of the Hopkins Ridge and Marengo (I and II) wind energy facilities. Present and ongoing activities in the immediate project vicinity include agricultural land uses, primarily crop production and livestock grazing. Reasonably foreseeable future actions in the vicinity of the proposed project include ongoing agricultural activities, construction of the Central Ferry Substation, and the development of wind energy facilities and associated electric transmission infrastructure.

Population in Garfield and Walla Walla counties is expected to increase from 2009 to 2025 by about 17 percent and 15 percent, respectively, compared to a projected statewide increase of 22 percent. Population in Columbia County is expected to remain at its current level over this period (Washington OFM 2007). The action alternatives are not expected to result in any permanent changes in population and would have no effect on short- or long-term population trends.

Construction of the proposed project is expected to result in a temporary influx of construction workers to the project area and generate income for motels, hotels, and RV parks. As noted in Section 3.9, there may be temporary shortages in temporary housing resources in Dayton and Pomeroy, but regional resources would be more than sufficient to accommodate the estimated project-related demand for temporary housing. Overall construction-related demand for temporary housing in the project vicinity and surrounding region would increase further if construction of the Lower Snake River Wind Energy project were to coincide with the proposed project. If this were to occur, there would be local temporary accommodation shortages (as there would be under either project alone), but sufficient resources appear to exist in the larger communities of Walla Walla and the Tri-Cities.

Local project-related expenditures, employment, and construction-related earnings would be small relative to the total amount of economic activity in the affected counties, and would, as a result, have a small positive impact on the local economy for the duration of construction. These impacts would be increased if construction of the Lower Snake River Wind Energy project were to coincide with the proposed project, but would still be low compared to the overall economy. This would also be the case with the other identified reasonably foreseeable projects were they to coincide in time with the proposed project. The proposed project would also be expected to generate sales tax in the affected counties as workers purchase goods and services, and this would likely be the case with other construction projects in the affected counties.

The proposed project would not be expected to cause significant demands on public services or facilities. During construction, public services such as police, fire, and medical facilities, would be needed only in cases of emergency, which would likely be the case with other construction projects that could potentially coincide in time with the proposed project. In addition, the proposed project is not expected to have a noticeable adverse impact on local landfill resources or their ability to handle other current or future waste streams. Therefore, the proposed project is not expected to contribute to cumulative impacts to public services or facilities.

Construction and operation of the proposed project is not expected to have high and adverse human health or environmental impacts on nearby communities (including potential minority or low income communities) and is, therefore, not expected to contribute to environmental justice-related cumulative impacts.

Transportation

The spatial boundary for the following evaluation consists of the area in the vicinity of the proposed project and more broadly the three counties that would be crossed by the action alternatives (Columbia, Garfield, and Walla Walla counties). The temporal boundary is expected to be limited to project construction, because operation of the proposed project would not be expected to noticeably affect local transportation patterns.

Past actions that have affected transportation in the vicinity of the proposed project include highway, local road, and railroad construction; construction and operation of the lower Snake River dams and locks, construction of the Little-Goose and Lower Monumental airstrips; and residential and commercial development in the rural communities of Garfield, Columbia, and Walla Walla counties. Present transportation-related actions in the vicinity of the proposed project include ongoing road maintenance projects; transportation of freight by railroad and by barge through the lower Snake River dams; and operation of the two local airstrips for small aircraft.

Reasonably foreseeable future actions planned in the vicinity of the proposed project that could affect transportation include ongoing road maintenance activities and construction of commercial and wind energy facilities that would generate increased traffic volumes on local roads.

All reasonably foreseeable future development projects in the vicinity of the proposed project would generate temporary increases in traffic volumes resulting from heavy and light vehicles using state highways and local roads to access construction project sites. Construction of the Lower Snake River Wind Energy Project in Garfield and Columbia counties could coincide in time with development of the proposed project and would generate similar traffic-related impacts to those that are expected for the proposed project. Cumulative impacts of the proposed project and the Lower Snake River Wind Energy Project would include relatively large increases in construction-related traffic on state highways, local roads, and access roads when compared to existing levels of use.

Based on a traffic analysis prepared for the Lower Snake River Wind Energy Project that compared projected construction traffic volumes with estimated vehicle capacities for US 12, SR 127, and SR 261 (Ecology and Environment 2009), the cumulative addition of construction-related traffic for the proposed project to existing volumes and Lower Snake River Wind Energy Project construction traffic would result in small changes to existing volume to capacity ratios on the affected highways, would be less than significant, and would not cause any section of road to fall below its applicable LOS.

As noted in Section 3.10, construction traffic associated with the proposed project could result in temporary delays at localized spots. Both of these projects would likely use some of the same local roads during construction and, if construction were to coincide temporally, would result in a cumulative impact to local traffic. With mitigation in place, including the use of flaggers, signage, and traffic reroutes, where necessary, potential cumulative impacts to roads would be reduced. The proposed project thus would contribute incrementally, though in a relatively minor way, to potential cumulative impacts.

Noise, Public Health and Safety

The spatial boundary for the following evaluation consists of the area in the vicinity of the proposed project and more broadly the three counties that would be crossed by the action alternatives (Columbia, Garfield, and Walla Walla counties). The temporal boundary is expected to be limited to project construction.

Implementation of past and present actions in the project vicinity has generally not resulted in lasting noise effects, and the project vicinity continues to enjoy relatively low noise levels on a continual basis. Past actions that have increased noise levels include construction of the lower Snake River dams, agricultural activities, highway and railroad construction, construction and operation of the existing BPA transmission lines and Lower Monumental Substation, and construction of existing wind energy facilities. Present and ongoing activities that cause noise in the immediate vicinity include agricultural activities, ongoing road maintenance projects, and operation of the existing BPA transmission lines and the Lower Monumental Substation.

Reasonably foreseeable future actions in the vicinity of the proposed project that could increase noise levels include ongoing agricultural activities, ongoing road maintenance activities, construction of Central Ferry Substation, operation of existing BPA facilities, and development of wind energy facilities and associated power transmission infrastructure. Cumulative noise impacts in the project vicinity typically occur when noise receptors are exposed to noise from sources at approximately the same time, such as from vehicles, train noise, and wind turbines.

There could be cumulative noise impacts if these actions are undertaken simultaneously and in relative close relation to each other. However, it is expected that these actions would not result in cumulative noise impacts due to temporal or spatial separation.

The proposed project would contribute a small increase in the overall risk of fire and injury to the public that could occur during construction and operation/maintenance.

The proposed project would not cumulatively increase the overall level of EMF exposure along the corridor. Few to no homes are located along the proposed routes.

Air Quality

The spatial boundary for the following evaluation consists of the area in the vicinity of the proposed project and more broadly the three counties that would be crossed by the action alternatives (Columbia, Garfield, and Walla Walla counties). The temporal boundary is expected to be limited to project construction, because operation of the proposed project would not be expected to affect air quality.

Past actions that have affected air quality in the proposed project area include highway, local road, and railroad construction; construction of the lower Snake River dams; agricultural activities; and construction of the existing BPA transmission lines and the Lower Monumental Substation. Present actions include agricultural activities and ongoing road maintenance projects. Construction-related dust and emissions from vehicles has potentially impacted air quality in the project area.

Reasonably foreseeable future actions planned in the vicinity of the proposed project that could affect air quality include ongoing agricultural activities, construction of Central Ferry Substation, and development of wind energy facilities.

Air emissions from the proposed action alternatives would occur during project construction from construction activities, as well as use of vehicles and heavy equipment. These emissions would result in a minor and short-term contribution to cumulative impacts on air quality from pollutants generated by agricultural uses, road maintenance, and other sources in the region. During construction, the proposed action alternatives would also contribute incrementally, though in a relatively minor way, to cumulative impacts related to air quality.

Greenhouse Gases

Given the nature and extent of greenhouse gas emissions and their contribution to climate change, the appropriate area of impact evaluation is global. For consideration of reasonably foreseeable future actions, the life of the project (approximately 50 years) is deemed appropriate. However, it is recognized that greenhouse gases have been accumulating, and will continue to accumulate, in the atmosphere.

Greenhouse gas concentrations in the atmosphere and corresponding climate change occurring over the past 50 years have been primarily caused by anthropogenic contributions. Greenhouse gas emissions have largely originated from the burning of fossil fuels and the clearing of forests around the world from many and varied sources during this time, as well as for a significant period of time before that (US Global Research Program 2009). Therefore, unlike the cumulative impacts analyses for other resources that are discussed in this section, the global nature of greenhouse gases makes cataloguing past, present, and reasonably foreseeable future actions for this resource impossible.

Nonetheless, in a general sense, it can be assumed that any action where fossil fuels have been or are being burned contributes to greenhouse gas concentrations. Examples of such actions include home heating, automobile and other vehicle use, electricity generation, processing and manufacturing of goods, and wood burning activities, among others. In addition, actions that result in the disturbance of soil or loss of vegetation can also increase concentrations. Vegetation can affect concentrations in two ways. First, if vegetation is removed prior to maturation, the carbon storing potential is lost and CO_2 can no longer be sequestered in that vegetation. Second, if that vegetation is burned, it will release all of the carbon it has sequestered back into the atmosphere as CO_2. These actions, as described above, that have occurred in the past are likely still occurring and will continue to occur in the future at some unknown level.

In analyzing the cumulative impact of the proposed action, global, national, and regional greenhouse gas emissions were considered. In 2006, the EIA estimated global GHG emissions at 29,017,000,000 metric tons of CO_2 equivalent (EIA 2009b). In 2008, total U.S. greenhouse gas emissions were estimated at 6,956,800,000 metric tons of CO_2 equivalent. Overall, total U.S. emissions have risen by approximately 14 percent from 1990 to 2008. In 2007, the four states within BPA's service territory emitted an estimated 180,060,000 metric tons of CO_2 (see Table 3-46).

Table 3-46. Estimated Annual CO_2 Emissions for Each State in the BPA Service Territory in 2007

State	CO_2 Emissions Only in Metric Tons
Idaho	16,280,000
Montana	37,700,000
Oregon	43,520,000
Washington	82,560,000
Total	**180,060,000**

Source: EPA 2007

As a result of increased greenhouse gas concentrations, the earth's temperature has increased between 1.1 and 1.6 degrees Fahrenheit (degrees F) over the last century (IPCC 2009). Models predict that the warming of the planet will continue and could be as much as 11.5 degrees warmer by 2100 with the current level of emissions. The effect of increased temperatures include sea level rise due to shrinking glaciers, changes in biodiversity as species try to move into more optimal temperature ranges, early initiation of phonological events, lengthening of growing seasons, and thawing of permafrost (US Global Research Program 2009).

In the Northwest region of the United States, statistical data indicates that the annual average temperature has risen approximately 1.5 degrees F over the past century, with some areas experiencing increases up to 4 degrees F. Many experts believe that this temperature rise is a major contributing factor to the 25 percent reduction in average snowpack in the Northwest over the past 40 to 70 years. A continued decline in snowpack in the mountains will decrease the amount of water available during the warm season. A 25- to 30-day shift in the timing of runoff has been observed in some places, and the trend is expected to continue as the region's average temperature is projected to rise another 3 to 10 degrees F in the twenty-first century (US Global Research Program 2009).

In terms of cumulative impacts to the atmospheric levels of greenhouse gases, any addition, when considered globally, could contribute to long-term significant effects in terms of climate change. However, the concentrations estimated for the proposed action, when compared to the regional, national, and global rates, are negligible and comparatively insignificant. In addition, the potential ability of the proposed action to assist in the development of renewable (non-fossil fuel burning) energy such as wind power by providing additional transmission capacity that allows for better use of renewable energy would help serve to offset the proposed project's contribution to cumulative greenhouse gas impacts.

3.15 Relationship Between Short-term Uses of the Environment and Long-term Productivity

The proposed line and alternatives under consideration do not pose impacts that would significantly alter the long-term productivity of the affected environment. Soils and vegetation within the affected environment that were disturbed in the 1970s during construction of the existing transmission lines have largely recovered. While there is never complete recovery, long-term productivity of the affected environment has not been significantly altered because revegetation of grasslands and crop production continues to occur. Similar impacts followed by recovery of productivity would occur for the proposed line.

3.16 Irreversible and Irretrievable Commitment of Resources

Irreversible commitment of resources is the use of nonrenewable resources such as minerals or petroleum-based fuels. Irretrievable commitments of resources cause the lost production or use of renewable resources such as timber or rangeland.

The proposed line would consume aluminum, steel, other metals, wood, gravel, sand, plastics, and various forms of petroleum products in the construction of the transmission line and development and improvement of access roads. Most of these materials are not renewable and could potentially be an irreversible commitment of resources if not recycled (metals and glass) or reused (sand and gravel) at the end of the life of the project. Development of the line would also cause commitments that result in the loss of wildlife habitat for certain species. The use of these nonrenewable resources would be irreversible.

Irretrievable commitments include small amounts of land lost to grazing and crop production. These commitments are irretrievable rather than irreversible because management direction could change and allow these uses in the future.

3.17 Adverse Impacts that Cannot be Avoided

Implementation of the proposed project would result in some adverse impacts that cannot be fully avoided even with implementation of mitigation measures. Most of these impacts would occur during the construction phase and thus would be temporary. However, there would be some long-term impacts. Adverse effects from the proposed project that cannot be avoided include the following:

- Short-term soil compaction, erosion, and vegetation degradation from construction.
- Short-term disturbance to some agricultural practices during construction.
- Short-term disturbance to and displacement of some species of wildlife.
- Short-term disturbance to nearby residents during construction.
- Short-term displacement of recreational users from hunting areas.
- Short-term delays to traffic in some areas during construction.
- Short-term, minor reductions in air quality from fugitive dust during construction.
- Long-term soil compaction and minor reduced soil productivity under new structures and on roadbeds.
- Long-term removal of some lands from participation in the CRP.
- Long-term changes in the viewing sensitivity for the general public and recreational users along the corridor from large steel towers.

3.18 Intentional Destructive Acts

Intentional destructive acts, that is, acts of sabotage, terrorism, vandalism, and theft sometimes occur at power utility facilities. Vandalism and thefts are most common, and recent increases in the prices of metal and other materials have accelerated thefts and destruction of federal, state and local utility property. BPA has seen a significant increase in metal theft from its facilities past years due in large part to the high price of metals on the salvage market. There were more than 50 burglaries at BPA substations in 2006. The conservative estimate of damages for these crimes is $150,000, but the actual amount is likely much higher since this number does not factor in all the labor-related costs associated with repairing the damage.

The impacts from vandalism and theft, though expensive, do not generally cause a disruption of service to the area. Stealing equipment from electrical substations, however, can be extremely dangerous. In fact, nationwide, many would-be thieves have been electrocuted while attempting to steal equipment from energized facilities. On October 11, 2006, a man in La Center, Washington, was electrocuted while apparently attempting to steal copper from an electrical substation.

Federal and other utilities use physical deterrents such as fencing, cameras, and warning signs to help prevent theft, vandalism, and unauthorized access to facilities. In addition, through its Crime Witness Program, BPA offers up to $25,000 for information that leads to the arrest and conviction of individuals committing crimes against BPA facilities. Anyone having such information can call BPA’s Crime Witness Hotline at (800) 437-2744. The line is confidential, and rewards are issued in such a way that the caller’s identity remains confidential.

Acts of sabotage or terrorism on electrical facilities in the Pacific Northwest are rare, though some have occurred. These acts generally focused on attempts to destroy large transmission line steel towers. For example, in 1999, a large transmission line steel tower in Bend, Oregon was toppled.

Depending on the size and voltage of the line, destroying towers or other equipment could cause electrical service to be disrupted to utility customers and end users. The effects of these acts would be as varied as those from the occasional sudden storm, accident, or blackout and would depend on the particular configuration of the transmission system in the area. While in some situations these acts would have no noticeable effect on electrical service, in other situations, service could be disrupted in the local area, or if the damaged equipment was part of the main transmission system, a much larger area could be left without power.

When a loss of electricity occurs, all services provided by electrical energy cease. Illumination is lost. Lighting used by residential, commercial, industrial and municipal customers for safe movement and security is affected. Residential consumers lose heat. Electricity for cooking and refrigeration is also lost, so residential, commercial, and industrial customers cannot prepare or preserve food and perishables. Residential, commercial, and industrial customers experience comfort/safety and temperature impacts, increases in smoke and pollen, and changes in humidity, due to loss of ventilation. Mechanical drives stop, causing impacts as elevators, food preparation machines, and appliances for cleaning, hygiene, and grooming are unavailable to residential customers. Commercial and industrial customers also lose service for elevators, food preparation, cleaning, office equipment, heavy equipment, and fuel pumps.

In addition, roadways experience gridlock where traffic signals fail to operate. Mass transit that depends on electricity, such as light rail systems, can be impacted. Sewage transportation and treatment can be disrupted.

A special problem is the loss of industrial continuous process heat. Electricity loss also affects alarm systems, communication systems, cash registers, and equipment for fire and police departments. Loss of power to hospitals and people on life-support systems can be life-threatening.

Overhead transmission conductors and the structures that carry them are mostly on unfenced utility rights-of-way. The conductors use the air as insulation. The structures and tension between conductors make sure they are high enough above ground to meet safety standards. Structures are constructed on footings in the ground and are difficult to dislodge.

While the likelihood for sabotage or terrorist acts on the proposed project is difficult to predict given the characteristics of the project, it is unlikely that such acts would occur. If such an act did occur, it could have a significant impact on the transmission system or electrical service because the Central Ferry-Lower Monumental transmission line would be an integral part of BPA’s transmission system; however, any impacts from sabotage or terrorist acts likely could be quickly isolated. The Department of Energy, public and private utilities, and energy resource developers include the security measures mentioned above and others to help prevent such acts and to respond quickly if human-caused damage or natural disasters occur.

Chapter 4 Environmental Consultation, Review, and Permit Requirements

This chapter addresses federal statutes, implementing regulations, and Executive Orders requiring consultation, review, and/or permits or approvals, and discusses the applicability of these requirements to the proposed project. 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.

4.1 National Environmental Policy Act

This Draft EIS was prepared by Bonneville Power Administration (BPA) pursuant to regulations implementing the National Environmental Policy Act (NEPA) (42 United States Code [USC] 4321 *et seq.*), which requires federal agencies to assess, consider, and disclose the impacts that their actions may have on the environment before decisions are made or actions are taken. BPA will consider the project's potential environmental consequences and comments from agencies, tribes, and the public when making decisions regarding the proposed project.

4.2 Endangered Species Act

The Endangered Species Act (ESA) of 1973 (16 USC 1536), as amended in 1988, establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants, and the preservation of the ecosystems on which they depend. The ESA is administered by the U.S. Fish and Wildlife Service (USFWS) for wildlife and freshwater species, and by the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service (NOAA Fisheries) for marine and anadromous species. The ESA defines procedures for listing species, designating critical habitat for listed species, and preparing recovery plans. It also specifies prohibited actions and exceptions.

Section 7(a) of the ESA requires federal agencies to ensure that the actions they authorize, fund, and carry out do not jeopardize endangered or threatened species or their critical habitats. Section 7(c) of the ESA and other federal regulations require that federal agencies prepare biological assessments addressing the potential effects of major construction actions on listed or proposed endangered species and critical habitats.

BPA reviewed USFWS species lists to identify the listed and proposed species that are either known to occur or have the potential to occur in the project area. The bull trout, Canada lynx, and Ute ladies'-tresses are threatened species to be considered. Washington ground squirrel and yellow-billed cuckoo are candidate species to be considered. BPA checked the NOAA Fisheries species lists and determined that Snake River spring/summer Chinook salmon, Snake River fall Chinook salmon, and Snake River Basin steelhead are threatened species that may occur in the project area. The potential for occurrences of threatened and endangered plant, animal, and fish species and their habitat and potential impacts to these species from the proposed project are discussed in Sections 3.3 Vegetation, 3.5 Wildlife, and 3.6 Water Resources and Fish of this EIS.

Field surveys of the project corridor were conducted during the fall of 2009. A field survey will be conducted in spring/summer 2010 to identify the presence of Ute's ladies tresses in the project corridor. However, the potential for this species to occur in the area is low due to the lack of potential habitat (see Table 3-13). During the fall 2009 survey, a known Washington ground squirrel colony located north and east of the proposed Tucannon River corridor crossing was surveyed with no sign of the species' presence (e.g., burrows). Washington ground squirrel-sized open burrows were found sporadically in the project area during the fall wildlife survey. No individual squirrels were seen or heard and no fresh diggings were observed, but this was not unexpected because the fall survey coincided with the period when this and other squirrel species are inactive and underground. Additional field surveys for nesting raptors, Washington ground squirrel, and other wildlife of interest will occur in spring 2010.

The proposed project would have no effect on Canada lynx, Washington ground squirrel, and yellow-billed cuckoo. Canada lynx are higher elevation species not found in the lower Snake River region. Yellow-billed cuckoo is considered extirpated from the state of Washington. If Washington ground squirrel burrows are found during the spring/summer 2010 surveys, they will be avoided during project construction if they are likely to be occupied at that time.

Bull Trout, Snake River spring/summer Chinook, Snake River fall Chinook, and Snake River Basin Steelhead are present in the Tucannon River where the proposed transmission line corridor crossing would occur under all of the action alternatives. No tower or road construction work would occur in the stream or the adjacent riparian area. Additionally, no trees would be cleared within the Tucannon River's riparian area; the conductor would span the river and riparian area at approximately 200 feet above ground. The nearest tower would be installed about 1,700 feet from the west shore of the river, and about 1,200 feet from the east shore of the river. The proposed project would have no effect on bull trout, Snake River spring/summer Chinook, Snake River fall Chinook, and Snake River Basin Steelhead.

4.3 Fish and Wildlife Conservation Act and Fish and Wildlife Coordination Act

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 (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.

BPA has consulted with the Washington Department of Fish and Wildlife (WDFW) and incorporated recommendations to avoid and minimize potential impacts to wildlife resources. The proposed project would have no effect on fish as shown in Section 4.2 above. Mitigation designed to avoid and minimize impacts to fish and wildlife and their habitat is identified in Sections 3.5 Wildlife, and 3.6 Water Resources and Fish, of this EIS.

4.4 Magnuson-Stevens Fishery Conservation and Management Act

NOAA Fisheries is responsible for ensuring compliance with the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (Magnuson-Stevens Act). In the exclusive economic zone, except as provided in Section 102, the United States claims, and will exercise, sovereign rights and exclusive fishery management authority over all fish and all continental shelf fishery resources. Beyond the exclusive economic zone, the United States claims, and will exercise, exclusive fishery management authority over all anadromous species throughout the migratory range of each such species, except when in a foreign nation's waters, and over all continental shelf fishery resources.

Public Law 104-297, the Sustainable Fisheries Act of 1996, amended the Magnuson-Stevens Act to establish requirements for Essential Fish Habitat (EFH) descriptions in federal fishery management plans, and to require federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH. EFH can include all streams, lakes, ponds, wetlands, and other viable water bodies, and most of the habitat historically accessible to salmon. Activities above impassible barriers are subject to consultation provisions of the Magnuson-Stevens Act.

Chinook salmon administered under the amended Magnuson-Stevens Act are present in the Tucannon River. However, no work would be conducted within the river or riparian area, all ground-disturbing actions would be greater than 1,000 feet from the Tucannon River, and no adverse effects from other project-related construction or operations actions are anticipated to the Tucannon River. Therefore, there would be no adverse impacts to EFH.

4.5 Migratory Bird Treaty Act

The Migratory Bird Treaty Act implements various treaties and conventions between the United States and other countries, including Canada, Japan, Mexico, and the former Soviet Union, for the protection of migratory birds (16 U.S.C. 703-712, July 3, 1918, as amended 1936, 1960, 1968, 1969, 1974, 1978, 1986, and 1989). Under the act, taking, killing, or possessing migratory birds or their eggs or nests is unlawful. Most species of birds are classified as migratory under the Act, except for upland and nonnative birds such as pheasant, chukar, gray partridge, house sparrow, European starling, and rock dove.

Potential impacts to migratory birds as a result of the proposed project are discussed in Section 3.5 Wildlife of this EIS. Although the proposed project would not be expected to result in a take or killing of migratory bird species within the meaning of the Act, impacts to migratory birds could occur through temporary disturbance during construction. BPA would ensure appropriate mitigating measures are employed to minimize and avoid impacts to migratory birds.

4.6 Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

Executive Order 13186, issued on January 17, 2001, directs each federal agency undertaking actions that may negatively impact migratory bird populations to work with the USFWS to develop an agreement to conserve those birds. The protocols developed by this consultation are intended to guide future agency regulatory actions and policy decisions; renewal of permits, contracts, or other agreements; and the creation of or revisions to land management plans. This order also requires that the environmental analysis process include effects of federal actions on migratory birds. On August 3, 2006, the USFWS and the U.S. Department of Energy signed a Memorandum of Understanding (MOU) to complement the Executive Order. BPA, as part of the Department of Energy, will work cooperatively in accordance with the protocols of the MOU.

4.7 Bald Eagle Protection Act

The Bald Eagle Protection Act of 1940 prohibits the taking or possessing of and commerce in bald and golden eagles, with limited exceptions (16 U.S.C. 668-668d, June 8, 1940, as amended 1959, 1962, 1972, and 1978). The Act only covers intentional acts or acts in "wanton disregard" of the safety of bald or golden eagles.

Potential occurrence of bald eagles in the project vicinity and potential impacts from the proposed project are discussed in Section 3.5 Wildlife of this EIS. Mitigation measures to avoid and minimize impacts to bald eagles are also identified. Because the proposed project would not involve intentional acts or acts in wanton disregard of bald or golden eagles, this project is not considered to be subject to compliance with the Bald Eagle Protection Act.

4.8 Heritage Conservation

Preserving cultural resources allows 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. Cultural resources include National Landmarks, archeological sites, and properties listed (or eligible for listing) on the National Register of Historic Places (NRHP). In addition, American Indian Tribes are afforded special rights under certain laws, as well as the opportunity to voice concerns about issues under these laws when their aboriginal territory falls within a proposed project area. Laws and other directives for the management of cultural resources include:

- Antiquities Act of 1906 (16 U.S.C. 431-433);
- Historic Sites Act of 1935 (16 U.S.C. 461-467);
- National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. 470 *et seq.*), as amended, inclusive of Section 106;
- Archaeological Data Preservation Act of 1974 (16 U.S.C. 469 a-c);
- Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C. 470 *et seq.*), as amended;
- Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001 *et seq.*);
- Executive Order 13007 Indian Sacred Sites; and
- American Indian Religions Freedom Act of 1978 (PL 95-341, 92 Stat. 469, 42 U.S.C. 1996, 1996a).

Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties, and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment. Historic properties are properties that are included in the NRHP or that meet the criteria for the National Register. If a federal agency plans to undertake a type of activity that could affect historic properties, it must consult with the appropriate State Historic Preservation Officer (SHPO) and/or Tribal Historic Preservation Officer to make an assessment of adverse effects on identified historic properties. BPA's 1996 government-to-government agreement with 13 federally-recognized Native American Tribes of the Columbia River basin provides guidance for the Section 106 consultation process with the Tribes.

The NHPA amendments specify that properties of traditional religious and cultural importance to a Native American Tribe (also known as Traditional Cultural Properties [TCPs]) may be determined to be eligible for inclusion on the National Register of Historic Places. In carrying out its responsibilities under Section 106, a federal agency is required to consult with any Native American Tribe that attaches religious or cultural significance to any such properties.

NAGPRA requires consultation with appropriate Native American Tribal authorities prior to the excavation of human remains or cultural items (including funerary objects, sacred objects, and cultural patrimony) on federal or tribal lands. NAGPRA recognizes Native American ownership interests in some human remains and cultural items found on federal lands and makes illegal the sale or purchase of Native American human remains, whether or not they derive from federal or Indian land. Repatriation, on request, to the culturally affiliated tribe is required for human remains.

Executive Order 13007 addresses “Indian sacred sites” on federal and tribal land. “Sacred site” means any specific, discrete, narrowly delineated location on federal land that is identified by a Tribe, or a Tribal individual determined to be any appropriately authoritative representative of a Native American religion. The site is sacred by virtue of its established religious significance to, or ceremonial use by, a Native American religion, provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site. This order calls on agencies to do what they can to avoid physical damage to such sites, accommodate access to ceremonial use of Tribal sacred sites, facilitate consultation with appropriate Native American Tribes and religious leaders, and expedite resolution of disputes relating to agency action on federal lands.

The American Indian Religious Freedom Act protects and preserves to American Indians their inherent right of freedom to believe, express, and exercise traditional religions.

BPA has undertaken the Section 106 consultation process for this project with the Yakama Indian Nation, the Confederated Tribes of the Colville Reservation, the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, the Wanapum Tribe, the Coeur d’Alene Tribe, and the Spokane Tribe of Indians. Thus far, the Confederated Tribes of the Umatilla Indian Reservation and the Nez Perce Tribe have expressed interest in the proposed project. Both tribes will be preparing a TCP study for this project.

Construction and maintenance of the transmission line and related facilities could potentially affect historic properties and other cultural resources. Initial data review has identified prehistoric and historic sites in the project vicinity, and a cultural resources field survey of the corridor will be performed to further determine whether any cultural resources are present and would be impacted (see Section 3.8 Cultural Resources of this EIS).

Through the design process, BPA will seek to avoid all known cultural resources sites. If some sites cannot be avoided, BPA will consult with the Washington SHPO, the Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe to determine if those sites are eligible for a listing under the NRHP. If they are, then in consultation with SHPO and the affected tribes, effects will be evaluated and appropriate mitigation will be applied.

If, during construction, previously unidentified cultural resources that would be adversely affected by the proposed project are found, BPA would follow all required procedures set forth in the NHPA, NAGPRA, ARPA, and the American Indian Religious Freedom Act.

4.9 Area-wide and Local Plan and Program Consistency

The proposed project would be constructed and owned by BPA, which is a federal agency. Pursuant to the supremacy clause of the U.S. Constitution, BPA is not subject to state and local land use or building regulations, and thus, is not obligated to obtain state and local land use approvals or permits. However, BPA is committed to plan the project to be consistent or compatible, to the extent practicable, with state and local land use plans and programs, and would provide the local jurisdictions with information relevant to any permits. In addition, BPA would strive to meet or exceed the substantive standards and policies of state and local regulations, and will enter into appropriate agreements with local jurisdictions concerning road crossings and approaches.

This section describes the consistency of the proposed project with local land use plans and polices, as well as transportation-related permits that potentially apply to the proposed project. For a discussion of the consistency of the proposed project with substantive environmental standards that have been identified by various state of Washington agencies, see Chapter 5 of this EIS.

4.9.1 County Land Use Planning Framework

The project corridor crosses through Garfield, Columbia and Walla Walla counties. The 40-mile corridor includes about 3 miles in Garfield County, 19 miles in Columbia County, and 17 miles in Walla Walla County.

Comprehensive plans are written by counties and cities in compliance with the Washington state Growth Management Act to manage urban growth and to coordinate land use and infrastructure planning. Zoning regulations are used by local governments to guide growth and development. The state and local land use planning framework for the proposed project includes the following regulations:

- Garfield County and City of Pomeroy Comprehensive Plan: This plan (Garfield County 2008a) represents the community's policy plan for growth over the next 20 years. Its goals include maintaining quality of life, maintaining infrastructure, building on and taking full advantage of existing assets, building on current stewardship of land, and reducing land-use conflicts and haphazard development.

  All four action alternatives would cross lands zoned for agricultural use in Garfield County. According to the Garfield County Zoning Ordinance (Garfield County 2008b) (Section 1.03.010), the Agricultural Zone is "(i)ntended to protect and preserve the character of existing agricultural lands with a minimal amount of development, only allowing land uses which are compatible with the established land use pattern, including the development of low-density residential and commercial uses which support agriculture." The Garfield County Zoning Ordinance does not contain any specific references to transmission lines or utility facilities in general (Brigham 2009). The ordinance allows underground transmission lines for wind energy projects in the Agricultural Zone as a conditional use. Utility buildings and yards are allowed in the Agricultural Zone, which has a minimum lot size of 5 acres.

- Columbia County Comprehensive Plan: This plan (Columbia County 2007a) guides land use and planning for growth and development within the county. The project would be located in the Plan's designated rural area, which includes a range of land uses that are compatible with the rural character of Columbia County. The most common uses in the rural area are agriculture and natural resource industries.

  All four action alternatives would cross lands zoned Agricultural (A-1) in Columbia County. According to the Columbia County Zoning Ordinance (Columbia County 2007b), the purpose of the Agricultural (A-1) Zone is to protect areas intended for agricultural activities and accessory uses from encroachment by non-agricultural land uses and to preserve areas containing prime farmland soils for agricultural activities. The minimum lot size in the A-1 Zone is 40 acres.

  The action alternatives would all be located almost entirely on lands identified as grasslands or agricultural lands but would result in minimal disturbance to existing agricultural activities. The project would be located away from densely built-up areas and private residences, and would not increase health and safety risks. The County's zoning regulations allow utility facilities as a conditional use in this zone (Hendricksen 2009a).

- Walla Walla County Integrated Comprehensive Plan: This plan (Walla Walla County 2007) guides decision making about the future development of Walla Walla County. It strives to balance the community's financial ability to support growth with its projected increase in population and employment and the need for environmental protection.

  All four action alternatives would cross lands allocated to Walla Walla County's Primary Agriculture Zone. According to Title 17 – Zoning in the Walla Walla Municipal Code, the County's Primary Agriculture Zone is intended to perpetuate the viability of resource lands of long-term commercial significance, allowing uses in this district that are distinctive of the agricultural sector (Walla Walla County 2008). The minimum lot size in the Primary Agriculture Zone is 40 acres.

No comprehensive plan or zoning changes within Garfield, Columbia, or Walla Walla counties would be required to site the proposed project regardless of the action alternative. BPA would obtain private transmission easements for construction of the proposed corridor on private lands, and would obtain right-of-way grants to cross federal or state lands. Agricultural operations would continue during construction and operation of the project, except in areas where transmission facilities would be located. The project would have short-term impacts on agricultural land uses and result in the permanent conversion of lands from agricultural to other uses, but would not result in the long-term displacement of existing agricultural operations (see Section 4.2 Land Use).

4.9.2 Shoreline Master Program

Columbia County's Shoreline Master Program applies to areas within 200 feet of the ordinary high water mark of the Tucannon River. Towers that would support the Tucannon River crossing would be placed 970 to 1,610 feet from the edge of the river, and thus would not be within areas covered by the Shoreline Master Program.

4.9.3 Transportation Permits

Washington State Department of Transportation

Washington State Department of Transportation (WSDOT) requires a Utility Permit for utilities that cross state highways and/or for utility projects that are located within 300 feet of highway rights-of-way. Also required are oversize load permits and/or overweight load permits for transportation of large construction materials on state highways (Staeheli 2009). Any loads larger than 8 feet in width, 14 feet in height, and/or 53 feet in length would require an oversize load permit. Any load more than 16 feet high and/or wide would require a superload permit, which would need to be coordinated with WSDOT headquarters in Olympia.

Garfield County

Garfield County would require completion of a Haul Agreement for construction traffic on county roads (Norland 2009). This agreement would include information on which county roads would be used, dates and hours of construction traffic, the number of vehicle trips per day, and anticipated gross vehicle weights.

Columbia County

Columbia County would require a Right-of-Way Agreement for construction of new access roads that would connect to county roads or improvements to existing access roads, as well as a Franchise Agreement/Bonding Requirement for use of county roads during project construction and operation (Yates 2009).

Walla Walla County

Walla Walla County would require BPA to submit an Application to Perform Work on County Right-of-Way for construction of any new access roads that would connect to county roads, as well as an access permit for construction traffic on county roads (Rowe 2009).

BPA and the construction contractor would consult with the WSDOT and the affected counties to secure necessary transportation permits.

4.10 Coastal Zone Management Consistency

As an agency of the federal government, BPA follows the guidelines of the Coastal Zone Management Act of 1972 (16 U.S.C. Sections 1451-1464) and would ensure that projects would be, to the maximum extent practicable, consistent with the enforceable policies of the state management programs. The proposed project is not in the coastal zone, and would not directly affect the coastal zone.

4.11 Floodplains and Wetlands Protection

The Department of Energy mandates that impacts to floodplains and wetlands be assessed and alternatives for protection of these resources be evaluated in accordance with Compliance with Floodplain/Wetlands Environmental Review Requirements (10 Code of Federal Regulations [CFR] 1022.12), and Federal Executive Orders 11988 and 11990. Evaluation of project impacts on floodplains and wetlands is included in Section 3.6 Water Resources and Fish of this EIS. This evaluation serves as the notice of floodplain/wetlands involvement for this project.

Based on a review of wetland maps from the National Wetlands Inventory, the only wetlands occurring within the project corridor are adjacent to each bank of the Tucannon River. Review of 100-year floodplain information from WDNR indicated that the only floodplain within the project corridor is adjacent to the Tucannon River. The nearest tower would be constructed about 970 feet east of the Tucannon River, and the project would have no impact on these wetlands or floodplain.

4.12 Farmlands

The Farmland Protection Policy Act (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 and other important farmlands is designated by the Natural Resource conservation Service (NRCS) and can be found in NRCS soil survey information. Prime farmland refers to land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oil seed crops. Land may also be identified as Farmland of Statewide Importance as discussed in Section 3.2 Land Use. Farmlands of statewide importance typically include land that is nearly prime farmland and has the potential to economically produce high yields of crops.

While much of the lands within the project corridor are considered to be farmland of statewide importance, only a small amount are considered prime farmland. Potential impacts to prime farmland and farmland of statewide importance are evaluated in Section 3.2 Land Use.

4.13 Recreation Resources

The Lewis and Clark National Historic Trail as identified in the National Trail System (16 U.S.C. Sec. 1242-1245) is located north and south of the project corridor. The outbound Lewis and Clark journey travelled down the Snake River north of the project area; a portion of the return journey crosses south of the project area. The proposed corridor regardless of route alternative would not cross either the outbound or the return journey trail route. For more information, see Section 3.4 Recreation and Section 3.8 Cultural Resources of this EIS.

Executive Order 12962 mandates disclosure of effects to recreational fishing. The proposed project would not affect recreational fishing species or opportunities in the project vicinity. For more information, see Section 3.6 Water Resources and Fish of this EIS.

Deer hunting may be interrupted in the project corridor in Garfield and Columbia counties during construction. For more information, see Section 3.4 Recreation of this EIS.

4.14 Permit for Structures in Navigable Waters

Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. §403) regulates all work done in, or structures placed below, the ordinary high water mark of navigable waters of the United States. Pursuant to the implementing regulations, Section 10 permits are required for electric transmission lines crossing navigable waters of the United States unless those lines are part of a water power project subject to the regulatory authorities of the U.S. Department of Energy under the Federal Power Act of 1920. A Section 10 permit would not be required for the proposed transmission line crossing of the Tucannon River because the river is not considered to be a navigable water of the United States within the meaning of Section 10.

4.15 Permit for Discharges into Waters of the United States

The Clean Water Act (933 U.S.C. §1251 *et seq.*) regulates discharges into waters of the United States. Field delineation may be necessary to fulfill permitting requirements.

Section 401 – A federal permit to conduct an activity that causes discharges into navigable waters is issued only after the affected state certifies that existing water quality standards would not be violated if the permit were issued. BPA is not expecting any discharges into waters of the United States.

Section 402 – This section authorizes stormwater discharges under the National Pollutant Discharge Elimination System (NPDES). For Washington, EPA has a general permit authorizing federal facilities to discharge stormwater from construction activities disturbing land of 1 acre or more into waters of the United States, 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 preparing a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP will address stabilization practices, structural practices, stormwater management, and other controls (see Section 3.1 Geology and Soils and Section 3.6 Water Resources and Fish in this EIS).

Section 404 – Authorization from the U.S. Army Corps of Engineers (USACE) under Section 404 is required when there is a discharge of dredge material or fill material into waters of the United States, including wetlands. BPA does not expect any waters (no wetlands are located within the project corridor) to be impacted by access road or tower construction. If there would be potential impacts, authorization would be sought from USACE and the appropriate state and local government agencies in Washington.

4.16 Energy Conservation at Federal Facilities

Federal energy conservation design standards apply to new buildings constructed by the federal government. The proposed project would not involve construction of new buildings, so the conservation design standards would not apply.

4.17 The Safe Drinking Water Act

The Safe Drinking Water Act (42 U.S.C. Section 200f *et seq.*) protects the quality of public drinking water and its source. BPA would comply with state and local public drinking water regulations. The proposed project would not affect any sole source aquifers or other critical aquifers, or adversely affect any surface water supplies.

4.18 Clean Air Act

The Federal Clean Air Act, as revised in 1990 (PL 101-542, 42 U.S.C. 7401), requires EPA and individual states to carry out programs intended to ensure attainment of National Ambient Air Quality Standards. In the project vicinity, authority for ensuring compliance with the act is delegated to the Washington Department of Ecology (Ecology) (Eastern Region). This agency has regulations requiring all industrial activities (including construction projects) to minimize windblown fugitive dust but does not regulate the operation of electrical transmission lines or electrical transformers.

The General Conformity Requirements of the CFR require that federal actions do not interfere with state programs to improve air quality in nonattainment areas. There are no nonattainment areas in the vicinity of the project.

Chapter 70.94 Revised Code of Washington (RCW)-Washington Clean Air Act and Chapter 173-400 Washington Administrative Code (WAC) require owners and operators of fugitive dust sources to prevent fugitive dust from becoming airborne and to maintain and operate sources to minimize emissions (Associated General Contractors, Fugitive Dust Task Force).

Air quality impacts of the proposed project would not be significant, as discussed in Section 3.12 Air Quality of this EIS.

4.19 Noise Control Act

The Federal Noise Control Act of 1972 (42 USC 4901) requires that federal entities, such as BPA, comply with state and local noise requirements. The EPA has established a guideline of 55 A-weighted decibel (dBA) for the annual average day-night level (Ldn) 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 p.m. and 7 a.m.

BPA transmission-line design criterion for corona-generated audible noise (L50, foul weather) is 50 dBA at the edge of the right-of-way (USDOE 2006). This criterion applies to new line construction and is under typical conditions of foul weather, altitude, and system voltage.

The proposed action would operate at or below existing state noise limits. The facilities would be designed to meet these limits for the worst case scenario: at night, at the edge of the right-of-way, during rainy weather. For more information, see Section 3.11 Noise, Public Health and Safety of this EIS.

4.20 Pollution Control Acts

Several pollution control acts potentially apply to the proposed project, depending on the exact quantities and types of hazardous materials that may be stored on site. Regulations would be enforced by Ecology, and development of a Hazardous Materials Management Plan in accordance with the Uniform Fire Code may be required by local fire districts.

The Resource Conservation and Recovery Act (RCRA), 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.

The Toxic Substances Control Act is intended to protect human health and the environment from toxic chemicals. Section 6 of the Act regulates the use, storage, and disposal of polychlorinated biphenyls (PCBs). BPA adopted guidelines to ensure that PCBs are not introduced into the environment. Equipment used for this project will not contain PCBs. Any equipment removed that may have PCBs will be handled according to the disposal provisions of this Act.

The Spill Prevention Control and Countermeasures Act is intended to prevent discharge of oil into navigable waters of the United States or adjoining shorelines as opposed to response and cleanup after a spill occurs. Facilities subject to the Act must prepare and implement a plan to prevent any discharge of oil into or upon navigable waters or adjoining shorelines. The plan is called a Spill Prevention, Control, and Countermeasure (SPCC) Plan. The proposed project does not include the storage of large amounts of oil and is, therefore, not subject to this Act.

The Federal Insecticide, Fungicide and Rodenticide Act registers and regulates pesticides. BPA uses herbicides (a kind of pesticide) only in a limited fashion and under controlled circumstances. Herbicides are used on transmission line rights-of-way and in substation yards to control vegetation, including noxious weeds. When BPA uses herbicides, the date, dose, and chemical used are recorded and reported to state government officials. Herbicide containers are disposed of according to RCRA standards.

If a hazardous material, toxic substance, or petroleum product is discovered that may pose an immediate threat to human health or the environment, BPA requires that the contractor notify the Contracting Officer's Technical Representative (COTR) immediately. Other conditions such as large dump sites, drums of unknown substances, suspicious odors, stained soil, etc. must also be reported immediately to the COTR. The COTR will coordinate with the appropriate personnel within BPA. In addition, the contractor will not be allowed to disturb such conditions until the COTR has given the notice to proceed.

4.21 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, states that each federal agency shall identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low income populations. Minority populations are considered members of the following groups: American Indian or Alaska Native; Asian or Pacific Islander; Black, not of Hispanic Origin; or Hispanic if the combined minority population of the affected area exceeds 50 percent, or is meaningfully greater than the minority population in the project area. The Executive Order further stipulates that the agencies conduct their programs and activities in a manner that does not have the effect of excluding persons from participation in, denying persons the benefits of, or subjecting persons to discrimination because of their race, color, or national origin.

The proposed project has been evaluated for disproportionately high environmental effects on minority and low-income populations; see Section 3.9 Socioeconomics and Public Facilities of this EIS. Construction of the proposed project would not result in disproportionately high and adverse effects to minority or low-income groups.

BPA has considered all input from persons or groups regardless of race, income status, or other social and economic characteristics. Potentially affected minority populations include American Indian tribes with an interest in the lands that could be affected. BPA is consulting with the Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation regarding the potential impacts of the proposed action alternatives. For more information on these consultations, see Section 4.8 in this chapter, as well as Section 3.8 Cultural Resources of this EIS.

4.22 Notice to the Federal Aviation Administration

As part of transmission line design, BPA seeks to comply with Federal Aviation Administration (FAA) procedures. The FAA requires BPA to submit its designs for FAA approval if a proposed structure is taller than 200 feet from the ground, if a conductor is 200 feet above the ground, or if any part of the proposed transmission line and/or its structure is within the approach path of an airport. Placement of the conductor above the Tucannon River would be greater than 200 feet above the ground. Additionally, the proposed line would also be within the approach path of the Lower Monumental airstrip near Lower Monumental Substation. Final locations of structures, structure heights, and conductor heights would be submitted to the FAA for approval.

4.23 Federal Communications Commission

Federal Communications Commission (FCC) regulations require that transmission lines be operated so that radio and television reception would not be seriously degraded or repeatedly interrupted. Further, the FCC regulations require that the operators of these devices mitigate such interference. It is expected that there would be no interference with radio, television, or other reception as a result of the proposed project (see Section 3.11 Public Health and Safety of this EIS). BPA would comply with FCC requirements relating to radio and television interference from the proposed project if any such interference occurs.

Chapter 5 Consistency with State Substantive Standards

As discussed in Chapter 4, the Bonneville Power Administration (BPA) is a federal agency subject to state regulation only if there has been a waiver of federal sovereign immunity through federal law, consistent with the supremacy clause of the U.S. Constitution. Certain federal laws, such as the Clean Water Act (CWA) and Clean Air Act (CAA), have provided this waiver of federal sovereign immunity, and BPA's activities thus can be regulated by state entities under these laws. In addition, the Federal Land Policy Management Act (FLPMA), 43 U.S.C. §1701 *et seq.*, provides a limited waiver of federal sovereign immunity, such that federal agencies like BPA are required to comply with specific substantive provisions for environmental protection that may be identified by states for portions of the federal agency's activities that would be located on federal lands.

Notwithstanding these aspects of federal supremacy, BPA is committed to planning its proposed transmission line projects to be consistent or compatible to the extent practicable with state plans and programs, as well as any substantive standards that these plans and programs may contain, even when not required by federal law. To work toward this goal, BPA typically provides project information relevant to state permitting processes to state entities with a potential interest in the project. In designing and carrying out its proposed projects, BPA also strives to meet or exceed the substantive standards and policies of state regulations.

To further memorialize this approach, BPA entered into a series of Memoranda of Understanding (MOUs) and Memoranda of Agreement (MOAs) in the 1980s with individual Pacific Northwest states concerning BPA's activities in each state. Each MOU called for general cooperation between BPA and each state regarding BPA's activities in that state, and each MOA called for cooperation specifically on the siting of proposed federal transmission facility projects to be located in that state. Each MOA also called for the development of project-specific work plan agreements between BPA and the state for individual BPA transmission line projects to be located in that state.

In the MOU and MOA with Washington state, the Washington Energy Facility Site Evaluation Council (Washington EFSEC) was designated as the Washington agency responsible for entering into and carrying out work plan agreements for each individual BPA transmission line project. Because the proposed Central Ferry-Lower Monumental Transmission Line Project would be located in Washington state, BPA has entered into a work plan agreement with Washington EFSEC for this project. Under this agreement, Washington EFSEC and other state agencies have provided BPA with potentially applicable state substantive standards that they believe should be addressed in this Environmental Impact Statement (EIS) to aid Washington EFSEC in its review of the proposed project. It is the objective of BPA and Washington EFSEC that by identifying and considering these standards as early as possible, the proposed project can be designed to be consistent or compatible with these standards to the maximum extent practicable.

In addition to this cooperative approach to working with state and local governmental entities, BPA recognizes that when a state or local governmental entity owns property that could potentially be crossed by the proposed transmission line, that entity may need to comply with certain state or local laws or regulations before it can agree to allow this use of their property by BPA. Through this compliance, additional state or local standards may be identified that could apply to the portion of the proposed transmission line located on state or local government-owned property. BPA is currently working with state agencies that own property along potential project corridors to identify any such standards that could apply to BPA's proposed project.

The remainder of this chapter identifies those state substantive standards that are potentially applicable to BPA's proposed project, and evaluates the extent to which the proposed project would be consistent with these standards. This discussion is organized by the Washington state agency that has established each standard, with the standards of each agency further organized by resource topic where appropriate. In most cases, BPA believes that implementation of its own design, construction, and operation standards would serve to meet or exceed the state substantive standard that has been identified. However, in some cases, additional measures may be required to be consistent with a particular state standard. For any state standard where it is likely that consistency cannot be achieved, an explanation is provided.

5.1 Washington EFSEC Standards

Washington EFSEC is the state agency responsible for siting new energy facilities, including certain thermal power plants, natural gas pipelines, and electrical transmission lines, in the state of Washington. Electrical transmission lines subject to Washington EFSEC authorization include those located in a national interest electrical transmission corridor as specified in the Revised Code of Washington (RCW) 80.50.045 and those for which the applicant chooses to seek authorization through Washington EFSEC. Washington EFSEC's authority in this area is provided by Chapter 80.50 of the RCW, and is implemented through Title 463 of the Washington Administrative Code (WAC).

BPA's proposed transmission lines are not subject to Washington EFSEC's siting jurisdiction except for portions proposed to be located on federal lands. As discussed above, BPA must comply with state substantive standards for environmental protection for these portions through a limited waiver of federal sovereign immunity provided by FLPMA. However, BPA has entered into an agreement with Washington EFSEC for the proposed Central Ferry-Lower Monument Transmission Line Project in furtherance of the cooperative agreements that BPA had previously entered into with the state of Washington. Through this agreement, BPA will seek to be consistent with Washington EFSEC's substantive standards to the extent practicable, regardless of the proposed project's location on or off federal lands.

The following Washington EFSEC substantive standards from WAC Title 463 (WAC 463-26, 463-60, 463-72, and 463-74) are potentially applicable to the proposed project:

Natural Environment – Energy and Natural Resources

- The application shall describe the rate of use and efficiency of consumption of energy and natural resources during both construction and operation of the proposed facility.
- The application shall describe the sources of supply, locations of use, types, amounts, and availability of energy or resources to be used or consumed during construction and operation of the facility.
- The application shall describe all nonrenewable resources that will be used, made inaccessible or unusable by construction and operation of the facility.
- The application shall describe conservation measures and/or renewable resources that will or could be used during construction and operation of the facility.

Consistency: While BPA does make every effort to comply with state substantive standards, the above standards are not applicable to the proposed project. Information regarding the rate of use and efficiency of consumption of energy and other resources has not been provided in this EIS because BPA is not required to submit an application to Washington EFSEC for construction of the proposed transmission line. Impacts to natural resources are addressed by resource in Chapter 3. Irreversible and Irretrievable Commitment of Resources (i.e., nonrenewable resources) are discussed in Section 3.16.

- The application shall describe any scenic resources which may be affected by the facility or discharges from the facility.

Consistency: Sections 3.4 (Recreation) and 3.7 (Visual Resources) describe the proposed project's impact on scenic resources including impacts to recreational areas. Impacts to most recreation resources would be none to low and temporary. Impacts to scenic resources are assessed in Section 3.7 for the general regional setting, as well as three specific areas: the Lewis and Clark National Historic Trail, the Lewis and Clark Scenic Byway, and the town of Starbuck. There would be no discharges from the transmission line.

Transportation

- Transportation systems. The application shall identify all permanent transportation facilities impacted by the construction and operation of the energy facilities, the nature of the impacts, and the methods to mitigate impacts. Such impact identification, description, and mitigation shall, at least, take into account:

  (a) Expected traffic volumes during construction, based on where the work force is expected to reside;

  (b) Access routes for moving heavy loads, construction materials, or equipment;

  (c) Expected traffic volumes during normal operation of the facility;

  (d) For transmission facilities, anticipated maintenance access; and

  (e) Consistency with local comprehensive transportation plans.

- Vehicular traffic. The application shall describe existing roads, estimate volume, types, and routes of vehicular traffic which will arise from construction and operation of the facility. The applicant shall indicate the applicable standards to be utilized in improving existing roads and in constructing new permanent or temporary roads or access, and shall indicate the final disposition of new roads or access and identify who will maintain them.

- Waterborne, rail, and air traffic. The application shall describe existing railroads and other transportation facilities and indicate what additional access, if any, will be needed during planned construction and operation. The applicant shall indicate the applicable standards to be utilized in improving existing transportation facilities and in constructing new permanent or temporary access facilities, and shall indicate the final disposition of new access facilities and identify who will maintain them.

- Parking. The application shall identify existing and any additional parking areas or facilities which will be needed during construction and operation of the energy facility, and plans for maintenance and runoff control from the parking areas or facilities.

- Movement/circulation of people and goods. The application shall describe any change to the current movement or circulation of people or goods caused by construction or operation of the facility. The application shall indicate consideration of multipurpose utilization of rights of way and describe the measures to be employed to utilize, restore, or rehabilitate disturbed areas. The application shall describe the means proposed to ensure safe utilization of those areas under applicant's control where public access will be granted during project construction, operation, abandonment, termination, or when operations cease.

- Traffic hazards. The application shall identify all hazards to traffic caused by construction or operation of the facility. Except where security restrictions are imposed by the federal government the applicant shall indicate the manner in which fuels and waste products are to be transported to and from the facility, including a designation of the specific routes to be utilized.

Consistency: Construction and improvement of the access road system for the proposed project is discussed in Section 2.2 (Project Components, including Access Roads). Section 3.10 (Transportation) describes the proposed project's impact on transportation resources including expected traffic volumes during construction and maintenance, proposed access routes during construction and maintenance, and possible impacts on local traffic during construction. The movement or circulation of people or goods would not be impacted by the proposed project. Potential impacts to waterborne, rail, and air traffic are also addressed in Section 3.10. Road use during construction and operation of the line would comply with regional transportation plans as discussed in Section 3.10. Access roads constructed and used during line construction would also be utilized during maintenance of the transmission line. Fuel would be transported to the work sites using the same access roads discussed in Chapter 2 and Section 3.10. Staging areas that would be used to store construction materials and vehicles are discussed in Section 2.2.

Socioeconomic Impacts

- The application shall include a detailed socioeconomic impact analysis which identifies primary, secondary, and positive as well as negative impacts on the socioeconomic environment in the area potentially affected by the project, with particular attention to the impact of the proposed facility on population, work force, property values, housing, health facilities and services, education facilities, governmental services, and local economy. The study area shall include the area that may be affected by employment within a 1-hour commute distance of the project site. The analysis shall use the most recent data as published by the U.S. Census or state of Washington sources.

- The analysis shall include the following:

  (a) Population and growth rate data for the most current 10-year period for the county or counties and incorporated cities in the study area;

  (b) Published forecast population figures for the study area for both the construction and operations periods;

  (c) Numbers and percentages describing the race/ethnic composition of the cities and counties in the study area;

  (d) Average per capita and household incomes, including the number and percentage of the population below the poverty level for the cities and counties within the study area;

  (e) A description of whether or not any minority or low-income populations would be displaced by this project or disproportionately impacted;

  (f) The average annual work force size, total number of employed workers, and the number and percentage of unemployed workers including the year that data are most recently available. Employment numbers and percentage of the total work force should be provided for the primary employment sectors;

(g) An estimate by month of the average size of the project construction, operational work force by trade, and work force peak periods;

(h) An analysis of whether or not the locally available work force would be sufficient to meet the anticipated demand for direct workers and an estimate of the number of construction and operation workers that would be hired from outside of the study area if the locally available work force would not meet the demand;

(i) A list of the required trades for the proposed project construction;

(j) An estimate of how many direct or indirect operation and maintenance workers (including family members and/or dependents) would temporarily relocate;

(k) An estimate of how many workers would potentially commute on a daily basis and where they would originate.

- The application shall describe the potential impact on housing needs, costs, or availability due to the influx of workers for construction and operation of the facility and include the following:

  (a) Housing data from the most recent 10-year period that data are available, including the total number of housing units in the study area, number of units occupied, number and percentage of units vacant, median home value, and median gross rent. A description of the available hotels, motels, bed and breakfasts, campgrounds, or other recreational facilities;

  (b) How and where the direct construction and indirect work force would likely be housed. A description of the potential impacts on area hotels, motels, bed and breakfasts, campgrounds, and recreational facilities;

  (c) Whether or not meeting the direct construction and indirect work force's housing needs might constrain the housing market for existing residents and whether or not increased demand could lead to increased median housing values or median gross rents and/or new housing construction. Describe mitigation plans, if needed, to meet shortfalls in housing needs for these direct and indirect work forces.

- The application shall have an analysis of the economic factors including the following:

  (a) The approximate average hourly wage that would likely be paid to construction and operational workers, how these wage levels vary from existing wage levels in the study area, and estimate the expendable income that direct workers would likely spend within the study area;

  (b) How much, and what types, of direct and indirect taxes would be paid during construction and operation of the project, and which jurisdictions would receive those tax revenues;

  (c) The other overall economic benefits (including mitigation measures) and costs of the project on the economies of the county, the study area, and the state, as appropriate, during both the construction and operational periods.

- The application shall describe the impacts, relationships, and plans for utilizing or mitigating impacts caused by construction or operation of the facility to the following public facilities and services:

  (a) Fire;

  (b) Police;

  (c) Schools;

  (d) Parks or other recreational facilities;

  (e) Utilities;

(f) Maintenance;

(g) Communications;

(h) Water/storm water;

(i) Sewer/solid waste;

(j) Other governmental services.

- The application shall compare local government revenues generated by the project (e.g., property tax, sales tax, business and occupation tax, payroll taxes) with their additional service expenditures resulting from the project; and identify any potential gaps in expenditures and revenues during both construction and operation of the project. This discussion should also address potential temporal gaps in revenues and expenditures.
- To the degree that a project will have a primary or secondary negative impact on any element of the socioeconomic environment, the applicant is encouraged to work with local governments to avoid, minimize, or compensate for the negative impact. The term "local government" is defined to include cities, counties, school districts, fire districts, sewer districts, water districts, irrigation districts, or other special purpose districts.

Consistency: Section 3.9 (Socioeconomics and Public Facilities) provides a detailed discussion of the socioeconomic impacts associated with the proposed project including impacts on population, work force, property values, housing, health facilities and services, education facilities, governmental services, and local economy. The study area includes Garfield, Columbia, Walla Walla, Benton, and Franklin counties.

Land Use-Zoning

- The council shall make a determination as to whether the proposed site is consistent and in compliance with land use plans and zoning ordinances pursuant to RCW 80.50.090 (2).

Consistency: Area-wide and local plan and program consistency is addressed in Section 4.9. Potential impacts to land use are addressed in Section 4.2 Land Use.

Site Restoration and Preservation

- When a site is subject to preservation or restoration pursuant to a plan as defined in WAC 463-72-040 through 463-72-060, the certificate holder shall conduct operations within terms of the plan; shall advise the council of unforeseen problems and other emergent circumstances at the site; and shall provide site monitoring pursuant to an authorized schedule. After approval of an initial site restoration plan pursuant to WAC 463-72-040, a certificate holder shall review its site restoration plan in light of relevant new conditions, technologies, and knowledge, and report to the council the results of its review, at least every 5 years or upon any change in project status. The council may direct the submission of a site preservation or restoration plan at any time during the development, construction, or operating life of a project based upon council's review of the project's status. The council may require such information and take or require such action as is appropriate to protect the environment and all segments of the public against risks or dangers resulting from conditions or activities at the site.

Consistency: Implementation of mitigation measures described in Sections 3.1.3, 3.2.3, and 3.3.3 of this EIS would reduce possible impacts during construction and maintenance and provide site restoration following construction.

Geology and Soils

- The seismicity standard for construction of energy facilities shall be the standards contained in the state building code.

Consistency: BPA will include any seismic standards applicable to transmission line construction from the state of Washington's building code in its design specifications for the proposed transmission line.

Water Quality

- Waste water discharges from projects under [Washington EFSEC's] jurisdiction shall meet the requirements of applicable state water quality standards, chapter 173-201A WAC, state groundwater quality standards, chapter 173-200 WAC, state sediment management standards, chapter 173-204A WAC, requirements of the Federal Water Pollution Control Act as amended (86 Stat 816,33 U.S.C. 1251, *et seq.*), and regulations promulgated thereunder.

Consistency: Through its compliance with the CWA, BPA seeks appropriate certifications and authorizations from state water quality regulatory agencies for its proposed projects. BPA will meet all applicable standards identified through this process to protect water quality from construction and operation of the proposed transmission line. See Section 3.6 for information concerning the proposed project's potential impacts on water quality, and Section 4.16 for more information concerning BPA's CWA compliance activities.

Wetlands

- Wetland impacts shall be avoided wherever possible.
- Where impacts cannot be avoided, the applicant shall be required to take one or more of the following actions (in the following order of preference): restore wetlands on upland sites that were formerly wetlands; create wetlands on disturbed upland sites; enhance significantly degraded wetlands; and preserve high-quality wetlands that are under imminent threat.
- Wetland mitigation actions proposed to compensate for project impacts shall not result in a net loss of wetland area except when the lost wetland area provides minimal functions and the mitigation action(s) will clearly result in a significant net gain in wetland functions as determined by a site-specific function assessment.

Consistency: In designing its proposed projects, BPA attempts to avoid identified wetland areas where feasible. If wetlands cannot be avoided, BPA works to minimize potential impacts and compensate appropriately for unavoidable impacts. BPA thus would act consistently with Washington EFSEC's standards related to wetlands during construction and operation of the proposed transmission line. See Sections 3.6 and 4.11 for information concerning the proposed project's potential impacts on wetlands, and Section 4.15 for more information concerning BPA's activities to comply with wetland regulations such as Section 404 of the CWA.

Fish and Wildlife

- Washington EFSEC encourages applicants to select sites that avoid impacts to any species on federal or state lists of endangered or threatened species or to priority species and habitats.
- An applicant must demonstrate no net loss of fish and wildlife habitat function and value.

- Restoration and enhancement are preferred over creation of habitats due to the difficulty in successfully creating habitat.
- Mitigation credits and debits shall be based on a scientifically valid measure of habitat function, value, and area.
- The ratios of replacement habitat to impacted habitat shall be greater than 1:1 to compensate for temporal losses, uncertainty of performance, and differences in functions and values.
- Fish and wildlife surveys shall be conducted during all seasons of the year to determine breeding, summer, winter, migratory usage, and habitat condition of the site.

Consistency: In designing its proposed projects, BPA attempts to avoid impacts to fish and wildlife species where possible. Field surveys of the project corridor for wildlife species were conducted during the fall of 2009; a follow-up field survey will be conducted in spring/summer 2010. Potential impacts to ESA-listed species are summarized in Section 4.2 and discussed in more detail in Sections 3.5 and 3.6, which also assess potential effects to state-listed species and priority habitat and species.

Air Quality

- Air emissions from energy facilities shall meet the requirements of applicable state air quality laws and regulations promulgated pursuant to the Washington State Clean Air Act, chapter 70.94 RCW, and the Federal CAA (42 U.S.C. 7401 *et seq.*), and chapter 463-78 WAC.

Consistency: To the extent that air emissions resulting from construction and maintenance of the proposed transmission line are regulated under state law, the project would comply with these regulations (see Section 3.12). Because operation of the proposed line would not result in any air emissions, there are no applicable standards for project operation.

Public Health and Safety

- The provisions of chapter 173-303 WAC shall apply to the on-site activities, at energy facilities subject to this chapter, which involve the generation, storage, transportation, treatment or disposal of dangerous wastes.
- No person shall cause or permit noise to intrude into the property of another person when noise exceeds the maximum permissible noise levels set forth below in this section.
- The noise limitations established are as set forth in the following table after any applicable adjustments provided for herein are applied.

EDNA[1/] of Noise Source	EDNA of Receiving Property		
	Class A	Class B	Class C
Class A	55 dBA[2/]	57 dBA	60 dBA
Class B	57	60	65
Class C	60	65	70

1/ EDNA – Environmental Designation for Noise Abatement
2/ dBA – A-weighted decibels

- Between the hours of 10:00 p.m. and 7:00 a.m. the applicable noise limitations shall be reduced by 10 dBA for receiving property within Class A EDNAs.
- At any hour of the day or night the applicable noise limitations may be exceeded for any receiving property by no more than: (i) 5 dBA for a total of 15 minutes in any one-hour period; or (ii) 10 dBA for a total of 5 minutes in any one-hour period; or (iii) 15 dBA for a total of 1.5 minutes in any one-hour period.
- Sounds originating from temporary construction sites as a result of construction activity are exempt from these standards, except where such provisions relate to the reception of noise within Class A EDNAs between the hours of 10:00 p.m. and 7:00 a.m.

Consistency: BPA would comply with all applicable state regulations concerning the generation, storage, transportation, treatment, or disposal of dangerous wastes during construction and maintenance of the proposed transmission line. BPA also would conduct its construction activities for the proposed line in conformance with Washington EFSEC's standards concerning maximum permissible noise levels through using appropriate muffling devices on construction equipment and limiting construction to daytime and evening hours (see Section 3.11).

5.2 Washington Department of Natural Resources Standards

The project area includes state lands managed by Washington Department of Natural Resources (WDNR). This agency manages uplands for many purposes, including protection of state and federal threatened and endangered species, revenue for school construction, and environmental protection. Lands held in trust to support public beneficiaries generate earnings that help build or remodel public schools and universities. These revenues come from timber harvest on state trust lands, as well as from leases to farmers and ranchers and leases for mineral exploration and wind power generation (WDNR 2009a). The WDNR trust lands crossed by the proposed action alternatives are currently leased to farmers and ranchers and used for agricultural cultivation and grazing (Berndt 2009). BPA would obtain easements and permits as appropriate for any WDNR lands crossed by the proposed project.

The following WDNR policies are potentially applicable to the proposed project:

Compliance and Cooperation with other State and Federal Laws

- PO08-028: The department will comply with the State Environmental Policy Act (SEPA) by managing activities on trust agricultural and grazing lands through a phased review process.
- PO08-035: The department will actively promote and maintain long-term relationships with public and private organizations that affect the agricultural and grazing program.
- The department will comply with Chapter 43.21C RCW State Environmental Policy Act and Chapter 197-11 WAC SEPA Rules for all non-exempt proposed actions as defined by the SEPA laws including Chapter 332-41 WAC WDNR SEPA Procedures.

Consistency: BPA is committed to planning its proposed transmission line projects to be consistent or compatible to the extent practicable with existing land uses. See Section 3.2 and 3.3 for information concerning the proposed project's potential impacts on agricultural and grazing lands and mitigation measures identified to reduce or eliminate impacts to those resources. See Section 4.12 for information on the Farmland Protection Policy Act which directs federal agencies to identify and quantify adverse impacts on farmlands.

As described in the introduction to this chapter, BPA is working with Washington EFSEC to help ensure this EIS is adoptable under SEPA for all state and local agencies. This EIS does analyze the significant impacts of the proposal to the SEPA defined natural and built environment.

Geology and Soils

- PO08-029: The department will actively maintain or enhance soil productivity and quality on agricultural and grazing lands.
- The provisions in chapter 43.92 RCW shall apply to geologic hazards, which include assessment and mapping of seismic, landslide, and tsunami hazards, estimation of potential consequences, and likelihood of occurrence.

Consistency: In designing its proposed projects, BPA attempts to reduce impacts to soil productivity by implementing mitigation measures as listed in Section 3.1.3. Geologic hazards are also taken into account during line design; landslides are avoided if possible and towers are designed to withstand seismic hazards.

Water Quality

- PO08-031: The department will maintain or enhance the quality and longevity of water resources originating from, flowing through, or applied on department-managed lands.

Consistency: As discussed above for Washington EFSEC water quality standards and in Section 4.16, BPA seeks appropriate certifications and authorizations from state water quality regulatory agencies and will meet all applicable standards identified through this process to protect water quality. See Section 3.6 for information concerning the proposed project's potential impacts on water quality. See Section 3.1 and 3.6 for mitigation measures that would reduce impacts to water quality.

Biological Resources

- PO-008: The department will actively participate with public and private sectors in developing and implementing pest and weed management programs.
- PO08-030: The department will maintain and enhance desirable vegetative communities on trust lands used for crop production, grazing, and wildlife habitat when compatible with agricultural and grazing program goals.
- The department will comply with Title 17 RCW Weeds, Rodents, and Pests.
- The department will comply with Chapter 15.58 RCW Washington Pesticide Control Act.

Consistency: As discussed in Section 2.2, BPA's vegetation management would be guided by its Transmission System Vegetation Management Program EIS. Additionally, BPA works with the county weed boards and landowners on area-wide plans for noxious weed control.

Cultural Resources

- PO08-034: The department will, within trust management obligations, protect significant archaeological and cultural resources on agricultural and grazing lands.

- The department will comply with PO06-001 Historical, Cultural, and Archeological sites.

Consistency: As discussed in Section 4.8, there are many laws and other directives for the management of cultural resources with which BPA seeks compliance. Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to take into account the effects of their undertakings on historic properties on all lands impacted by projects including agricultural and grazing lands. As discussed in Section 3.8, a cultural resources inventory of the action alternatives will be conducted in the spring of 2010.

Land Use and Socioeconomics

- PO08-012: The department will sell valuable materials from and lease, permit or contract agricultural and grazing lands for other surface and subsurface uses when in the best interest of the trust beneficiaries. In such cases:
    - Existing agricultural lessees will be compensated by subsequent users for loss when crops or authorized improvements are damaged, when the lease is terminated, or lease renewal negotiation is denied.
    - Existing grazing lessees will be compensated by subsequent users for loss when crops or authorized improvements are damaged, when the lease is terminated, or lease renewal negotiation is denied.
- RCW 79.10.125 Land open to public for fishing, hunting, and nonconsumptive wildlife activities.
- RCW 79.36.440 Right-of-way for public roads.
- RCW 79.36.510 Utility pipe lines, transmission lines, etc.
- RCW 79.36.520 Utility pipe lines, transmission lines, etc. – Procedure to acquire.
- RCW 79.36.530 Utility pipe lines – Appraisal – Certificate – Reversion.
- RCW 79.38.040 Permits for use of roads.

Consistency: As described above, BPA is committed to planning its proposed transmission line projects to be consistent or compatible to the extent practicable with existing land uses. See Section 3.2 for mitigation measures identified to reduce potential impacts to land owners and their lessees.

Fish and Wildlife

- PO08-032: The department will recognize the natural resource values of riparian zones and implement management plans to maintain or enhance these zones.
- PO08-033: The department will avoid effects on plant and animal species considered endangered. Within trust management obligations, the department will avoid adverse effects on species considered threatened and consider avoiding or lessening effects on species considered sensitive.

Consistency: As described above under consistency with Washington EFSEC standards, BPA attempts to avoid impacts to fish and wildlife species where possible. Sections 3.5 and 3.6 display the listed and proposed species that are either known to occur or have the potential to occur in the project area, the proposed project’s potential impacts on wildlife and fish, and mitigation measures identified to minimize those impacts.

Transportation and Access

PO14-020 pertaining to forest roads in WDNR's Policy Manual states the following:

- The department will develop and maintain forest roads to meet trust objectives and Board of Natural Resources policy, including protecting and enhancing the asset value.
- To minimize adverse environmental impacts, the department will rely on the requirements of WDNR's *Habitat Conservation Plan*, state forest practices rules, and the State Environmental Policy Act, and will minimize the extent of the road network, consistent with other Board of Natural Resources policy.

In response to WDNR's policy and in order to achieve the regulatory requirements under Washington Forest Practice Act, a comprehensive discussion of WDNR standards for roads designed, constructed, maintained, and abandoned on state-managed lands was developed in the Draft 2010 Forest Roads Guidebook.

Three general management practices characterize a small portion of the objectives and standards outlined in the 2010 Forest Roads Guidebook, but are representative of the considerations WDNR must make when adding a new road to the overall transportation system:

1. Build no more new road than is necessary to accomplish and economically conduct harvest and/or management objectives for the basic plan of operations, regardless of whether a road is in sensitive areas or not.
2. The protection of sensitive species and areas including, but not limited to, streams and watersheds is vital. Proper logging methods, road locations, and construction techniques must be considered to mitigate a potential increase in erosion from forest areas and sediment delivery to surface water.
3. Consider the overall transportation plan for a geographic area. Do not ignore pre-planning for future sales and access. This will avoid construction of parallel roads or extra lengths of roads to access far corners that will be harvested in the future.

Consistency: BPA would not construct any forest roads to remove timber as part of the proposed project because no trees are present within the proposed corridor.

Public Health and Safety

- The provisions of chapter 332-24 WAC and chapter 76.04 RCW shall apply to forest protection measures and operator responsibilities related to fire prevention and fire hazard abatement.

Consistency: BPA is committed to reducing the potential for fire during construction. See Section 3.11 for mitigation measures identified to minimize potential health and safety risks from fire.

5.3 Washington Department of Fish and Wildlife Standards

Washington Department of Fish and Wildlife (WDFW) serves as the state's principal agency on species protection and conservation. Legislative mandate RCW 77.04.012 established that wildlife, fish, and shellfish are property of the state and that WDFW is entrusted by and through the Fish and Wildlife Commission to "preserve, protect, perpetuate, and manage the wildlife and food fish, game fish, and shellfish…" and "…attempt to maximize the public recreational game fishing and hunting opportunities of all citizens…"

In 2003, WDFW and a broad range of wind power stakeholders developed the WDFW Wind Power Guidelines to provide consistent statewide direction for development of land-based wind energy projects while still protecting the state's wildlife and habitat. The Guidelines were revised in 2009. While the proposed project is not a wind energy project, the following guidelines for impact avoidance and minimization are potentially applicable to the proposed project:

Wildlife

- Where appropriate develop in agricultural and other disturbed lands, including using existing transmission corridors and roads where possible.

Consistency: Where feasible, BPA typically considers line alternatives that are routed across already disturbed areas such as agricultural lands, and attempts to use existing roads where possible. See Sections 2.1 and 2.2 for proposed alternative development and placement of roads, and Section 3.2.2 for potential impacts to land uses including agriculture.

- Avoid high bird and bat aggregation areas, and areas used by sensitive status species.

Consistency: BPA attempts to route transmission lines away from these areas where possible; however, because new lines most often extend from one specific existing substation to another existing substation, routing options can be limited. See Section 3.5 for the proposed project's potential impacts on wildlife and mitigation measures identified to minimize those impacts.

- Encourage the protection of Priority Habitats and Species (PHS).

Consistency: BPA attempts to route transmission lines away from sensitive species' habitat where possible; however, because new lines most often extend from one specific existing substation to another existing substation, routing options can be limited. As described above, see Section 3.5 of this EIS.

- Minimize use of overhead collector lines, unless underground collector lines are not appropriate or feasible due to environmental conditions (e.g., topography, soil conductivity, environmental impacts, etc.).

Consistency: BPA would not construct collector lines for the proposed project. Undergrounding of high-voltage (230- and 500-kV) transmission lines is usually not an option because of the greater environmental impacts and associated costs of undergrounding. See Section 2.5 for alternatives considered but eliminated from detailed study.

- When overhead lines are used, use designs that avoid and minimize impacts to raptors and other birds (refer to Avian Power Line Interaction Committee [APLIC] guidelines regarding adequate conductor spacing and use of perch guards).

Consistency: BPA always designs conductor spacing to comply with APLIC (see Section 3.5.2).

- Use tubular towers to reduce the likelihood that birds will perch on towers and to possibly reduce the risk of collision. Avoid use of lattice towers, particularly those with horizontal cross-members.

Consistency: The industry standard design for towers for high-voltage transmission lines is steel lattice towers. See Section 2.2 for information on the design of the proposed transmission line.

- Avoid using permanent tower types that employ guy wires. If guy wired towers are approved, encourage the requirement of bird flight diverters on the guy wires.

Consistency: BPA typically does not use guy wires on towers for its high-voltage transmission lines. In the event that guy wires are necessary, BPA would consider placing bird flight diverters on the guy wires. See Section 3.5.3 for proposed mitigation measures identified to minimize impacts to birds.

- Discourage the use of rodenticides to control rodent burrowing around towers.

Consistency: BPA does not use rodenticides.

- Minimize the use of lights on towers and facilities structures, in accordance with federal, state, and local requirements.

Consistency: BPA typically only uses lights on very tall towers (such as at river crossings) and towers near airports/heliports, in compliance with FAA requirements. See Section 3.10.3 for proposed mitigation measures to mark river crossings.

- Control noxious weeds in accordance with federal, state, and local laws.

Consistency: BPA controls weeds in accordance with federal, state, and local laws. See Section 3.3.3 for proposed mitigation measures to reduce or eliminate the potential for the spread of noxious weeds under the action alternatives.

- Encourage the control of detrimental weedy species that invade as a result to disturbance from construction, maintenance and operation.

Consistency: BPA controls weeds in accordance with federal, state, and local laws (see Section 3.3.3)

- Encourage the permitting authority to require a fire protection plan and a complete road siting and management plan that includes vehicle-driving speeds that minimize wildlife mortality.

Consistency: Because BPA is not subject to state or county permitting authorities, this guideline does not apply to the proposed project. However, Section 3.5.3 does include proposed mitigation for the safe operation of vehicles and construction equipment.

- Reduce availability of carrion *(animal carcasses).*

Consistency: This guideline does not apply to the proposed project.

- Minimize roads and stream crossings.

Consistency: BPA typically proposes to build/improve the minimum amount of roads needed to access the transmission line and avoid stream crossings where possible. See Section 2.2 for information on the design of the proposed transmission line.

- Encourage a decommissioning condition for restoration of the site to approximate or improved pre-project conditions that would require removal of the turbines and infrastructure when the project ceases operation.

Consistency: This guideline does not apply to the proposed project.

5.4 Washington Department of Ecology Standards

Washington Department of Ecology (Ecology) is the state agency responsible for protecting air and water quality in the state of Washington, including management of shorelines and wetland areas and implementation of federal and state water pollution control laws and regulations.

Shorelines and Wetlands

The Coastal Zone Management Program is authorized by the Coastal Zone Management Act of 1972 and administered at the federal level by the National Oceanic and Atmospheric Administration's Office of Ocean and Coastal Resource Management, Coastal Programs Division. Management of the program is delegated to the states participating in the program. In Washington, Ecology administers the program. The Coastal Zone Management Act requires federal development projects and activities directly affecting the coastal zone "shall be conducted in a manner which is, to the maximum extent practicable, consistent with approved state management programs" (Section 307(c)(1), (2)).

A federal agency or applicant for a federal license, permit, or financial assistance is responsible for determining whether the proposed activity may affect any natural resource, land use, or water use in Washington's coastal zone. Ecology will concur with a determination if the federal activity is consistent to the maximum extent practicable with the Washington Coastal Zone Management Program. Consistency with the state program is described below.

The Washington State Shoreline Management Act establishes a planning program and regulatory permit system initiated at the local level under state guidance. While Ecology is designated as the lead state agency, local governments exercise primary authority for implementing the Act. Each local government's master program consists of a shoreline inventory and a "shoreline master program" (SMP) to regulate shoreline uses. The Shoreline Master Program for Columbia County, adopted June 1975, regulates land uses impacting shorelines of the state in Columbia County. The proposed transmission facilities would only impact state shorelines if the towers or access roads would be located within 200 feet of them or their associated wetlands. Regulations pertaining to utilities are listed in Section 16 of the SMP. Utility services in shoreline areas designated Conservancy, Rural and Urban Environments, shall be permitted subject to the following regulations:

- All utility systems shall be underground when such undergrounding is economically feasible.
- All clearing for installation of maintenance shall be kept to the minimum width necessary.
- Upon completion of the installation of utility systems or of any maintenance, disturbed areas shall be restored as nearly as practical to the pre-existing condition.
- Utilities shall be located above flood levels wherever practical.

Consistency: All action alternatives for the proposed project would cross the Tucannon River north of Starbuck, Washington. Towers would be placed approximately 970 to 1,610 feet from the edge of the river. The proposed project would be located well above flood levels and not within the shoreline area of the Tucannon River. As described in Section 2.5 of the EIS, it would not be economically feasible to underground the transmission line. No trees would be cleared within the riparian zone of the Tucannon River for installation of the transmission line. Since the height of the conductor would be greater than 200 feet, removal of trees during maintenance of the line also would not occur. As described in Section 3.1.3 of the EIS, areas disturbed during construction would be restored.

Water Quality

The following Ecology substantive standards from Chapter 90.48 RCW, Chapter 173-216 WAC, Chapter 173-220 WAC, Chapter 173-200 WAC, and Chapter 173-201A WAC are potentially applicable to the proposed project:

- Proper erosion and sediment control practices must be used on the construction site and adjacent areas to prevent upland sediments from entering surface water. All ground disturbance by construction activities must be stabilized. When appropriate, use native vegetation typical of the site.
- Any operation which would generate a waste discharge or have the potential to impact the quality of state waters, must receive specific prior authorization from Ecology.
- Routine inspections and maintenance of all erosion and sediment control BMPs are recommended both during and after development of the sites.
- A Stormwater Pollution Prevention Plan for the project site may be required and should be developed by a qualified person(s). Erosion and sediment control measures in the plan must be implemented prior to any clearing, grading, or construction. These control measures must be effective to prevent soil from being carried into surface water by stormwater runoff. Sand, silt, and soil can damage aquatic habitat and are considered pollutants. The plan must be upgraded as necessary during the construction period.
- Proper disposal of construction debris must be in such a manner that debris cannot enter the natural stormwater drainage system or cause water quality degradation of surface waters. Dumpsters and refuse collection containers shall be durable, corrosion resistant, nonabsorbent, nonleaking, and have close fitting covers. If spillage or leakage does occur, the waste shall be picked up immediately and returned to the container and the area properly cleaned.
- The operator of a construction site that disturbs one acre or more of total land area, and which has or will have a discharge of stormwater to a surface water or to a storm sewer, must apply for coverage under Department of Ecology’s Construction Stormwater General Permit.

Consistency: As noted above for Washington EFSEC water quality standards and discussed in Section 4.16, BPA seeks appropriate certifications and authorizations from state water quality regulatory agencies and will meet all applicable standards identified through this process to protect water quality. See Section 3.6 for information concerning the proposed project’s potential impacts on water quality. See Sections 3.1.3 and 3.6.3 for mitigation measures that would reduce potential impacts to water quality.

5.5 Washington Department of Archaeology and Historic Preservation Standards

The Department of Archaeology and Historic Preservation works with agencies, tribes, private citizens, and developers to identify and develop protection strategies to ensure that Washington’s cultural heritage is not lost. In Washington state, archaeological sites and Native American graves are protected from known disturbance by a variety of state laws. While federal law applies to all federal and Native American lands, Washington state law applies to all other lands. The following state laws on archaeology and historic preservation for the management of cultural resources are potentially applicable to the proposed project:

- Indian Graves and Records (RCW 27.44)
- Archaeological Sites and Resources (RCW 27.53)
- Archaeological Excavation and Removal Permit (WAC 25-48)
- Abandoned and Historic Cemeteries and Historic Graves (RCW 68.60)
- Advisory Council on Historic Preservation (WAC 25-12)

Consistency: As discussed in Section 4.8, Heritage Conservation, Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties. If a federal agency plans to undertake a type of activity that could affect historic properties, it must consult with the appropriate State Historic Preservation Officer to make an assessment of adverse effects on identified historic properties. BPA will comply with NHPA and all applicable state laws.

Chapter 6 References

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Chapter 7 Glossary

Access road — Roads constructed to each tower site first to build the tower and line, and later to maintain and repair it.

Alluvium — Deposits left by flowing water, usually clay, silt, sand, or gravel.

Anadromous fish — Chinook, coho, and sockeye salmon and steelhead trout, which hatch in fresh water, spend part of their life at sea, and then migrate up rivers to their home waters to spawn.

Bedrock — Solid rock beneath the soil and superficial rock.

Best Management Practices (BMPs) — A practice or combination of practices that are the most effective and practical means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals.

Blackout — The disconnection of the source of electricity from all electrical loads (users) in a certain geographical area.

Bull trout — Members of the char subgroup of the salmon family (salmonids), which also include the Dolly Varden, lake trout, and Arctic char.

Capacity — The maximum load that a generator, piece of equipment, substation, transmission line, or system can carry under existing service conditions.

Carbon monoxide (CO) — An odorless and colorless gas formed from one atom of carbon and one atom of oxygen.

Census block group – smallest area for which a census compiles sample data; comprised of census blocks.

Census tract – A subdivision of a county smaller than a CCD that often follows visibile features, but may also follow governmental boundaries and other non-visible features; homogenous with respect to population characteristics, economic status, and living conditions.

Clean Water Act 303(d) list – List of waterbodies that do not meet water quality standards.

Colluvium — Rock fragments, sand, etc., that accumulate on steep slopes or at the foot of cliffs.

Conductor — The wire cable strung between transmission towers through which electric current flows.

Corona — Corona occurs in regions of high electric field strength on conductors, insulators, and hardware when sufficient energy is imparted to charged particles to cause ionization (molecular breakdown) of the air.

CRP Lands – Lands enrolled in the Conservation Reserve Program.

Culvert — A corrugated metal or concrete pipe used to carry or divert runoff water from a drainage; usually installed under roads to prevent washouts and erosion.

Cumulative impact — Cumulative impacts are created by the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions.

Current — The amount of electrical charge flowing through a conductor (as compared to voltage, which is the force that drives the electrical charge).

dBA — The first two letters (dB) are an abbreviation for decibel, the unit in which sound is most commonly measured (see decibel). The last letter (A) is an abbreviation for the scale (A-scale) on which the sound measurements were made.

Dead-end towers — Heavy towers designed for use where the transmission line loads the tower primarily in tension rather than compression, such as in turning large angles along a line or bringing a line into a substation.

Decibel — A decibel is a unit for expressing relative difference in power, usually between acoustic signals, equal to 10 times the common logarithm of the ratio of two levels.

Easement — A grant of certain rights to the use of a piece of land (which then becomes a "right-of-way"). This includes the right to enter the right-of-way to build, maintain, and repair the facilities. Permission for these activities is included in the negotiation process for acquiring easements over private land.

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.

Endangered species — Those species officially designated by the U.S. Fish and Wildlife Service that are in danger of extinction throughout all or a significant portion of their range.

Endangered Species Act (ESA) — A 1973 Federal law, amended in 1978 and 1982, to protect troubled species from extinction. NOAA Fisheries and the U.S. Fish and Wildlife Service decide whether to list species as Threatened or Endangered. Under the Act, Federal agencies must avoid jeopardy to and aid the recovery of listed species.

Environmental Impact Statement (EIS) — A detailed statement of environmental impacts caused by an action, written as required by the National Environmental Policy Act.

Essential Fish Habitat (EFH) — Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (Magnuson Fishery Conservation and Management Act).

Exceedence levels (L levels) — The A-weighted sound level that is exceeded for a specified percentage of the time.

Fallow Land — Cropland that is not seeded for a season; it may or may not be plowed.

Farmland of Statewide Importance – Land, in addition to prime farmlands, that is of statewide importance for the production of food, feed, fiber, forage, and oil seed crops. Farmlands of statewide importance typically include land that is nearly prime farmland and has the potential to economically produce high yields of crops.

Federally listed — Species listed as **Threatened** or **Endangered** by the U.S. Fish and Wildlife Service.

Fiber optic lines — Special wire installed on the transmission line that is used for communication between one location and another.

Floodplain — That portion of a river valley adjacent to the stream channel which is covered with water when the stream overflows its banks during flood stage.

Forb — Any herbaceous plant that is not a grass or not grasslike.

Gauss — A unit of magnetic induction.

Geographic Information System (GIS) — A computer system that analyzes graphical map data.

Glacial moraine – Material transported by a glacier and then deposited; can be sand, gravel, boulders, etc.

Glacial outwash — Stratified sediment, consisting chiefly of sand and gravel, removed or "washed out" from a glacier by meltwater streams and deposited in front of or beyond the terminal moraine or the margin of an active glacier.

Glacial till — Unstratified, unsorted, glacial drift of clay, silt, sand, boulders and gravel.

Groundwater — Water that occurs below the surface of the Earth, where it occupies spaces in soils or geologic strata.

Hertz (Hz) — The unit of frequency in cycles per second; power systems in the U.S. operate with a frequency of 60 Hz.

High-voltage — Lines with 230 kV or above electrical capacity.

Hydrology — The science dealing with the properties, distribution, and circulation of water.

Insulators — A ceramic or other nonconducting material used to keep electrical circuits from jumping over to ground.

Intermittent drainage — Referring to periodic water flow in creeks or streams.

Invertebrates — Any animal without a backbone or spinal cord; any animal other than a fish, amphibian, reptile, bird, or mammal.

Kilovolt — One thousand volts. (See **Volt.**)

Landslide — Any mass-movement process characterized by downslide transport of soil and rock, under gravitational stress, by sliding over a discrete failure surface; or the resultant landform. Can also include other forms of mass wasting not involving sliding (rockfall, etc.).

Large woody debris (LWD) — Any piece of downed wood larger than 4 inches in diameter and 6 feet long.

Line losses — Energy consumed by the conductor generating heat during transport of power through each line; a function of load, circuit length, conductor size, and electrical "resistance."

Load — The amount of electric power or energy delivered or required at any specified point or points on a system. Load originates primarily at the energy-consuming equipment of customers.

Load growth — Increase in demand for electricity. (See **Load**.)

Low-gradient — With gentle slopes.

Mass wasting — The slow downward slope of rock debris.

Megawatts (MW) — A megawatt is one million watts, or one thousand kilowatts; an electrical unit of power.

Milligauss (mG) — A unit used to measure magnetic field strength; one-thousandth of a gauss.

Mitigation — Steps taken to lessen the effects predicted for each resource, as potentially caused by the transmission project. They may include reducing the impact, avoiding it completely, or compensating for the impact. Some mitigation, such as adjusting the location of a tower to avoid a special resource, is taken during the design and location process. Other mitigation, such as reseeding access roads to desirable grasses and avoiding weed proliferation, is taken after construction.

Monitor species — Those species for which Washington State monitors status and distribution either because they have been listed as state Threatened, Endangered, or Sensitive within the previous 5 years; they require a habitat that has limited availability during at least some portion of their life cycle; they are environmental indicators; or their taxonomy is in question and it is unclear whether they should be included as listed species.

National Environmental Policy Act (NEPA) — This act requires an environmental impact statement on all major Federal actions significantly affecting the quality of the human environment. [42 U.S.C. 4332 2(2)(C).]

Nitrogen oxides — A group of compounds consisting of various combinations of nitrogen and oxygen atoms.

NOAA Fisheries — The Federal agency that oversees threatened and endangered anadromous fish species.

Non-attainment area — An area that does not meet air quality standards set by the Clean Air Act for specified localities and periods.

Notice of Intent (NOI) — A public notice that an environmental impact statement will be prepared and considered in the decision making for a proposed action.

Noxious weeds — Plants that are injurious to public health, crops, livestock, land or other property.

100-year floodplain — Areas that have a 1 percent chance of being flooded in a given year. (See **Floodplain**.)

Outage — Events caused by a disturbance on the electrical system that requires the provider to remove a piece of equipment or a portion or all of a line from service. The disturbances can be either natural or human-caused.

Overload — Moving too much current flow over transmission facilities. Equipment has safeguards: in the event of system overload, switches will disconnect sensitive equipment from the flow of electricity.

Ozone — Associated with the corona discharge of high-voltage transmission lines. Rapidly recombines back to O_2.

Perennial streams or **creeks** — Those with year-round water flow.

Physiographic — Pertaining to the features and phenomena of nature.

Prime Farmland — Federally designated land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses.

Revegetate — Re-establishing vegetation on a disturbed site.

Right-of-way (**ROW)** — An easement for a certain purpose over the land of another, such as a strip of land used for a road, electric transmission line, pipeline, etc.

Riparian habitat — The zone of vegetation that extends from the water's edge landward to the edge of the vegetative canopy. Associated with watercourses such as streams, rivers, springs, ponds, lakes, or tidewater.

Scoping — Part of the environmental impact document process where significant issues are identified for detailed analysis.

Sedimentation — The deposition or accumulation of sediment.

Species — A group of interbreeding individuals not interbreeding with another such group; similar, and related species are grouped into a genus.

Substation — The fenced site that contains the terminal switching and transformation equipment needed at the end of a transmission line.

Surface Water — Water collecting on the ground or in a stream, river, lake, sea or ocean.

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.

Threatened species — Those species officially designated by the U.S. Fish and Wildlife Service that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Transformers — Electrical equipment usually contained in a substation that is needed to change voltage on a transmission system.

Transmission line — The structures, insulators, conductors, and other equipment used to transmit electrical power at high voltage to electric distribution facilities (substation).

Turbidity — The state or condition of opaqueness or reduced clarity of a fluid, due to the presence of suspended matter.

U.S. Fish and Wildlife Service (USFWS) — The Federal agency that is charged with the protection of threatened and endangered plants and animals.

Viewpoint — Specific locations where transmission facilities constructed along the alternative corridors would be visible.

Volt — The international system unit of electric potential and electromotive force.

Voltage — The driving force that causes a current to flow in an electrical circuit.

Watershed — The area that drains to a common waterway.

Wetlands — An area where the soil experiences anaerobic conditions because of inundation of water during the growing season. Indicators of a wetland include types of plants, soil characteristics, and hydrology of the area.

Zoning — Regulations used to guide growth and development; typically involve legally adopted restrictions on uses and building sites in specific geographic areas to regulate private land use.

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Chapter 9
List of Agencies, Organizations, and Persons Sent the EIS

The project mailing list contains about 176 potentially interested or affected landowners; tribes; local, state, and federal agencies; utilities; public officials; interest groups; businesses; libraries and the media. They have directly received or have been given instructions on how to receive all project information made available so far, and they will have an opportunity to review the Draft and Final EIS.

Federal Agencies

Environmental Protection Agency
Army Corps of Engineers
Forest Service
National Park Service

Tribes and Tribal Groups

Coeur d'Alene Tribe
Confederated Tribes of the Colville Reservation
Confederated Tribes of the Umatilla Indian Reservation
Confederated Tribes of Warm Springs
Nez Perce Tribe
Spokane Tribe of Indians
Wanapum Tribe
Yakama Indian Nation

State Agencies

Washington Department of Ecology
Washington Department of Fish and Wildlife
Washington Department of Natural Resources
Washington Energy Facility Site Evaluation Council
Washington Governors Office of Regulatory Assistance
Washington Parks and Recreation Commission
Washington Utilities and Transportation Commission

Public Officials

Federal Congressional

U.S. House of Representatives, Cathy McMorris Rogers
U.S. Senate, Maria Cantwell
U.S. Senate, Patty Murray

Local Governments

Cities

Dayton
Pomeroy
Starbuck
Walla Walla

County

Columbia County
Garfield County
Nez Perce County
Walla Walla County

Organizations

Columbia County Grain Growers
Port of Columbia
Washington Association of Wheat Growers
Washington Farm Bureau

Businesses

Iberdrola Renewables
Burlington Northern & Santa Fe Railroad Company
Motley Motley, Inc.

Utilities

Pacific Power and Light
Puget Sound Energy

Libraries

Central Washington University
City of Basin Public Library
City of Clarkston Public Library
City of Colfax Library
City of Kahlotus Public Library
City of Pasco Public Library
City of Spokane Public Library
County of Columbia Rural Library District
Dayton Memorial Library
Denny Ashby Library
Eastern Washington University, JFK Memorial Library
Gonzaga University, Chastek Library
Merrills Corner Library
Town of LaCrosse Public Library
Washington State University Library
Weller Public Library
Whitman College, Penrose Memorial Library

Interest Groups

Oregon Rural Action

Media

Tri-City Herald
Walla Walla Union-Bulletin

Individuals

David R Archer
Pat and Rhonda Barker
H C Barr Family Trust
R Clay Barr
Janette Black
Deborah Brinkman
Dwayne Brinkman
Broughton Land Co
Melvena Carpenter
Clyde Cline Ranch
Mary Rygg Cline
Bette Cook
Grim Davis Farms
Ferrell Family Farms
Gerald B Finnie
Rita Finnie
Gary D Fletcher
Greg Fletcher
John Fredrickson
Natalie Fredrickson
Sam Grant Jr
William A Grant
Bart Ginrich
Cheryl Hair
Frederic Hair
Jason Hair
John E Hair III
John E Hair II
John E and Sheila K Hair Jr.
Naomi L Hair
Sheila Hair
Richard E Hair
Hair Land Company & Lavene Hair Living Trust
Barbara Harold
Brett Leaman Harold
Cecil A Harrison
Melinda A Hastings
Michael R Hastings
Jake J Hill
Hobson & Dutro
Merle Jackson
Klicker Estate
Sheryl Klicker-Cox
Virgil Klaveano
Gary C Lasater
Lemaster & Daniels
Susan E Lima
Luvaas Trust
Sue MacDougall Palmer
Gerald Magill
Richard L McFarland Trustee
Elizabeth McFarland
McGregor Land & Livestock
Parker Farms
Pleasant View Ranch
Kathleen Porter
Kenneth J Reinsch Trustees
Lucille E Reinsch
Dick Rubernser
Betty Schumacher
Skirvin Farms
Albert C Statler
Starbuck Ranch LLC
Joseph Taylor
Julie Taylor
Marjorie R Tompkins
Susan Zajichek Tompkins
Ronald W Tompkins
Tompkins & Sons Inc
Tucannon Ranch
Haidee Tucker Trustees
Pat Tucker
Ted Tucker
Tucker Land Company
Jacqueline Turner
Carrie Welch
Z M I Joint Venture

Chapter 10 Index

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Appendix A

Vegetation Species Documented During the Fall 2009 General Vegetation Survey

Table A-1
Vascular Plant Species Encountered in the Study Area
in the Fall 2009 General Vegetation Survey

Scientific name	Common name	Native/ Non-native
Achillea millefolium	yarrow	native
Aegilops cylindrica	jointed goatgrass	non-native
Agoseris heterophylla	large-flowered agoseris	native
Agropyron cristatum	crested wheatgrass	non-native
Agrostis exarta	spike bentgrass	native
Agrostis variabilis	mountain bentgrass	native
Allium cf. *acuminatum*	taper-tip onion	native
Alnus rhombifolia	white alder	native
Amaranthus albus	prostrate pigweed	non-native
Amorpha fruticosa	false indigo; river-locust	non-native
Amsinckia sp.	fiddleneck	native
Aristida purpurea	red threeawn	native
Artemisia absinthium	absinth wormwood	non-native
Artemisia ludoviciana	white sagebrush	native
Astragalus purshii	woolly-pod milk-vetch	native
Astragalus spaldingii	Spalding's milk-vetch	native
Balsamorhiza cf. *sagittata*	Arrow-leaf balsamroot	native
Bromus diandrus (B. rigidus)	great brome	non-native
Bromus hordeaceus ssp. *hordeaceus* (*B. mollis*)	soft brome/smooth brome	non-native
Bromus tectorum	cheatgrass	non-native
Centaurea diffusa	diffuse knapweed	non-native
Centaurea solstitialis	yellow starthistle	non-native
Chenopodium album	lambsquarters	non-native
Chondrilla juncea	rush skeletonweed	non-native
Chrysothamnus viscidiflorus	green rabbitbrush	native
Cichorium intybus	chicory	non-native
Cirsium arvense	Canada thistle	non-native
Cirsium undulatum	wavy-leaf thistle	native
Clematis ligusticifolia	western white clematis	native
Collinsia parviflora	small-flowered blue-eyed mary	native
Cicuta douglasii	western water-hemlock	native
Convolvulus arvensis	field bindweed	non-native
Conyza canadensis	horseweed	native
Cryptantha ambigua	basin cryptantha	native
Dactylis glomerata	orchard-grass	non-native
Daucus carota	Queen Anne's lace	non-native
Dipsacus sp.	teasel	non-native
Elaeagnus angustifolia	Russian-olive	non-native
Elymus elymoides	squirreltail	native
Epilobium brachycarpum	tall annual willowher	native
Ericameria nauseosa	gray rabbitbrush / rubber rabitbrush	native
Erigeron filifolius	threadleaf fleabane	native
Eriogonum heracleoides	parsnip-flower buckwheat	native
Eriogonum niveum	snow buckwheat	native

Table A-1 continued

Scientific name	Common name	Native/Non-native
Erodium cf. *cicutarium*	common stork's bill	non-native
Erythronium cf. *grandiflorum*	yellow avalanche-lily	native
Festuca idahoensis	Idaho fescue	native
Gaillardia aristata	blanket flower	native
Galium sp.	bedstraw	native
Grindelia squarrosa	curlycup gumweed	native
Helianthus annuus	common sunflower	unknown
Hordeum marinum (H. geniculatum)	seaside barley	non-native
Juglans nigra	black walnut	non-native
Lactuca serriola	prickly lettuce	non-native
Lagophylla ramosissima	branched lagophylla	native
Lepidium cf. *perfoliatum*	clasping pepperweed	non-native
Leptosiphon cf. *harknessii (Linanthus harknessii)*	Harness' flaxflower	native
Leymus cinereus	basin wildrye	native
Linum lewisii	prairie flax/wild blue flax	native
Lithospermum ruderale	western stoneseed	native
Lomatium sp.	biscuitroot / desert-parsley	native
Lupinus leucophyllus	velvet lupine	native
Lupinus sp.	lupine	native
Machaeranthera canescens	hoary aster	native
Medicago sativa	alfalfa	non-native
Phacelia hastata	silver-leaf phacelia	native
Phalaris arundinacea	reed canarygrass	non-native
Plantago patagonica	woolly plantain	native
Poa bulbosa	bulbous blue grass	non-native
Poa secunda (P. sandbergii)	Sandberg bluegrass	native
Polygonum aviculare	prostrate knotweed	non-native
Pseudoroegneria spicata	bluebunch wheatgrass	native
Rumex crispus	curly dock	non-native
Salsola tragus (Salsola kali)	Russian thistle	non-native
Secale cereale	cultivated rye	non-native
Setaria viridis	green bristlegrass	non-native
Sisymbrium altissimum	tall tumblemustard	non-native
Solidago canadensis	Canada goldenrod	native
Spergularia rubra	red sandspurry	non-native
Sporobolus cryptandrus	Sand dropseed	native
Taeniatherum caput-medusae	medusa-head	non-native
Thinopyrum ponticum	tall wheatgrass	non-native
Tragopogon dubius	yellow salsify	non-native
Triticum aestivum	cultivated wheat	non-native
Urtica dioica	stinging nettle	native
Verbascum thapsus	common mullein	non-native
Verbena bracteata	bigbract verbena	native
Vicia villosa	hairy vetch	non-native
Vulpia bromoides	brome fescue	non-native

Appendix B

Wildlife Species Documented During the Fall 2009 Wildlife Survey

Table B-1
Wildlife Species Documented
During the Fall 2009 General Wildlife Survey

Common Name	Scientific Name	Habitat	Abundance
Birds			
Red-tailed Hawk	*Buteo jamaicensis*	All	High
Say's Phoebe	*Sayornis saya*	Draws	Low
Sharp-shinned Hawk	*Accipiter striatus*	Draws, Roadsides	High
Northern Flicker	*Colaptes auratus*	Draws, Roadsides	Medium
Common Raven	*Corvus corax*	All	High
Horned Lark	*Eremophila alpestris*	Roadsides, Open Grassland/herb	High
Ring-necked Pheasant	*Phasianus colchicus*	All	High
Western Meadowlark	*Sturnella neglecta*	Open Grassland/herb	High
Savannah Sparrow	*Passerculus sandwichensis*	Open Grassland/herb	Medium
Chucker	*Alectoris chukar*	All	Medium
Hermit Thrush	*Catharus guttatus*	Draws, Roadsides	Low
Mourning Dove	*Zenaida macroura*	Draws, Roadsides	Medium
White-crowned Sparrow	*Zonotrichia leucophrys*	Roadsides, Riparian	Medium
Brewer's Sparrow	*Spizella breweri*	Open Grassland/herb	Low
Oregon Vesper Sparrow	*Pooecetes gramineus affinis*	Open Grassland/herb	Medium
Rock Wren	*Salpinctes obsoletus*	Draws	Medium
Northern Harrier	*Circus cyaneus*	Open Grassland/herb	Medium
Spotted Towhee	*Pipilo maculatus*	Draws	Medium
Black-capped Chickadee	*Poecile atricapillus*	Riparian	Medium
Hairy Woodpecker	*Picoides villosus*	Riparian	Low
Bewick's Wren	*Thryomanes bewickii*	Riparian	Low
Black-billed Magpie	*Pica pica*	Riparian	Low
American Tree Sparrow	*Spizella arborea*	Riparian	Low
Song Sparrow	*Melospiza melodia*	Riparian	Low
Sage Sparrow	*Amphispiza belli*	Open Grassland/herb	Medium
Killdeer	*Charadrius vociferus*	Riparian	Low
Ruby Crowned Kinglet	*Regulus calendula*	Riparian	Low
Great Horned Owl*	*Bubo virginianus*	Draws	Low
Ferruginous Hawk*	*Buteo regalis*	Open Grassland/herb, Draws	
Merlin	*Falco columbarius*	Open Grassland/herb	Low
Western kingbird	*Tyrannus verticalis*	All	Low
Mammals			
Sagebrush Vole*	*Lemmiscus curtatus*	Open Grassland/herb	Low
Northern Pocket Gopher *	*Thomomys talpoides*	All	Medium
Mule deer	*Odocoileus hemionus*	All	High
Coyote	*Canis latrans*	All	Medium
Porcupine*	*Erethizon dorsatum*	Riparian	Low
American badger*	*Taxidea taxus*	Open Grassland/herb	Low
River otter*	*Lontra canadensis*	Riparian	Low
Elk*	*Cervus elaphus*		
Columbian Ground Squirrel*	*Spermophilus columbianus*	Open Grassland/herb	Medium
Washington Ground Squirrel*	*Spermophilus washingtoni*	Open Grassland/herb	Low
Reptiles			
Western Yellow-bellied Racer	*Coluber constrictor mormon*	Riparian	Low

Note:
*Only signs of the species were identified; no visual detection was made

Appendix C

Visual Simulations

Table C-1. Visual Simulations – Table of Contents

Figure C-1a shows the view to the northwest from Viewpoint 1.

Viewpoint 1

West of State Route 127
Garfield County, Washington

Figure C-1a

Figure C-1b shows the simulated view of a routing alternative segment common to all action alternatives from Viewpoint 1.

Viewpoint 1

West of State Route 127
Garfield County, Washington

Figure C-1b

Figure C-2a shows the view to the northwest from Viewpoint 2.

Viewpoint 2

US Route 12
Columbia County, Washington

Figure C-2a

Figure C-2b shows the simulated view of the South and Combination B Alternatives from Viewpoint 2.

Viewpoint 2

Figure C-3a shows the view to the southwest from Viewpoint 3.

Viewpoint 3

Riparia Road
Whitman County, Washington

Figure C-3a

Figure C-3b shows the simulated view of the North and Combination A Alternatives from Viewpoint 3.

Viewpoint 3

Riparia Road
Whitman County, Washington

Figure C-3b

Figure C-3c shows the simulated view of the South and Combination B Alternatives from Viewpoint 3.

Viewpoint 3

Riparia Road
Whitman County, Washington

Figure C-3c

Figure C-4a shows the view to the northwest from Viewpoint 4.

Viewpoint 4

State Route 261 Northwest of Starbuck
Columbia County, Washington

Figure C-4a

Figure C-4b shows the simulated view of a routing alternative segment common to all action alternatives from Viewpoint 4.

Viewpoint 4

State Route 261 Northwest of Starbuck
Columbia County, Washington

Figure C-4b

Figure C-5a shows the view to the south from Viewpoint 5.

Viewpoint 5

Snake River and Tucannon River Confluence
Columbia County, Washington

Figure C-5a

Figure C-5b shows the simulated view of a routing alternative segment common to all action alternatives from Viewpoint 5.

Viewpoint 5

Snake River and Tucannon River Confluence
Columbia County, Washington

Figure C-5b

Figure C-6a shows the view to the northeast from Viewpoint 6.

Viewpoint 6

Lyons Ferry Road
Walla Walla County, Washington

Figure C-6a

Figure C-6b shows the simulated view of the North and Combination B Alternatives from Viewpoint 6.

Viewpoint 6

Lyons Ferry Road
Walla Walla County, Washington

Figure C-6b

Figure C-6c shows the simulated view of the South and Combination A Alternatives from Viewpoint 6.

Viewpoint 6

Lyons Ferry Road
Walla Walla County, Washington

Figure C-6c

Figure C-7a shows the view to the south from Viewpoint 7.

Viewpoint 7

Ayer Road and Casey Road Intersection
Walla Walla County, Washington

Figure C-7a

Figure C-7b shows the simulated view of the North and Combination B Alternatives from Viewpoint 7.

Viewpoint 7

Ayer Road and Casey Road Intersection
Walla Walla County, Washington

Figure C-7b

Figure C-8a shows the view to the southwest from Viewpoint 8.

Viewpoint 8

Lower Monumental Road
Walla Walla County, Washington

Figure C-8a

Figure C-8b shows the simulated view of a routing alternative segment common to all action alternatives from Viewpoint 8.

Viewpoint 8

Lower Monumental Road
Walla Walla County, Washington

Figure C-8b

Figure C-9a shows the view to the south from Viewpoint 9.

Viewpoint 9

State Route 263
Walla Walla County, Washington

Figure C-9a

Figure C-9b shows the simulated view of both the North and Combination B Alternatives and a routing alternative segment common to all action alternatives from Viewpoint 9.

Viewpoint 9

State Route 263
Walla Walla County, Washington

Figure C-9b

Figure C-9c shows the simulated view of a routing alternative segment common to all action alternatives from Viewpoint 9.

Viewpoint 9

State Route 263
Walla Walla County, Washington

Figure C-9c

Appendix D

Living and Working Safely around High-Voltage Power Lines

BONNEVILLE POWER ADMINISTRATION

LIVING AND WORKING SAFELY

AROUND HIGH-VOLTAGE POWER LINES

2

High-voltage power lines can be just as safe as the electrical wiring in our homes — or just as dangerous. The key is learning to act safely around them.

This booklet is a basic safety guide for those who live and work around power lines. It deals primarily with nuisance shocks caused by induced voltages and with possible electric shock hazards from contact with high-voltage lines.

In preparing this booklet, the Bonneville Power Administration has drawn on more than 70 years of experience with high-voltage power lines. BPA operates one of the world's largest networks of long-distance, high-voltage lines, ranging from 69,000 volts to 500,000 volts. This system has more than 200 substations and more than 15,000 miles of power lines.

BPA's lines make up the main electrical grid for the Pacific Northwest. The grid delivers large blocks of power to substations located near load centers. Public and investor-owned utilities and rural cooperatives take delivery of the power at these points and deliver it to the ultimate customers.

BPA's lines cross all types of property: residential, agricultural, industrial, commercial and recreational.

If you have questions about safe practices near power lines, call BPA.

Due to safety considerations many of the practices suggested in this booklet are restrictive. This is because they attempt to cover all possible situations, and the worst conditions are assumed. In certain circumstances, the restrictions can be re-evaluated. To determine what practices are applicable to your case, contact BPA at 1-800-836-6619 or find the contact information for the local BPA office at *www.transmission.bpa.gov/LanCom/Real_Property.cfm*.

Using the Right-of-Way

Before a power line is built, BPA negotiates with the landowner for the right to cross the land as required for the construction, operation and maintenance of the line. Usually, BPA acquires right-of-way rights to construct, operate and maintain a power line and the right to keep the right-of-way clear of all structures, fire hazards, vegetation and any other use that may interfere with the operation or maintenance of the line. Most crops, less than 10 feet in height, can be grown safely under power lines. Orchards, Christmas trees and structure-supported crops (i.e., trellises) require special consideration.

Call BPA if you plan to use the right-of-way for any use.

BPA's "Landowner's Guide for Compatible Use of BPA Rights-of-Way" explains how to apply for permission to use a portion of a BPA right-of-way for approved purposes. This document can be found online at *www.transmission.bpa.gov/LanCom/Real_ Property.cfm* or by contacting BPA at 1-800-836-6619.

Construction and maintenance of any structures are specifically prohibited within a BPA right-of-way. Coordinating with BPA early in your planning process can keep you safe and avoid wasting time and money.

Most crops, less than 10 feet in height, can be grown safely under power lines.

General Safe Practices

BPA designs and maintains its facilities to meet or exceed the rules set forth in the National Electrical Safety Code. BPA provides information on safe practices because serious accidents involving power lines can be avoided if simple precautions are taken. Every kind of electrical installation — from the 110-volt wiring in your home to a 500,000-volt power line — must be treated with respect.

The most significant risk of injury from a power line is the danger of electrical contact. Electrical contact between an object on the ground and an energized wire can occur even though the two do not actually touch. In the case of high-voltage lines, electricity can arc across an air gap. The gap distance varies with the voltage at which the line is operated. Unlike the wiring in a home, the wires of overhead power lines are not enclosed by electrical insulating material.

The most important safe practice is this:

Avoid bringing yourself, or any object you are holding, too close to an overhead power line.

In other words, do not lift, elevate, build or pass under a power line with any object, equipment, facility or vehicle that could come close to the energized wires.

BPA does not recommend that anyone attempt to calculate how close they can come to a power line. As a general precaution, when under a line, never put yourself or any object any higher than 14 feet above the ground.

The National Electrical Safety Code specifies a minimum safe clearance for each operating voltage. BPA builds its lines so the clearance between the wires of a power line and the ground meets or exceeds the minimum safe clearance set forth in the code. Therefore, do not alter the ground elevation; without first applying to BPA, call 1-800-836-6619 to ensure safe distances are maintained.

Vehicles and large equipment that do not extend more than 14 feet in height, such as harvesting combines, cranes, derricks and booms, can be operated safely under all BPA lines that pass over roads, driveways, parking lots, cultivated fields or grazing lands.

For your safety, coordinate with BPA if you need to exceed the 14-foot limitation.

Possible Shock Hazards

The previous section discussed dangerous electrical contact conditions that can occur when getting too close to the high-voltage wires. This section

Farm equipment or large machinery 14 feet or less in height may be operated safely under all BPA lines in cultivated fields.

will discuss the possible electrical shock hazards that can occur when touching transmission towers or metallic objects near the power line but away from the high-voltage wires.

These types of shocks are caused by a voltage induced from the power line into the nearby metallic objects. Typically the shocks can be avoided when the nearby metallic objects are grounded or connected to earth. The severity of these shocks depends on the operating voltage of the power line, the distance from the conductor, the size or length of the object, its orientation to the line and how well the object is grounded.

Normally, shocks do not occur when BPA's guidance is followed (see the following sections). However, under certain conditions, non-hazardous nuisance shocks can still occur and possibly cause discomfort.

The severity of nuisance shocks can vary in sensation from something similar to a shock you might receive when you cross a carpet and then touch a door knob to touching the spark-plug ignition wires on your lawnmower or car. The nuisance shock, however, would be continuous as long as you are touching the metallic object. Such objects include vehicles, fences, metal buildings or roofs and irrigation systems that are near the line or parallel the line for some distance.

The possibility of nuisance shocks can be eliminated by grounding metal pipe when unloading near BPA lines.

Irrigation Systems

All types of irrigation systems have been operated safely near BPA power lines for years. Nonetheless, caution should be used in storing, handling and installing irrigation pipe, and in operating spray irrigation systems near power lines.

To avoid electrical contact with power lines, two very important safety practices should be observed at all times:

1. While moving irrigation pipe under or near power lines, keep the equipment in a horizontal position to keep it away from overhead wires.
2. Electricity can be conducted through water so never allow the irrigation system to spray a continuous stream onto power lines or towers.

In addition, central pivot circular irrigation systems installed near or under power lines can develop hazardous shock potentials during operation and maintenance. To eliminate these hazards:

- Provide a good electrical ground for the pivot point.
- Do not touch the sprinkler pipe or its supporting structures when the system is operating under or parallel to and near a power line.
- Perform repairs/maintenance of the system with the sprinkler pipe perpendicular to the power line.

For more information on storing, handling, installing or operating an irrigation system on BPA rights-of-way and to apply to use BPA's right-of-way please contact BPA at 1-800-836-6619. A copy of "Guidelines for Installation and Operation of Irrigation Systems" will be provided when you contact BPA for approval. This document describes methods for safely installing and operating an irrigation system under high-voltage power lines. This document also can be obtained at *www.transmission.bpa.gov/LanCom/Real_ Property.cfm.*

Irrigation pipe should be moved in a horizonal position under and near all power lines to keep it away from the lines overhead.

Underground Pipes, Telephone Cables and Electric Cables

Underground pipes and cables may be compatible with power lines provided installation and maintenance are done properly. Pipes and cables should not be installed closer than 50 feet to a BPA tower, any associated guy wires or grounding systems. These grounding systems are long, buried wires that are sometimes attached to the structures and can run up to 300 feet along the right-of-way. These grounding systems are not visible above ground and must be located before installing any underground utilities.

Proper positioning of underground utilities is required to prevent an accident in an extreme case when an unusual condition might cause electricity to arc from the high-voltage wire to the tower and then to ground. This could produce a dangerous voltage on underground piping or cable system. Contact BPA at 1-800-836-6619 to apply before installing any underground utilities within a BPA power line right-of-way.

Fences

BPA strongly discourages locating fences within the right-of-way as they can cause a potential safety hazard and an access problem (particularly in high-density subdivisions). Contact BPA at 1-800-836-6619 if you are interested in submitting an application to place a fence on the right-of-way using the guideline that the location must be a minimum of 50 feet from BPA structures as well as other considerations discussed below.

Wire Fences

Barbed wire and woven wire fences insulated from ground on wood posts can assume an induced voltage when located near power lines. If you are having a shock-related problem, call BPA for an investigation. The fence may need to be grounded if:

- it is located within the right-of-way;
- it parallels the line within 125 feet of the outside wire and is longer than 150 feet; or
- it parallels the line 125 to 250 feet from the outside wire and is longer than 6,000 feet.

These fences should be grounded at each end and every 200 feet with a metal post driven at least 2 feet into the ground. Attach all wire strands of the fence to the metal post. Install the grounding posts at least 50 feet from the nearest transmission tower. If shocks are experienced when contacting a fence or gate, or if you have any questions about the need for grounding, call BPA at 1-800-836-6619.

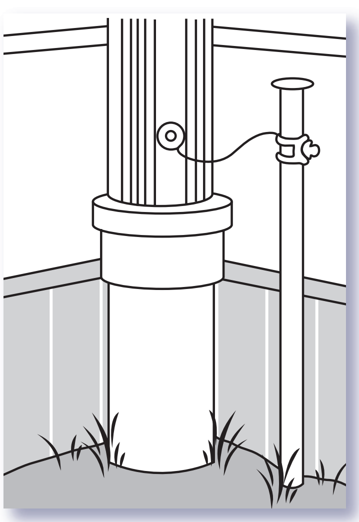
Electric Fences

In situations where a fence cannot be grounded (electric fences, for example), a filter may be installed to remove voltages induced by the power lines. BPA may provide this filter after an investigation has been conducted. Do not use fence chargers that are not approved by Underwriters' Laboratories, Inc. They may carry voltages and currents that are hazardous to anyone touching the fence — even if power lines are not present. For more information about fences, fence chargers or filters, call BPA at 1-800-836-6619.

Buildings

This section applies to buildings outside BPA's rights-of-way, since BPA prohibits buildings within a right-of-way.

Buildings located off BPA's rights-of-way may collect an induced voltage. This voltage is often drained through the building's plumbing, electrical service, metal sheeting or metal frame. If the voltage does not drain through the systems described above, then it can result in a nuisance shock situation.



Example of grounding a metal building at a down spout.

BPA recommends grounding metallic components on buildings near a power line when:

- the building is within 100 feet of the outside wire;
- the building has more than 2,000 square feet of metal surface and is within 100 to 150 feet of the outside wire; or
- the building is used to store flammable materials and is within 250 feet of the outside wire.

BPA will assist in grounding metallic objects after receiving a request and an investigation has been conducted. Call BPA at 1-800-836-6619 if you are having shock-related problems or if you have any question on grounding a building.

Vehicles

Under some high-voltage lines, vehicles can collect an induced voltage. This is particularly true if the vehicle is parked on a nonconductive surface such as asphalt or dry rock. You can drain the voltage from your vehicle to the ground by attaching a chain that reaches the ground or by leaning a metal bar against your vehicle. The only way to be sure you won't get shocked is to park your car away from the high-voltage power line.

BPA has specific restrictions for parking and roads within the right-of-way to keep possible shocks at a low level. Contact BPA at 1-800-836-6619 to apply before locating roads and parking areas within the BPA right-of-way.

Refueling vehicles is not allowed on BPA rights-of-way because there is a chance that a spark from an induced voltage could ignite the fuel.

Lightning

Lightning will usually strike the highest nearby object, which might be a power line tower or wire. Transmission facilities are designed to withstand lightning strikes by channeling them to ground at the tower.

Play it safe. Stay away from power lines and other tall objects during electrical storms. Lightning is dangerous if you are standing near where it enters the ground.

Fires

Smoke and hot gases from a large fire can create a conductive path for electricity. When a fire is burning under a power line, electricity could arc from the wire, through the smoke and to the ground, endangering people and objects near the arc. BPA does not permit burning within the right-of-way.

Field burning and other large fires in and around power lines can damage power lines and cause power outages. Water and other chemicals used to extinguish those fires should never be directed toward a power line.

Contact BPA at 1-800-836-6619 if you need to burn near a BPA right-of-way.

A fire burning under a power line can create a dangerous situation. Stay away from lines if a fire is nearby.

Kite Flying and Model Airplanes

BPA strongly discourages anyone from flying a kite or model airplane anywhere near a power line. The electricity from the line can travel through the string or hand line and electrocute a person on the other end. If your kite or model airplane is about to touch a power line, drop the string or hand line instantly, before it touches the line. Do not try to pull the kite or airplane down or climb up after it. Call the nearest electric utility.

Vandalism, Shooting and Trespassing

People entering high-voltage electrical facilities, such as substations and power line rights-of-way, for the purpose of vandalism or theft, run the risk of serious injury or death. For example, when hunting, do not shoot at transmission facilities. Gunshot damage can cause flashovers or may cause the wire to fall to the ground. This could be a serious hazard to anyone close to the power line. It could also cause a power outage and a fire.

Removal of equipment from substations or power line facilities can result in unsafe operating conditions and put people nearby at risk of serious injury or death. Those who cause willful damage to BPA transmission facilities or associated property can be prosecuted by the federal government, the property owner, or both.

Please report damage to transmission facilities to BPA's Crime Witness Program at 1-800-437-2744. The Crime Witness Program allows you to confidentially report an illegal activity that you witness against BPA's transmission system, property or personnel. This includes:

- Shooting at power lines, transmission towers or substation equipment.

- Dumping any waste or material on BPA property.
- Vandalism to BPA property, buildings and vehicles.
- Theft of BPA equipment, supplies, tools or materials.

This program offers rewards of up to $25,000 for information leading to the arrest and conviction of the perpetrator(s).

Tall Objects

Facilities

Temporary or permanent facilities within the right-of-way such as, light standards, signs, above-ground utilities, etc., can create unsafe situations when constructed too close to BPA power lines and structures. Permissable heights for such facilities can vary depending on site specfic conditions. Call BPA at 1-800-836-6619 to apply for these uses.

Activities

As a precautionary practice, do not raise any metal object more than 14 feet in the air underneath a power line. For example, when you mount an antenna on a vehicle that you plan to operate on a BPA right-of-way, do not let it extend more than 14 feet above the ground.

Before you sail a boat on a lake or river, check the allowable clearance under any power line. We recommend that all masts or guy wires above the deck be connected electrically to an underwater metallic part such as the keel or centerboard.

This precaution, which protects against lightning or accidental contact with a power line, may save your life.

Remember, if you plant, dig or build within the right-of-way an application is required. Any activities or use with a reach capacity greater than 14 feet (eg. cranes, dump trucks, irrigation systems, etc.) may cause safety concerns. Please specifically identify these uses and equipment in your application. Contact BPA to apply at 1-800-836-6619.

Cutting trees within power line rights-of-way can be dangerous. It is safer to have BPA do it for you.

Pools

BPA does not permit the building of swimming pools within BPA rights-of-way because it impedes our ability to operate and maintain the power line and presents a potential safety hazard to the public. Hazards range from possible electrical contact with the wires (with pool skimmers or rescue poles, for example) to dangers that can be encountered during and after lightning strikes on transmission facilities.

Climbing

Climbing on power line towers or guy wires can be extremely hazardous. Do not do it under any circumstance. It is dangerous and illegal.

Pacemakers

Under some circumstances, voltages and currents from power lines and electrical devices can interfere with the operation of some implanted cardiac pacemakers. However, we know of no case where a BPA line has harmed a pacemaker patient.

As a precaution, people who may have reason to be very near high-voltage facilities should consult with a physician to determine whether their particular implant may be susceptible to power line interference.

If a person with a pacemaker is in an electrical environment and the pacemaker begins to produce a regularly spaced pulse that is not related to a normal heartbeat, the person should leave the environment and consult a physician.

Trees and Logging

No logging or tree cutting should be done within BPA's right-of-way without first contacting BPA at 1-800-836-6619 to apply. In many cases, BPA owns the timber within its rights-of-way.

Additionally, logging or tree cutting near power lines can be very hazardous and requires special caution. Since trees conduct electricity, if one should fall into or close to a power line, the current could follow the tree trunk to the ground and endanger anyone standing near its base. Here are two simple rules:

1. If you come upon a tree that has fallen into a power line, stay away from it.

2. If you accidentally cause a tree to fall into a power line, run for your life! Do not go back to retrieve your saw or equipment. Call BPA or your local utility immediately.

If you have trees either on or close to the right-of-way that need to be cut, contact BPA at 1-800-836-6619. It is unsafe to do it yourself.

Since power line rights-of-way usually are not owned by BPA but are acquired through easements from landowners, trees or logs stacked within or alongside the rights-of-way are not public property. People removing trees and logs without permission are stealing and can be prosecuted.

Explosives

If you plan to detonate explosives near a BPA power line, apply to BPA well in advance by calling 1-800-836-6619 or find the contact information for your local office at *www.transmission.bpa.gov/LanCom/Real_ Property.cfm.* BPA will tell you if any special precautionary measures must be taken at a particular blasting site.

Any blasting near or within BPA rights-of-way must not damage any BPA facilities or permitted uses within the rights-of-way. Do not use electric detonating devices when blasting within 1,000 feet of a power line. Use of non-electric methods of detonation will avoid the danger of accidentally discharging an electric blasting cap due to induced voltages from energized transmission facilities.

Towers and Wires

- Do not climb towers.
- Do not shoot or otherwise damage transmission facilities.
- Never touch a fallen wire.
- Do not attempt to dismantle towers.
- Do not attach anything to towers.
- Stay away from towers and lines during extreme windstorms, thunderstorms, ice storms or under other extreme conditions.

Preventive measures include:

- Report any suspicious activities to BPA at 1-800-437-2744 or to your nearest electrical utility.
- Stay away from and report damage to transmission facilities to BPA at 1-800-437-2744 or your nearest electrical utility.
- Stay away from and report broken, damaged or abnormally low-hanging wires to BPA at 1-800-437-2744 or your nearest electrical utility.

Conclusion

We live in an age of electric power. Almost everything we do requires it. Consequently, high-voltage power lines have become about as commonplace as the wiring in our homes. Nevertheless, every year people are killed or seriously injured by power lines and home wiring. In almost every case, lives could have been saved and injuries avoided if the basic safety practices outlined in this booklet had been followed. BPA and your local utilities make every effort to design and build power lines that are safe to live and work around. Ultimately, however, the safety of high-voltage lines depends on people behaving safely around them. No line can practicably be made safe from a person who, through ignorance or foolishness, violates the basic principles of safety. Please take time now to learn the practices outlined in this booklet and share your knowledge with your family, friends and colleagues. Your own life, or that of a loved one, might well hang in the balance.

Related BPA Publications and Guidelines

For more information, call BPA at 1-800-836-6619 for the following publications:

1. **"Landowner's Guide for Compatible Use of BPA Rights-of-Way"** (DOE/BP-3657)
2. **"Landowner's Guide to Trees and Transmission Lines"** (DOE/BP-3076)
3. **"Keeping the Way Clear for Better Service"** (DOE/BP-2816)
4. **"Guidelines for Installation and Operation of Irrigation Systems"**

These documents also can be found at *www.transmission.bpa.gov/LanCom/Real_Property.cfm.*

Appendix E

Electrical Effects

CENTRAL FERRY – LOWER MONUMENTAL 500-kV TRANSMISSION LINE PROJECT

APPENDIX E

ELECTRICAL EFFECTS

December 2009

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for

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ELECTRICAL EFFECTS FROM THE PROPOSED CENTRAL FERRY – LOWER MONUMENTAL 500-kV TRANSMISSION PROJECT

1.0 Introduction

The Bonneville Power Administration (BPA) is proposing to build a 40-mile 500-kilovolt (kV) transmission line from the new Central Ferry substation in Garfield County, Washington to the existing BPA Lower Monumental Substation near the Lower Monumental Dam on the Snake River in southeastern Washington. The proposed line is designated as the Central Ferry – Lower Monumental line.

The purpose of this report is to describe and quantify the electrical effects of the proposed Central Ferry - Lower Monumental 500-kV transmission line. These effects 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 500-kV lines already present in the area of the proposed route for the Central Ferry - Lower Monumental line. Therefore, the levels of these quantities for the proposed line are computed and compared with those from the existing lines in Washington and elsewhere.

There are four proposed routing alternatives for the new transmission line (as described below and shown in Figure 1). For the purposes of assessing electrical effects, all four routing alternatives are equivalent, since the line design and operating characteristics would be the same for all routing alternatives.

- North Alternative - This routing alternative is approximately 40 miles in length. From the new Central Ferry Substation, the line would proceed southwesterly and westerly for about 12 miles. This first segment of the route would run mostly parallel to and about 1200 feet to one half-mile south of BPA's two existing Little Goose – Lower Granite lines. At this point, the route would angle away from these lines and proceed in a southwesterly direction for about 6 miles before crossing the Tucannon River directly north of the Town of Starbuck. From the Tucannon River crossing, the route would continue southwest and west for about 3 miles before angling northwest for about 5 miles to a point approximately 1500 feet south of BPA's two existing Lower Monumental - Little Goose lines. From this point, the route would proceed west for about 14 miles to BPA's existing Lower Monumental Substation. Much of this latter segment of the route would run parallel to and approximately 1500 feet south of the existing lines.

- South Alternative - This routing alternative is approximately 38 miles in length. From the new Central Ferry Substation, the line would proceed southwesterly for about 3 miles. This first segment of the route would run mostly parallel to and approximately 1200 feet south of BPA's two existing Little Goose – Lower Granite lines. At this point, instead of following these existing lines as they angle to the west, the route would continue southwesterly and then westerly for about 15 miles before crossing the Tucannon River directly north of the Town of Starbuck. From the Tucannon River crossing, the route would continue westerly for about 20 miles to BPA's existing Lower Monumental Substation.

- Combination A of the North and South Alternatives – This routing alternative is approximately 38 miles in length. The line would travel from Central Ferry Substation along the North Alternative until the Tucannon River where it would then travel along the South Alternative to Lower Monumental Substation.

- Combination B of the North and South Alternatives – This routing alternative is approximately 40 miles in length. The line would travel from Central Ferry Substation along the South Alternative until the Tucannon River where it would then travel along the North Alternative to Lower Monumental Substation.

The proposed line, regardless of routing alternative, would be built entirely on new right-of-way. Sections of the alternatives to the north would parallel existing 500-kV lines in the area, but would have a separation of at least 1200 feet to meet reliability criteria established by the Federal Energy Regulatory Commission (FERC). At a separation distance of 1200 feet, the electrical effects from a transmission line would not be discernable. The proposed routes would be closer to existing transmission lines only for short distances (< 1 mile) where the line would terminate at the Central Ferry and Lower Monumental substations. Electrical effects analysis was not performed for these sections because of their short lengths and the lack of any dwellings or other areas frequented by the public at these locations. Thus, the configuration of interest for this report is the proposed line alternative with no parallel 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 proposed line, 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 Central Ferry -Lower Monumental 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 for each three-phase circuit and the contribution of induced image currents in the conductive earth is not included. Peak current and power flow direction for the proposed line were provided by BPA and are based on the projected system normal annual peak power loads in 2019.

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 existing corridor. 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). 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 over a span of 52 ft. (15.9 m). 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 proposed routes of the Central Ferry -Lower Monumental transmission line, such conditions are expected to occur about 2 percent of the time during a year, based on hourly records for the Whitman Mission near Walla Walla during five years with complete records (1995-96, 1998, 2000 and 2005). Corona activity also increases with altitude. For purposes of evaluating corona effects from the proposed line, an altitude of 1300 ft. (396 m) was assumed.

All of the proposed transmission line alternatives will traverse arid pasture and agricultural land that is sparsely populated. Only three structures, identified as farm buildings, are within 1200 feet of any of the alternatives, with the nearest being 200 feet from centerline. Six residences, seven farm buildings and ten structures of unknown usage lie between 1200 feet and one mile of the proposed line alternatives. All these latter structures are located beyond distances where electrical effects from transmission lines would have an impact.

2.0 Physical Description

2.1 Proposed Line

The proposed 500-kV transmission line would be a three-phase, single-circuit line with the phases arranged in a delta (triangular) configuration. Voltage and current waves are displaced by 120° in time (one-third of a cycle) on each electrical phase. BPA provided the physical and operating characteristics of the proposed and existing lines. The electrical characteristics and physical dimensions for the configuration of the proposed line are shown in Figure 2, and summarized in Table 1.

The maximum phase-to-phase voltage would be 550 kV and the average voltage would be 540 kV. The maximum electrical current on the line would be 1700 amperes (A) per phase, based on the BPA projected system annual peak load in 2019 as the base year. The load factor for this line will be about 0.35 (average load = peak load x load factor).

Each phase of the proposed 500-kV line will have three 1.300-inch diameter conductors (ACSR: steel-reinforced aluminum conductor) arranged in an inverted triangle bundle configuration with approximately 18-in. (43.3 cm) spacing between conductors. The horizontal phase spacing between the lower conductor positions would be 46 ft. (14 m). The vertical spacing between the conductor positions would be 31.5 ft. (9.6 m).

Minimum conductor-to-ground clearance would be 35 ft. (10.7 m) at a conductor temperature of 122°F (50°C), which represents heavy operating conditions and high ambient air temperatures; clearances above ground would be greater under normal operating temperatures. The average clearance above ground along a span will be approximately 52 ft. (15.9 m); this value was used for corona calculations and to estimate average electric and magnetic fields along the line. At road crossings, the ground clearance would be at least 50 ft. (15.2 m). The 35-ft. (10.7-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, 2002). The final design of the proposed line could entail larger clearances. The right-of-way width for the proposed line is 150 ft. (46 m).

2.2 Existing Lines

The proposed single-circuit 500-kV line would be on new right-of-way. There are no existing parallel lines that would be on the same right-of-way as the proposed line along the proposed routing alternatives except for a few spans at the ends of the proposed line where it enters the Central Ferry and Lower Monumental substations. Consequently, no existing transmission lines are included in the analysis of electrical effects.

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 hertz (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 field exerts 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, 2002). 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 2019, 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 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 2 shows the calculated values of electric field at 3.28 ft. (1 m) above ground for the proposed Central Ferry - Lower Monumental 500-kV transmission-line configuration used for all alternatives. The peak value on the right-of-way and the value at the edge of the right-of-way are given for the proposed configuration at minimum conductor clearance and at the estimated average clearance over a span. Figure 3 shows lateral profiles of the peak electric field from the proposed line for the minimum (35-ft.) and average (52-ft.) conductor heights.

The calculated peak electric field expected on the right-of-way of the proposed line is 8.9 kV/m. For average clearance, the peak field would be 4.6 kV/m. As shown in Figure 3, 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. The largest values expected at the edge of the right-of-way of the proposed line would be 2.4 kV/m.

3.4 Environmental Electric Fields

The electric fields associated with the proposed Central Ferry - Lower Monumental 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. In a 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 (IIT 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. Electric-field levels in public buildings such as shops, offices, and malls appear to be comparable with levels in residences.

In a survey of 1,882 volunteers from utilities, electric-field exposures were measured for 2,082 work days 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 all alternative routings of the proposed Central Ferry - Lower Monumental 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. 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 will depend on the relative electrical phasing of the conductors and the direction of power flow.

4.3 Calculated Values for Magnetic Fields

Table 2 gives the calculated values of the magnetic field at 3.28 ft. (1 m) height for all alternative routings of the proposed 500-kV transmission-line. Field values on the right-of-way and at the edge of the right-of-way are given for projected maximum currents and minimum clearance during system annual peak load in 2019. Field levels at the same locations for average current and average conductor clearance are also given. . The maximum currents are 1700 A on each of the three phases of the proposed line. Figure 4 shows lateral profiles of magnetic fields under these same current and clearance conditions for the proposed 500-kV transmission line. 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 35 percent of the maximum values. The levels for maximum current and minimum clearance shown in the figure represent the highest magnetic fields expected under the proposed Central Ferry – Lower Monumental 500-kV line. Average fields along the line over a year would be considerably reduced from the peak values, as a result of increased clearances and reduced current.

The maximum calculated 60-Hz magnetic field expected at 3.28 ft. (1 m) above ground for the proposed line is 279 mG. This peak field is calculated for the maximum current of 1700 A, with the conductors at a height of 35 ft. (10.7 m). The peak magnetic field for the average clearance of 52 ft. (15.9 m) and average current of 595 A would be 54 mG for the proposed line.

At the edge of the right-of-way of the proposed line, the calculated magnetic field for maximum current load conditions is 75 mG. The magnetic field falls off rapidly as distance from the line increases. At a distance of 200 ft. (61 m) from the centerline of the proposed line, the field would be 11 mG for maximum current conditions. The average field at this location would be about 4 mG.

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 Central Ferry -Lower Monumental 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. 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 only present 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. The technology of newer energy-efficient appliances is likely to reduce fields from appliances further.

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 office equipment. 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 old style VDTs (n = 6) and 1.1 mG for those not using VDTs (n = 3).

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.

Fields near distribution lines and equipment are generally lower than those near transmission lines. Measurements in Montreal indicated that typical fields directly above underground distribution systems were 5 to 19 mG (Heroux, 1987). 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. 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 line would be comparable to or less than those from existing 500-kV lines in Washington and elsewhere. On and near the right-of-way of 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 assessment of the proposed 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 infrequently under the proposed Central Ferry -Lower Monumental 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 below the 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 (2002) 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 50 ft. (15.2 m) over road crossings along the route to meet the BPA requirement of electric fields less than 5.0 kV/m at road crossings. 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 5 kV/m (at 3.28-foot height) would be 4.5 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, but are not expected on the roads crossed by the proposed line. 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 less than 4.5 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 BPA 5-kV/m and NESC 5-mA criteria are met. 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 electric fields higher than will occur under the proposed line, 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. Even so, BPA recommends that vehicles should not be refueled under the proposed line unless specific precautions are taken to ground the vehicle and the fueling source (USDOE, 2001).

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.

The electric fields from the proposed 500-kV line would be comparable to those from existing 500-kV lines in the project area and elsewhere. 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 have been observed to cause distortion of the image on older VDTs and computer monitors that employ cathode ray tubes. This can occur in fields as low as 10 mG, depending on the type and size of the monitor (Baishiki et al., 1990; Banfai et al., 2000). Generally, the problem arose when computer monitors were in use near electrical distribution facilities in large office buildings. Display devices using flat-panel technologies, such as liquid-crystal or plasma displays are not affected.

Interference from magnetic fields can be eliminated by shielding the affected device or moving it to an area with lower fields. 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.

The magnetic fields from the proposed line will be comparable to those from existing 500-kV lines in the area of the proposed 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, 2002), 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, 2001).

Field limits or guidelines have been adopted in several states and countries and by national and international organizations (Maddock, 1992). 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.

General guidelines for EMF exposure have been established for occupational and public exposure by national and international organizations. Three sets of such guidelines are described in Table 3.

The American Conference of Governmental Industrial Hygienists (ACGIH) sets guidelines (Threshold Limit Values or TLV) for occupational exposures to environmental agents (ACGIH, 2008). 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, 2008).

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).

More recently the International Committee on Electromagnetic Safety (ICES) under the auspices of the IEEE has established exposure guidelines for 60-Hz electric and magnetic fields (ICES, 2002). The ICES recommended limits for occupational exposures are 20 kV/m for electric fields and 27,100 mG for magnetic fields. The recommended limits for the general public are lower: 5 kV/m for the general public, except on power line rights-of-way where the limit is 10 kV/m; and 9,040 mG for magnetic fields.

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 older pacemakers still in use could be affected by 60-Hz fields from transmission lines. There were also numerous models of pacemakers that were not affected by fields 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, lacking additional information about their pacemaker, 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, 2008). Additional discussion of interference with implanted devices is given in the accompanying technical report on health effects (Exponent, 2009).

There are currently no national standards in the United States for 60-Hz electric and magnetic fields. The state of Washington does not have guidelines for electric or magnetic fields from transmission lines. However, 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. Florida and New York have established regulations for magnetic fields. These regulations are summarized in Table 4.

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.

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, but would be below IEEE guideline limits. The magnetic fields from the proposed line would be below the ACGIH, ICNIRP, and IEEE limits.

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 4). 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.

Audible noise 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 5 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 BPA design criterion for corona-generated audible noise (L_{50}, foul weather) is 50 ±2 dBA at the edge of the ROW (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 p.m. and 7 a.m.

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 proposed 500-kV line will produce some noise under foul weather conditions.

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 about 2 percent of the time during the year (175 hours). 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 1.30-inch diameter conductors per phase which will yield acceptable corona levels.

7.3 Predicted Audible Noise Levels

Audible noise levels are calculated for average voltage and average conductor heights for fair- and foul-weather conditions. The predicted levels of corona-generated audible noise for all routing alternatives of the proposed line operated at a voltage of 540 kV are: median level (L_{50}) during foul weather at the edge of the right-of-way is 49 dBA and maximum level (L_5) during foul weather at the edge of the right-of-way is 53 dBA.

During fair-weather conditions, which occur about 98 percent of the time, audible noise levels at the edge of the right-of-way 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 to not be perceived even during foul weather when ambient noise is higher.

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 and well below 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 49-dBA level would meet the BPA design criterion and, hence, the Washington Administrative Code limits for transmission lines. The computed annual L_{dn} level for transmission lines operating in areas with 2 percent foul weather is about $L_{dn} = L_{50} - 6$ dB (Bracken, 1987). Therefore, assuming such conditions in the Central Ferry Transmission Line Project area, the estimated L_{dn} at the edge of the right-of-way would be approximately 43 dBA, which is below the EPA L_{dn} guideline of 55 dBA.

7.5 Conclusion

Along the proposed line, there could be increases in the perceived noise above ambient levels during foul weather at the edges of the right-of-way. The corona-generated noise during foul weather would 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 from the proposed line 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 proposed 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 bundle of three 1.3-inch diameter conductors used in the design of the proposed 500-kV line will 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 (Federal Communications Commission, 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" (Federal Communications Commission, 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 broadcast 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

The predicted L_{50} fair-weather RI level at 100 ft. (30 m) from the outside conductor is 40 dBμV/m for 540-kV line operation. This level is compliant with the IEEE guideline level. Median foul-weather levels would be about 17 dB higher than the fair-weather levels.

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

The foul-weather TVI level predicted at 100 ft. (30 m) from the outside conductor of all routing alternatives of the proposed line operating at 540 kV is 23 dBμV/m. This is comparable to or lower than that from existing 500-kV lines in Washington.

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. The absence of residences within 1200 feet of the proposed line makes it very unlikely that any type of TVI will occur along the route.

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 or higher, 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, or lower, than those that already exist near 500-kV lines and no impacts of corona-generated interference on radio, television, or other reception are anticipated. Furthermore, if interference should occur, there are various methods for correcting it; BPA has a program to respond to legitimate complaints.

9.0 Other Corona Effects

Corona is visible as a bluish glow or as bluish plumes. On the proposed 500-kV line, corona levels would be very low, so that corona on the conductors would be observable only under the darkest conditions and only with the aid of binoculars, if at all. Without a period of adaptation for the eyes and without intentional looking for the corona, it would probably 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 from existing 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 2.4 kV/m. Clearances at road crossings would be increased to reduce the peak electric-field value to 5 kV/m or less.

Under maximum current conditions, the maximum magnetic fields under the proposed line would be 279 mG; at the edge of the right-of-way the magnetic field would be 74 mG. Under average current and clearance conditions the peak magnetic field would be 52 mG on the right-of-way and 20 mG at the edge of the right-of-way.

The electric fields from the proposed line would meet regulatory limits for public exposure in some states and guidelines set established by IEEE. However, the electric fields from the line could exceed the regulatory limits or guidelines for peak fields established in some states and by ICNIRP. The magnetic fields from the proposed line would be within the regulatory limits of the two states that have established such limits and below the guidelines for public exposure established by ICNIRP and IEEE. 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. The absence of any residences closer than 1200 feet (366 m) to the line make it very unlikely that interference would occur. However, if legitimate complaints arise, BPA has a mitigation program.

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Table 1: Physical and electrical characteristics of proposed Central Ferry – Lower Monumental 500-kV transmission line for all routing alternatives.

Description	Proposed Line **Central Ferry – Lower Monumental 500-kV**	**Existing Corridor None**
Voltage, kV Maximum/Average[1]	550/540	–
Current, A Peak/Average	1700/595	–
Electric Phasing	ABC	–
Clearance, ft. Minimum/Average[1]	35/52	–
Centerline distance to edge of ROW, ft.	75	–
Tower configuration	Delta	–
Phase spacing, ft.	46H, 31.5V	–
Conductor: #/Diameter, in.	3/1.3	–

1 Average voltage and average clearance used for corona calculations.

Table 2: Calculated electric and magnetic fields for the proposed Central Ferry – Lower Monumental 500-kV line for all routing alternatives operated at maximum voltage and maximum current. Configuration is described in Table 1.

Clearance	Minimum	Average
Electric Field		
Peak field, kV/m	8.9	4.6
Edge of ROW, kV/m	2.4	2.3
Magnetic Field		
Peak field, mG	279	52
Edge of ROW, mG	74	20

Table 3: Electric- and magnetic-field exposure guidelines

ORGANIZATION	TYPE OF EXPOSURE	ELECTRIC FIELD, kV/m	MAGNETIC FIELD, mG
ACGIH	Occupational	25[1]	10,000
ICNIRP	Occupational	8.3[2]	4,200
	General Public	4.2	833
IEEE	Occupational	20	27,100
	General Public	5[3]	9,040

[1] Grounding is recommended above 5 –7 kV/m and conductive clothing is recommended above 15 kV/m.
[2] Increased to 16.7 kV/m if nuisance shocks are eliminated.
[3] Within power line rights-of-way, the guideline is 10 kV/m.

Sources: ACGIH, 2008; ICNIRP, 1998; IEEE, 2002b

Table 4: 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 high voltage direct current (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)[3]	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
3 At highway and private road crossings, respectively
Source: USDOE, 1996

Table 5: Common noise levels

Sound Level, dBA	Noise Source or Effect
130	Threshold of pain
110	Rock-and-roll band
80	Truck at 50 ft. (15.2 m)
70	Gas lawnmower at 100 ft. (30 m)
60	Normal conversation indoors
50	Moderate rainfall on foliage
49	L_{50} at edge of proposed 500-kV right-of-way during rain
40	Refrigerator
25	Bedroom at night
0	Hearing threshold

Adapted from: USDOE, 1985; USDOE, 1996.

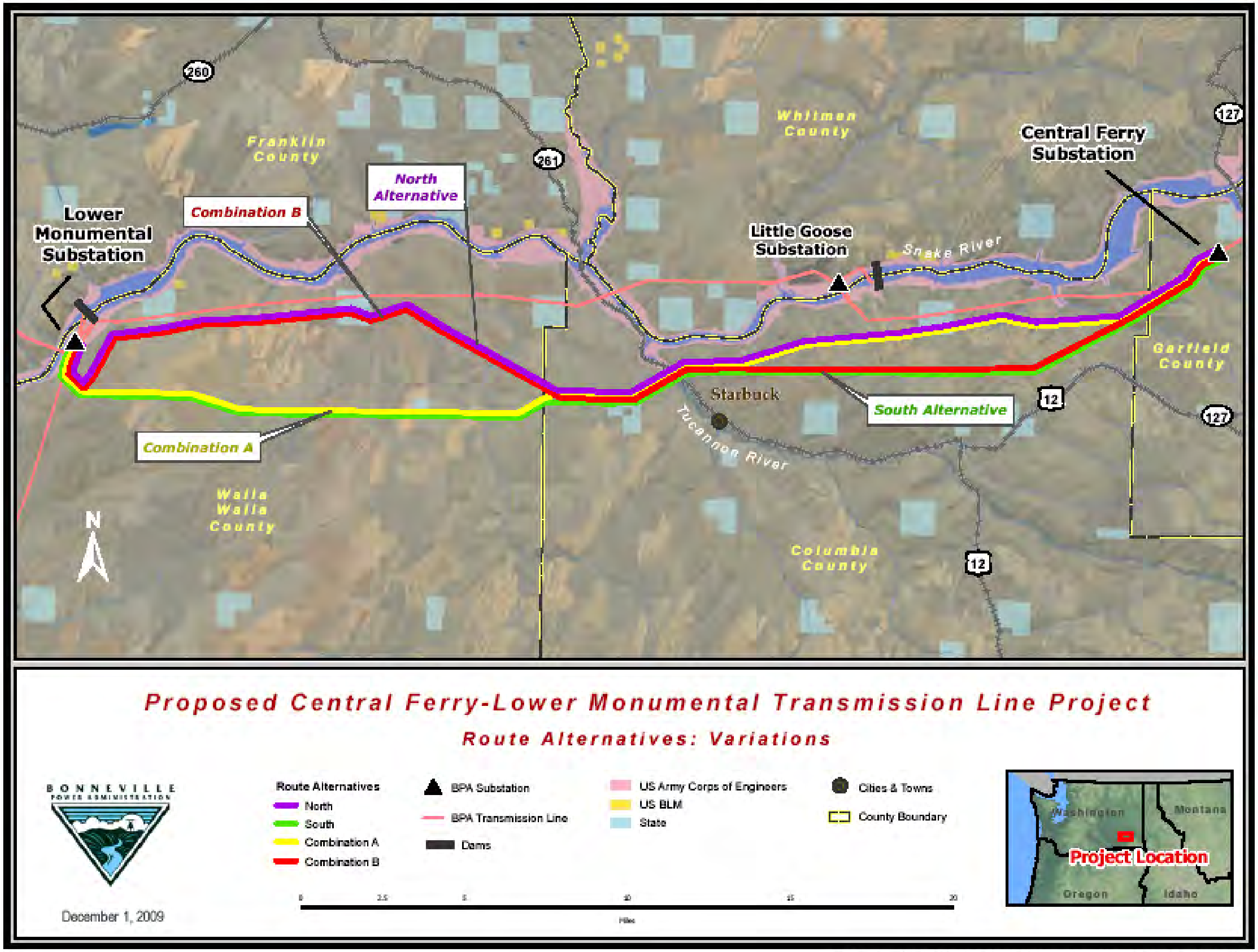

Figure 1: Central Ferry – Lower Monumental transmission line project routing alternatives

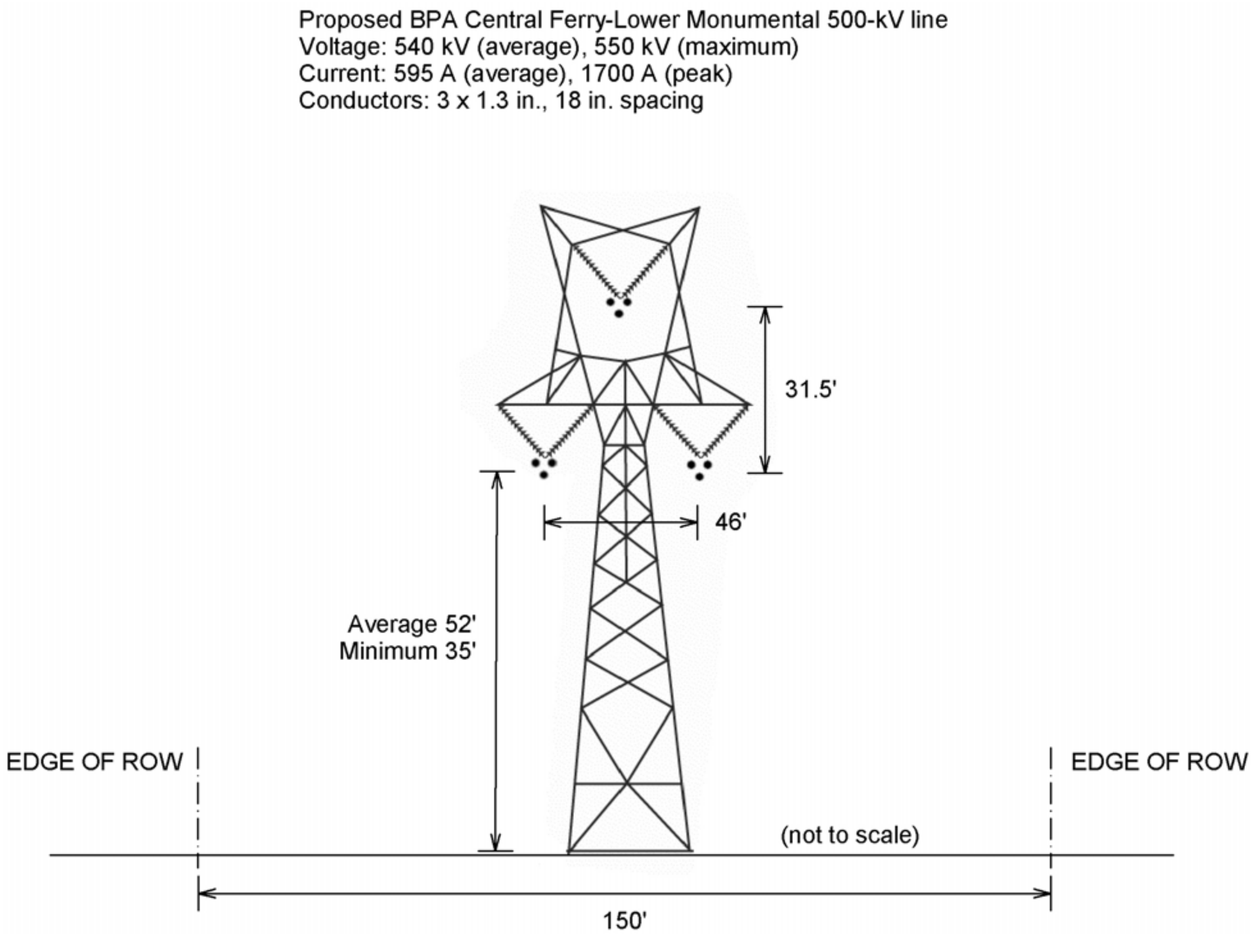

Figure 2: Configuration for proposed Central Ferry – Lower Monumental 500-kV transmission line for all routing alternatives

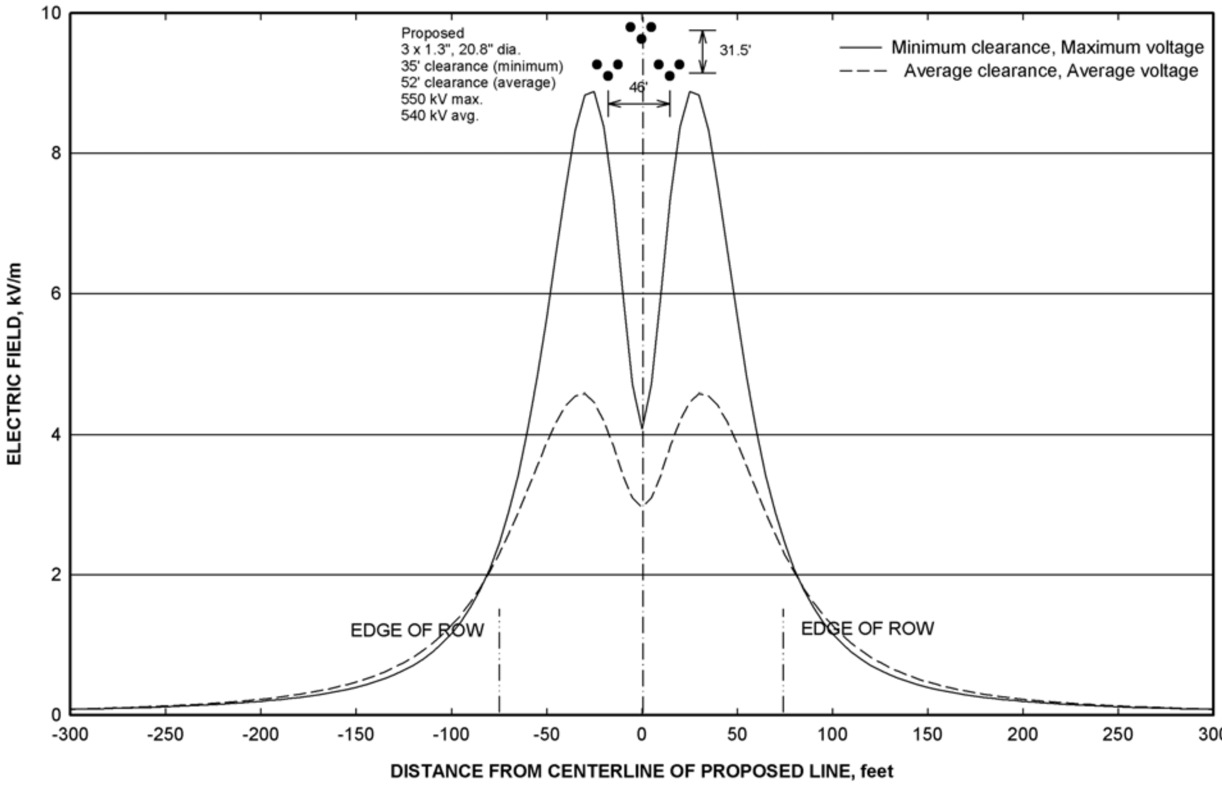

Figure 2: Electric-field profiles for all routing alternatives of the proposed Central Ferry – Lower Monumental 500-kV line: Fields for maximum voltage with minimum and average clearances are shown.

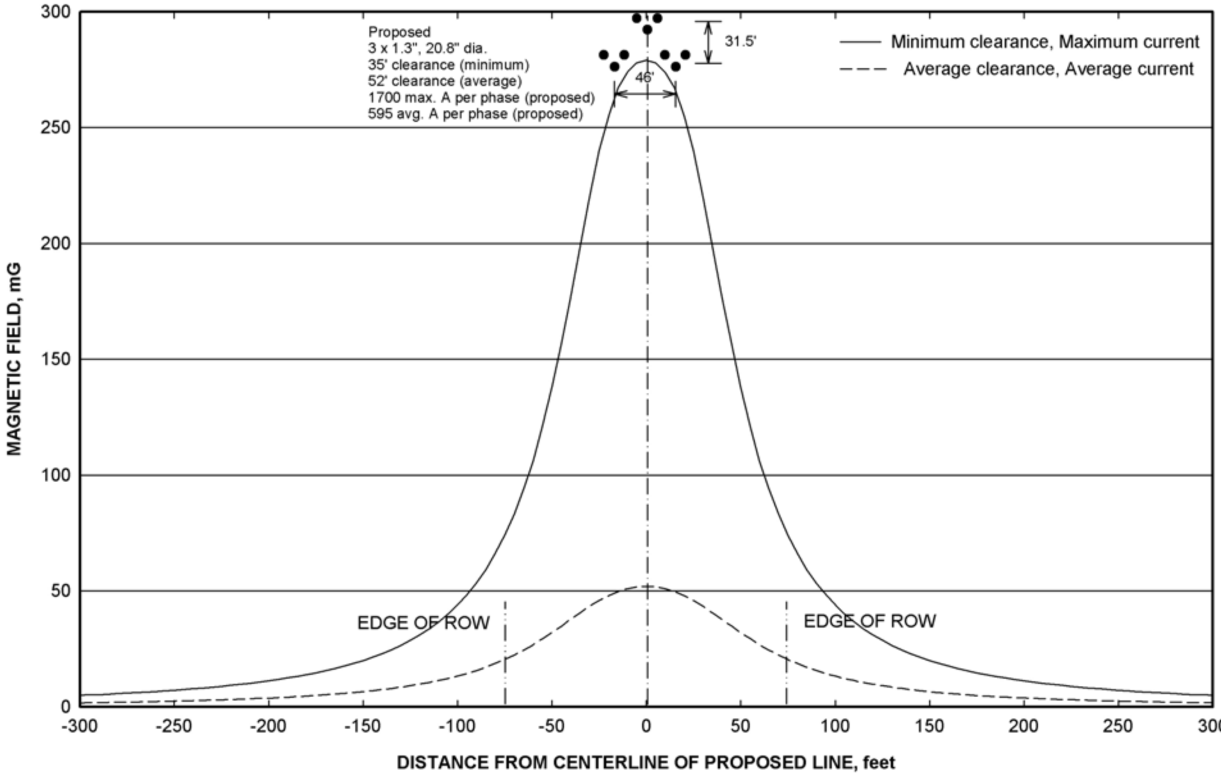

Figure 3: Magnetic-field profiles for all routing alternatives of the proposed Central Ferry – Lower Monumental 500-kV line. Fields for maximum current with minimum clearance and for average current with average clearance are shown.

Appendix F

Health Effects

Health Sciences

Update of EMF Research - 2009

Update of EMF Research - 2009

Prepared for:
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April 15, 2009

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Introduction

Electrical objects produce two field types – electric fields and magnetic fields. The term “field” is used to describe the way an object influences its surrounding area. A temperature field, for example, surrounds a warm object, such as a space heater. Electric and magnetic fields (EMF) surround any object that is generating, transmitting or using electricity, including appliances, wiring, office equipment, generators, batteries and any other electrical devices. EMFs are invisible and they cannot be felt or heard.

Electric fields occur as a result of the electric potential (or voltage) on these objects, and **magnetic fields** occur as a result of current flow through these objects.[1] Just like a temperature field, electric and magnetic fields can be measured and their levels depend on, among other things:

- Properties of the source of the field (voltage, current, configuration, etc.)
- Distance from the source of the field

Both electric and magnetic fields decrease rapidly with distance from the source, such that a magnetic field of 300 milligauss (mG) within 6 inches of a vacuum cleaner diminishes to 1 mG at 4 feet (NIEHS, 2002). This is similar to the way that the heat from a candle or campfire lessens as you move farther away. Although ordinary objects do not block magnetic fields, objects such as trees and buildings easily block electric fields.

The electrical power system in the United States (US) produces alternating current (AC) EMF that changes direction and intensity 60 times per second – i.e., a frequency of 60 Hertz (Hz).[2] This frequency is in the extremely low frequency (ELF) range of the electromagnetic spectrum. Electricity produced by generating stations flows as 60 Hz current through transmission and distribution lines and provides power to the many appliances and electrical devices that we use

[1] The electric field is expressed in measurement units of volts per meter (V/m) or kilovolts per meter (kV/m); one kilovolt per meter is equal to 1,000 V/m. The strength of magnetic fields is expressed as magnetic flux density in units called gauss (G), or in milligauss (mG), where 1 G is equal to 1,000 mG.

[2] Europe’s electrical system produces 50 Hz EMF. Since 50 Hz EMF is also in the ELF range, research on 50 Hz EMF is relevant to questions on 60 Hz EMF.

in our homes, schools, and workplaces. Because electricity powers so many things in our daily lives, from lighting, heating and cooling our homes to powering our refrigerators and computers, magnetic fields are found throughout our daily environments.

Questions about whether these ubiquitous exposures could affect our health were raised in the 1970s. Since then, researchers from many different scientific disciplines have investigated this question and hundreds of studies have been conducted. The public frequently expresses concern about EMF, particularly in the context of new transmission lines. The intent of this report is to describe what this large body of research has told us about EMF and the precautions, if any, we should take to reduce or avoid exposures.

The Bonneville Power Administration (BPA) requested that Exponent update a report from July 2007 to provide a current summary of the status of the research on EMF.[3] The focus of the July 2007 report was on the conclusions of a comprehensive, weight-of-evidence review published by the World Health Organization (WHO) in June 2007, since that report represented the most recent review of the literature by a multidisciplinary scientific panel. The WHO organized a multidisciplinary Task Group of 21 scientists from around the world to draft a Monograph that summarized the research and provided conclusions as to whether there are risks associated with ELF-EMF and, if so, at what exposure levels (WHO, 2007a). The report concluded that the only established effects of ELF-EMF exposure are acute neurostimulatory effects that occur at very high levels of exposure; these exposure levels are not encountered in ordinary residential or occupational environments. The factsheet from this report is attached as Appendix 1 (WHO, 2007b) and can be found at http://www.who.int/mediacentre/factsheets/fs322/en/print.html.

Research is a constantly evolving process. Despite the volume of research available on EMF and the large reduction in uncertainty that research has achieved over the years, research continues with the goal of clarifying and replicating old findings and testing new hypotheses. New studies on ELF-EMF are published each year. To update its perspective on EMF research, this supplemental report identifies newly published studies and provides the reader with

[3] Exponent. Assessment of Research Regarding EMF and Health and Environmental Effects. Olympic Peninsula Reinforcement Transmission Line Project. July 2007.

perspective on if, and how, these recent studies have strengthened or changed the WHO conclusions.

A short section on the methods that scientists use to conduct studies and make decisions about health risks is also included as a framework for understanding later discussions (Section 1). The discussion of new research is broadly grouped by disease – cancer, reproductive/developmental effects, and neurodegenerative diseases – in Section 2. Both epidemiologic and *in vivo* research is summarized within the disease category and *in vitro* research is discussed separately. The possible effects of EMF on the functioning of pacemakers (Section 3) and on flora and fauna (Section 4) are also discussed.[4] Finally, guidelines for ELF-EMF exposure developed by scientific organizations to prevent against established health effects are summarized in Section 5.

[4] Neither of these topics was covered in the WHO report, but a discussion is provided to determine whether recent studies alter statements from Exponent's 2007 BPA report.

1 Scientific Methods

Weight-of-evidence review

Most things that we encounter in our environment have no effect on our health. But, there are some things that may affect our health in a harmful or beneficial way. These include things that we encounter in the environment, such as sunlight, or things we eat, such as certain foods. Much time and money is spent by scientists around the world designing, conducting and publishing research to determine what factors may affect our health, including environmental exposures (like EMF), infectious agents and our genetics. The process for arriving at a conclusion about whether there is a health risk associated with any of these factors is usually not as straightforward or definitive as reporting by the lay media may suggest. Rather, it is a long process that requires repeated hypothesis generation and testing.

The process begins when a scientist forms a hypothesis and conducts a study to test that hypothesis. Studies are conducted by scientists at academic universities and scientific institutions around the world. Once the study is complete, the authors submit it to a scientific journal for publication, where it undergoes peer review prior to publication. The evidence to evaluate any health risk, therefore, is all of the relevant studies published in the peer-reviewed literature.

These individual research studies can be thought of as puzzle pieces. When all of the research is placed together, we have some understanding of possible health effects; however, no conclusions can be reached by looking at only one study, just as no picture can be formed with just one puzzle piece. Each study provides a different piece of information to the puzzle because of its unique strengths and weaknesses – if the study used valid methods and had no obvious sources of bias, it may provide a wealth of information or, if the study was not well done, it may provide little (if any) information.

This process of evaluating all of the research together to determine whether something poses a health risk (or benefit) is referred to as a weight-of-evidence review. There are three types of research that are considered in a weight-of-evidence review: epidemiologic observations in people, experimental studies in animals (*in vivo* research), and experimental studies in cells and tissues (*in vitro* research). It is important to consider all three types of research together because they provide complementary information:

- For epidemiology studies, scientists collect observational data about human populations in their day-to-day environments to determine whether there are patterns between exposures and diseases. These studies measure statistical associations to evaluate whether a disease and exposure occur together more often than expected. An important limitation of these studies is that, if an association is measured, they do not tell scientists how the exposure is truly related to the disease. That conclusion can only be reached by considering the entire body of research. Most of the studies evaluating EMF look at whether people with disease have higher estimates of EMF exposure in the past compared to people without disease.

- Experimental studies in which scientists expose animals (*in vivo*) to varying levels of electric or magnetic fields (some as high as 50,000 mG) are an important source of information. These studies compare the amount of disease they observe in exposed animals to the amount of disease they observe in animals that have not been exposed. The strength of animal studies is that scientists are able to control all aspects of the animals' lives to minimize the potential confounding effects of factors other than the exposure of interest. Of these studies, the most valuable for understanding disease are those in which the animals receive life-long exposures.

- A second type of experimental EMF study involves the exposure of isolated cells and tissues *in vitro* to EMF, and compares the characteristics of exposed and unexposed samples to look for differences that are indicative of a disease process. These studies are limited because what happens in cells or tissue outside a human body may not be the same as what happens inside a body.

Scientists, scientific organizations, and regulatory agencies use the weight-of-evidence approach worldwide to assess the possible health risks associated with exposures. A weight-of-evidence review begins with a systematic review of published, peer-reviewed scientific research in the fields of epidemiology, *in vivo* research, and *in vitro* research. The weight that individual studies provide to the overall conclusions is not equal – studies vary widely in terms of the sophistication and validity of their methods. Therefore, each study from each discipline must be critically evaluated and assigned a weight. A final conclusion is then reached by considering the cumulative body of research, giving more weight to studies of higher quality (see Figure 1).

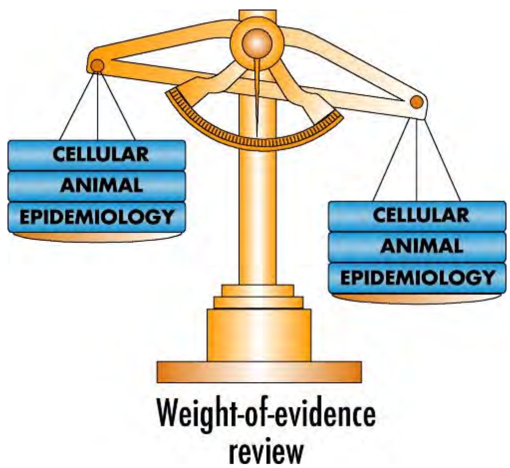

Figure 1. Weight-of-evidence reviews consider three types of research

Continuing with the puzzle example from above, the picture that is formed when the individual studies (or puzzle pieces) are assembled can take on many different shapes. In some cases (e.g., smoking and lung cancer), a clear picture of an adverse health effect was presented by the research within a relatively short time. In most cases, however, the picture is unclear and more questions are raised. It is impossible to prove the negative in science – i.e., to say that any exposure is completely safe – therefore, when it appears that there is little risk, research studies endeavor to reduce the uncertainty that there is a health effect through continued research. The only way to reduce this uncertainty is to conduct high quality studies with meaningful results that are replicated across study populations. Thus, in most areas of research, unless the data clearly indicates an increased risk at defined exposure levels, scientific panels will conclude that the research is inadequate and requires future research, until the uncertainty has been reduced below an acceptable level. While the public may interpret this conclusion as indicating concern, it is natural for scientists to recommend future research to either reduce uncertainty around a largely “negative” body of research or replicate findings that appear “positive” in nature.

Established scientific and health agencies organize panels to conduct weight-of-evidence reviews. These panels consist of experts from around the world in the areas of interest (e.g., epidemiology, neurophysiology, toxicology), and they follow standard scientific methods for arriving at conclusions about possible health risks. The conclusions of these reviews are looked to for the current scientific consensus on a particular topic and form the basis of recommendations made by organizations and governments on exposure standards and precautionary measures.

Numerous national and international organizations responsible for public health have convened multidisciplinary panels of scientists to conduct weight-of-evidence reviews and arrive at conclusions about the possible risks associated with ELF-EMF. These organizations include the following (in ascending, chronological order of their most recent publication):

- The **National Institute for Environmental Health Sciences** (**NIEHS**) assembled a 30-person Working Group to review the cumulative body of epidemiologic and experimental data and provide conclusions and recommendations to the United States government (NIEHS, 1998, 1999).

- The **International Agency for Research on Cancer** (**IARC**) completed a full carcinogenic evaluation of electric and magnetic fields in 2002.

- The **International Commission on Non-Ionizing Radiation Protection** (**ICNIRP**), the formally recognized organization for providing guidance on standards for non-ionizing radiation exposure for the WHO**,** published a review of the cumulative body of epidemiologic and experimental data on ELF-EMF in 2003.

- The **National Radiological Protection Board** (**NRPB**)[5] of the United Kingdom (UK) issued full evaluations of the research in 1992, 2001 and 2004, with supplemental updates (1993, 1994a) and topic-specific reports (1994b; 2001b; HPA, 2006) published in the interim.

- The **World Health Organization (WHO)** released a review in June 2007 as part of its International EMF Program to assess the scientific evidence of possible health effects of EMF in the frequency range from 0 to 300 GHz.

- The SSI of the **Swedish Radiation Protection Authority**, using other major scientific reviews as a starting point, evaluated recent studies in consecutive annual reports (SSI, 2007; SSI, 2008).

- The **Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR)** issued a report in March 2007 and March 2009 updating previous conclusions (SSC, 1998; CSTEE, 2001) to the Health Directorate of the European Commission.

In August 2007, an *ad hoc* group of 14 scientists and public health and policy "experts" published a report, referred to as the BioInitiative Report, online to "assess scientific evidence on health impacts from electromagnetic radiation below current public exposure limits and evaluate what changes in these limits are warranted now to reduce possible public health risks in the future" (p. 4). The report was followed by two publications that summarized some of the online report's conclusions (Hardell and Sage, 2008; Davanipour and Sobel, 2009). The individuals who comprised this group did not represent any well-established regulatory agency, nor were they convened by a recognized scientific authority. The report has been criticized by scientific agencies because it did not follow the methods of a standard weight-of-evidence review and, for this reason, its conclusions and recommendations are not considered further in this report (HCN, 2008).[6] Appendix 2 provides a full criticism of the report.

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5 The NRPB merged with the Health Protection Agency (HPA) in April 2005 to form its new Radiation Protection Division.

6 http://www.gr.nl/pdf.php?ID=1743&p=1

Epidemiology basics

For reference, this section briefly describes the main types of epidemiology studies and the major issues that are relevant to evaluating their results. The two, main types of epidemiology studies are cohort studies and case-control studies (see Figure 2).

Figure 2. Basic design of cohort and case-control studies

A case-control study is a type of epidemiology study that compares the characteristics of people that have been diagnosed with a disease (i.e., cases) to a similar group of people who do not have the disease (i.e., controls). The prevalence and extent of past exposure to a particular agent is estimated in both groups to assess whether the cases have a higher exposure level than the controls, or vice versa.

In a case-control study, this comparison (or statistical association) is estimated quantitatively with an odds ratio (OR). An odds ratio is the ratio of the odds of exposure among persons with a disease to the odds of exposure among persons without a disease. The general interpretation of an odds ratio equal to 1.0 is that the odds of exposure are the same in the case and control groups (i.e., there is no statistical association between the exposure and disease). If the odds ratio is greater than 1.0, the inference is that the odds of exposure are greater in the case group or, in other words, the exposure may increase the risk of the disease (see Figure 3 below).

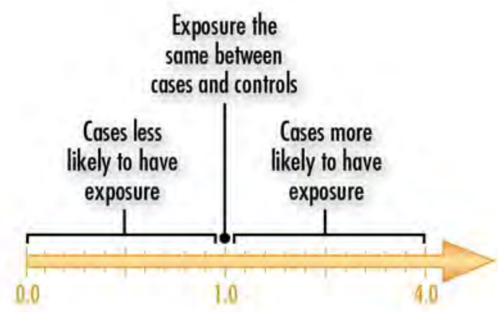

Figure 3. Interpretation of an odds ratio in a case-control study

Each OR is reported with a confidence interval (CI), which is a range of OR values that have a specified probability of occurring if the study is assumed to be repeated a large number of times. A 95% CI, for example, provides the range of values that are likely to occur in 95% of repeated experiments. In short, a CI tells you how certain (or confident) you are about the OR you calculated from your data; if the CI includes 1.0, for example, you cannot statistically exclude the possibility that the OR is 1.0, meaning the odds of exposure are the same in the case and control groups.

A cohort study is the reverse of a case-control study – researchers study a population without disease and follow them over time to see if persons with a certain exposure develop disease at a higher rate than unexposed persons. The mathematics of cohort studies are similar to a case-control studies, although the risk estimate is referred to as a relative risk (RR). The RR is equal to rate of disease in the exposed group divided by the rate of disease in the unexposed group, with values greater than 1.0 suggesting that the exposed group has a higher rate of disease.

A RR or OR value is simply a measure of how often a disease and exposure occur together in a particular study population – it does not mean that there is a known or causal relationship. Before any conclusions can be drawn, all studies must be identified and each study must be evaluated to determine the possible role that factors such as chance, bias and/or confounding may have played in the study's results.

- *Chance* refers to a random event, like a coincidence. An association can be observed between an exposure and disease that is simply the result of a chance occurrence. Statistics, such as the CI, are calculated to determine whether chance is a likely explanation for the findings.
- *Bias* refers to any error in the design, conduct, or analysis of a study that results in a distorted estimate of an exposure's effect on the risk of disease. There are many different types of bias; for example, selection bias may occur if the characteristics of cases that participate in a study differ in a meaningful way from the characteristics of those subjects that do not participate (e.g., if cases that live near a power line are more likely to participate because they are concerned about this possible exposure).
- *Confounding* is a situation in which an association is distorted because the exposure being studied is associated with other risk factors for the disease. For example, a link between coffee drinking in mothers and low birth weight babies may be observed in a study. However, some women who drink coffee also smoke cigarettes. When the smoking habits of mothers are taken into account, coffee drinking may not be associated with low birth weight babies because the confounding effect of smoking has been removed.

As part of the weight-of-evidence review process, each study's design and methods are critically evaluated to determine if and how chance, bias, and confounding may have affected the results, and, as a result, the weight that should be placed on the study's findings.

IARC classifications

This section briefly describes the method that the IARC uses following a weight-of-evidence review to classify exposures based on the evidence in support of carcinogenicity. The WHO adopted this method in their 2007 report on ELF-EMF, and other scientific agencies refer to it as well.

First, each research type (epidemiology, *in vivo* and *in vitro*) is evaluated to determine the strength of evidence in support of carcinogenicity (as defined in Figure 4). With regard to epidemiologic studies, *sufficient evidence* is used to describe a body of research where an association is found and chance, bias and confounding can be ruled out with "reasonable confidence." *Limited evidence* is used to describe a body of research where the findings are inconsistent, or where an association is observed but there are outstanding questions about study design or other methodological issues that preclude making strong conclusions. *Inadequate evidence* describes a body of research where it is unclear whether the data is supportive or unsupportive of causation because there is a lack of data or there are major quantitative or qualitative issues. The same overall categories apply for *in vivo* research (see Figure 4). *In vitro* research, although not described in Figure 4, is used to a lesser degree in evaluating carcinogenicity and is classified as strong, moderate or weak.

Agents are then classified into the following categories using the combined categories from epidemiology, *in vivo* and *in vitro* research: carcinogenic to humans, probably carcinogenic to humans, possibly carcinogenic to humans, unclassifiable, and probably not carcinogenic to humans (from highest to lowest risk). For example, the category "possibly carcinogenic to humans" typically denotes exposures for which there is limited evidence of carcinogenicity in epidemiology studies and less than sufficient evidence of carcinogenicity in *in vivo* studies.

The IARC has reviewed over 900 substances and exposure circumstances to evaluate their potential carcinogenicity. For context, Figure 5 provides examples of some of the more common exposures that have been classified in each category. As Figure 5 shows, over 80% of exposures fall in the categories "possible carcinogen" (27%) or "non-classifiable" (55%). This occurs because, as described above, it is nearly impossible to prove that something is completely safe and few exposures show a clear-cut or probable risk, so most agents will end up in either of these two categories. Note that throughout the entire history of the IARC only one agent has been classified in the category "probably not carcinogenic," which illustrates the conservatism of the evaluations and the difficulty in proving the absence of an effect beyond all doubt.

Over half of the agents are *not classifiable* in terms of carcinogenicity, i.e., it is unclear whether they can cause cancer, and hair coloring products, jet fuel and tea are included in this category. *Possible carcinogens* include occupation as a firefighter, coffee, and pickled vegetables, in addition to magnetic fields. Exposures identified as *probable carcinogens* include high temperature frying of food, occupation as a hairdresser, and use of sun beds. Finally, *known carcinogens* include benzene, asbestos, solar radiation and tobacco smoke. As Figure 5 shows, there is much uncertainty about whether certain agents will lead to cancer, and possible and probable carcinogens include substances to which we are commonly exposed or are common exposure circumstances.

	Epidemiology Studies				Animal Studies			
	Sufficient evidence	Limited evidence	Inadequate evidence	Evidence suggesting lack of carcinogenicity	Sufficient evidence	Limited evidence	Inadequate evidence	Evidence suggesting lack of carcinogenicity
Known Carcinogen	✓							
Probable Carcinogen		✓			✓			
Possible Carcinogen		✓				✓	✓	
Not Classifiable			✓			✓	✓	
Probably not a Carcinogen				✓				✓

Sufficient evidence in epidemiology studies—A positive association is observed between the exposure and cancer in studies, in which chance, bias and confounding were ruled out with "reasonable confidence."

Limited evidence in epidemiology studies—A positive association has been observed between the exposure and cancer for which a causal interpretation is considered to be credible, but chance, bias or confounding could not be ruled out with "reasonable confidence."

Inadequate evidence in epidemiology studies—The available studies are of insufficient quality, consistency or statistical power to permit a conclusion regarding the presence or absence of a causal association between exposure and cancer, or no data on cancer in humans are available.

Evidence suggesting a lack of carcinogenicity in epidemiology studies—There are several adequate studies covering the full range of levels of exposure that humans are known to encounter, which are mutually consistent in not showing a positive association between exposure to the agent and any studied cancer at any observed level of exposure. The results from these studies alone or combined should have narrow confidence intervals with an upper limit close to the null value (e.g. a relative risk of 1.0). Bias and confounding should be ruled out with reasonable confidence, and the studies should have an adequate length of follow-up.

Sufficient evidence in animal studies—An increased incidence of malignant neoplasms is observed in (a) two or more species of animals or (b) two or more independent studies in one species carried out at different times or indifferent laboratories or under different protocols. An increased incidence of tumors in both sexes of a single species in a well-conducted study, ideally conducted under Good Laboratory Practices, can also provide sufficient evidence.

Limited evidence in animal studies—The data suggest a carcinogenic effect but are limited for making a definitive evaluation, e.g. (a) the evidence of carcinogenicity is restricted to a single experiment; (b) there are unresolved questions regarding the adequacy of the design, conduct or interpretation of the studies; etc.

Inadequate evidence in animal studies—The studies cannot be interpreted as showing either the presence or absence of a carcinogenic effect because of major qualitative or quantitative limitations, or no data on cancer in experimental animals are available

Evidence suggesting a lack of carcinogenicity in animal studies—Adequate studies involving at least two species are available which show that, within the limits of the tests used, the agent is not carcinogenic.

Figure 4. Basic IARC method for classifying exposures based on potential carcinogenicity

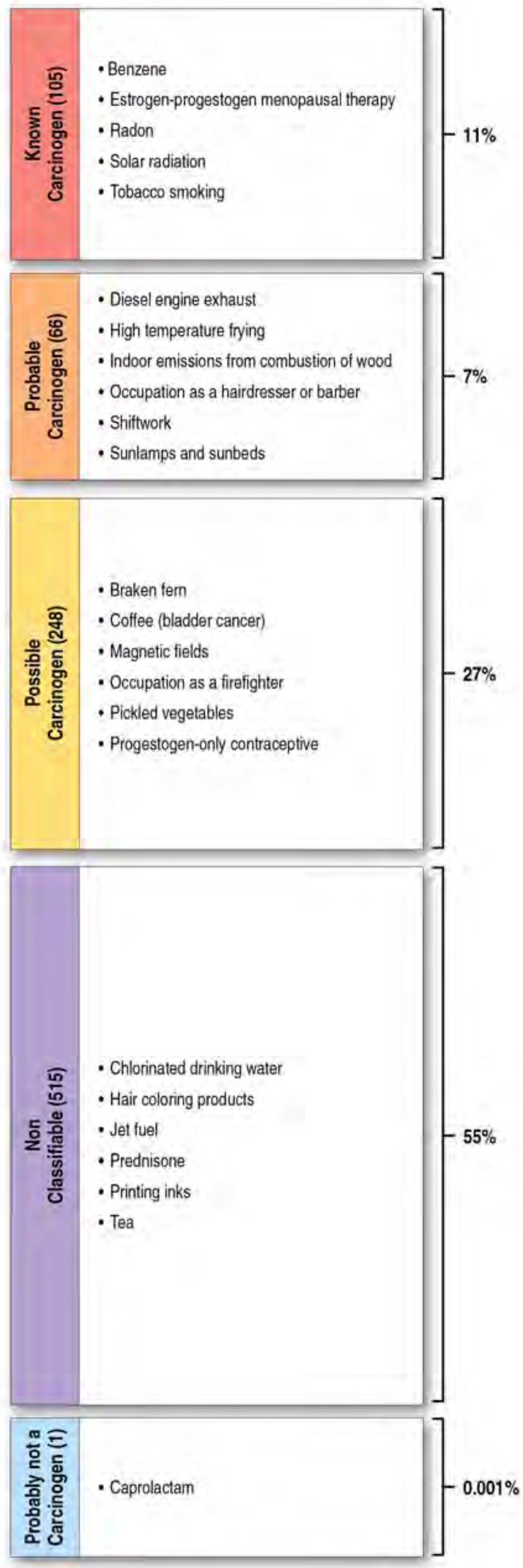

Figure 5. Percentage of substances classified in each IARC category with examples

2 Human Health Research

The following sections describe peer-reviewed research published between January 1, 2006 and March 20, 2009. A literature review was conducted to identify new epidemiologic, *in vivo* and *in vitro* research published on 50 or 60 Hz ELF-EMF. A large number of search strings referencing the exposure and diseases of interest, as well as authors that regularly publish in this area, were included as search terms in a database known as PubMed (http://www.ncbi.nlm.nih.gov/PubMed/).[7] A scientist with experience in this area reviewed the search results to identify relevant studies. This report focuses on the diseases that have received the most attention – cancer, reproductive or developmental effects, and neurodegenerative diseases. Many other health effects have been studied (suicide, depression, electrical hypersensitivity, cardiovascular effects, etc.), but for brevity and because research on these topics evolves slowly, these topics are not summarized here. The WHO report provides a good resource for the status of research on these additional health effects.

This update focuses on identifying and summarizing new epidemiologic and *in vivo* research, since this research is the most informative for risk assessment in this field; for the status of *in vitro* research, we include our discussion from the July 2007 report.

Cancer

Childhood leukemia

What was previously known about childhood leukemia and what did the WHO report conclude?

Scientific panels have concluded consistently that magnetic fields are a "possible carcinogen" largely because of findings from case-control studies of childhood leukemia. Since 1979, approximately 35 studies from the US, Canada, Europe, New Zealand and Asia have evaluated the relationship between childhood leukemia and some proxy of magnetic field exposure,

[7] PubMed is a service of the U.S. National Library of Medicine that includes over 17 million citations from MEDLINE and other life science journals for biomedical articles back to the 1950s. PubMed includes links to full text articles and other related resources.

including: long-term (48 hour) personal monitoring; spot or long-term (24 or 48 hours) measurements in structures and outdoors; calculations using loading, line configuration, and distance of nearby power installations to estimate historical, residential exposure; and wire code categories.[8] As a group of independent studies, they did not show a clear or consistent association between magnetic fields and childhood leukemia. The largest and most methodologically sound case-control studies to directly estimate magnetic field exposure did not report a consistent relationship, for example (Linet et al., 1997; McBride et al., 1999; UKCCS, 2000). When two independent pooled analyses combined the data from these case-control studies, however, an approximate 2-fold statistically significant association was observed between rare average magnetic field exposure above 3-4 mG and childhood leukemia (Ahlbom et al., 2000; Greenland et al., 2000); in other words, children with leukemia were about 2 times more likely to have had estimated magnetic field exposures above 3-4 mG. Average exposures at this level are rare; according to the WHO, results from several extensive surveys showed that approximately 0.5–7% of children had time-averaged exposures in excess of 3 mG and 0.4–3.3% had time-averaged exposures in excess of 4 mG (WHO, 2007a).

The most significant limitation of these studies is their methods for estimating exposure, in that (at best) spot or long-term measurements and calculations post-diagnosis are used to approximate cumulative exposure pre-diagnosis in the absence of any information on the etiologically relevant exposure metric or window. Most studies have used the time-weighted average (TWA) exposure metric, meaning the average of all exposures encountered over the day, but it is possible that other metrics may be more biologically relevant to disease causation, such as the percentage of time above a certain threshold or exposure to peak magnetic fields. Pooled analyses are limited because they combine data that was collected in very different ways. Since the individual epidemiology studies and the pooled analyses are limited in many ways (including the way that they estimate exposure), it is unclear whether this association is causal in nature – i.e., whether exposure to magnetic fields in the range of 3-4 mG has any relationship with the development of childhood leukemia or whether the association is simply a consequence of an error in the study's design. Furthermore, *in vivo* studies do not provide any evidence to suggest that the association is causal in nature: these studies have not indicated any consistent

[8] Wire code categories are categories used to classify the potential magnetic field exposures at residences based on the characteristics of nearby power installations.

increase in cancer in animals when they are exposed to high levels of magnetic fields over the course of their lifetime (see section "*In vivo* studies of carcinogenesis"), and there is no known mechanism by which magnetic fields cause cancer (see section "*In vitro* studies of carcinogenesis").

Since chance, bias and confounding could not be ruled out as an explanation for the association, the IARC concluded in 2002 that the data on childhood leukemia provided limited evidence of carcinogenicity. In 2007, the WHO reviewed studies published since the 2002 IARC review and concluded that the new epidemiologic studies were consistent with the classification of limited epidemiologic evidence in support of carcinogenicity and, together with the largely negative *in vivo* and *in vitro* research, consistent with the classification of magnetic fields as a possible carcinogen (see Figure 4).[9]

Since it is unclear whether the association is real, the WHO report evaluated other factors that might be partially, or fully, responsible for the association, including: chance, control selection bias, confounding from hypothesized or unknown risk factors, and misclassification of magnetic field exposure, as noted below and exemplified in Figure 6. See page 8 for a description of these technical terms.

- ✓ The WHO report concluded that **chance** is an unlikely explanation since the pooled analyses had a larger sample size and decreased variability.

- ✓ **Control selection bias** occurs when the controls that decide to participate in the study do not represent the true exposure experience of the non-diseased population. In the case of magnetic fields, the WHO speculates that controls with a higher socioeconomic status (SES) may participate in studies more than lower SES controls and, since higher SES persons may have lower magnetic field exposures or tend to live farther from transmission lines, the control group's magnetic field exposure may be artificially low. Thus, when the exposure experience of the control group is compared to the case group, it appears that there is a difference between the case and control group. The WHO

[9] The WHO concluded the following: "Consistent epidemiological evidence suggests that chronic low intensity ELF magnetic field exposure is associated with an increased risk of childhood leukaemia. However, the evidence for a causal relationship is limited, therefore exposure limits based upon epidemiological evidence are not recommended, but some precautionary measures are warranted" (p. 355-6, WHO, 2007a).

concluded that **control selection bias** is probably occurring in these studies and would result in an overestimate of the true association, but would not explain the entire observed statistical association

- ✓ The WHO panel concluded that it is less likely that **confounding** is causing the observed association, although the possibility that some yet-to-be identified confounder is responsible for the association cannot be fully excluded. Suggested risk factors that may be confounding the relationship include SES, residential mobility, contact currents, and traffic density.[10]

- ✓ The WHO stated that the possible effects of **exposure misclassification** are the most difficult to predict. EMF presents unique challenges in exposure assessment because it is ubiquitous, imperceptible, and has many sources (Kheifets and Oksuzyan, 2008). No target exposure or exposure window has been identified, and the numerous methods of estimating exposure likely result in a different degree of error within and between studies. Most reviews have concluded that exposure misclassification would likely result in an underestimate of the true association, meaning the association we observe is lower than the true value; however, the extent to which this might occur varies widely and is difficult to assess (Greenland et al., 2000). The WHO concluded that exposure misclassification is likely present in these studies, but is unlikely to provide an entire explanation for the association.

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[10] For example, if dwellings near power lines encounter higher traffic density and pollution from traffic density causes childhood leukemia, traffic density may cause an observed association between magnetic field exposure and childhood leukemia.

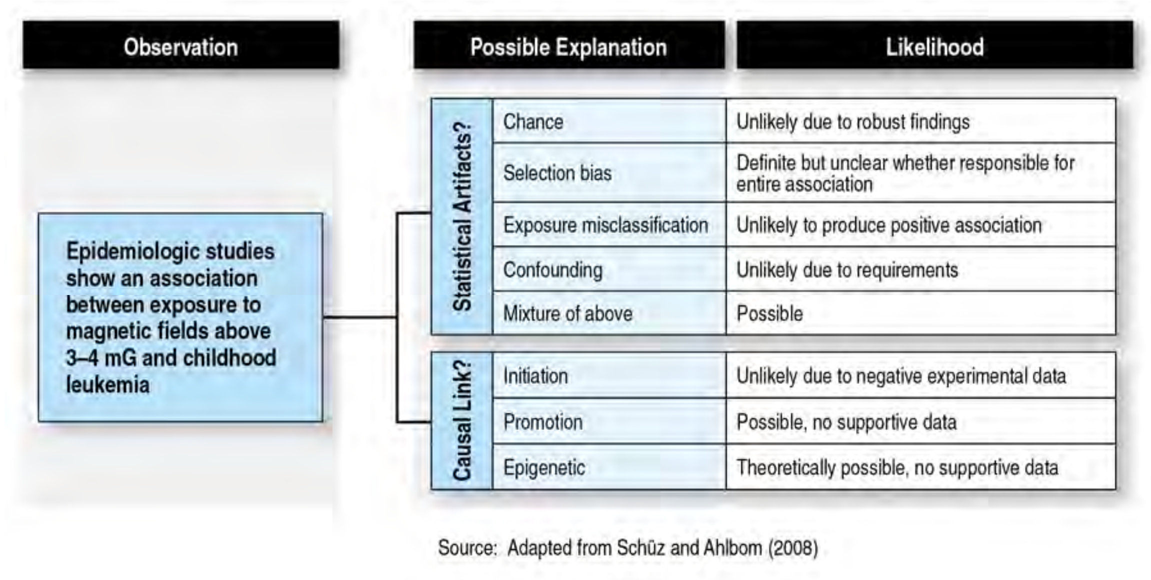

Figure 6. Possible explanations for the observed association between magnetic fields and childhood leukemia

The WHO stated that reconciling the epidemiologic data on childhood leukemia and the negative (i.e., no hazard or risk observed) experimental findings through innovative research is currently the highest priority in the field of ELF-EMF research. Given that few children are expected to have average magnetic field exposures greater than 3-4 mG, however, the WHO stated that the public health impact of magnetic fields on childhood leukemia would be low if the association was determined to be causal.

What relevant studies have been published since the WHO report?

Several relevant studies published after the WHO review (see Table 1) report statistically significant associations between estimates of magnetic field exposure and childhood leukemia, including reports of an association between childhood leukemia and magnetic field levels greater than approximately 6 mG in children genetically susceptible to leukemia (Mejia-Arangure et al., 2007) and greater than approximately 4 mG in children with poor outcomes following a leukemia diagnosis (Foliart et al., 2006, 2007; Svendsen et al., 2007). There was no consistent exposure-response relationship in these studies, however, and small numbers in the upper exposure categories limit the overall conclusions we can make about these studies.

In a pooled analysis of previously published studies, Schüz et al. (2007) evaluated the hypothesis that nighttime residential magnetic-field exposure may be a more biologically relevant exposure for leukemia risk. The authors observed associations between leukemia and nighttime exposures that were similar to those observed in the original pooled analyses of 24- and 48-hour exposures (Ahlbom et al., 2000), suggesting that nighttime exposure does not reduce exposure misclassification and result in a stronger association.

A relationship between residential distance within 500 meters of a power line and childhood leukemia was reported in a recent study in Iran (Feizi and Arabi, 2007). The validity of this study is limited significantly by its small size, possible selection bias, lack of assessment of possible confounding variables (such as SES and mobility), and reliance upon distance as a proxy for exposure. The WHO noted that distance is a poor proxy of magnetic field exposure[11] and a recent re-analysis of data from two case-control studies in the UK and Germany confirmed this statement. Maslanyj et al. (2009) reported that only 23% of homes in a 200-meter corridor of 220-440 kV lines had a magnetic field level above 2 mG. This finding calls into question the relevance of the associations reported in the large case-control study by Draper et al. in 2005 and in the later study by Feizi and Arabia. The fact that the association is observed at distances greater than where magnetic or electric fields from a transmission line could be measured and there is very little correlation between distance and magnetic field levels argues against magnetic fields as the explanation for the statistical association.

Most childhood leukemias are characterized by a genetic anomaly that can be identified prenatally, but not all children with these anomalies go on to develop childhood leukemia (Buffler et al., 2005). It has been suggested that other postnatal events (e.g., environmental or viral exposures) are necessary for childhood leukemia to occur, although little research has been done in this area. This hypothesis suggests that the association may be concentrated in subgroups of the population that have both the genetic anomaly and some other exposure.

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[11] The WHO concluded the following, with respect to the Draper et al. (2005) findings: "[the] observation of the excess risk so far from the power lines, both noted by the authors and others, is surprising. Furthermore, distance is known to be a very poor predictor of magnetic field exposure, and therefore, results of this material based on calculated magnetic fields, when completed, should be much more informative" (p. 270, WHO 2007a).

The first study to examine a magnetic field-gene interaction in relation to childhood leukemia was published recently in China (Yang et al., 2008). They evaluated residential distance from power lines and the genetic variation of five genes associated with DNA repair in a group of children with childhood leukemia. The authors illustrated that a variation of one gene involved in DNA repair (but not four other genes) was more likely to be measured in children with leukemia living within 100 meters from a power line or transformer, compared to children with leukemia living at a farther distance. The significance of this finding is unknown and, as with all genetic epidemiology studies, the results cannot be deemed reliable until they are replicated. Several major limitations of the study are important to consider: (1) since this study enrolled only cases of childhood leukemia and no control group, the authors do not provide any information about the distribution of this DNA repair variation in children without leukemia and, as a result, no conclusions can be drawn about the relationship of this gene to childhood leukemia risk or etiology, (2) it is unknown what role (if any) DNA repair genes play in the development of childhood leukemia, and (3) distance is a poor proxy for magnetic field exposure. Although a positive association between distance and one specific gene was observed in this study, the results do not provide information to draw any conclusions about gene-magnetic field interactions in the etiology of childhood leukemia at this time. A study that could truly elucidate magnetic field-gene interactions has been proposed in the Danish National Birth Cohort (Greenland and Kheifets, 2009).

Mezei et al. (2008b) assessed the likelihood that control selection bias could be causing the observed association in a previously published study of childhood leukemia in Canada (McBride et al., 1999). This study evaluated whether there were differences between the controls that participated and the controls that did not participate in the 1999 study. The goal of the study was to assess whether the non-participating controls had a higher prevalence of some factor that made them more likely to have a higher magnetic field exposure than the participating controls and, thus, resulted in an under-representation of exposure prevalence in the control group and an overestimation of the risk estimate. The study suggested that control selection bias was operating to some extent, although the authors noted the inherent problems associated with estimating magnetic field exposure and, therefore, concluded, “the role of selection bias cannot entirely be dismissed on the basis of these results alone” (p. 1).

In response to the WHO recommendations to "focus on new aspects of exposure, potential interaction with other factors or on high exposure groups" (p. 17), some recent research has been innovative in the area of childhood leukemia and magnetic field exposure. These recent studies, like some early studies, have observed associations between estimates of high average magnetic field exposure/distance and childhood leukemia, although recent data suggests that control selection bias may play some role in this observed association. None of these recent studies are sufficiently strong methodologically, nor do the findings display causal patterns (exposure-response, consistency and strength) to alter previous conclusions that the epidemiologic evidence on magnetic fields and childhood leukemia is limited. Chance, confounding, and several sources of bias cannot be ruled out. The lack of evidence from recent *in vivo* research supports this conclusion (see section "*In vivo* studies of carcinogenicity" below).

This conclusion is supported by recent reviews (Kheifets and Oksuzyan, 2008; Schüz and Ahlbom, 2008) and the recent conclusions of scientific organizations (SSI, 2007; SSI, 2008; HCN, 2009; SCENIHR, 2009).

Do researchers investigating childhood leukemia consider magnetic fields a very important area of research?

Researchers will continue to investigate the magnetic field-childhood leukemia association. Magnetic fields, however, are just one area of study in the large body of research on the possible causes of childhood leukemia. There are many other hypotheses that are under investigation that point to possible genetic, environmental, and infectious explanations for childhood leukemia. There are other hypotheses with similar or stronger support in epidemiology studies; magnetic fields are one among many research priorities in the field of childhood leukemia (Ries et al., 1999; McNally and Parker, 2006; Belson et al., 2007; Rossig and Juergens, 2008).

Table 1. Relevant studies of childhood leukemia published after WHO report

Authors	Year	Study
Feizi and Arabi	2007	Acute childhood leukemias and exposure to magnetic fields generated by high voltage overhead power lines – a risk factor in Iran
Foliart, et al.	2006	Magnetic field exposure and long-term survival among children with leukaemia.
Foliart, et al.	2007	Magnetic field exposure and prognostic factors in childhood leukemia.
Maslanyj, et al.	2009	Power frequency magnetic fields and risk of childhood leukaemia: Misclassification of exposure from the use of the distance from power line' exposure surrogate.
Mejia-Arangure, et al.	2007	Magnetic fields and acute leukemia in children with Down Syndrome.
Mezei, et al.	2008b	Assessment of selection bias in the Canadian case-control study of residential magnetic field exposure and childhood leukemia.
Svendsen, et al.	2007	Exposure to magnetic fields and survival after diagnosis of childhood leukemia: a German cohort study.
Schüz, et al.	2007	Nighttime exposure to electromagnetic fields and childhood leukemia: an extended pooled analysis.
Yang, et al.	2008	Case-only of interactions between DNA repair genes (hMLH1, APEX1, MGMT, XRCC1 and XPD) and low-frequency electromagnetic fields in childhood acute leukemia

Childhood brain cancer

What was previously known about childhood brain cancer and what did the WHO report conclude?

The research related to magnetic fields and childhood brain cancer has been less consistent than that observed for childhood leukemia. The WHO report recommended the following:

> As with childhood leukaemia, a pooled analysis of childhood brain cancer studies should be very informative and is therefore recommended. A pooled analysis of this kind can inexpensively provide a greater and improved insight into the existing data, including the possibility of selection bias and, if the studies are sufficiently homogeneous, can offer the best estimate of risk (p. 18, WHO 2007a).

What relevant studies have been published since the WHO report?

The two relevant studies of childhood brain cancer and magnetic field exposure are listed in Table 2 below. In response to the WHO recommendation, Mezei et al. (2008a) performed a meta-analysis of studies on childhood brain tumors and residential magnetic field exposure. Thirteen epidemiologic studies were identified that used various proxies of magnetic field exposure (distance, wire codes, calculated magnetic fields, and measured magnetic fields). For all of the exposure proxies considered, the combined effect estimate was close to 1.0 and not statistically significant, indicating no association between magnetic field exposure and childhood brain tumors. A sub-group of five studies, however, with information on childhood brain tumors and calculated or measured magnetic fields greater than 3-4 mG reported a combined OR that was elevated but not statistically significant (OR=1.68, 95% CI=0.83-3.43). The authors suggested two explanations for this elevated OR. First, they stated that an increased risk of childhood brain tumors could not be excluded at high exposure levels (i.e., >3-4 mG). Second, they stated that the similarity of this result to the findings of the pooled analyses of childhood leukemia suggests that control selection bias is operating in both analyses. Overall, the authors concluded that the analysis did not find a significant increase in childhood brain cancer risk using various proxies of residential exposure to magnetic fields.

Studies of parental occupational magnetic field exposure and childhood brain tumors have been inconsistent. In a pooled analysis of two Canadian case-control studies, Li et al. (2009) calculated individual maternal occupational magnetic field exposure pre- and post-conception and analyzed these estimates in relation to brain cancer in their offspring. The study provided some indication of an association with all brain cancer and average maternal occupational magnetic field exposure and confirmed a previously observed association with the occupation of seamstress. More research is required to understand if magnetic fields during or before pregnancy are related to the development of childhood brain cancer.

These two studies do not change the classification of the epidemiologic evidence as inadequate in relation to childhood brain cancer. Although the meta-analysis of brain cancer observed an association, it could not be distinguished from a chance finding.

Table 2. Relevant studies of childhood brain cancer published after WHO report

Authors	Year	Study
Li, et al.	2009	Maternal occupational exposure to extremely low frequency magnetic fields and the risk of brain cancer in the offspring.
Mezei et al.	2008a	Residential magnetic field exposure and childhood brain cancer: a meta-analysis.

Breast cancer

What was previously known about breast cancer and what did the WHO report conclude?

The WHO reviewed studies of breast cancer and residential magnetic field exposure, electric blanket usage, and occupational magnetic field exposure. These studies did not report consistent associations between magnetic field exposure and breast cancer, and the WHO concluded that, since the recent body of research was higher in quality compared with previous studies, it provided strong support to previous consensus statements that magnetic field exposure does not influence the risk of breast cancer.[12]

Breast cancer received particular attention because researchers hypothesized that it could be related to magnetic field exposure through a pathway involving the hormone melatonin. While this hypothesis was novel, it did not receive consistent or strong support from epidemiology or experimental studies. While research will continue in this area, scientific reviews have been strong in their conclusion that the part of this hypothesis linking magnetic fields to breast cancer is unlikely (NRPB, 2006; WHO, 2007a).

The WHO recommended no further research with respect to breast cancer and magnetic field exposure.

What relevant studies have been published since the WHO report?

Two case-control studies have recently been published, both of which qualitatively estimated occupational magnetic field exposure among breast cancer cases and compared it to controls.[13] Ray et al. (2007) was a nested case-control study in a cohort of approximately 250,000 textile workers in China followed for breast cancer incidence, and McElroy et al. (2007) evaluated occupational exposures to high, low, medium, or background EMF levels in a large number of breast cancer cases and controls. Neither study observed a significant association between breast cancer and higher estimated magnetic field exposure. A large cohort study of utility workers in Denmark also recently reported that women exposed to higher occupational magnetic field levels did not have higher rates of breast cancer (Johansen et al., 2007).

[12] The WHO concluded, “Subsequent to the IARC monograph a number of reports have been published concerning the risk of female breast cancer in adults associated with ELF magnetic field exposure. These studies are larger than the previous ones and less susceptible to bias, and overall are negative. With these studies, the evidence for an association between ELF exposure and the risk of breast cancer is weakened considerably and does not support an association of this kind” (p. 307, WHO 2007a).

[13] Peplonska et al. (2007) is a case-control study of female breast cancer reporting associations for a wide range of occupations and industries. It is not considered in depth in this report because no qualitative or quantitative estimates of magnetic field exposure were made, beyond occupation and industry titles.

These studies, particularly the large cohort of utility workers, add to growing support against a role for magnetic fields in breast cancer. This is consistent with the recent conclusion by the SCENIHR, which stated that the association is "unlikely" (p. 7, SCENIHR 2007).

Table 3. Relevant studies of breast cancer published after WHO report

Authors	Year	Study
Johansen, et al.	2007	Risk for leukaemia and brain and breast cancer among Danish utility workers: A second follow-up.
McElroy, et al.	2007	Occupational exposure to electromagnetic field and breast cancer risk in a large, population-based, case-control study in the United States.
Ray, et al.	2007	Occupational exposures and breast cancer among women textile workers in Shanghai.

Other adult cancers

What was previously known about other adult cancers and what did the WHO report conclude?

In general, scientific panels have concluded that there is not a strong or consistent relationship between other adult cancers (leukemia, lymphoma, or brain cancers) and exposure to magnetic fields; however, the possibility cannot be entirely ruled out because the findings have been inconsistent (IARC, 2002; WHO 2007a). The fact that stronger findings have not been observed in studies with better exposure assessment methods has led the scientific panels to conclude that the evidence for an association is weak and the observed inconsistency is probably due to chance or bias. The IARC classified the epidemiologic data with regard to adult leukemia, lymphoma and brain cancer as "inadequate" in 2002, and the WHO confirmed this classification in 2007, with the remaining uncertainty attributed mainly to limitations in exposure assessment methods.

Much of the research on EMF and adult cancers is related to occupational exposures, given the higher range of exposures encountered in the occupational environment. The main limitation of these studies, however, has been the methods used to assess exposure, with early studies relying simply on a person's occupational title (often taken from a death certificate) and later studies linking a person's full or partial occupational history to representative average exposures for each occupation (i.e., a job exposure matrix). The latter method, while advanced, still has some important limitations, as highlighted recently in a review summarizing an expert panel's findings by Kheifets et al. (2009).[14] While a person's occupation may provide some indication of the overall magnitude of their occupational magnetic field exposure, it does not take into account the possible variation in exposure due to different job tasks within occupational titles, the frequency and intensity of contact to relevant exposure sources, or variation by calendar time. Furthermore, since scientists do not know any mechanism by which magnetic fields could lead to cancer, an appropriate exposure metric is unknown.

Therefore, in order to reduce the remaining uncertainty about whether there is an association between magnetic fields and these cancers, researchers have recommended (1) meta-analyses to clarify the inconsistency of the data and (2) better exposure assessment methods that incorporate a greater level of detail on tasks and exposure characteristics such as spark discharge, contact current, harmonics, etc. (WHO, 2007a; Kheifets et al., 2009).

Adult brain cancer

What was previously known about adult brain cancer and what did the WHO report conclude?

As described above, the WHO classified the epidemiologic data on adult brain cancer as inadequate[15] and recommended (1) updating the existing cohorts of occupationally-exposed individuals in Europe and (2) pooling the epidemiologic data on brain cancer and adult leukemia to confirm the absence of an association.

What relevant studies have been published since the WHO report?

Epidemiologic studies published after 2006 on adult brain cancer and EMF exposure are listed in Table 6 and include two case-control studies, two cohort studies, and a meta-analysis, all of which are related to occupational magnetic field exposure.

In response to the WHO recommendation, two cohorts of approximately 20,000 occupationally-exposed persons each were updated: a cohort of utility workers in Denmark and a cohort of

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[14] Kheifets et al. (2009) reports on the conclusions of an independent panel organized by the Energy Networks Association in the UK in 2006 to review the current status of the science on occupational EMF exposure and identify the highest priority research needs.

[15] The WHO concluded, "In the case of adult brain cancer and leukaemia, the new studies published after the IARC monograph do not change the conclusion that the overall evidence for an association between ELF [EMF] and the risk of these disease remains inadequate" (p. 307, WHO 2007a).

railway workers in Switzerland (Johansen et al., 2007; Röösli et al, 2007a). In both cohorts, brain cancer rates were similar between jobs with high magnetic field exposure and jobs with lower exposures. A case-control study of gliomas was conducted in Australia and reported no associations with higher estimated magnetic field exposure, using a standard job-exposure matrix (Karipidis et al., 2007a). Forssén et al. (2006) performed a large registry-based case-control study of acoustic neuroma and reported no association between higher occupational magnetic field exposures and this benign and rare brain cancer type. Another large case-control study was recently published of gliomas and meningiomas in the United States (Coble et al., 2009). For the first time, the exposure metric in this study incorporated the frequency of exposure to EMF sources, as well as the distance people worked from these sources, on an individual basis. The authors also evaluated exposure metrics aside from TWA exposure (maximum exposed job, total years of exposure above 1.5 mG, cumulative lifetime exposure, and average lifetime exposure). No association was reported between any of these exposure metrics and brain cancer.

As recommended in the WHO report, a meta-analysis of occupationally exposed cohorts was performed by Khefeits et al. (2008). All relevant publications of occupational EMF exposure and adult leukemia or brain cancer were collected and summary risk estimates were calculated using various schemes to weight and categorize the study data. The authors reported a small and statistically significant increase of leukemia and brain cancer in relation to the highest estimate of magnetic field exposure in the individual studies. Several findings, however, led the authors to conclude that magnetic field exposure is not responsible for the observed associations with leukemia and brain cancer, including the lack of a consistent pattern among leukemia subtypes when the past and new meta-analyses were compared. In addition, for brain cancer, the recent meta-analysis reported a weaker estimated association than the previous meta-analysis, whereas a stronger association would be expected since the quality of studies has increased over time. The authors concluded, “the lack of a clear pattern of EMF exposure and outcome risk does not support a hypothesis that these exposures are responsible for the observed excess risk” (p. 677).

Recent studies have reduced possible exposure misclassification by improving exposure assessment methods (i.e., the expanded job-exposure matrix in Coble et al., 2009) and attempted to clarify inconsistencies by updating studies and meta-analyzing data (Johansen et al., 2007; Röösli et al., 2007a; Kheifets et al., 2008); however, despite these advancements, no association has been observed. While an association still cannot be *entirely* ruled out because of the remaining deficiencies in exposure assessment methods, the current database of studies provides weak evidence of an association between magnetic fields and brain cancer.[16] The lack of evidence from *in vivo* research supports this conclusion (see section "*In vivo* studies of carcinogenicity" below). The recent report by the SCENIHR described the data on brain cancers as "uncertain" (p. 43, SCENIHR 2009).

Table 4. Relevant studies of adult brain cancer published after WHO report

Authors	Year	Study
Coble et al.	2009	Occupational exposure to magnetic fields and the risk of brain tumors.
Forssén et al.	2006	Occupational magnetic field exposure and the risk of acoustic neuroma.
Johansen et al.	2007	Risk for leukaemia and brain and breast cancer among Danish utility workers: A second follow-up.
Karipidis et al.	2007a	Occupational exposure to low frequency magnetic fields and the risk of low grade and high grade glioma.
Kheifets et al.	2008	Occupational electromagnetic fields and leukemia and brain cancer: An update to two meta-analyses.
Röösli et al.	2007a	Leukaemia, brain tumours and exposure to extremely low frequency magnetic fields: cohort study of Swiss railway employees.

Adult leukemia and lymphoma

What was previously known about adult leukemia/lymphoma and what did the WHO report conclude?

The same issues discussed above with regard to adult brain cancer are relevant to research on adult leukemia/lymphoma. The WHO classified the epidemiologic evidence as "inadequate" and recommended updating the existing occupationally exposed cohorts in Europe and the meta-analysis on occupational magnetic field exposure[17] (p. 307, WHO 2007a).

What relevant studies have been published since the WHO report?

Two cohorts of occupationally exposed workers and a meta-analysis of occupational magnetic field exposure (all of which were described above) reported on the possible association of

[16] A recent consensus statement by the National Cancer Institute's Brain Tumor Epidemiology Consortium confirms this statement. They classified residential power frequency EMF in the category "probably not risk factors" and described the epidemiologic data as "unresolved" (p. 1958, Bondy et al., 2008).

[17] No specific conclusions were provided by the WHO with regard to lymphoma.

occupational magnetic field exposure and adult leukemia. Also, a case-control study described patterns of estimated residential magnetic field exposure and combined lymphoma and leukemia diagnostic categories.

In the occupational cohort of Swiss railway workers, the authors noted a stronger association among occupations with higher estimates of magnetic field exposures, but the associations were not statistically significant (Röösli et al, 2007a). In the study of Danish utility workers, no increases in leukemia rates were observed in job titles that involved higher exposures to magnetic fields (Johansen et al., 2007). As described above, the updated meta-analysis by Kheifets et al. (2008) reported a weak association between estimated occupational magnetic field exposure and leukemia, but the authors felt that the data was not indicative of a true association.

Lowenthal et al. (2007) grouped cases in five diagnostic categories as lymphoproliferative disorders (LPD) (including acute lymphoblastic leukemia [ALL]) and cases in three diagnostic categories (including acute myeloid leukemia [AML] and other leukemias) as myeloproliferative disorders (MPD). These groups included both adults and children of all ages. The authors estimated exposure by obtaining a lifetime residential history and assessing distance of residences from 88-kV, 110-kV, and 220-kV power lines. They reported elevated, but not statistically significant, ORs for those who lived within 50 meters of any of these power lines, and an indication of decreasing ORs with increasing distance. This study adds very little to the existing database of information on adult leukemia and residential exposure, however, because of fundamental limitations. For example, different cancer types were combined and for different ages of diagnosis. It is well known that cancer etiology varies by cancer type, cancer subtype and diagnostic age.

Very little is known about the etiology of Non-Hodgkin lymphoma (NHL) in general and few studies have been conducted in relation to magnetic field exposure. In one of the first studies to estimate cumulative occupational magnetic field exposure among NHL cases, Karipidis et al. (2007b) reported a statistically significant association between NHL and the highest category of exposure (OR=1.59, 95% CI=1.07-2.36). Overall, the study was well conducted, with its most significant limitation being the possibility of uncontrolled confounding. Since this is one of the first studies on NHL and magnetic field exposure, further research is required. Of note, the cohort of railway workers in Switzerland did not report an increase in NHL deaths among the more highly exposed workers (Röösli et al, 2007a).

The recent literature also includes a novel study examining whether there are differences in the activity of the natural killer (NK) cell, which is known to control cancer development, among persons occupationally exposed to magnetic fields (Gobba et al., 2008). Higher measured magnetic field levels during three complete work shifts (i.e., > 10 mG) were associated with reduced NK activity. This is suggests a cancer-causing mechanism, but future studies are required to replicate this finding and understand the significance of NK activity in cancer causation.

Recent studies of adult leukemia have attempted to clarify inconsistencies by updating studies and meta-analyzing data (Johansen et al., 2007; Kheifets et al., 2008; Röösli et al, 2007a); however, despite these advancements, no clear or statistically significant association has been observed. While an association still cannot be *entirely* ruled out because of the remaining deficiencies in exposure assessment methods, the current database of studies provides weak evidence of an association between magnetic fields and leukemia. The lack of evidence from *in vivo* research (see section "*In vivo* studies of carcinogenicity" below) supports this conclusion. Preliminary results related to NHL have been published and require further investigation, although *in vivo* research does not suggest a relationship between lymphoma and magnetic fields.

Table 5. Relevant studies of adult leukemia/lymphoma published after WHO report

Authors	Year	Study
Gobba et al.	2008	Extremely low frequency-magnetic fields (ELF-EMF) occupational exposure and natural killer activity in peripheral blood lymphocytes.
Johansen et al.	2007	Risk for leukaemia and brain and breast cancer among Danish utility workers: A second follow-up.
Karipidis et al.	2007b	Occupational exposure to power frequency magnetic fields and risk of non-Hodgkin lymphoma
Lowenthal et al.	2007	Residential exposure to electric power transmission lines and risk of lymphoproliferative and myeloproliferative disorders: a case-control study.
Röösli et al.	2007a	Leukaemia, brain tumours and exposure to extremely low frequency magnetic fields: cohort study of Swiss railway employees.

In vivo studies of carcinogenesis

What was previously known about *in vivo* studies of carcinogenesis and what did the WHO report conclude?

It is standard procedure to conduct studies on laboratory animals to determine whether exposure to a specific agent leads to the development of cancer (USEPA, 2005). This approach is used because all known human carcinogens cause cancer in laboratory animals. In the field of ELF-EMF research, a number of research laboratories have exposed rodents, including those with a particular genetic susceptibility to cancer, to high levels of magnetic fields over the course of their lifetime and performed tissue evaluations to assess the incidence of cancer in many organs. In these studies, magnetic field exposure has been administered alone (to test for the ability of magnetic fields to act as a complete carcinogen), in combination with a known carcinogen (to test for a promotional or co-carcinogenetic effect), or in combination with a known carcinogen and a known promoter (to test for a co-promotional effect).

The WHO described four large-scale, long-term studies of rodents exposed to magnetic fields over the course of their lifetime that did not report increases in any type of cancer (Mandeville et al., 1997; Yasui et al., 1997; Boorman et al., 1999a, b; McCormick et al., 1999). No directly relevant animal model for childhood ALL existed at the time of the WHO report. Some animals, however, develop a type of lymphoma similar to childhood ALL and studies exposing transgenic mice predisposed to this lymphoma to ELF magnetic fields did not report an increased incidence of lymphoma (Harris et al., 1998; McCormick et al., 1998; Sommer and Lerchel, 2004).

Studies investigating whether exposure to magnetic fields can promote cancer or act as a co-carcinogen used known cancer-causing agents, such as ionizing radiation, UV radiation or other chemicals. No effects were observed for studies on chemically-induced preneoplastic liver lesions, leukemia/lymphoma, skin tumors, or brain tumors; however, the incidence of 7,12-dimethylbenz[a]anthracene (DMBA)-induced mammary tumors was increased with magnetic field exposure in a series of experiments in Germany (Löscher et al., 1993, 1994, 1997; Baum et al., 1995; Löscher and Mevissen, 1995; Mevissen et al., 1993a,b, 1996a,b, 1998), suggesting that magnetic field exposure increased the proliferation of mammary tumor cells. These results were not replicated in subsequent series of experiments in a US laboratory (Anderson et al., 1999; Boorman et al.1999a,b; NTP, 1999), possibly due to differences in experimental protocol and the species strain. In Fedrowitz et al. (2004), exposure enhanced mammary tumor development in one sub-strain (Fischer 344 rats), but not in another sub-strain that was obtained from the same breeder, which argues against a promotional effect of magnetic fields.[18]

Some studies have reported an increase in genotoxic effects among exposed animals (e.g., DNA strand breaks in the brains of mice [Lai and Singh, 2004]), although the results have not been replicated.

In summary, the WHO concluded the following with respect to *in vivo* research: "There is no evidence that ELF exposure alone causes tumours. The evidence that ELF field exposure can enhance tumour development in combination with carcinogens is inadequate" (p. 322, WHO 2007a). Recommendations for future research included the development of a rodent model for childhood ALL and the continued investigation of whether magnetic fields can act as a promoter or co-carcinogen.

What relevant studies have been published since the WHO report?

Pursuant to the WHO recommendation and in view of the available evidence that exposure to magnetic fields *alone* does not increase the occurrence of cancer, the literature published following the WHO report includes numerous *in vivo* studies testing different hypotheses of cancer promotion, including effects on brain cancer (Chung et al., 2008), breast cancer (Fedrowitz and Löscher, 2008), and lymphoma/leukemia (Bernard et al., 2008; Negishi et al., 2008), as referenced below. In each of these studies, the animals were treated first with chemicals known to initiate the cancer process in cells. Initiated animals are more likely to develop cancer, and a subsequent exposure, known as a promoter, is often needed for an initiated cell to reproduce into many cancer cells. Recent studies first treated the animals with the initiators ethylnitrosourea (ENU) (Chung et al., 2008), n-butylnitrosourea (BNU) (Bernard et al., 2008), or DMBA (Fedrowitz and Löscher, 2008; Negishi et al., 2008). An additional

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[18] The WHO concluded with respect to the German studies of mammary carcinogenesis, "Inconsistent results were obtained that may be due in whole or in part to differences in experimental protocols, such as the use of specific substrains" (p. 321, WHO 2007a).

study by Sommer and Lerchel (2006) tested whether magnetic fields alone increased the incidence of lymphoma in mice virally predisposed to lymphoblastic lymphoma.

Chung et al. (2008) examined the possible role of 60 Hz magnetic fields in promoting brain tumors initiated by ENU injections *in utero*; the authors concluded that there was no evidence from this study that 60 Hz magnetic field exposures up to 5,000 mG promoted tumor development.

Fedrowitz and Löscher (2008) is the most recent study from the German laboratory that previously reported increases in DMBA-induced mammary tumors with high magnetic field exposure. In this recent study, the researchers exposed DMBA-treated Fischer 344 rats (the strain of inbred rats used in previous experiments) to either high levels of magnetic fields (1,000 mG) or no exposure for 26 weeks and reported that the incidence of mammary tumors was significantly elevated in the group exposed to magnetic fields (Fedrowitz and Löscher, 2008). No independent replication of this experiment has yet occurred and questions still remain about the effect of experimental protocol and species strain.

Sommer and Lerchl (2006) is a follow-up to an earlier study (Sommer and Lerchl, 2004) that reported no increases in lymphoma among predisposed animals chronically exposed to magnetic fields (up to 1,000 mG for 24 hours per day for 32 weeks). Sommer and Lerchl (2006) increased magnetic field exposure to 10,000 mG and exposed some of the animals only during the night to test the hypothesis that nighttime exposure may have a stronger effect than continuous exposure. Magnetic fields did not influence body weight, time to tumor, cancer incidence, or survival time in this study. In another study of lymphatic system cancers, researchers treated newborn mice with DMBA and magnetic fields up to 3,500 mG (Negishi et al., 2008). The authors reported that the percentage of mice with lymphoma/lymphatic leukemia was not higher in magnetic field-exposed groups, compared to the sham-exposed group.

A recent study by Bernard et al. (2008) provides a significant development, in that it is the first study to use an animal model of ALL, the leukemia type that has been associated with high magnetic field exposure in children. All rats were exposed to BNU to initiate the leukemogenic process, and a sub-group of rats was exposed to 1,000 mG 18 hours per day for 52 weeks. No difference in leukemia incidence was observed between the BNU-treated group exposed to magnetic fields and the BNU-treated unexposed group. This study supports the hypothesis that magnetic fields do not affect the development of ALL and provides additional support to the conclusion that experimental data is not supportive for a role of magnetic fields in the incidence of childhood leukemia. The researchers followed guidelines for the experimentation and care of laboratory animals and conducted the analyses blind to the treatment group. Experience with this strain of rat is limited, however, so it is unclear whether the results are more or less reliable than other animal models; replication is required.

Thus, aside from the most recent replication of enhanced mammary carcinogenesis in a specific sub-strain of rats in a German laboratory, recent studies provide further evidence against a role for magnetic fields as a co-carcinogen (i.e., agents that enhance the effect of known carcinogens). These studies strengthen the conclusion that there is inadequate evidence of carcinogenicity from *in vivo* research, although independent confirmation of the German results is of high priority.

Table 6. Relevant *in vivo* studies of carcinogenesis published after WHO report

Authors	Year	Study
Bernard et al.	2008	Assessing the potential Leukemogenic effects of 50 Hz and their harmonics using an animal leukemia model.
Chung et al.	2008	Lack of a co-promotion effect of 60 Hz rotating magnetic fields on n-ethyl-n-nitrosourea induced neurogenic tumors in F344 rats.
Fedrowitz and Löscher	2008	Exposure of Fischer 344 rats to a weak power frequency magnetic field facilitates mammary tumorigenesis in the DMBA model of breast cancer.
Negishi et al.	2008	Lack of promotion effects of 50 Hz magnetic fields on 7,12-dimethylbenz(a)anthracene-induced malignant lymphoma/lymphatic leukemia in mice
Sommer and Lerchl	2006	50 Hz magnetic fields of 1 mT do not promote lymphoma development in AKR/J mice.

In vitro studies of carcinogenesis

What did the WHO and other scientific panels conclude with respect to *in vitro* studies of carcinogenesis?

In vitro studies are widely used to investigate the mechanisms for effects that are observed in humans and animals. The relative value of *in vitro* tests to human health risk assessment, however, is much less than that of *in vivo* and epidemiology studies. Responses of cells and tissues outside the body may not always reflect the response of those same cells if maintained in a living system, so the relevance of *in vitro* studies cannot be assumed (IARC, 1992).

The IARC and other scientific review panels that systematically evaluated *in vitro* studies concluded that there is no clear evidence indicating how ELF magnetic fields could adversely affect biological processes in cells (IARC, 2002; ICNIRP, 2003; NRPB, 2004). The WHO panel reviewed the *in vitro* research published since the time of these reviews and reached the same conclusion. The WHO noted that previous studies have not indicated a genotoxic effect of ELF magnetic fields on mammalian cells, however a recent series of experiments reported DNA damage in human fibroblasts exposed intermittently to 50 Hz magnetic fields (Ivancsits et al., 2002a,b; Ivancsits et al., 2003a,b). These findings have not been replicated by other laboratories (Scarfi et al., 2005), and the WHO recommended continued research in this area. Recently, investigators reported that they were unable to confirm any evidence for damage to DNA in cells exposed to magnetic fields over a range of exposures from 50 to 10,000 mG (Burdak-Rothkamm et al., 2009). Research in the field of *in vitro* genotoxicity of magnetic fields combined with known DNA-damaging agents is also recommended, following suggestive findings from several laboratories. As noted by the SSI, however, the levels at which these effects were observed are much higher than the levels we are exposed to in our everyday environments and are, therefore, not directly relevant to questions about low-level, chronic exposures (SSI, 2007). *In vitro* studies investigating other possible mechanisms, including gene activation, cell proliferation, apoptosis, calcium signaling, intercellular communication, heat shock protein expression and malignant transformation, have produced “inconsistent and inconclusive” results, according to the WHO (p. 347, WHO, 2007a).

Reproductive and developmental effects

What was previously known about reproductive and developmental effects and what did the WHO report conclude?

Two studies received considerable attention because of a reported association between peak magnetic field exposure greater than approximately 16 mG and miscarriage: a prospective cohort study of women in early pregnancy (Li et al., 2002) and a nested case-control study of women who miscarried compared to their late-pregnancy counterparts (Lee et al., 2002).

These two studies improved on the existing body of literature because average exposure was assessed using 24-hour personal magnetic field measurements (early studies on miscarriage were limited because they used surrogate measures of exposure, including visual display terminal use, electric blanket use or wire code data). Following the publication of these two studies, however, a hypothesis was put forth that the observed association may be the result of behavioral differences between women with "healthy" pregnancies that went to term (less physically active) and women who miscarried (more physically active) (Savitz, 2002). It was proposed that physical activity is associated with an increased opportunity for peak magnetic field exposures, and the nausea experienced in early, healthy pregnancies and the cumbersomeness of late, healthy pregnancies would reduce physical activity levels, thereby decreasing the opportunity for exposure to peak magnetic fields. Furthermore, nearly half of the miscarriages reported in the cohort by Li et al. had magnetic field measurements taken after miscarriage occurred, when changes in physical activity may have already occurred, and all measurements in Lee et al. occurred post-miscarriage.

The scientific panels that have considered these two studies concluded that the possibility of this bias precludes making any conclusions about the effect of magnetic fields on miscarriage (NRPB, 2004; FPTRPC, 2005; WHO, 2007a). The WHO concluded, "There is some evidence for increased risk of miscarriage associated with measured maternal magnetic field exposure, but this evidence is inadequate" (p. 254, WHO 2007a). The WHO stated that, given the potentially high public health impact of such an association, further epidemiologic research is recommended.

What relevant studies have been published since the WHO report?

No new original studies on magnetic field exposure and miscarriage have been conducted; however, recent methodological studies evaluated the likelihood that the observed association was due to the proposed bias.

It is not possible to directly "test" for the effects of this bias in the original studies, but two recent analyses examined whether reduced physical activity was associated with a lower probability of encountering peak magnetic fields (Mezei et al., 2006; Savitz et al., 2006). In a seven-day study of personal magnetic field measurements in 100 pregnant women, Savitz et al. reported that active pregnant women were more likely to encounter peak magnetic fields. In addition, an analysis by Mezei et al. of pre-existing databases of magnetic field measurements among pregnant and non-pregnant women found that increased activity levels were associated with peak magnetic fields (Mezei et al., 2006). These findings are broadly supportive of the hypothesis that reduced activity among women in early pregnancies because of nausea and in later pregnancies because of cumbersomeness may explain the observed association between peak magnetic fields and miscarriage. As noted in a recent commentary on this issue, however, the possibility that there is a relationship between peak magnetic field exposure and miscarriage still cannot be excluded and further research that accounts for this possible bias should be conducted (Neutra and Li, 2008; Mezei et al., 2006). There remains no biological basis to indicate that magnetic field exposure increases the risk of miscarriage (WHO, 2007a).

An additional study was recently published related to developmental outcomes. Fadel et al. (2006) conducted a cross-sectional study in Egypt of 390 children 0-12 years of age living in an area within 50 meters of an electrical power line and 390 children 0-12 years of age living in a region with no power lines in close proximity. Measurements were taken as proxies of growth retardation, and radiological assessments were performed on carpal bones. The authors reported that children living in the region near power lines had a statistically significant lower weight at birth and a reduced head and chest circumference and height at all ages. The authors concluded that "exposure to low frequency electromagnetic fields emerged [*sic*] from high voltage electric power lines increases the incidence of growth retardation among children" (p. 211). However, this conclusion fails to adequately take into account the many limitations of their cross-sectional analysis (namely, inadequate control for the possible confounding effects of nutritional and SES status) and the pre-existing body of literature, which does not support such an association (WHO, 2007a).

The recent research does not provide sufficient evidence to alter the conclusion that the evidence for developmental or reproductive effects is inadequate. Recent studies of animals *in vivo* also do not provide evidence to change the conclusions expressed by the WHO (Al-Akhras et al., 2006; Anselmo et al., 2006; Okundan et al., 2006; Kim et al., 2009).

Table 7. Relevant studies of reproductive and developmental effects published after WHO report

Authors	Year	Study
Al-Akhras et al.	2006	Influence of 50 Hz magnetic field on sex hormones and other fertility parameters of adult male rats.
Anselmo et al.	2006	Influence of a 60 Hz, 3 microT, electromagnetic field on the reflex maturation of Wistar rats offspring from mothers fed a regional basic diet during pregnancy.
Fadel et al.	2006	Growth assessment of children exposed to low frequency electromagnetic fields at the Abu Sultan area in Ismailia (Egypt).
Kim et al.	2009	Effects of 60 Hz 14 µT magnetic field on the apoptosis of testicular germ cell in mice.
Mezei et al.	2006	Analyses of magnetic-field peak-exposure summary measures.
Okundan et al.	2006	DEXA analysis on the bones of rats exposed in utero and neonatally to static and 50 Hz electric fields.
Savitz et al.	2006	Physical activity and magnetic field exposure in pregnancy.

Neurodegenerative disease

What was previously known about neurodegenerative disease and what did the WHO report conclude?

Research into the possible effect of magnetic fields on the development of neurodegenerative diseases began in 1995, and the majority of research since then has focused on Alzheimer's disease and a specific type of motor neuron disease called amyotrophic lateral sclerosis (ALS), which is also known as Lou Gehrig's disease. The inconsistency of the Alzheimer's disease studies prompted the NRPB to conclude that there is "only weak evidence to suggest that it [ELF magnetic fields] could cause Alzheimer's disease" (p. 20, NRPB, 2001). Early studies on ALS, which had no obvious biases and were well conducted, reported an association between ALS mortality and estimated occupational magnetic field exposure. The review panels, however, were hesitant to conclude that the associations provided strong support for a causal relationship. Rather, they felt that an alternative explanation (i.e., electric shocks received at work) may be the source of the observed association.

The majority of the more recent studies discussed by the WHO reported statistically significant associations between occupational magnetic field exposure and mortality from Alzheimer's disease and ALS, although the design and methods of these studies were relatively weak (e.g., disease status was based on death certificate data, exposure was based on incomplete occupational information from census data, and there was no control for confounding factors).

Furthermore, there was no biological data to support an association between magnetic fields and neurodegenerative diseases. The WHO panel concluded that there is "inadequate" data in support of an association between magnetic fields and Alzheimer's disease or ALS.[19] The panel recommended more research in this area using better methods; in particular, studies that enrolled incident Alzheimer's disease cases (rather than ascertaining cases from death certificates) and studies that estimated electrical shock history in ALS cases were recommended.

What relevant studies have been published since the WHO report?

Numerous studies have been published since the WHO report. Two occupational cohorts were followed for neurodegenerative diseases – approximately 20,000 railroad workers in Switzerland (Röösli et al., 2007b) and over 80,000 electrical and generation workers in the UK (Sorahan and Kheifets, 2007). Two case-control studies collected incident cases of Alzheimer's disease and estimated occupational magnetic field exposure (Davanipour et al., 2007; Seidler et al., 2007), and a meta-analysis was conducted of occupational magnetic field exposure and Alzheimer's disease studies (García et al., 2008). The first study of non-occupational exposure followed the Swiss population to evaluate associations with residential distance to power lines and death due to neurodegenerative diseases (Huss et al., 2009).

García et al. (2008) identified 14 epidemiologic studies with information on Alzheimer's disease and occupational EMF exposure; the WHO considered the majority of these studies in their 2007 review. A statistically significant association between Alzheimer's disease and occupational EMF exposure was observed for both case-control and cohort studies (OR =2.03, 95% CI=1.38-3.00 and RR =1.62, 95% CI=1.16-2.27, respectively), although the results from the individual studies were so different that the authors cautioned against the validity of these combined results. While some subgroup analyses had statistically significant increased risks and were not significantly heterogeneous between studies, the findings were contradictory between study design types (e.g., elevated pooled risk estimates were reported for *men* in cohort studies and elevated pooled risk estimates were reported for *women* in case-control studies).

[19] After considering the entire body of literature and its limitations, the WHO report concluded, "When evaluated across all the studies, there is only very limited evidence of an association between estimated ELF exposure and [Alzheimer's] disease risk" (p. 194, WHO 2007a).

The authors concluded that their results suggest an association between Alzheimer's disease and occupational magnetic field exposure, but noted the numerous limitations associated with these studies, including the difficulty of assessing EMF exposure during the appropriate time period, case ascertainment issues due to diagnostic difficulties, and differences in control selection. They recommended further research that uses more advanced methods.

An earlier publication by the same group of investigators documented the relatively poor quality of the studies included in the meta-analysis. Santibáñez et al. (2007) evaluated studies related to occupational exposures and Alzheimer's disease, which included seven of the studies in the García et al. meta-analysis. Two epidemiologists blindly evaluated each of these studies using a questionnaire to assess the possibility of a number of biases, with a score assigned to each study that represents the percentage of possible points that the study obtained (range 0 – 100%). Only one of the seven studies obtained a score above 50% (a retrospective cohort study by Savitz et al. in 1998), and disease and exposure misclassifications were the most prevalent biases.

Davanipour et al. (2007) extended the early hypothesis-generating study by Sobel et al. (1996) by collecting cases from eight California Alzheimer's Disease Diagnostic and Treatment Centers. Self-reported primary occupation was collected from patients with verified diagnoses of Alzheimer's disease and compared to occupational information collected from persons diagnosed with other dementia-related problems at the Centers. The results of this study were consistent with the previous studies by Sobel et al.; cases were approximately twice as likely to be classified as having medium/high magnetic field exposures, compared with controls. The strengths of this study included its large size and self-reported occupational information. The main limitation of this study was that the exposure assessment only considered a person's primary occupation, classified as low, medium or high magnetic field exposure. The WHO noted limitations of the 1996 publication that are relevant to this publication as well, including the use of controls with dementia (which some studies report have an increased risk of Alzheimer's disease) and the classification of seamstresses, dressmakers and tailors as "high exposure" occupations, which drives the increase in risk.

Seidler et al. (2007) conducted a similar case-control study in Germany, except cases included all types of dementia (55% of which had Alzheimer's disease). Cumulative magnetic field exposure was estimated from occupational histories taken from proxy respondents, and no difference was reported between cases of dementia or probable Alzheimer's disease and controls, although an association was reported among electrical and electronics workers. The authors reported that exposure misclassification was likely to be a significant problem, and concluded that their results indicate a strong effect of low-dose EMF is "rather improbable" (p. 114).

Death from several neurodegenerative conditions was also evaluated in the cohort of more than 20,000 Swiss railway workers described above (Röösli et al., 2007b). Magnetic field exposure was characterized by specific job titles as recorded in employment records; stationmasters were considered to be in the lowest exposure category and were, therefore, used as the reference group. Train drivers were considered to have the highest exposure, and shunting yard engineers and train attendants were considered to have exposure intermediate to stationmasters and train drivers. Cumulative magnetic field exposure was also estimated for each occupation using on-site measurements and modeling of past exposures. The authors reported an excess of senile dementia disease among train drivers, compared to station masters, however, the difference was not statistically significant. The association was larger when restricted to Alzheimer's disease, but was still not statistically significant (hazard ratio [HR]=3.15, 95% CI=0.90-11.04); an association was observed between cumulative magnetic field exposure and Alzheimer's disease/senile dementia. No elevation in mortality was reported for multiple sclerosis, Parkinson's disease, or ALS among train drivers, shunting yard engineers, or train attendants, compared with stationmasters, nor were more deaths from these causes observed for higher estimated magnetic field exposures. Similar to another recent Swedish study (Feychting et al., 2003), the authors reported that recent exposure was more strongly associated with Alzheimer's disease than past exposure.

There are several strengths of this study relative to the existing body of data. First, there is little turnover among Swiss railway employees, which means that study participants are enrolled in the cohort and possibly exposed for long periods of time. The wide variation in exposure levels between different occupations in the same industry allows for comparison of similar workers with different levels of exposure. Another advantage is that the company kept detailed registers of employees, which means that there is less potential for bias in the enumeration of the cohort and reconstruction of exposures. Finally, the authors reported that exposures to chemicals or electric shocks, which often occur in other occupational settings (for example, in electric utility workers or welders), are rare in this occupation.

Sorahan and Kheifets (2007) followed a cohort of approximately 84,000 electrical and generation workers in the UK for deaths attributed to neurodegenerative disease on death certificates. Cumulative magnetic field exposure was calculated for each worker, using job and facility information. The authors reported that the cohort did not have a significantly greater number of deaths due to Alzheimer's disease or motor neuron disease, compared to the general UK population. They also reported that persons with higher estimated magnetic field exposures did not have a consistent excess of death due to Alzheimer's disease or motor neuron disease, compared to persons with lower estimated magnetic field exposure. A statistically significant excess of deaths due to Parkinson's disease was observed in the cohort, although there was no association between calculated magnetic field exposure and Parkinson's disease. The authors concluded "our results provide no convincing evidence for an association between occupational exposure to magnetic fields and neurodegenerative disease" (p. 14). This result is consistent with two other Alzheimer's mortality follow-up studies of electric utility workers in the US (Savitz et al., 1998) and Denmark (Johansen and Olsen, 1998). The findings may be limited by the use of death certificate data, but are strengthened by the detailed exposure assessment.

Another cohort study conducted in Switzerland linked all persons older than 30 years of age at the 2000 census with a national database of death certificates from 2000 through 2005 (Huss et al., 2009). Residential location was also extracted from 1990 and 2000 census data and the closest distance of a person's home in 2000 to nearby 220-380 kV transmission lines was calculated. The authors reported that persons living within 50 meters of these high-voltage transmission lines were more likely to have died from Alzheimer's disease, compared to those living farther than 600 meters, although chance could not be ruled out as an explanation (HR=1.24, 95% CI=0.80-1.92). The association was stronger for persons that lived at the residence for at least 15 years (HR=2.00, 95% CI=1.21-3.33). Associations of similar magnitude were reported for senile dementia and residence within 50 meters of a high-voltage line. No associations were reported beyond 50 meters for Alzheimer's disease or senile dementia, and no associations were reported at any distance for Parkinson's disease, ALS, or multiple sclerosis.

The study's main limitation is the use of residential distance from transmission lines as a proxy for magnetic-field exposure (Maslanyj et al, 2009). It is also limited by the use of death certificate data, which are known to under-report Alzheimer's disease, and the lack of a full residential and occupational history. Furthermore, while the underlying cohort was very large, relatively few cases of Alzheimer's disease lived within 50 meters of a high-voltage transmission line – 20 cases total and 15 cases who lived at the residence for at least 15 years. This means that misclassification of a small number of cases could have a large impact on the risk estimate.

In summary, two cohort studies of the Swiss population of relatively high quality were recently followed for death due to neurodegenerative disease. Röösli et al. (2007b) reported an association between Alzheimer's disease/senile dementia and occupational magnetic-field exposure, while Huss et al. (2009) reported an association between Alzheimer's disease/senile dementia and living within 50 meters of a high-voltage transmission line for at least 15 years. Neither study reported an association with any other neurodegenerative disease, including ALS. A cohort of utility workers, however, did not confirm an association with Alzheimer's disease mortality and magnetic field exposure. The meta-analysis and supporting evaluation of study quality by García, Santibáñez and colleagues confirmed that the associations reported in previous occupational studies are highly inconsistent and the studies have many limitations (Santibáñez et al., 2007; García et al., 2008).

The main limitations of these studies include the difficulty in diagnosing Alzheimer's disease; the difficulty of identifying a relevant exposure window given the long and nebulous course of this disease; the difficulty of estimating magnetic field exposure prior to appearance of the disease; the under-reporting of Alzheimer's disease on death certificates; crude exposure evaluations that are often based on the recollection of occupational histories by friends and family given the cognitive impairment of the study participants; and the lack of consideration of both residential and occupational exposures or confounding variables.

The recent epidemiologic studies do not alter the conclusion that there is "inadequate" data on Alzheimer's disease or ALS. While a good number of studies have been published since the WHO report, little progress has been made on clarifying these associations. Further research is still required, particularly on electrical occupations and ALS (Kheifets et al., 2008). There is currently no body of *in vivo* research to suggest an effect, and a recent study reported no effect of magnetic fields on ALS progression (Poulletier de Gannes et al., 2008). These conclusions are consistent with the recent review by the SCENIHR (SCENIHR, 2009).

Table 8. Relevant studies of neurodegenerative disease published after WHO report

Authors	Year	Study
Davanipour et al.,	2007	A case-control study of occupational magnetic field exposure and Alzheimer's disease: results from the California Alzheimer's Disease Diagnosis and Treatment Centers.
García, et al.	2008	Occupational exposure to extremely low frequency electric and magnetic fields and Alzheimer disease: a meta-analysis.
Huss, et al.	2009	Residence near power lines and mortality from neurodegenerative diseases: longitudinal study of the Swiss population.
Poulletier de Gannes et al.	2008	Amyotrophic lateral sclerosis (ALS) and extremely-low frequency (ELF) magnetic fields: a study in the SOD-1 transgenic mouse model.
Röösli, et al.	2007b	Mortality from neurodegenerative disease and exposure to extremely low-frequency magnetic fields: 31 years of observations on Swiss railway employees.
Santibáñez, et al.	2007	Occupational risk factors in Alzheimer's disease: a review assessing the quality of published epidemiological studies.
Seidler et al.	2007	Occupational exposure to low frequency magnetic fields and dementia: a case-control study.
Sorahan and Kheifets	2007	Mortality from Alzheimer's, motor neurone and Parkinson's disease in relation to magnetic field exposure: findings from the study of UK electricity generation and transmission workers, 1973-2004.

3 Possible Effects of ELF Electric and Magnetic Fields on Implanted Cardiac Devices

The sensing system of pacemakers and other implanted cardiac devices (ICD) is designed to be responsive to the heart's electrical signal. For this reason, other electrical signals can potentially interfere with the normal functioning of pacemakers and ICDs, a phenomenon called electromagnetic interference (EMI). Most sources of EMF are too weak to affect a pacemaker or ICD; however, EMF from certain sources, e.g., some appliances and industrial equipment, may cause interference. This section considers potential electromagnetic interference with implanted cardiac devices such as pacemakers and defibrillators.

In the presence of electromagnetic fields, devices can respond in different ways, defined as modes. The likelihood of interference occurring, and the mode of the response depend on the strength of the interference signal, the patient's orientation in the electromagnetic field, the exact location of the device and the variable parameters of the device that are specific to a patient. Experimental research has been conducted to assess whether interference may occur when currents are induced in the patient's body by environmental electric and magnetic fields.

We performed an extensive search on PubMed for literature related to the effects of EMI on pacemakers and ICDs dating back to 1990. The studies (Toivonen et al., 1991; Astridge et al., 1993; Scholten et al., 2001) showed that the unipolar pacemakers, in general, were sensitive to electric fields of approximately 1 kV/m and above. Bipolar devices, which are specifically designed to reduce the effects of EMI, were much less sensitive and interference effects were observed at electric field strengths of 4-5 kV/m and above.

To prevent against pacemaker EMI, the American Conference of Governmental Industrial Hygienists (ACGIH) and the Electric Power Research Institute (EPRI) suggest that exposures be kept below 1.5-2 kV/m for electric fields and the ACGIH recommends 1 G for magnetic fields (ACGIH 2001, EPRI 2004). These recommendations are general in nature and do not address the fact that classes of pacemakers from some manufacturers are quite immune to interference even at levels much greater than the above recommendations. All standards recommend that the patient consult their physicians and the respective pacemaker manufacturer before following the standard guidelines.

Out of the approximately 12 cardiac device manufacturers only 2, Boston Scientific and Medtronic, are known to provide a general guideline for electric and magnetic field exposure limits (Hauser, 2007). Boston Scientific recommends values below 1-4 kV/m and 1 G at 60 Hz, based in part on the guidelines issued by ACGIH and EPRI (Boston Scientific, 2006). Medtronic recommends an electric field exposure below 6 kV/m for their implanted devices.

In order to reduce the potential effects of environmental exposure to electric and magnetic fields, the Center for Devices and Radiological Health of the United States Food and Drug Administration (FDA) has issued guidelines for both the development of pacemakers and the design of new electrical devices to minimize susceptibility to electrical interference from any source. Pacemakers today are designed to filter out electrical stimuli from sources other than the heart, e.g., the muscles of the chest, currents encountered from touching household appliances, or currents induced by external electric or magnetic fields. Used in both temporary and permanent pacemakers, these electrical filters increase the pacemaker's ability to distinguish extraneous signals from legitimate cardiac signals (Toivonen et al., 1991). Furthermore, most circuitry of modern pacemakers is encapsulated by titanium metal, which insulates the device by shielding the pacemaker's pulse generator from electric fields. Some pacemakers may also be programmed to automatically pace the heart if interference from electric and magnetic fields is detected (fixed pacing mode). This supports cardiac function and allows the subject to feel the pacing and move away from the source.

Due to recent design improvements, many pacemakers currently in use would not be susceptible to low intensity electric fields. There remains a very small possibility that some pacemakers, particularly those of older design and with single-lead electrodes (i.e., unipolar devices), may sense potentials induced on the electrodes and leads of the pacemaker and provide unnecessary stimulation to the heart.

In summary, interference from strong electric fields is theoretically possible under certain circumstances. The likelihood of interference occurring is low, however, particularly with respect to sources that produce low levels of electric fields and when modern devices are implanted. It is recommended that concerned patients contact their doctor to discuss the make and model of their implanted device, their clinical condition, and any lifestyle factors that put them in close contact with strong fields.

4 Fauna and Flora Research

Fauna

Our previous report concluded that the research to date did not suggest that electric or magnetic fields result in any adverse effects on the health, behavior or productivity of fauna, including livestock such as cows, sheep, and pigs, and a variety of small mammals, deer, elk, birds and bees. The research indicates that some species of animals, unlike humans, are able to detect magnetic fields at levels that may be associated with transmission lines, and this detection may be important for navigational purposes in particular species such as birds. Detection, however, does not imply that the fields result in any effects, or that these effects are adverse. Furthermore, studies of small mammals and birds associated with the research programs by the U.S. Navy and the Bonneville Power Administration reported that there were not any changes in the movement patterns of these animals to suggest that they were avoiding areas near high-voltage rights-of-way (ROW), nor were there any physiological changes or alterations in homing behavior. Reports by two investigators found that commercial honeybee hives can be impacted by EMF from transmission lines because of a current induced by metal parts on the hive; however, this effect is easily remedied and does not apply to wild bees. In summary, the research did not suggest that EMF exposure, or audible noise, would cause any harm to fauna living in the vicinity of high-voltage transmission lines.

Subsequent to Exponent's 2007 report, one study has been published on the possible effects of AC EMF on fauna (Burchard et al., 2007). This study is the most recent publication in a long series of controlled studies at McGill University on the possible effects of strong and continuous EMF exposure on the health, behavior and productivity of dairy cattle (Burchard et al., 1996; Burchard et al., 1998a,b,c; Burchard et al., 1999; Rodriquez et al., 2002; Burchard et al., 2003; Rodriquez et al., 2003; Burchard et al., 2004; Rodriguez et al., 2004). The goal of the research program was to assess whether EMF exposure could mimic the effect of days with long periods of light and *increase* milk production and feed intake through a hormonal pathway involving melatonin. In previous studies, some differences were reported between EMF-exposed and unexposed cows; however, they were not reported consistently between studies, the changes were still within the range of what is considered normal, and it did not appear that the changes were adverse in nature or had any ecological significance. The study by Burchard et al. in 2007 differed from previous studies in that the exposure was restricted to magnetic fields; the outcomes evaluated included the hormones progesterone, melatonin, prolactin, and insulin-like growth factor 1 (IGF-1), as well as feed consumption. No significant differences in melatonin levels, progesterone levels, or feed intake were reported. Significant decreases in prolactin and IGF-1 levels were reported, which is inconsistent with the authors' theory that EMF exposure may increase these hormone levels.

Thus, similar to the previous studies by this group of investigators, Burchard et al. (2007) did not report findings that suggest magnetic fields cause changes in the melatonin pathway that could result in effects on reproduction or production. The authors concluded the following: "The absence of abnormal clinical signs and the absolute magnitude of the significant changes detected during MF [magnetic field] exposure, make it plausible to preclude any major animal health hazard" (p. 471).

Flora

The previous report described the body of research on the possible effects of EMF on forest species and agriculture crops, concluding that researchers have found no adverse effects on plant responses at the levels of EMF produced by high-voltage transmission lines, excluding some corona-related effects from high-voltage lines on the growth of nearby trees.

A recent study by Huang and Wang (2008) evaluated the effects of magnetic fields induced by an inverter system on the early seed germination of mung beans. The exposures were applied at six different frequencies between 10-60 Hz, producing magnetic field levels from 6-20 mG. At 20 and 60 Hz, magnetic field exposure enhanced early growth of the mung beans, while magnetic fields induced by other frequencies had an inhibitory effect on early growth of the mung beans.

5 Standards and Guidelines

Following a thorough review of the research, scientific agencies develop exposure standards to protect against known health effects. The major purpose of a weight-of-evidence review is to identify the lowest exposure level below which no health hazards have been found (i.e., a threshold). Exposure limits are then set well below the threshold level to account for any individual variability or sensitivities that may exist.

Several scientific organizations have published guidelines for exposure to EMF based on acute health effects that can occur at very high field levels. The ICNIRP reviewed the epidemiologic and experimental evidence through 1997 and concluded that there was insufficient evidence to warrant the development of standards or guidelines on the basis of hypothesized long-term adverse health effects such as cancer; rather, the guidelines put forth in their 1998 document set limits to protect against acute health effects (i.e., the stimulation of nerves and muscles) that occur at much higher field levels. The ICNIRP recommends a residential screening value of 833 mG and an occupational exposure screening value of 4,200 mG (ICNIRP, 1998). If exposures exceed these screening values, then additional dosimetry evaluations are needed to determine whether basic restrictions on induced current densities are exceeded.

The International Committee on Electromagnetic Safety (ICES) also recommends limiting magnetic field exposures at high levels because of the risk of acute effects, although their guidelines are higher than ICNIRP's guidelines; the ICES recommends a residential exposure limit of 9,040 mG and an occupational exposure limit of 27,100 mG (ICES, 2002). The ICNIRP and ICES guidelines provide guidance to national agencies and only become legally binding if a country adopts them into legislation. The WHO strongly recommends that countries adopt the ICNIRP guidelines, or use a scientifically sound framework for formulating any new guidelines (WHO, 2006).

There are no national or state standards in the United States limiting exposures to ELF fields based on health effects. Two states, Florida and New York, have enacted standards to limit magnetic fields at the edge of the right-of-way from transmission lines (150 mG and 200 mG, respectively) (NYPSC, 1978; FDER, 1989; NYPSC, 1990; FDEP, 1996). The basis for limiting magnetic fields from transmission lines was to maintain the "status quo" so that fields from new transmission lines would be no higher than those produced by existing transmission lines.

Table 9. Screening guidelines for EMF exposure

Exposure (60 Hz)	Electric field	Magnetic field
ICNIRP		
Occupational	8.3 kV/m	4.2 G (4,200 mG)
General Public	4.2 kV/m	0.833 G (833 mG)
ICES		
Occupational	20 kV/m	27.1 G (27,100 mG)
General Public	5 kV/m^	9.040 G (9,040 mG)

Sources: ICNIRP, 1998; ICES, 2002
^Within power line right-of-ways, the guideline is 10 kV/m under normal load conditions.

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Appendix 1 – WHO Fact Sheet

Fact sheet N°322
June 2007

Electromagnetic fields and public health
Exposure to extremely low frequency fields

The use of electricity has become an integral part of everyday life. Whenever electricity flows, both electric and magnetic fields exist close to the lines that carry electricity, and close to appliances. Since the late 1970s, questions have been raised whether exposure to these extremely low frequency (ELF) electric and magnetic fields (EMF) produces adverse health consequences. Since then, much research has been done, successfully resolving important issues and narrowing the focus of future research.

In 1996, the World Health Organization (WHO) established the International Electromagnetic Fields Project to investigate potential health risks associated with technologies emitting EMF. A WHO Task Group recently concluded a review of the health implications of ELF fields (WHO, 2007).

This Fact Sheet is based on the findings of that Task Group and updates recent reviews on the health effects of ELF EMF published in 2002 by the International Agency for Research on Cancer (IARC), established under the auspices of WHO, and by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) in 2003.

ELF field sources and residential exposures

Electric and magnetic fields exist wherever electric current flows **-** in power lines and cables, residential wiring and electrical appliances. **Electric** fields arise from electric charges, are measured in volts per metre (V/m) and are shielded by common materials, such as wood and metal. **Magnetic** fields arise from the motion of electric charges (i.e. a current), are expressed in tesla (T), or more commonly in millitesla (mT) or microtesla (µT). In some countries another unit called the gauss, (G), is commonly used (10,000 G = 1 T). These fields are not shielded by most common materials, and pass easily through them. Both types of fields are strongest close to the source and diminish with distance.

Most electric power operates at a frequency of 50 or 60 cycles per second, or hertz (Hz). Close to certain appliances, the magnetic field values can be of the order of a few hundred microtesla. Underneath power lines, magnetic fields can be about 20 µT and electric fields can be several thousand volts per metre. However, average residential power-frequency magnetic fields in homes are much lower **-** about 0.07 µT in Europe and 0.11 µT in North America. Mean values of the electric field in the home are up to several tens of volts per metre.

Task group evaluation

In October 2005, WHO convened a Task Group of scientific experts to assess any risks to health that might exist from exposure to ELF electric and magnetic fields in the frequency range >0 to 100,000 Hz (100 kHz). While IARC examined the evidence regarding cancer in 2002, this Task Group reviewed evidence for a number of health effects, and updated the evidence regarding cancer. The conclusions and recommendations of the Task Group are presented in a WHO Environmental Health Criteria (EHC) monograph (WHO, 2007).

Following a standard health risk assessment process, the Task Group concluded that there are no substantive health issues related to ELF electric fields at levels generally encountered by members of the public. Thus the remainder of this fact sheet addresses predominantly the effects of exposure to ELF magnetic fields.

Short-term effects

There are established biological effects from acute exposure at high levels (well above 100 µT) that are explained by recognized biophysical mechanisms. External ELF magnetic fields induce electric fields and currents in the body which, at very high field strengths, cause nerve and muscle stimulation and changes in nerve cell excitability in the central nervous system.

Potential long-term effects

Much of the scientific research examining long-term risks from ELF magnetic field exposure has focused on childhood leukaemia. In 2002, IARC published a monograph classifying ELF magnetic fields as "possibly carcinogenic to humans". This classification is used to denote an agent for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence for carcinogenicity in experimental animals (other examples include coffee and welding fumes). This classification was based on pooled analyses of epidemiological studies demonstrating a consistent pattern of a two-fold increase in childhood leukaemia associated with average exposure to residential power-frequency magnetic field above 0.3 to 0.4 µT. The Task Group concluded that additional studies since then do not alter the status of this classification.

However, the epidemiological evidence is weakened by methodological problems, such as potential selection bias. In addition, there are no accepted biophysical mechanisms that would suggest that low-level exposures are involved in cancer development. Thus, if there were any effects from exposures to these low-level fields, it would have to be through a biological mechanism that is as yet unknown. Additionally, animal studies have been largely negative. Thus, on balance, the evidence related to childhood leukaemia is not strong enough to be considered causal.

Childhood leukaemia is a comparatively rare disease with a total annual number of new cases estimated to be 49,000 worldwide in 2000. Average magnetic field exposures above 0.3 µT in homes are rare: it is estimated that only between 1% and 4% of children live in such conditions. If the association between magnetic fields and childhood leukaemia is causal, the number of cases worldwide that might be attributable to magnetic field exposure is estimated to range from 100 to 2400 cases per year, based on values for the year 2000, representing 0.2 to 4.95% of the total incidence for that year. Thus, if ELF magnetic fields actually do increase the risk of the disease, when considered in a global context, the impact on public health of ELF EMF exposure would be limited.

A number of other adverse health effects have been studied for possible association with ELF magnetic field exposure. These include other childhood cancers, cancers in adults, depression, suicide, cardiovascular disorders, reproductive dysfunction, developmental disorders, immunological modifications, neurobehavioural effects and neurodegenerative disease. The WHO Task Group concluded that scientific evidence supporting an association between ELF magnetic field exposure and all of these health effects is much weaker than for childhood leukaemia. In some instances (i.e. for cardiovascular disease or breast cancer) the evidence suggests that these fields do not cause them.

International exposure guidelines

Health effects related to short-term, high-level exposure have been established and form the basis of two international exposure limit guidelines (ICNIRP, 1998; IEEE, 2002). At present, these bodies consider the scientific evidence related to possible health effects from long-term, low-level exposure to ELF fields insufficient to justify lowering these quantitative exposure limits.

WHO's guidance

For high-level short-term exposures to EMF, adverse health effects have been scientifically established (ICNIRP, 2003). International exposure guidelines designed to protect workers and the public from these effects should be adopted by policy makers. EMF protection programs should include exposure measurements from sources where exposures might be expected to exceed limit values.

Regarding long-term effects, given the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukaemia, the benefits of exposure reduction on health are unclear. In view of this situation, the following recommendations are given:

- Government and industry should monitor science and promote research programmes to further reduce the uncertainty of the scientific evidence on the health effects of ELF field exposure. Through the ELF risk assessment process, gaps in knowledge have been identified and these form the basis of a new research agenda.
- Member States are encouraged to establish effective and open communication programmes with all stakeholders to enable informed decision-making. These may include improving coordination and consultation among industry, local government, and citizens in the planning process for ELF EMF-emitting facilities.
- When constructing new facilities and designing new equipment, including appliances, low-cost ways of reducing exposures may be explored. Appropriate exposure reduction measures will vary from one country to another. However, policies based on the adoption of arbitrary low exposure limits are not warranted.

Further reading

WHO - World Health Organization. Extremely low frequency fields. Environmental Health Criteria, Vol. 238. Geneva, World Health Organization, 2007.

IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Non-ionizing radiation, Part 1: Static and extremely low-frequency (ELF) electric and magnetic fields. Lyon, IARC, 2002 (Monographs on the Evaluation of Carcinogenic Risks to Humans, 80).

ICNIRP - International Commission on Non-Ionizing Radiation Protection. Exposure to static and low frequency electromagnetic fields, biological effects and health consequences (0-100 kHz). Bernhardt JH et al., eds. Oberschleissheim, International Commission on Non-ionizing Radiation Protection, 2003 (ICNIRP 13/2003).

ICNIRP – International Commission on Non-Ionizing Radiation Protection (1998). Guidelines for limiting exposure to time varying electric, magnetic and electromagnetic fields (up to 300 GHz). Health Physics 74(4), 494-522.

IEEE Standards Coordinating Committee 28. IEEE standard for safety levels with respect to human exposure to electromagnetic fields, 0-3 kHz. New York, NY, IEEE - The Institute of Electrical and Electronics Engineers, 2002 (IEEE Std C95.6-2002).

For more information contact:

WHO Media centre
Telephone: +41 22 791 2222
E-mail: mediainquiries@who.int

Appendix 2 – Comment on the BioInitiative Report

Background

In August 2007, an *ad hoc* group of 14 scientists and public health and policy "experts" published a report to "assess scientific evidence on health impacts from electromagnetic radiation below current public exposure limits and evaluate what changes in these limits are warranted now to reduce possible public health risks in the future" (p. 4). The individuals who comprised this group did not represent any well-established regulatory agency, nor were they convened by a recognized scientific authority. The report (hereafter referred to as the BioInitiative report) is a collection of 17 sections on various topics each authored by one to three persons from the working group. The research on both ELF and radio frequency (RF) EMF was addressed, with major portions of the report focused largely or entirely on RF research. With regard to ELF-EMF, the epidemiologic literature related to childhood cancers, Alzheimer's disease and breast cancer was discussed, as well as the experimental data for a number of mechanistic hypotheses.

Conclusions and comments

The authors of the BioInitiative Report contended that the standard procedure for developing exposure guidelines – i.e., to set guidelines where adverse health effects have been established by using a weight-of-evidence approach – is not appropriate and should be replaced by a process that sets guidelines at exposure levels where biological effects have been reported in some studies, but not substantiated in a rigorous review of the science or linked to adverse health effects.

Based on this argument, the main conclusion of the BioInitiative report was that existing standards for exposure to ELF-EMF are insufficient because "effects are now widely reported to occur at exposure levels significantly below most current national and international limits" (Table 1-1). Specifically, the authors concluded that there was strong evidence to suggest that magnetic fields were a cause of childhood leukemia based on epidemiologic findings. The report recommended the following:

> ELF limits should be set below those exposure levels that have been linked in childhood leukemia studies to increased risk of disease, plus an additional safety factor … While new ELF limits are being developed and implemented, a reasonable approach

> would be a 1 mG (0.1 μT) planning limit for habitable space adjacent to all new or upgraded power lines and a 2 mG (0.2 μT) limit for all other new construction. It is also recommended that a 1 mG (0.1 μT) limit be established for existing habitable space for children and/or women who are pregnant. (p. 22)

The recommendations made in the BioInitiative report are not based on appropriate scientific methods and, therefore, do not warrant any changes to the conclusions from the numerous scientific agencies that have already considered this issue. These organizations are consistent in their conclusions that the research does not support the setting of exposure standards at these low levels of magnetic field exposure.

The World Health Organization (WHO) published the most recent weight-of-evidence review in June 2007 and concluded the following:

> Everyday, low-intensity ELF magnetic field exposure poses a possible increased risk of childhood leukaemia, but the evidence is not strong enough to be considered causal and therefore ELF magnetic fields remain classified as possibly carcinogenic. (p. 357)

The report continued:

> Given the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukaemia and the limited potential impact on public health, the benefits of exposure reduction on health are unclear and thus the cost of reducing exposure should be very low. (p. 372)

The WHO made no recommendations for exposure standards at the magnetic field levels where an association has been reported in some epidemiologic studies of childhood leukemia. In a fact sheet created for the general public and published on their website, the WHO stated,

> When constructing new facilities and designing new equipment, including appliances, low-cost ways of reducing exposures may be explored…However, policies based on the adoption of arbitrary low exposure limits are not warranted.[20]

The conclusions in the BioInitiative report deviate substantially from those of reputable scientific organizations because they were not based on standard, scientific methods. Valid scientific conclusions are based on weight-of-evidence reviews, which entail a systematic evaluation of the entire body of scientific evidence in three areas of research (i.e., epidemiology, *in vivo* research and *in vitro* research) by a panel of experts in these relevant disciplines. The report by the BioInitiative working group does not represent a valid weight-of-evidence review for the following key reasons:

[20] http://www.who.int/mediacentre/factsheets/fs322/en/index.html

1. **Review panels should consist of a multidisciplinary team of experts that reach consensus statements by collaboratively contributing to and reviewing the final work product.** This process ensures that overall conclusions represent a valid and balanced view of each relevant area of research. The document released by the BioInitiative working group was a compilation of sections, with each authored by one to three members of the group. It does not appear that the report was developed collaboratively or reviewed in its entirety by each member.

2. **Valid conclusions about causality are based on systematic evaluations of three lines of evidence - epidemiology, *in vivo* research and *in vitro* research.** The conclusions in the BioInitiative report are not based on this multidisciplinary approach. In particular, little attention is provided to the results from whole animal *in vivo* studies on cancer and disproportionate weight is given to the results of *in vitro* studies reporting biological effects.

3. **The entire body of evidence to date should be considered when drawing conclusions regarding the strength of evidence in support of a hypothesis.** The BioInitiative report is not a comprehensive review of the cumulative evidence. Rather, results from specific studies are cited, but no rationale is provided for their inclusion relative to the many other relevant, published studies.

4. **The evidence from each study must be critically evaluated to determine its validity and the degree to which it is relevant and able to support or refute the hypothesis under question.** The significance of the results reported in any study depend on the validity of the methods used in that study, so weight-of-evidence reviews must include an evaluation of the strengths and limitations of each study. In some discussions, the report claimed to use a weight-of-evidence approach, but the individual sections of the report provide little evidence that the strengths and limitations of individual studies (e.g., the quality of exposure assessment, sample size, biases, and confounding factors) were systematically evaluated.

5. **Support for a causal relationship is based on consistent findings from methodologically sound epidemiologic studies that are coherent with the results reported from *in vivo* and *in vitro* studies**. The BioInitiative group often arrived at conclusions about causality by considering only a few studies from one discipline, with no consideration of the significance and validity of the study's results.

In summary, the authors of this report largely ignored basic scientific methods that should be followed in the review and evaluation of scientific evidence. These methods are fundamental to scientific inquiry and are not, as the BioInitiative report states, "unreasonably high."

The policy responses proposed in the report are cast as consistent with the precautionary principle, i.e., taking action in situations of scientific uncertainty before there is strong proof of harm. A central tenet of the precautionary principle is that precautionary recommendations are proportional to the perceived level of risk and that this perception is founded largely on the weight of the available scientific evidence. The BioInitiative report recommends precautionary measures on the basis of argument, rather than sound peer-reviewed scientific evidence.

Unlike the BioInitiative report, the WHO report was the product of a multidisciplinary scientific panel assembled by an established public health agency that followed appropriate scientific methods, including the systematic and critical examination of all the relevant evidence. The recommendations from the WHO report (pp. 372-373) are presented below:

- Policy-makers should establish guidelines for ELF field exposure for both the general public and workers. The best source of guidance for both exposure levels and the principles of scientific review are the international guidelines.

- Policy-makers should establish an ELF EMF protection programme that includes measurements of fields from all sources to ensure that the exposure limits are not exceeded either for the general public or workers.

- Provided that the health, social and economic benefits of electric power are not compromised, implementing very low-cost precautionary procedures to reduce exposures is reasonable and warranted.

- Policy-makers and community planners should implement very low-cost measures when constructing new facilities and designing new equipment including appliances.

- Changes to engineering practice to reduce ELF exposure from equipment or devices should be considered, provided that they yield other additional benefits, such as greater safety, or involve little or no cost.

- When changes to existing ELF sources are contemplated, ELF field reduction should be considered alongside safety, reliability and economic aspects.

- Local authorities should enforce wiring regulations to reduce unintentional ground currents when building new or rewiring existing facilities, while maintaining safety. Proactive measures to identify violations or existing problems in wiring would be expensive and unlikely to be justified.

- National authorities should implement an effective and open communication strategy to enable informed decision-making by all stakeholders; this should include information on how individuals can reduce their own exposure.

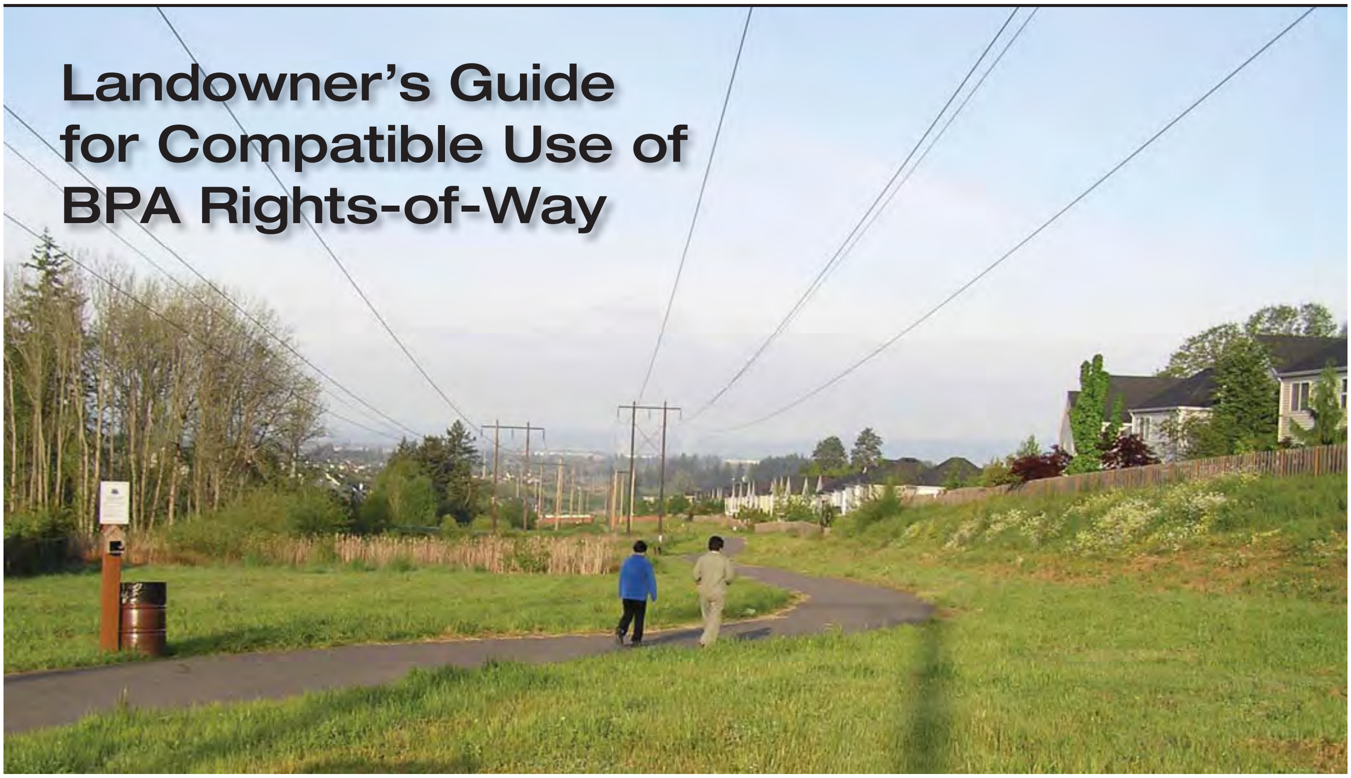
- Local authorities should improve planning of ELF EMF-emitting facilities, including better consultation between industry, local government, and citizens when siting major ELF EMF-emitting sources.

- Government and industry should promote research programmes to reduce the uncertainty of the scientific evidence on the health effects of ELF field exposure.

Appendix G

Landowner's Guide for Compatible Use of BPA Rights-of-Way

Landowner's Guide for Compatible Use of BPA Rights-of-Way



July 2007

We need your help to keep the way clear for safe and reliable service

Keeping transmission lines safe and reliable is a critical priority for the Bonneville Power Administration. The key element in achieving those objectives is BPA's ability to construct, operate and maintain its transmission lines and rights-of-way — the area under and around the lines.

You can help BPA keep these rights-of-way clear of trees, brush and structures that could affect the safety or reliability of the transmission system.

Prior to planting, digging, or constructing within BPA's rights-of-way, fill out BPA's Land Use Application Form. The information you provide on the application helps BPA understand your proposed use and the potential impacts to public safety, and the safety of our crews. BPA also reviews the application to determine whether a proposed use of land is compatible with the construction, operation and maintenance of BPA transmission lines. Coordinating with BPA early in your planning process can keep you safe and avoid wasting time and money.

Keep the way clear for safety and service

Coordination of land uses

BPA's rights-of-way can sometimes be available for other, compatible, uses. BPA wants to help you carry out your plans in ways that are safe and satisfactory for everyone. Therefore, you are encouraged to make prior arrangements with BPA through the Land Use Application process.

BPA takes several factors into consideration when applications for use of the right-of-way are reviewed. Our transmission lines were designed to take topography, physical features, environmental and cultural constraints into consideration. BPA's land rights as they relate to the location of your proposed use are also reviewed. If your project is not compatible with BPA's transmission lines, you may be asked to modify your design. In extreme cases, BPA may be able to modify its transmission facilities; however, you would be required to pay for the modifications.

Please consider the following guidelines when preparing your application:

- Maintain at least 50 feet of clearance from BPA's poles, structures or guy wires, whether it be vegetation, roads, fences, utilities, pipelines, or any other improvements.
- Maintain at least 30 feet of clearance from the top of any vegetation and the lowest point of BPA's wires. Do not attempt to measure this distance yourself! You only need to identify the species of the vegetation you propose to plant in the right-of-way so that BPA can consider the mature height of the vegetation.
- Design underground utilities to withstand HS-20 loadings (a federal highway standard).
- Design roads, utilities and pipelines to cross BPA's rights-of-way, rather than a long, linear alignment.
- Ensure concurrence of underlying property owner when not BPA.

Who we are

The Bonneville Power Administration is a federal agency headquartered in Portland, Ore., that markets wholesale electricity and transmission services to the Pacific Northwest's public and private utilities as well as to some large industries.

BPA provides about 40 percent of the electricity used in the Northwest and operates more than 15,000 circuit miles of transmission lines. To deliver power, BPA operates and maintains a transmission network throughout Oregon, Washington, Idaho and Montana with small portions into Wyoming, Nevada, Utah and California.

Three important steps

There are three important steps that you can take to keep safe and avoid wasting time and money:

1. Call BPA before you plant, dig or construct: 1-800-836-6619.
2. Fill out BPA's Land Use Application: *www.transmission.bpa.gov/LanCom/Real_Property.cfm.*
3. Obtain a permit from BPA before proceeding with your project.

Location surveys

You are encouraged to have a licensed surveyor determine the location of the BPA easement before beginning any construction activities. Unfortunately, many people inadvertently build structures on BPA easements because they believe they know the boundaries of their property, and believe measuring off the conductor or centerline of the towers is sufficient to fix the location of the easement. Without survey instruments, knowledge of survey law and an understanding of BPA's right-of-ways, it is impossible to accurately locate property boundaries. By having your surveyor coordinate with the BPA Survey Section, we can prevent many of the encroachment problems that BPA experiences (call 1-800-836-6619 and ask to be connected to BPA's Survey Section).

Danger trees

BPA must identify and arrange to cut trees that, although outside the right-of-way, may threaten the transmission line because they could fall into the conductor (wires) or structures. Trees that are unstable, diseased, dead or leaning toward the transmission facilities don't need to touch power lines to be dangerous. Electricity can "arc" or

Never cut or trim a tree near a power line. Call BPA!

"flashover" from wires, through the air, to trees or equipment, where it can cause fires, injuries or even fatalities to anyone near the tree or equipment. BPA will arrange to remove these trees.

Available uses of BPA-owned land

Although BPA acquired most of its transmission line rights-of-way as easements, some of BPA's transmission lines are constructed on property BPA owns in fee. BPA also has fee ownership of most of its substation sites as well as other properties BPA acquired to meet its responsibilities. There are three possible options if you wish to use land that BPA owns in fee. You will need to fill out BPA's Land Use Application so that we can determine whether your proposed use interferes with BPA's use. Easements may be granted for permanent uses such as private road crossings or utilities. Leases may be granted primarily for agricultural purposes on occupied or vacant BPA property. Nontransferrable Land Use Agreements may also be granted for use of BPA's fee owned property. Current market value of the land is the basis for the consideration for these transactions.

Information resources

For more information, including regional realty specialist contacts, or access to BPA's electronic Land Use Application form visit BPA's Web site at: *www.transmission.bpa.gov/LanCom/Real_Property.cfm*

Should you have any questions or would like assistance in completing the application, please call 1-800-836-6619. A BPA realty representative will return your call within two business days.

DOs and DON'Ts

BPA does not permit any use of rights-of-way that are unsafe or might interfere with constructing, operating or maintaining our facilities. These restrictions are part of the legal rights BPA acquires for its rights-of-way. Even when no transmission line has been constructed on the easement area, BPA's rights are maintained for future use. You can avoid or minimize incurring redesign or removal costs and benefit from developing reasonable construction schedules by being aware of the prohibited uses and by applying early in your planning process to BPA for concurrence.

DO call BPA before planting, digging or constructing.

DO check your property and review your property records for transmission right-of-way easements.

DO take the time to plan projects that conform to proper use of the rights-of-way which includes submitting a BPA Land Use Application form for approval.

DO comply with the terms and conditions of the agreement provided by BPA for your safety.

DO consult with BPA when planning subdivisions. Backyards and BPA rights-of-way are not compatible.

DO report criminal or suspicious activities to local authorities and to BPA's federal Crime Witness Hotline at 1-800-437-2744.

DON'T cut or trim a tree near a power line. Call BPA!

DON'T plant, dig or construct in BPA's rights-of-way without first contacting BPA and submit a BPA Land Use Application for approval.

DON'T store equipment, materials, waste, flammable material or anything that would cause a fire hazard or other safety issue or impede access by line crews to towers and lines.

DON'T assume the location of BPA's fee-owned or easement boundaries without first contacting a licensed surveyor and having them coordinate with BPA's surveyors by calling 1-800 836-6619.

Vandalizing BPA property is a crime.

Please report any vandalism or theft to BPA property by calling BPA's 24-hour toll-free hotline at 1-800-437-2744. All information reported through the Crime Witness Program is kept confidential. Cash rewards of up to $25,000 will be paid to those providing information that leads to the arrest and conviction of persons committing the crime.

Bonneville Power Administration

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Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208-3621

Appendix H

Contractor Disclosure Forms

NEPA Financial Disclosure Statement For Preparation of Resources Reports for the Proposed Central Ferry-Lower Monumental 500-Kilovolt Transmission Line Project

CEQ regulations at 40 CFR 1506.5(c), which have been adopted by DOE (10 CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project," for the purposes of this disclosure, is defined in the March 23, 1981 guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 FR 18026-18038 at Question 17a and b.

Financial or other interest in the outcome of the project 'includes' any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)." 46 FR 18026- 18038 at 18031.

In accordance with these requirements, the offeror and any proposed subcontractors hereby certify as follows: [check either (a) or (b) to assure consideration of your proposal]

(a) ____X____ Offeror and any proposed subcontractor have no financial interest in the outcome of the project.

(b) ____________ Offeror and any proposed subcontractor have the following financial or other interest in the outcome of the project and hereby agree to divest themselves of such interest prior to award of this contract.

Financial or Other Interests:

1.

2.

3.

Certified by:

John R. Bock (signature)
Signature

John R. Bock
Name

September 15, 2009
Date

NEPA Financial Disclosure Statement For Preparation of Resources Reports for the Proposed Central Ferry-Lower Monumental 500-Kilovolt Transmission Line Project

CEQ regulations at 40 CFR 1506.5(c), which have been adopted by DOE (10 CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project," for the purposes of this disclosure, is defined in the March 23, 1981 guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 FR 18026-18038 at Question 17a and b.

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(a) __X__ Offeror and any proposed subcontractor have no financial interest in the outcome of the project.

(b) ____________ Offeror and any proposed subcontractor have the following financial or other interest in the outcome of the project and hereby agree to divest themselves of such interest prior to award of this contract.

Financial or Other Interests:

1.

2.

3.

Certified by:

[signature]
Signature

T. DAN BRACKEN
Name

1/27/2010
Date

NEPA Financial Disclosure Statement for Preparation of the Environmental Impact Statement for the Proposed Central Ferry-Lower Monumental 500-Kilovolt Transmission Line Project

CEQ regulations at 40 CFR 1506.5(c), which have been adopted by DOE (10 CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project," for the purposes of this disclosure, is defined in the March 23, 1981 guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 FR 18026-18038 at Question 17a and b.

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In accordance with these requirements, the offeror and any proposed subcontractors hereby certify as follows: [check either (a) or (b) to assure consideration of your proposal]

(a) ✓ Offeror and any proposed subcontractor have no financial interest in the outcome of the project.

(b) ____________ Offeror and any proposed subcontractor have the following financial or other interest in the outcome of the project and hereby agree to divest themselves of such interest prior to award of this contract.

Financial or Other Interests:

1.

2.

3.

Certified by:

Kathleen A. Concannon
Signature

Kathleen A. Concannon
Name

January 28, 2010
Date

NEPA Financial Disclosure Statement For Preparation of Resources Reports for the Proposed Central Ferry-Lower Monumental 500-Kilovolt Transmission Line Project

CEQ regulations at 40 CFR 1506.5(c), which have been adopted by DOE (10 CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term “financial interest or other interest in the outcome of the project,” for the purposes of this disclosure, is defined in the March 23, 1981 guidance “Forty Most Asked Questions Concerning CEQ’s National Environmental Policy Act Regulations,” 46 FR 18026-18038 at Question 17a and b.

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(a) _____X________ Offeror and any proposed subcontractor have no financial interest in the outcome of the project.

(b) _____________ Offeror and any proposed subcontractor have the following financial or other interest in the outcome of the project and hereby agree to divest themselves of such interest prior to award of this contract.

Financial or Other Interests:

1.

2.

3.

Certified by:

Signature

Todd Ahlman, Associate Archaeologist, Historical Research Associates, Inc.

Name

January 29, 2010

Date

Appendix I

Greenhouse Gas Emissions Calculations

Central Ferry-Lower Monumental CO_2 Emissions for 1 Year of Transmission Line Construction

Note: Only vehicle round trips/day or year and distance need to be changed to calculate emissions

CO_2

Vehicle round trips/day	Distance (miles)	Miles/year	Gallons/year[1/]	*CO_2 Emissions in Metric tons CO_2/year*[2/]
120	40	1,752,000	302,069	**3,066**

1/ Gallons/year is calculated using a fuel economy factor of 5.8 mpg for heavy trucks (more than 26,000 lbs)

2/ CO_2 emission factor for diesel fuel No. 1 and 2 = 10.15 kg CO_2/gallon

CH_4

Vehicle round trips/day	Distance (miles)	Miles/year	Gallons/mile[1/]	CH_4 Emissions in Metric tons	*CO_2e Emissions in Metric tons/year*[2/]
120	40	1,752,000	8,935	0.009	**0.19**

1/ Gallons/mile is calculated using a CH_4 emission factor of 0.0051 g/mi for all model years of diesel heavy-duty vehicles

2/ CO_2 equivalent conversion factor for CH_4 is 21 GWP

NO_2

Vehicle round trips/day	Distance (miles)	Miles/year	Gallons/mile[1/]	CH_4 Emissions in Metric tons	*CO_2e Emissions in Metric tons/year*[2/]
120	40	1,752,000	8,410	0.008	**2.61**
				Total CO_2 Emissions over one year of transmission line construction in metric tons/year	***3,069***

1/ Gallons/mile is calculated using a NO_2 emission factor of 0.0048 g/mi for all model years of diesel heavy-duty vehicles

2/ CO_2 equivalent conversion factor for NO_2 is 310 GWP

Central Ferry-Lower Monumental CO_2 Emissions per Year for Operations and Maintenance

CO_2				
Vehicle round trips/year	**Distance (miles)**	**Miles/year**	**Gallons/year[1/]**	***CO_2 Emissions in Metric tons CO_2/year [2/]***
4	160	640	80	**0.7**
Helicopter round trips/year	**Distance (miles)**	**Miles/year**	**Gallons/year[3/]**	***CO_2 Emissions in Metric tons CO_2/year [4/]***
2	130	260	96	**0.8**
			Total CO_2	**1.5**

1/ Gallons/year is calculated using a fuel economy factor of 8.0 mpg for medium trucks (more than 26,000 lbs)

2/ CO_2 emission factor for motor gasoline = 8.81 kg CO_2/gallon

3/ Gallons/year is calculated using a fuel economy factor of 2.7 mpg (2.35 nautical miles/g) for a helicopter

4/ CO_2 emission factor for aviation gasoline = 8.32 kg CO_2/gallon

CH_4					
Vehicle round trips/year	**Distance (miles)**	**Miles/year**	**Gallons/mile[1/]**	**CH_4 Emissions in Metric tons**	***CO_2e Emissions in Metric tons/year [2/]***
4	160	640	0.64	0.000001	**0.000013**
Helicopter round trips/year	**Distance (miles)**	**Gallons/year[3/]**	**Grams/year[4/]**	**CH_4 Emissions in Metric tons**	***CO2e Emissions in Metric tons/year [2/]***
2	130	96	678	0.0001	**0.002**
				Total CH_4	**0.00204**

1/ Gallons/mile is calculated using a CH_4 emission factor of 0.0010 g/mi for model years 1996-2004 diesel light trucks

2/ CO_2 equivalent conversion factor for CH_4 is 21 GWP

3/ Gallons used per year = miles per year/2.7 mpg for helicopter

4/ Grams/year is calculated using an emission factor of 7.04 grams/gallon fuel for aviation gasoline

N_2O					
Vehicle round trips/year	**Distance (miles)**	**Miles/year**	**Gallons/mile[1/]**	**N_20 Emissions in Metric tons**	***CO_2e Emissions in Metric tons/year[2/]***
4	160	640	0.96	0.000001	**0.0003**
Helicopter round trips/year	**Distance (miles)**	**Gallons/year[3/]**	**Grams/year[4/]**	**N_20 Emissions in Metric tons**	***CO2e Emissions in Metric tons/year[2/]***
2	130	96	11	0.00010	**0.030**
				Total N_2O	**0.030**
				Total CO_2 Emissions over one year of transmission line operation and maintenance in metric tons/year	***1.54***

1/ Gallons/mile is calculated using a N_20 emission factor of 0.0015 g/mi for model years 1996-2004 diesel light trucks

2/ CO_2 equivalent conversion factor for NO_2 is 310 GWP

3/ Gallons used per year = miles per year/2.7 mpg for helicopter

4/ Grams/year is calculated using an emission factor of 0.11 grams/gallon fuel for aviation gasoline