McNary-John Day Transmission Line Project

Draft Environmental Impact Statement
(DOE/EIS-0332)

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

Cooperating Agencies: U.S. Department of Interior: U.S. Fish and Wildlife Service, Bureau of Land Management, and Bureau of Indian Affairs. Department of Army: Corps of Engineers.

States Involved: Oregon and Washington

Abstract: Bonneville is proposing to construct, operate, and maintain a 79-mile-long 500-kilovolt-transmission line in Benton and Klickitat Counties, Washington, and Umatilla and Sherman counties, Oregon. The new line would start at Bonneville's McNary Substation in Oregon and would cross the Columbia River just north of the substation into Washington. The line would then proceed west for about 70 miles along the Columbia River. At the John Day Dam, the line would again cross the Columbia River into Oregon and terminate at Bonneville's John Day Substation. The new line would parallel existing transmission lines for the entire length; mostly within existing available right-of-way. Presently, the existing transmission lines in the area are operating at capacity. These lines help move power from the east side of the Cascades to the west side, where there is a high need for electricity (cities along the I-5 corridor). Because the Northwest has only recently recovered from a shortfall in electric energy supply and a volatile wholesale power market in which prices reached record highs, there are many new proposals for facilities to generate new power. Some of these facilities are in the vicinity of the McNary-John Day project; the proposed line would help insure that existing and newly generated power could move through the system. Bonneville is also considering the No Action Alternative and several short-line routing alternatives. The short routing alternatives include three half-mile-long routes for getting from the McNary Substation to the Columbia River crossing; three two-mile-long routes where the Hanford-John Day transmission line joins the existing corridor; two 1,000-foot-long routes at corridor mile 32; and two 500-foot-long routes at corridor mile 35.

Public comments are being accepted through April 23, 2002.

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For information on DOE National Environmental Policy Act (NEPA) activities, please contact:

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Summary

Introduction

This summary includes information regarding the following elements of the National Environmental Policy Act (NEPA) environmental impact statement (EIS) for the McNary-John Day Transmission Line Project:

- the purpose and need for action;
- short-line routing alternatives; and
- affected environment, impacts, and mitigation measures.

The project would involve construction of a new 500-kilovolt (kV) transmission line parallel to existing Bonneville Power Administration (Bonneville) transmission lines from the McNary Substation to the John Day Substation, a distance of approximately 79 miles.

Purpose and Need for Action

Bonneville is a federal agency responsible for purchasing, developing, marketing, and transmitting electrical power to utility, industrial, and other customers in the Pacific Northwest. Bonneville is required to ensure its transmission system can reliably serve customer power needs under all operating conditions, including times of peak use (maximum demand).

The Federal Columbia River Transmission Act directs Bonneville to construct additions to the transmission system that are required to provide interregional transmission facilities [16 U.S.C. § 838b(c)], integrate and transmit electric power from new generating sources [§ 838b(a)], and for maintaining the electrical stability and reliability of the transmission system [§ 838b(d)]. The proposed action is needed to comply with these Congressional mandates.

Bonneville is facing two problems regarding power flow on the system: there is not enough electricity being generated to meet demand, and many of Bonneville's transmission lines are now at capacity and cannot carry more power. To solve the problem of lack of power, private investors have proposed and are developing gas-fired and wind-powered generation facilities. Many of these facilities are in southeast Washington and northeast Oregon (Figure S-1). This is a prime area for power generation because of sufficiency of wind or access to gas pipelines, as well as access to high voltage transmission lines. The newly generated power from these facilities will need to be transmitted to the west side of the Cascades because there is a high demand for electricity from the west side's urban areas. However, the existing transmission lines connecting southeast Washington and northeast Oregon to the west side of the Cascades are at or near capacity. In order to help ensure that existing and newly generated power can move east to west through the system, Bonneville needs to increase the capacity of its transmission system between the McNary and John Day Substations.

Two of the generation facilities proposed in this area are the Starbuck Power Project (near Starbuck, Washington) and the Wallula Power Project (near Wallula, Washington). These gas-turbine facilities would generate a total of 2,500-megawatts (MW) of power. The new transmission line would be necessary to allow the power from these facilities to integrate into the transmission system and would allow Bonneville to grant firm transmission service to these facilities.

Purposes

While meeting the need to increase the capacity of the transmission system in this area, the proposed action has other purposes (or objectives). Bonneville intends to base its decisions on the following objectives:

- maintenance of transmission system reliability;
- consistency with Bonneville's environmental and social responsibilities; and
- cost and administrative efficiency.

Cooperating Agencies

The U.S. Army Corps of Engineers, the U.S. Bureau of Land Management, the U.S. Fish and Wildlife Service, and the Bureau of Indian Affairs are cooperating agencies in the development of this EIS because of their roles as managers of lands crossed or need to make findings on the project.

Proposed Action and Alternatives

Bonneville proposes to construct a 500-kV transmission power line from its McNary Substation to its John Day Substation, a distance of about 79 miles. The new line would begin at the existing McNary Substation in Umatilla City (Umatilla County, Oregon) near the Columbia River and cross the Columbia River into Washington between the McNary Dam and the Umatilla Bridge. The proposed line would then generally follow the Columbia River and State Route (SR) 14 west through Benton and Klickitat Counties. At

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the John Day Dam, the proposed line would cross back into Oregon and connect into the John Day Substation near Rufus (Sherman County, Oregon). The proposed line would parallel existing transmission lines in an existing corridor that runs between the McNary and John Day Substations.

For most of the route in Washington, Bonneville already has existing right-of-way or easement available next to the lines.

Along the majority of the existing corridor between the McNary Substation and the crossing at John Day Dam, there are two existing transmission lines; in two areas along the corridor there are three existing lines.

Some new right-of-way easements would need to be purchased adjacent to the existing corridor along approximately 14 miles of the route.

Towers

The towers for the proposed new 500-kV line would be 145 to 165 feet tall lattice steel towers with spans of 1,150 to 1,500 feet between towers. The towers would be similar to the towers of the existing lines. The towers would be made of galvanized steel and may appear shiny for two to four years before they dull with the weather. About 360 transmission towers would be needed to carry the wires (conductors) for the proposed transmission line.

Tower Footings

Three types of footings would be used depending on the terrain and tower type (ranging from 4 feet by 4 feet to 12.5 feet by 12.5 feet in area).

A trackhoe would be used to excavate an area for the footings. The excavated area would be at least 2 feet larger than the footings to be installed (if the soil is loose or sandy, then a wider hole may be necessary). Each tower would use an area about 0.06 acre, with a temporary disturbance during construction of about 0.25 acre (equipment, soils, etc.).

Conductors

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

Two smaller wires (0.5-inch diameter), called overhead ground wires, would also be attached to the top of the transmission towers. Ground wires are used for lightning protection.

Tree Clearing

Most of the vegetation along the corridor is low-growing sagebrush or fields that are compatible with transmission lines. Tall trees cannot be allowed to grow under or near the lines because electricity can arc, which can start a fire or injure or kill someone nearby.

Access Roads

Much of the existing transmission line corridor lies within 2 miles of public highways. Because the proposed transmission line would be next to existing lines, the proposed new line would utilize up to 90% of the existing 90 miles of access roads.

The new transmission line would require some upgrades to existing access roads (approximately 40 miles would need to be reconditioned and widened); construction of new access roads (about 3 miles of new road would need to be built); construction of new access road spurs (about 270 short spur roads, each about 250 feet long from an existing access road to a new tower); and purchase of new easement (for up to 30 new access roads in areas off of the right-of-way).

Staging Areas

Temporary staging areas would be needed along or near the proposed transmission line for construction crews to store materials and trucks.

Substation Facilities

At the McNary Substation, the east side of the substation would require an expansion measuring 80 feet by 700 feet, about 1.3 acres. The substation expansion would be on Bonneville property.

At the John Day Substation, the line would terminate into a new 500-kV bay located within the existing substation fence. No expansion would be necessary.

Maintenance

During the life of the project, Bonneville would perform routine, periodic maintenance and emergency repairs to the transmission line. For lattice steel structures, maintenance usually involves replacing insulators. Every 2 months, a helicopter would fly over the line to look for hot spots (areas where electricity may not be flowing correctly) or other problems indicating that a repair may be needed.

Vegetation is also maintained along the line for safe operation and to allow access to the line. The area along the McNary-John Day transmission line needs little vegetation maintenance because of the low-growing nature of a majority of the vegetation along the right-of-way.

Alternatives

This EIS addresses short-line routing alternatives at four locations along the project corridor, as described in Table S-1.

Table S-1. Short-Line Routing Alternatives at Four Locations Along the Project Corridor

Alternatives	Description
McNary Substation Alternatives	
A – Relocate Building	Under this alternative, a 2,000-square-foot Bonneville office building would need to be relocated because the new 500-kV line would cross directly over the top of it, causing potential safety hazards. The building would be relocated somewhere adjacent to the substation within the Bonneville property line.
B – Cross Wildlife Natural Area	With this alternative, the new transmission line would exit the northeast side of the substation, cross Third Street, and run behind the office building and across the U.S. Army Corps of Engineers (Corps) Wildlife Natural Area. This alternative may require removal of some cottonwood trees.
C – Bus Work in Wildlife Area	For this alternative, the transmission line would exit the northeast side of the substation, cross Third Street, then descend into bus work across the Wildlife Natural Area behind the office building. The bus work would be about 2,000 feet long by 75 feet wide.
Hanford-John Day Junction Alternatives	
A – North Side	With this alternative, the proposed transmission line would stay in the same alignment paralleling the existing lines. This would require moving the existing Hanford-John Day line 200 feet to the north. At corridor mile 70, the proposed line would cross to the south side of the corridor and the Hanford-John Day line would ease back into its alignment in the corridor.
B – South Side	With this alternative, the proposed transmission line would cross to the south side of the corridor just before the Hanford-John Day line enters the right-of-way. The proposed line would stay on the south side through the rest of the route. For the first mile on the south side, the line would also be on the south side of the highway. Just before corridor mile 70, there is a house with a barn and a shed on the south side of the highway. This alternative would require the removal of the barn and shed, and may require the removal of the house.

Alternatives	Description
C – South Side, Highway	This alternative is very similar to Alternative B; the proposed line would cross to the south side of the corridor and highway just before the Hanford-John Day line enters the right-of-way. This alternative differs from Alternative B in that the proposed line would stay on the south side of the highway until the exiting lines crosses the highway, eliminating two highway crossings of the proposed line. As with Alternative B, the barn and shed (and possibly the house) would need to be removed. With this Alternative C, the line would be about 35 feet closer to the house than with Alternative B.
Corridor Mile 32 Alternatives	
A – Parallel Existing Line	With this alternative, Bonneville would construct the proposed line across the tribal-owned property at corridor mile 32, paralleling the existing lines within the existing right-of-way. About 1,100 feet of conductor and perhaps one tower would be located on the property.
B – Move Entire Corridor	With this alternative, the proposed line would be moved to skirt around the tribal-owned property. The other two existing lines would also be moved to avoid the property. This alternative would require one additional tower for the proposed line. For the existing lines, eight towers (four for each line) would be removed and ten new towers (five for each line) constructed for the reroute. New right-of-way would be purchased from the landowners.
Corridor Mile 35 Alternatives	
A – Parallel Existing Line	With this alternative, Bonneville would construct the proposed line across the tribal-owned property at corridor mile 35, paralleling the existing lines within the existing right-of-way. About 500 feet of conductor would be located across the property.
B – Move Entire Corridor	With this alternative, the proposed line would be moved to skirt around the tribal-owned property at corridor mile 35. The other two existing lines would also be moved to avoid the property. No additional towers would be required for this alternative (compared to Alternative A). For the existing lines, eight towers (four for each line) would be removed and eight new towers (four for each line) constructed for the reroute. New right-of-way would be purchased from the landowners.

No Action Alternative

The No Action Alternative would be to not build the proposed transmission line. If Bonneville did not build this line, new generation facilities in the area could not connect and send power over the transmission system.

Alternatives Considered but Eliminated from Detailed Study

During the scoping process, Bonneville considered a range of 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 impacts than the proposed action, were eliminated from detailed study. The following alternatives did not meet the need and purposes.

- **Oregon Route Alternative.** Bonneville examined various ways to transmit power from east to west, including a new transmission line from the McNary Substation to the John Day Substation through Oregon. This Oregon routing alternative would have required the purchase of all new right-of-way as there is no existing vacant right-of-way available for a 500-kV line in this area of Oregon. The social and environmental impacts of an Oregon route would also be much greater with the relocation of residents, disruption of existing land uses, construction of new access roads (erosion, water quality), and potential vegetation clearing.

- **McNary Substation Southeast Alternative.** In examining ways for the line to exit the McNary Substation and reach the river crossing, Bonneville considered exiting the southeast side of the substation. This alternative was eliminated from consideration for reliability reasons.

- **Increased Capacity Line Alternative.** The proposed line would have a capacity of 1,400 to 2,300 MW. During scoping, commenters requested a line capable of carrying 5,000 MW or more. Transmission lines need back-up line(s) in case any component of the transmission system were to fail. There is sufficient back-up in the area for the proposed line. In order to maintain the reliability of a new line carrying 5,000 MW, a new second high voltage line would have to be built as a back-up. Rather than building two high voltage lines now, Bonneville's system planners will continue to evaluate the need for increased capacity as new generation facilities request interconnection.

- **Underground Transmission Line Alternative.** Underground transmission lines (cables), are highly complex in comparison to overhead lines. For 500-kV lines, underground cable may be ten times as costly as overhead designs. Because of the cost, Bonneville uses underground cable in limited, special reliability, or routing situations, such as near nuclear power stations, at locations where high capacity lines must cross, at long bay crossings, or in urban areas.

- **Double Circuit Alternative.** Double circuiting would involve taking out one of the existing lines and putting in a double circuit line (one set of towers to hold both the existing line and the proposed line). This alternative was eliminated due to costs because the transmission towers for a double circuit line are twice as much as for a single circuit line. The overall cost of removing one of the existing lines and constructing a double circuit line would be much greater than constructing the proposed single circuit line.

Affected Environment, Environmental Impacts, and Mitigation

The affected environment, potential impacts, and mitigation for the resource elements evaluated in this EIS are briefly described below.

Land Use and Recreation

Affected Environment

The existing Bonneville corridor (the site for the proposed transmission line) crosses mostly private land (94% of lands crossed) as well as tribal, federal, and state lands in eastern Washington and Oregon bordering the Columbia River.

Land use within the corridor is primarily agriculture (irrigated cropland, dryland wheat farming, and grazing). Irrigated agricultural uses in the project corridor include poplar tree farms, orchards, and a variety of crops such as potatoes, corn, onions, carrots, and asparagus. Some crops change annually. There are no lands designated as prime farmland in the project corridor.

Thirteen formal recreational sites lie within one mile of the proposed transmission line in Benton and Klickitat Counties, Washington, and Sherman and Umatilla Counties, Oregon. A majority of the facilities are located on, or are associated with the Columbia River. Informal recreational opportunities in the vicinity of the project corridor include upland bird hunting in certain areas of the corridor in Benton County, and various water sports on the Columbia River along most of the project corridor. SR 14 is designated as a Scenic and Recreation Highway by the state of Washington.

Environmental Consequences—Proposed Action

Construction

Development of the proposed project would add an additional transmission line to the current land uses within the existing Bonneville transmission line corridor.

The project would be consistent with the purpose and intent of the zoning and comprehensive plans of the local jurisdictions.

Temporary impacts on land use would be due to construction activities such as heavy equipment causing soil and crop disturbance, noise, and dust. The construction activities that could cause impacts would include placement of towers, access roads upgrades and construction, and conductor tensioning sites.

Approximately 47 acres (12 acres in cropland and 35 acres in grazing land) would be impacted during the construction of the new access roads and spur roads. Approximately 93 acres (29 acres of upland and 64 acres of grazing land) would be impacted during the construction of the towers.

Approximately 25 acres of trees would need to be removed from the poplar tree farm in the vicinity of Glade Creek, and a total of 50 acres would be removed from cottonwood production.

None of the formal recreation facilities would be disturbed during construction. Upland bird hunting may be temporarily disturbed in the project corridor in Benton County, depending on the time of year when construction occurs.

Operation and Maintenance

The permanent footprints of the towers would occupy approximately 19 acres total (6 acres of irrigated and nonirrigated cropland and 13 acres of grazing land). New access roads would occupy approximately 47 acres of additional area. The cropland no longer available for farm use would represent a small portion of the agricultural land in the project corridor and a negligible portion of agricultural land in each of the four affected counties. This would not appreciably disrupt the current and planned agricultural uses of the land in the four affected counties.

Environmental Consequences—Short-Line Routing Alternatives

The potential land use and recreation impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

The following mitigation measures would help minimize land use impacts.

- Locate towers and roads so as not to disrupt irrigation circles, where possible.
- Locate structures and roads outside of agricultural fields, orchards, and vineyards, where possible.
- Coordinate with landowners for farm operations, including plowing, crop dusting, and harvesting.
- Redesign irrigation equipment and compensate landowner for additional reasonable costs where new right-of-way needs to be acquired.
- Compensate farmers for crop damage and restore compacted soils.
- Control weeds around the base of the towers.
- Keep gates and fences closed and in good repair to contain livestock.

No mitigation measures are warranted for recreation since no impacts are anticipated.

Environmental Consequences—No Action Alternative

If the No Action Alternative was implemented, existing land uses in the project corridor would continue without influence from the proposed project.

Geology, Soils, and Seismicity

Affected Environment

The project corridor and vicinity consist mainly of river terraces, ridges, bluffs, and volcanic tableland adjacent to the north bank of the Columbia River running parallel to SR 14. The corridor crosses numerous incised stream channels draining into the Columbia River.

Soils along the project corridor primarily consist of wind-blown loess deposits or glacial outburst flood sands and gravels underlain by basaltic bedrock. Most soils along the corridor are designated as suitable for rangeland, woodland, or wildlife, and some steeper areas may require complex conservation methods when used for cultivation.

The project corridor and vicinity lie in a low earthquake hazard area (seismic zone 2B) recognized by the 1994 Uniform Building Code. Published geologic maps and field observation indicated five faults (probably inactive) along the corridor (Phillips and Walsh 1987).

Environmental Consequences—Proposed Action

Construction

Construction of the proposed project would potentially remove vegetation and disturb the underlying soils in up to 222 acres. This temporary impact is projected to last up to one year and has the potential to increase the rate of erosion along the corridor. In areas along the corridor where quaternary period loess soils have developed as a result of wind deposition, removal of vegetation would likely increase the rate of wind erosion.

Operation and Maintenance

Anticipated erosion rates during operation and maintenance are expected to remain at or near current levels, once revegetation has occurred.

Environmental Consequences—Short-Line Routing Alternatives

The potential impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

The following mitigation measures would help minimize impacts to soil and seismicity impacts.

- Minimize vegetation removal.
- Avoid construction on steep slopes where possible.
- Properly engineer cut-and-fill slopes.
- Install appropriate roadway drainage to control and disperse runoff.
- Ensure graveled surfaces on access roads in areas of sustained wind.
- Develop additional mitigation measures (using a certified engineer) between corridor miles 39 and 41 due to the presence of an active landslide in the vicinity of tower 40/3.
- Apply erosion control measures such as silt fence, straw mulch, straw wattles, straw bale check dams, other soil stabilizers, and reseeding disturbed areas as required.
- Regularly inspect and maintain project facilities, including the access roads, to ensure erosion levels remain the same or less than current conditions.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, the potential impacts to geology and soils from the proposed project would not change from the current site conditions. No impact to geology and soils is predicted.

Streams, Rivers, and Fish

Affected Environment

A total of 15 streams, the Columbia River, and 146 dry washes cross the project corridor. Of the streams and river, 11 are considered fish bearing or potentially fish bearing and five are non-fish-bearing.

Five of the 11 fish-bearing streams (Glade Creek, the unnamed tributary to Glade Creek, Dead Canyon, Alder Creek, and Rock Creek) along the project corridor were found to have water temperatures in excess of 64.4°F during the June 2001 field surveys. These conditions identify water quality in these streams as impaired under Section 303(d) of the Clean Water Act and may indicate problems for fish species.

All streams identified as either fish bearing or potentially fish bearing in the project area are included in designated Essential Fish Habitat (EFH) for chinook and coho salmon. Chinook salmon that utilize the streams intersected by the project corridor are not currently federally listed, while coho salmon are a candidate for federal protection. Steelhead trout is another anadromous salmonid known to occur in the fish-bearing streams crossed by the project corridor.

The 146 non-fish-bearing dry washes that cross the project corridor (channels lacking any semblance of a riparian zone) are intermittent, primarily providing seasonal drainage off of hills (WDFW 2000).

Environmental Consequences—Proposed Action

Construction

The construction of the proposed project could potentially impact fish habitat through the transport of sediment (and hazardous materials) from construction sites to streams.

Riparian vegetation would not be removed, but instead would be spanned by the transmission line. Some short-term sediment transport would occur until stream channels are stabilized following installation of culverts on ephemeral streams.

There is a risk of sediment transport into streams from construction of towers, access roads, spur roads, and staging areas; and impacts to fish from blasting, if such blasting is within 200 feet of fish-bearing streams. No fish-bearing streams would be crossed by the construction of new access roads and no existing access road currently crosses a fish-bearing or potentially fish-bearing stream that Bonneville owns and/or manages.

Several common construction materials (e.g., concrete and paint) and petroleum products (e.g., fuels, lubricants, and hydraulic fluids) could be toxic to fish and other aquatic organisms if spilled into or near streams.

The work associated with the McNary Substation and the towers spanning the Columbia River adjacent to the Umatilla Bridge would occur within the FEMA-designated 100-year floodplain of the Columbia River. However, the McNary Substation and the new towers are above the elevation of the 100-year flood event as designated by the U.S. Army Corps of Engineers. This is based on water level control through the dam system along the Columbia River.

All other new access roads and towers would be installed outside the 100-year floodplains of other streams crossed and would create no impacts to the floodplains.

Operation and Maintenance

Routine inspections, monitoring, and vegetation management would not impact fish or fish habitat.

Environmental Consequences—Short-Line Routing Alternatives

The potential impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

The following mitigation measures would minimize potential impacts to streams and fisheries habitat from possible erosion and clearing of vegetation.

- Place towers outside of stream riparian areas and utilize natural landscape features to span the conductor over existing shrub and tree riparian zones and avoid cutting.
- Place new access roads outside of stream riparian areas, where possible.
- Construct fords instead of culverts at access road crossings of dry washes or seasonal streams if possible. If culverts are required, design and install to accommodate flows associated with a 100-year flood event.
- Preserve existing vegetation where practical, especially next to intermittent and perennial streams.
- Avoid construction within the 200-foot designated stream buffers in Klickitat and Benton Counties, Washington.
- Maximize the use of existing roads, minimizing the need for new road construction.
- Avoid tower or access road construction on potentially unstable slopes where feasible.
- Use erosion control methods during construction (see mitigation measures for Geology, Soils, and Seismicity, Chapter 3), to minimize transport of sediments to streams via runoff.
- Install appropriate water and sediment control devices at all dry wash crossings, if necessary.
- Reseed disturbed areas following construction where appropriate.
- Construct any required culverts using Washington Department of Fish and Wildlife culvert installation guidelines. Methods may include avoiding installation during periods of flow, armoring streambanks near the culvert entrance and exit, installing culverts on straight sections of stream to ensure unimpeded flow, and following the contour of the stream channel.
- Repair existing road failures and drainage devices between corridor mile 33 to 47 to reduce potential impacts to dry washes.
- Avoid blasting during periods when salmonid eggs or alevins are present in gravels.

- Avoid blasting within 200 feet of fish-bearing or potentially fish-bearing streams.
- Develop and implement a Spill Prevention and Contingency Plan to minimize the potential for spills of hazardous material including provisions for storage of hazardous materials and refueling of construction equipment outside of riparian zones, spill containment and recovery plan, and notification and activation protocols.
- Keep vehicles and equipment in good working order to prevent oil and fuel leaks.
- Return staging areas to pre-construction condition.

Environmental Consequences—No Action Alternative

The No Action Alternative would result in no changes to the existing corridor, and aquatic habitats would not be affected in the project vicinity. Therefore, no impacts to fish or fish habitat would occur as a result of the No Action Alternative.

Wetlands and Groundwater

Affected Environment

Wetlands in the area are mostly seasonal because of low annual precipitation and common drought during the summer. Typically, the area receives approximately 8 inches of precipitation annually. Most precipitation falls as light showers or snowfall in the winter (SCS 1972).

A total of 25 wetlands totaling 45 acres were identified within the project corridor. These wetlands are generally supported by water sources associated with riparian areas, seasonal spring seeps, shallow depressions fed by precipitation, and surface runoff. Wetland sizes range from narrow riparian fringes 5 to 10 feet wide, to large wetland complexes covering 5 to 10 acres.

Near the McNary Substation, there is a large wetland complex associated with the floodplain of the Columbia River. Near corridor miles 48 to 50, there is a large depressional wetland complex associated with alkali saltgrass communities on saline-alkali soils. Between corridor miles 71 and 75, there are several palustrine emergent wetlands located in depressions among rock outcroppings.

Groundwater is generally available in large quantities in the Columbia Plateau province from the basalt bedrock. Aquifer recharge occurs primarily by precipitation through direct infiltration and seepage from the numerous intermittent streams along the corridor. Some recharge may occur from the spray irrigation of orchards and other agricultural crops using well water, but this is negligible relative to recharge from irrigation canals elsewhere in eastern Washington and eastern Oregon.

Environmental Consequences—Proposed Action

Construction

Of the 43 acres of wetlands located within the project corridor, no wetland areas would be filled to construct the proposed project. Vegetation would be cut within wetlands for McNary Substation Alternative B where the line would cross the wildlife refuge.

Construction of access roads or towers located adjacent to some wetlands may require removal of wetland buffer vegetation. The quality of vegetation of the wetland buffers in these areas is marginal; the areas are mostly used for grazing and are dominated by invasive weeds such as cheatgrass. However, the reduction of some of the vegetated buffers adjacent to these wetlands would reduce overland flow and slightly increase the likelihood of silts and sediments entering wetland surface waters, thus decreasing water quality. These anticipated impacts are minor.

Oils and pollutants from machinery could also enter surface water, potentially effecting fish or wildlife species. The construction of roads and tower pads could also alter overland flow patterns, thereby either increasing or decreasing wetland hydroperiod (the duration of soil saturation or inundation within a wetland).

The potential for impacts on groundwater is minor due to the use of construction techniques that avoid trenching and drilling. Potential groundwater impacts that could occur during construction include the potential for localized groundwater contamination from refueling and equipment maintenance. Erosion in areas of soil disturbance and vegetation removal could result in increased groundwater turbidity, and interception of groundwater seeps in road cutbanks could alter the hydrology or water quality of adjacent wetlands and streams.

Operation and Maintenance

Impacts during operation and maintenance of the proposed line could result from the use of access roads for tower maintenance, and from vegetation clearing. These activities could potentially introduce sediment into local wetlands through surface runoff, potentially affecting water quality. These operational impacts on groundwater are considered minimal.

Environmental Consequences—Short-Line Routing Alternatives

The potential impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

The following mitigation measures would minimize wetland and groundwater impacts.

- Locate structures, new roads, and staging areas so as to avoid waters of the United States, including wetlands.
- Avoid construction within designated Klickitat and Benton Counties wetland and stream buffers to protect potential groundwater recharge areas (Klickitat County Critical Areas Ordinance; Benton County Code Title 15).
- Avoid mechanized land clearing within wetlands and riparian areas to avoid soil compaction from heavy machinery, destruction of live plants, and potential alteration of surface water patterns to reduce groundwater turbidity risk.
- Anticipate and avoid, as required, contaminated soil and underground tanks during construction activities near pipelines and agricultural and other historic projects. Anticipate and avoid orphaned wells, as required, particularly near the communities of Plymouth, Paterson, Roosevelt, Sundale, and Towal.
- Use erosion control measures (see mitigations listed in the Geology, Soils, and Seismicity section) when conducting any earth disturbance within 100 feet of wetlands, or within the resource buffer as established by Benton and Klickitat Counties.
- Avoiding refueling and/or mixing hazardous materials where accidental spills could enter surface or groundwater.
- Using existing road systems, where possible, to access tower locations and for the clearing of the transmission line alignment.
- Avoid construction on steep, unstable slopes if possible.
- Place tower footings on upland basalt outcroppings and limit access road construction in wetlands complex and buffers between corridor miles 70 and 74, if possible.
- Place tower footings and access roads within uplands within the wetland complex between corridor miles 48 and 50.
- Avoid placing towers and roads that would necessitate the cutting of the palustrine-forested wetland near the McNary Substation (Alternative B).

Environmental Consequences—No Action Alternative

Under the No Action Alternative, the existing transmission corridor would remain as at present. Potential impacts to wetlands and groundwater resources along the corridor associated with the proposed project would not occur.

Vegetation

Affected Environment

The area is characterized by flat buttes, rolling hills, basalt cliffs, terraces, and scablands including rock outcroppings interspersed with wet areas. Portions of the project corridor cross irrigated agricultural cropland, particularly in the eastern half of the corridor. Shrub-steppe communities dominated by bunchgrasses and sagebrushes dominate the dry, rocky areas. Within the corridor, shrub-steppe and mixed grasslands are the most common plant communities, comprising approximately 61% of the corridor.

Other vegetation communities present include agricultural areas, scabland/lithosol (shallow soils) communities, riparian corridors, and ruderal communities in developed areas. Past disturbance of the corridor has influenced the types of plant communities present. Along the project corridor, the invasive species cheatgrass is prevalent in most of the plant communities.

The U.S. Fish and Wildlife Service has identified one federally listed threatened species (Utes ladies' tresses) and one candidate plant species (northern wormwood) as having potential habitat present within the project corridor. Neither species was found during field surveys conducted in July 2001.

The Washington Natural Heritage Program (WNHP) has identified potential habitat in or near the project corridor for three state sensitive plant species. None of these plant species were found during field surveys conducted in July 2001. However, the field surveys verified that favorable habitat for all three species is present in portions of the corridor.

Environmental Consequences—Proposed Action

Construction

The proposed transmission line expansion would result in both permanent and temporary impacts to vegetation within the project corridor from vegetation removal or trampling and soil compaction. Permanent impacts would total approximately 54 acres. Temporary impacts would total 121 to 134 acres, depending upon the number and location of conductor tensioning sites.

The project is not likely to adversely affect any federal or state-listed sensitive plant species, since none are likely to occur within the project area. Construction would temporarily disturb soils, creating opportunities for colonization by noxious weeds or other undesirable plants.

The proposed project would result in temporary impacts to 24 to 27 acres of native plants and approximately 4 acres of cryptogamic crusts. Permanent project impacts would require the removal of approximately 12 acres of native plant species, and 2 acres of cryptogamic crusts. Loss of the cryptogamic crusts could result in an increase in soil erosion and decreased soil nutrient and water retention.

Of the transmission towers to be placed, approximately 144 would be placed in grazed shrub-steppe vegetative cover, 118 would be placed in agricultural cover, 75 would be in grasslands, 26 would be in scabland/lithosol communities, and 11 would be in shrub-dominated shrub-steppe cover. No towers would be placed in riparian communities.

The proposed expansion of the McNary Substation would result in the loss of approximately 2 acres of mixed native/nonnative grassland communities. The construction of a new 3-mile-long access road, and 270 (250-foot-long) spur roads would result in 95 acres of temporary impacts to vegetation communities on the proposed route.

Operation and Maintenance

Operations and maintenance of new access roads would result in the permanent alteration of 31 acres of existing vegetation communities in the proposed roadbeds. Impacts to local vegetative cover types during operation and maintenance of the access roads include continued disturbance and compaction of soils and the potential for spreading noxious weed species. An additional potential impact to local vegetation would be the risk of fire from vehicles driving along the access roads, particularly during dry periods.

Environmental Consequences—Short-Line Routing Alternatives

The potential impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

The following measures would help minimize potential impacts to vegetation along the proposed transmission line corridor.

- Locate the proposed transmission line adjacent to the existing corridor to minimize additional clearing.
- Utilize the existing access road system to the extent possible to reduce the need for new access roads.
- Keep vegetation clearing to the minimum required to maintain safety and operational standards.
- Avoid construction activities or permanent tower or access road siting in native shrub-dominated shrub-steppe communities if possible.
- Reseed areas temporarily disturbed in higher quality shrub-steppe with native grasses and forbs (if recommended by local county) and salvage topsoil and bunchgrass plant material. Reseeding should occur at the appropriate planting season. Reseed all disturbed areas with seeds recommended by the local county.

- Equip all vehicles with basic fire-fighting equipment including extinguishers, shovels, and other equipment deemed appropriate for fighting grass fires.
- Avoid tree removal to the extent possible.
- Limit construction equipment to tower sites, access roads, and conductor tensioning sites.
- Minimize disturbance to native species to the extent possible during construction to prevent invasion by nonnative species.
- Conduct a pre-construction and a post-construction noxious weed survey to determine if construction contributed to the spread of noxious weed populations.
- Enter into active noxious weed control programs with land owners/mangers or county weed control districts where activities may have caused or aggravated an infestation.
- Wash vehicles that have been in weed-infested areas (removing as much weed seed as possible) before entering areas of no known infestations.
- Use certified weed-free mulching.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, vegetation in the project area would not be disturbed by the proposed transmission line construction. The existing transmission line corridor would remain at its present width, with no additional area that would likely become dominated by invasive species.

Wildlife

Affected Environment

Five habitats are present within or near the project corridor, including ruderal areas (made up of grazed shrub-steppe, agricultural lands, and grasslands), cliffs, shrub-dominated shrub-steppe, stream riparian zones, and tree stands.

The U.S. Fish and Wildlife Service has identified the bald eagle as the only listed wildlife species known to occur in the project vicinity. A winter foraging and roosting area is located approximately 2,300 feet south of the corridor on an island in the Columbia River near the town of Paterson. The U.S. Fish and Wildlife Service has also identified the spotted frog and the Mardon skipper butterfly as candidate wildlife species potentially occurring in the project vicinity. Habitat for 29 different Washington and/or Oregon state-listed species occurs within or near the corridor.

The Columbia River basin is a wintering and breeding area for waterfowl. Waterfowl rest during migration and forage in wetlands, agricultural fields, and other open water bodies. Shallow wetlands are located near streams crossed by the project corridor. Waterfowl also feed in agricultural fields near Paterson. Open water habitat occurs within the project corridor at the major stream crossings and in the vicinity of the existing transmission lines at Rock Creek and the Columbia River crossings at McNary and John Day Dams.

Raptors (such as hawks, eagles, falcons, and owls) use grasslands, cliffs, and agricultural lands, habitats that are relatively common in the project vicinity. Such habitats are relatively common in the project vicinity.

Mule deer are known to occur in the Rock Creek watershed and in the Umatilla National Wildlife Refuge. The primary mule deer concentration area is more than 2 miles north of the crossing location at Rock Creek (PHS 2001).

Environmental Consequences—Proposed Action

Construction

During construction, wildlife may be impacted by noise and human presence that cause disturbance to foraging and breeding behavior. Additionally, construction would cause disturbance to and the modification of vegetation and soils that would result in loss of habitat. Temporary construction impacts would be associated with noise and human presence such as tower installation activities involving the use of heavy equipment, helicopters, and blasting, explosive couplers, and high levels of human activity around the construction site; construction of the substation addition and roads; clearing rights-of-way; and pulling conductors.

The project is not likely to adversely affect the bald eagle. The primary potential impact of construction activities would be to eagles foraging on the Columbia River in the area of construction. Few trees in the project corridor representing potential eagle perching habitat would be removed by the proposed project.

Construction of the proposed project could impact raptor nesting activities particularly near cliffs or rocky outcrops. Temporary disturbance would be caused by activities such as road and tower building construction near known burrowing owl burrows. Owls could be flushed from their nests, and road construction or tower erection in burrow areas could cause burrow abandonment and loss of recruitment for the year. An incremental amount of burrowing owl habitat could be lost from access roads and towers.

Noise and human disturbance from construction activity would be temporary and result in no permanent displacement of waterfowl from feeding or breeding areas.

Operation and Maintenance

Potential operation and maintenance impacts include bird collisions with power lines, and avoidance of areas by wildlife due to such activities as road or vegetation maintenance and repair of towers, helicopter flights for line surveys, and replacement of insulators.

Operations and maintenance activities are not likely to adversely affect nesting or wintering bald eagles.

Impacts during operation and maintenance would be limited to bird collisions with power lines and potential disturbance of roosting or foraging due to maintenance activities.

The proposed line would cross few areas of open water or wetlands and would run primarily through upland grazed shrub-steppe and croplands. One area of high seasonal bird use is the Umatilla National Wildlife Refuge. This area would represent the highest risk areas for avian collisions because of the high seasonal use and the species involved.

Because of the temporary nature of maintenance activities, the noise, and human disturbance, impacts from those activities would be minor and of short duration.

Environmental Consequences—Short-Line Routing Alternatives

The potential impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

The following mitigation measures would be employed to minimize potential impacts to wildlife along the proposed transmission corridor.

Threatened, Endangered or Other Sensitive Species

- Prior to construction, conduct raptor nest surveys (for existing and new nests) of cliffs located within 0.25 mile of the right-of-way (corridor miles 3, 54, 56, 57, 72, 73). See potential mitigation measures below for specific species.
- Between January 1 and July 30, avoid using helicopters within 0.25 mile of cliffs identified as priority habitat by the Washington Department of Fish and Wildlife (use ground-based equipment near cliffs.
- Avoid blasting cliffs identified as priority habitats by Washington Department of Fish and Wildlife and consult with the Washington Department of Fish and Wildlife or Oregon Department of Wildlife regarding measures to minimize nest disturbance on a site-by-site basis if nests are found.
- If bald eagle nests are found on the cliffs, restrict construction during nesting season (January 1 through July 15).

- **Mitigation for burrowing owls.** If possible, avoid disturbance within 160 feet of occupied burrows during the non-breeding season of September 1 through January 31 or within 250 feet during the breeding season of February 1 through August 31.
- **Mitigation for peregrine falcon.** If possible, avoid disturbance within 0.25 mile of any active nests during the breeding season (March through June).
- **Mitigation for prairie falcon.** If possible, avoid construction activities between February 15 and July 15 within 0.25 mile of active nests.
- **Mitigation for red-tail hawk.** If possible, avoid construction activities within 320 feet between February 15 and July 15
- **Mitigation for other raptors.** Consult with Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife.

Avian Collisions

- If deemed appropriate, install line markers in avian flight paths or migration corridors, such as near crop irrigation circles in the vicinity of the town of Paterson (north of the Umatilla National Wildlife Refuge) if appropriate and for the Columbia River crossing.
- For the McNary Substation Alternatives, avoid placing towers and lines across wetlands to minimize risk of bird collision.

Shrub-Steppe Dependent Wildlife

- Minimize the amount of shrub-steppe plant communities removed by clearing only the amount of vegetation necessary to prepare tower footings or build roads.
- Minimize road construction in shrub-steppe areas with burrows. Burrows were found in the field near corridor miles 19, 21, 63, and 76.

Riparian Dependent Wildlife

- Span riparian corridors to minimize removal of shrubs or trees within riparian areas.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, wildlife and wildlife habitats would not be altered. Agricultural lands would continue to be managed for crop production. The shrub-steppe lands to the east would continue to be used as grazing lands.

Cultural Resources

Affected Environment

The 73-mile portion of project corridor that lies within Washington State is within the Mid-Columbia Study Unit as defined by the Resource Protection Planning Process (RP3). Archival records indicate ten known archaeological sites along the corridor. Near the corridor, there are at least 70 additional archaeological sites recorded within a 1-mile radius of the proposed transmission line. Of these 70 sites, 26 (37%) are underwater behind the John Day Dam.

Historical data demonstrate continuous use of the Mid-Columbia Study Unit from the time of the first Euro-American exploration through the arrival of a trans-continental railroad, a state highway system, and construction of two federal dams.

A total of 12 cultural resource sites were identified during the field surveys. An additional 14 isolate finds were also documented. Of the 10 previously recorded sites situated within or adjacent to the corridor, eight were re-identified in the field.

Jones & Stokes, on behalf of Bonneville, contracted with the Confederated Tribes of the Umatilla Indian Reservation (Umatilla Tribes), Confederated Tribes of the Warm Springs Reservation Oregon (Warm Springs Tribes), and the Yakama Nation to provide the oral history of the project vicinity. Detailed oral accounts were prepared and are summarized in Chapter 3 of this EIS.

Environmental Consequences—Proposed Action

Construction

No impacts to cultural resources are anticipated during construction of the proposed project. Tower construction would be limited to a relatively small area adjacent to existing transmission line towers. Road construction and improvements are the most likely activities to disturb unknown cultural resources.

Of the 14 cultural resource sites found along the corridor, 12 require avoidance and two sites should have cultural resource monitors during construction excavation. Of the 10 previously documented cultural resource sites along the corridor, nine require avoidance and one site requires a cultural resource monitor during construction excavation.

Operation and Maintenance

No impacts to cultural resources are anticipated during the continuing operation and maintenance of the proposed McNary-John Day Transmission Line.

Environmental Consequences—Short-Line Routing Alternatives

The potential impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

The following mitigation measures would minimize impacts to significant cultural resources.

- Locate structures, new roads, and staging areas so as to avoid known cultural resource sites.
- If archaeological or historic materials are discovered during construction, further surface-disturbing activities at the site would cease and Bonneville, state historic preservation offices, and tribal personnel would be notified to ensure proper handling of the discovery.
- Utilize existing access road system to the extent possible to reduce the need for new access roads.
- Limit construction equipment to tower sites, access roads and conductor tensioning sites.
- Limit the number of contractors to cultural resource site sensitive information on a need-to-know basis.
- The Umatilla Tribes CRPP identified ten TCP areas. Based on file and literature searches and oral history interviews with tribal elders, the CRPP recommends that a tribal monitor be present during all ground disturbing activities throughout the construction process. The CRPP further requests that the Tribe be consulted with through the entire construction process, including the planning phase and until the completion of the transmission line project. Furthermore, the CRPP recommends that Jones & Stokes and Bonneville meet with the Cultural Resources Commission and the Board of Trustees to set up consultation protocols on site mitigation and management because the law requires consultation.
- The Umatilla Tribes would like Bonneville to ensure that the cultural and natural resources are protected. The Umatilla Tribes would like Bonneville to guarantee that traditional use of this area, in accordance with treaty reserved rights, be able to be utilized.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, cultural resources in the project area would not be disturbed by the proposed transmission line construction. The existing transmission line corridor would remain at its present width, with no additional disturbance to known or previously undocumented cultural resources. Continued impacts associated with operation and maintenance of the two existing lines would remain.

Visual Resources

Affected Environment

The affected environment and visual impacts of the proposed project was evaluated by assessing the visual quality of the project corridor, viewer sensitivity, and the visibility of the towers and transmission line as seen from sensitive viewpoints.

The visual quality of the project corridor is predominantly rural, with a few low-density settlement areas, including Umatilla City, Plymouth, Paterson, Roosevelt, and Rufus. In addition, there are single houses, small groupings of houses, and small farm complexes scattered along the corridor outside of these settlements.

Sensitive viewpoints include residences in Umatilla City and Rufus, Oregon (at the east and west ends of the corridor, respectively) and in Plymouth, Paterson, and Roosevelt, Washington. There are also small groupings of houses and small farm complexes scattered along the corridor outside of these settlements.

Other sensitive viewpoints include segments of SR 14 where the project corridor is in close proximity to the highway and from various recreational sites in relatively close proximity to the project corridor.

Environmental Consequences—Proposed Action

Potential visual impacts include temporary visual changes during construction and the overall permanent visual changes caused by the presence of the towers and the transmission lines.

Construction, Operations and Maintenance

Impacts during construction and operations and maintenance would be relatively the same, except during construction when equipment would also be part of the viewscape. Construction sites would be visible from a distance in Benton County, Washington from I-82 through corridor mile 13. As the line moves further away from SR 14 and as the topography changes to hills and canyons, views would be intermittent and sites would not likely be seen from a distance due to the topography. Installation of the towers by sky-crane helicopters would likely be visible from a distance regardless of the location in the corridor.

The proposed towers and transmission lines, which would be located in an existing Bonneville transmission line corridor and would be spaced to match the existing spans and towers in the corridor where possible, would be visible for some distance.

Residences in Umatilla City would probably not notice the McNary Substation expansion or the new line leaving the substation because their views would be partially obstructed by the existing substation and several transmission lines that originate at or leave the substation.

The flat terrain in Plymouth would provide residents relatively unobstructed views of the proposed transmission line, especially for residences located close to the existing transmission line corridor (closest resident is about 500 feet).

In Paterson at corridor mile 16, orchards, farm buildings, and other transmission lines could partially obstruct some residents' views of the new transmission line, depending on their location. In North Roosevelt and West Roosevelt, the hilly terrain would partially obstruct some residents' views, again depending on location. In West Roosevelt, the hills would provide a backdrop for the towers, causing them to blend into the landscape. In these communities, the new line would add more humanmade elements to the landscape.

Scattered residences located along the corridor would see the new line.

Environmental Consequences—Short-Line Routing Alternatives

The potential impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

The mitigation measures that would help minimize visual impacts are as follows.

- Site all construction staging and storage areas away from locations that would be clearly visible from SR 14 as much as practical.
- Provide a clean-looking facility following construction by cleaning-up after construction activities.
- Keep the areas around the towers clean and free of debris.
- Provide regular maintenance of the access roads and fences within and leading to the corridor.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, the visual quality and sensitivity of the viewers along the existing Bonneville corridor would not be influenced by the proposed project. Viewers would continue to see the existing transmission lines and towers in the existing Bonneville transmission line corridor.

Socioeconomics, Public Services, and Utilities

Affected Environment

The area of potential effect for this section covers six counties, four of which are where the proposed project would be located. The other two counties, Franklin County in Washington and Wasco County in Oregon, are less likely to be affected, but were also included in the population, employment, and housing analyses. In 2000, the six-county study area had a population of 307,256 people. Benton County, Washington, was the most populated with 142,475 people and Sherman County, Oregon, was the least populated with 1,934 people.

In 2000, Oregon's three-county study area employment was 42,135 people, of that the average annual agricultural employment was 4,350. In 1999, Washington's three-county study area total employment (including agriculture) was 87,627.

Environmental Consequences—Proposed Action

Construction

The project would be constructed by one or more construction crews. A typical transmission line construction crew for the 500-kV line would likely consist of up to 60 construction workers.

The typical crew would likely construct about 10 miles of line in 3 months. To meet the proposed construction schedule for this project (1 year), two or more crews would work simultaneously on separate sections of the 79-mile-long transmission line. During the 1-year construction period, approximately 180 workers would be required to complete the project, assuming three crews are mobilized at the start of the construction period. Of these crews, one would likely be stationed out of the Umatilla and Hermiston area (Umatilla County) and the other two would likely be stationed either in Goldendale (Klickitat County) or in the Biggs, Wasco, or Rufus area (Sherman County). Franklin and Wasco counties—which have relatively large metropolitan areas including Pasco (Tri-Cities Area) and The Dalles—could also provide workers and attract workers to stay there during construction.

A potential temporary increase in spending on goods and services in the study area would also occur. The potential influx of workers from outside the project area would create a temporary increase in population.

No adverse impacts to housing in the project area are expected, and the influx of workers would create modest economic benefits to the area. Schools are not expected to be impacted.

The impact of introducing a new right-of-way easement for transmission towers and lines along the corridor would vary depending on the placement of the right-of-way in relation to the property's size, shape, and location of existing improvements. The transmission line could diminish the utility of a portion of the property if the line effectively severed this area from the remaining property.

If the new transmission line crossed a portion of a property in agricultural use such as pasture or cropland, little utility would be lost between the towers, but 100% of the utility would be lost within the base of the tower. Towers may also present an obstacle for operating farm equipment and controlling weeds at tower locations. To the extent possible, the new transmission lines and towers would be designed to minimize the impact to existing and proposed (if known) irrigation systems.

Minority and low-income populations would not be disproportionately affected by the proposed project because the project would occur entirely within or adjacent to an existing Bonneville transmission line corridor. The population that would be crossed by the line are a mix of income levels and there are no minority groupings.

Operation and Maintenance

During operation of the project, no impacts are expected to housing, schools, or water and sanitary sewer systems, and only minor adverse impacts could occur to emergency services, due mainly to the risk of fire. Positive benefits include increased service capacity for the Bonneville transmission grid.

The proposed transmission line is not expected to have long-term impacts on property values in the area. The proposed action would have no direct beneficial effect on the local taxing districts because Bonneville, as a federal agency, is exempt from local taxes. Conversely, the proposed action could have a minor but negative impact on local taxing authorities if any properties are devalued as a result of limits the proposed easement might impose on the highest and best use of a parcel.

Environmental Consequences—Short-Line Routing Alternatives

The potential impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

See the Land Use and Recreation section for mitigation measures for agricultural uses. No additional mitigation measures are needed.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, there would not be opportunity to hire people from the area to work on the project, nor would there be an increase in goods and services and lodging revenues from workers staying in the area during construction.

Transportation

Affected Environment

Structural parts for the transmission line would likely travel by truck to the project via I-5. I-5 provides access across the Columbia River and connects with SR 14 in Vancouver, Washington, and with I-84/US 30 in Portland, Oregon. East-west access on the south (Oregon) side of the Columbia for the project is provided by I-84/US 30. The Bonneville right-of-way and SR 14 follow the north (Washington) side of the Columbia River for more than 80% of the project length. If parts are trucked from the east, they would likely be transported via I-90, connecting to I-82/SR 97 near Ellensburg, and connecting to the project site via SR 97 near Goldendale or I-82/SR 12 on east past the Tri Cities via I-82/US 295 into Hermiston.

Bonneville could choose to utilize the Burlington Northern Santa Fe Railway that follows SR 14 and the project corridor to transport materials.

The Columbia River could also be utilized to transport equipment and components via barge. Ports in the project vicinity are located at Umatilla, Morrow, and Arlington.

The Port of Morrow and Port of Umatilla would be able to assist in the import or export of materials for Bonneville; the Port of Arlington is a grain barging facility.

There are seven airports and landing strips of various sizes in the project vicinity.

Environmental Consequences—Proposed Action

Construction

Transportation impacts during the 12-month construction period are anticipated to be minimal. During project construction, heavy and light vehicles would access the corridor, and equipment and components would be transported to the project site via trucks, along the routes previously described in the Affected Environment section above.

There are numerous transportation options for getting equipment to the project sites. Highway SR 14, in combination with local roads and the access road system, provide adequate pathways for getting materials and workers to the project with minor impacts to existing traffic flows.

There may be short interruptions of SR 14 traffic when trucks cross the road or there is blasting (to protect cars from flying debris). If the railroad needs to be crossed, the contractors would appropriately time the crossing to avoid interrupting train service.

Operation and Maintenance

Transportation impacts during operation and maintenance of the transmission line would be negligible. Operation and maintenance traffic would normally consist of personnel vehicles and project pickup trucks. On infrequent occasions, larger equipment, such as flatbed trucks or a crane, may be required to replace or repair the transmission line and towers.

Environmental Consequences—Short-Line Routing Alternatives

The potential impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

The following mitigation measures would help minimize transportation impacts.

- Coordinate routing and scheduling of construction traffic with state and county road staff and Burlington Northern Santa Fe Railway.
- Employ traffic control flaggers and post signs warning of construction activity and merging traffic, when necessary for short interruptions of traffic.
- Repair any damage to local farm roads caused by the project.
- Install gates on access roads when requested by property owners to reduce unauthorized use.

Environmental Consequences—No Action Alternative

No impacts on existing transportation facilities would occur if the proposed project is not constructed.

Air Quality

Affected Environment

There are no major industrial facilities along the corridor and no significant existing air quality problems. Local air pollutant emissions are limited mainly to windblown dust from agricultural operations and tailpipe emissions from traffic along state highways and local roads.

The nearest air quality monitoring stations are in Washington at Wallula, Kennewick, and Goldendale. The project area has been designated by the Washington State Department of Ecology (Central Region and Eastern Region), the Benton Clean Air Authority, and the Oregon Department of Environmental Quality, as having attainment status.

Environmental Consequences—Proposed Action

Construction

Air quality impacts associated with the construction of the proposed transmission line and associated facilities would be minimal. The primary type of air pollution during construction would be combustion pollutants from equipment exhaust and fugitive dust particles from disturbed soils becoming airborne.

The amount of pollutants emitted from construction vehicles would be relatively small and similar 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 project would be negligible. Operation and maintenance vehicles would mainly use access roads with native surfaces, causing dust particles to be stirred up. Quantities of potential emissions would be very small, temporary, and localized.

Environmental Consequences—Short-Line Routing Alternatives

The potential impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

The following mitigation measures would help to control dust and reduce emissions.

- Water exposed soil surfaces if necessary to control blowing dust.
- Cover construction materials if they are a source of blowing dust.
- Limit vehicle speeds along dirt roads to 25 miles per hour.
- Shut down idling construction equipment, if feasible.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, potential impacts to air quality associated with the proposed project would not occur.

Noise

Affected Environment

Most of the proposed corridor is near highways or freeways, so existing noise levels are mainly characterized by traffic noise. Background noise in the more remote areas of the corridor far from highways would mainly consist of corona noise from existing transmission lines.

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 transmission line wires. 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 during wet weather. Conductors can be wet during periods of rain, fog, snow, or icing. Such conditions are expected to occur infrequently in the project area.

Environmental Consequences—Proposed Action

Construction

Sources of noise associated with construction of the proposed project include construction of access roads and foundations at each tower site, erection of steel towers at each tower site, helicopter assistance during tower erection and stringing of conductors, potential blasting, and potential use of implosive couplers for conductor splicing.

The Washington state limit for noise levels at residential areas caused by permanent daytime industrial operations is 65 dBA. Construction noise levels would exceed these limits, but construction noise is exempt from state limits.

An estimated 19 homes in the cities of Plymouth, Paterson, and North and West Roosevelt in Washington, and the cities of Umatilla and Rufus in Oregon; and single residences, small groupings of houses, or small farm complexes located along the line would be within approximately 600 feet of construction activity and may experience noise levels at or above 65 dBA. If helicopters are used to install the towers a wider range of residences could be affected.

Operation and Maintenance

Noise impacts during operation and maintenance of the proposed project would be negligible. Every 2 months a helicopter would fly the line to look for any problems or repair needs. When and if these needs arise, field vehicles would be used to access the trouble spots.

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.

Environmental Consequences—Short-Line Routing Alternatives

The potential impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

To reduce the potential for temporary, adverse noise impacts during construction, the following measures would be incorporated into contract specifications.

- All equipment will have sound-control devices no less effective than those provided on the original equipment.
- All equipment will have muffled exhaust.
- No noise-generating construction activity will be conducted within 1,000 feet of a residential structure between the hours of 10:00 p.m. and 7:00 a.m.
- Landowners directly impacted along the corridor will be notified prior to construction activities.
- Bonneville will take measures to restore reception to a quality of reception as good or better than before the radio or television interference.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, existing background noise levels in the project vicinity would continue without influence of the proposed project.

Public Health and Safety

Affected Environment

Potential hazards along the corridor include fire (both natural and human-caused), existing overhead transmission line crossings, and natural gas pipeline crossings.

Environmental Consequences—Proposed Action

Construction

During construction and installation of the towers and conductor/ground wires, 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 towers or access roads, and other risks associated with working near high-voltage lines. There is also a potential for fire during refueling of hot equipment such as trackhoes and bulldozers that cannot be taken off-site for refueling. Connection of conductors may be accomplished using implosion bolts, which could be a source of injury to construction personnel. In addition, there are potential safety issues with more traffic on the highways and roads in the project area during construction.

Operation and Maintenance

With the addition of the proposed transmission line, there will be slight additional risks for fire and injuries as maintenance workers and vehicles travel along the corridor to perform required maintenance.

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 79-mile-long corridor in which the proposed line would be built is sparsely populated. There are about 40 structures within 400 feet of either side of the right-of-way edge.

Environmental Consequences—Short-Line Routing Alternatives

The potential impacts of the short-line routing alternatives are presented in Table S-2.

Mitigation

The following mitigation measures would help minimize potential health and safety risks during construction.

- Prior to starting construction, the contractor would prepare and maintain a safety plan in compliance with Washington and Oregon 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.
- During construction, the contractors would also hold crew safety meetings at the start of each workday to go over potential safety issues and concerns.
- At the end of each workday, the contractor and subcontractors will secure the site to protect equipment and the general public.
- As necessary, employees would be trained in tower climbing, cardiopulmonary resuscitation, first aid, rescue techniques, and safety equipment inspection.
- To minimize the risk of fire, all highway-authorized vehicles would be fueled off-site. Fueling of construction equipment that was transported to the site via truck and is not highway authorized would be done in accordance with regulated construction

practices and state and local laws. Helicopters would be fueled and housed at local airfields.

- Helicopter pilots and the contractor would work with communities along the corridor to ensure public safety. For example, flight paths could be established for transport of project components in order to avoid flying over populated areas or near schools (Helicopter Association 1993). Contractors would also work with local crop dusters and agricultural businesses to minimize interruption in agricultural activity during construction (for instance, to schedule work or tower placement so it does not conflict with crop dusting and harvesting).
- If blasting is required, a notice would be sent to residents in the affected area. A public meeting would be held prior to blasting to inform residents and other interested parties of the date and time of the blasting and to answer questions. During blasting, appropriate safety measures would be taken as required by state and local codes and regulations. All explosives would be removed from the work site at the end of the work day.
- If implosion bolts are used to connect the conductors, they would be installed in such a way as to minimize potential health and safety risks.
- Construction and operation/maintenance workers would need to be trained in what to do in the event of a chemical release from the Umatilla Army Depot.
- Operation and maintenance vehicles would be required to carry fire suppression equipment including (but not limited to) shovels and fire extinguishers.
- Drivers would be required to stay on established access roads and smoking would be prohibited.
- The corridor would be maintained to control tall grass that could potentially start fires via contact with hot vehicle parts. Trees and other tall vegetation would be trimmed to Bonneville standards to avoid contact with transmission lines.
- The towers are not expected to exceed 200 feet in height. However, Federal Aviation Administration laws would be followed regarding the placement of line markers to warn approaching aircraft. Bonneville would submit final locations and tower heights to the Federal Aviation Administration for review and requirements for markings and lighting would be addressed at that time.
- Because of the proximately of the proposed transmission line to agricultural fields, crop dusting pilots planning to enter the area would take suitable precautions to avoid collision with the proposed transmission lines.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, the proposed transmission line would not be built and the potential increased health and safety risks associated with the proposed transmission line project would not occur.

Table S-2: Summary of Impacts of Short-Line Alternatives, McNary-John Day Transmission Project

McNary Substation Alternatives			Hanford-John Day Junction Alternatives			Corridor Mile 32 Alternatives		Corridor Mile 35 Alternatives	
Alternative A	**Alternative B**	**Alternative C**	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative A**	**Alternative B**	**Alternative A**	**Alternative B**
Wildlife viewing temporarily obstructed; no impact to soils; some sedimentation to Columbia River and pond habitat; about 0.1 acre of trees in wetland; about 2 acres grassland removed for building relocation; about 2 acres marginal grassland habitat removed; no cultural resource impacts with mitigation; recreationists and travelers would have views of construction; no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	Wildlife viewing temporarily obstructed; no impact to soils; some sedimentation to Columbia River and pond habitat, though less ground disturbance than Alternative A, but closer to river; about 0.2 acre of willows in wetland removed; cottonwood trees and vegetation removed; bird nesting and ground dwelling animal habitat removed, increased risk of avian collisions; no cultural resource impacts with mitigation; recreationists and travelers would views of construction; no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	No recreation impacts anticipated; no impact to soils; slight increased (than Alternative A or Alternative B) sedimentation to Columbia River and pond habitat though ground disturbance and permanent surface of bus work; minor sediments to wetland; about 0.7 acre of grassland removed for bus work; negligible wildlife impacts; no cultural resource impacts with mitigation; recreationists, travelers, and residence would have views of bus work; no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	About 1.5 acres of grazing land disturbed; no impact to soils; no impact to fish/water; invasive *Ailanthus* sp. trees in wetland may be removed; sedimentation to small wetland; about 1.6 acres of vegetation impacted; negligible wildlife impacts; no cultural resource impacts with mitigation; views of line from highway and residence (less than Alternative B or C); no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	About 1.5 acres of grazing land disturbed, residence may need to be removed; no impact to soils; no impact to fish/water; trees in wetland may be removed, sedimentation to small wetland; about 1acre of vegetation impacted, 10 invasive *Ailanthus* sp. trees removed; loss of trees reduce bird nesting habitat; no cultural resource impacts with mitigation; views of line from highway and residence (more than Alternative A); no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise and corona noise; no specific health and safety impacts	About 1.5 acres of grazing land disturbed, residence may need to be removed; no impact to soils; no impact to fish/water; invasive ailanthus sp. trees in wetland may be removed; sedimentation and potential fill in small wetland; about 1acre of vegetation impacted, 10 invasive ailanthus sp. trees removed; loss of trees reduce bird nesting habitat; no cultural resource impacts with mitigation; views of line from highway and residence (more than Alternative A); no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise and corona noise; no specific health and safety impacts	About 0.8 acre of cropland removed from production; no impact to soils; no impact to fish/water; no wetland impacts; about .4 acres grazed shrub-steppe impacted; minor impacts to grazed shrub-steppe designated Priority Habitat by WDFW; no cultural resource impacts with mitigation; travelers on highway and agricultural workers would view line (less than Alternative B); agreement between tribes and Bonneville needed to cross tribal; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	About 0.6 acre of cropland; no impact to soils; no impact to fish/water; no wetland impacts; about 5.5 acres grazed shrub-steppe impacted; about 1 acre of marginal agricultural habitat removed; no cultural resource impacts with mitigation; travelers on highway and agricultural workers would view line (more than Alternative A); no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	About 0.8 acre of cropland removed from production; no impact to soils; slight sedimentation to Columbia River (less than Alternative B); no wetland impacts; no vegetation impacts; minor impact to heavily grazed shrub-steppe habitat; no cultural resource impacts with mitigation; travelers on highway and agricultural workers would view line (less than Alternative B); agreement between tribes and Bonneville needed to cross tribal; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	About 0.6 acre of cropland; no impact to soils; slight sedimentation to Columbia River (more than Alternative A); no wetland impacts; about 5.5 acres grazed shrub-steppe impacted; minor impact to heavily grazed shrub-steppe habitat (more than Alternative A); no cultural resource impacts with mitigation; travelers on highway and agricultural workers would view line (more than Alternative A); no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts

Chapter 1
Purpose of and Need for Action

Chapter 1 Purpose of and Need for Action

Need for Action

Bonneville Power Administration (Bonneville) is a federal agency that owns and operates more than 15,000 miles of high-voltage transmission lines. The transmission lines move most of the Northwest's high-voltage power from facilities that generate the power to power users throughout the region and to nearby regions (e.g., north to Canada and south to California and Arizona). The facilities that generate the power include federally-owned dams on the Columbia River and private investor-owned facilities (gas-turbine, coal-fired, and wind-turbine facilities). Buyers of high-voltage power include electric utilities (public utility districts, municipalities, and investor-owned utilities) and direct service industries (e.g., aluminum plants). The electric utilities, in turn, provide electricity to homes, businesses, and farms. Bonneville also provides transmission service; generation facilities use this service by connecting to Bonneville's transmission system and using the transmission lines to send power to their buyers.

Presently, Bonneville is facing two problems regarding power flow on the system: there is not enough electricity being generated to meet demand, and many of Bonneville's transmission lines are now at capacity and cannot carry more power. To solve the problem of lack of power, private investors have proposed and are developing gas-fired and wind-powered generation facilities. Many of these facilities are in southeast Washington and northeast Oregon (see Figure 1-1 for locations and the section on Other Projects or Documents at the end of this Chapter for descriptions). This is a prime area for power generation because of sufficiency of wind or access to gas pipelines, as well as access to high voltage transmission lines. The newly generated power from these facilities will need to be transmitted to the west side of the Cascades because there is a high demand for electricity from the west side's urban areas. However, the existing transmission lines connecting southeast Washington and northeast Oregon to the west side of the Cascades are at or near capacity.

Bonneville has a statutory obligation to ensure that there is sufficient capacity and reliability in Bonneville's transmission system. The Federal Columbia River Transmission Act directs Bonneville to construct additions to the transmission system that are required to provide interregional transmission facilities [16 U.S.C. § 838b(c)]. In addition, the Act directs Bonneville to construct additional transmission lines that are necessary to integrate and transmit electric power from new Federal and non-federal generating sources [§ 838b(a)]. Finally, the Act directs Bonneville to construct additional transmission lines necessary for maintaining the electrical stability and reliability of the transmission system [§ 838b(d)]. The proposed action is needed to comply with these Congressional mandates.

In order to help ensure that existing and newly generated power can move east to west through the system, Bonneville needs to increase the capacity of its transmission system between the McNary and John Day Substations.

Need for Power

As recognized by the National Energy Policy report submitted by Vice President Cheney on May 16, 2001, resolution of the Western energy crisis requires development of new generation resources. About 1,000-megawatts (MW) of generation currently under construction have contracted for wheeling (transferring power) over the Bonneville system. An additional 3,000-MW of new generation is proposed to be online by 2004 and developers for nearly 30,000-MW of generation have requested interconnection. While many of these plants will likely not be built, regional studies have identified a shortfall of about 3,000-MW by 2004 (based on regional load and generation resource forecasts). Most proposed new generation resources cannot obtain firm transmission service, or be integrated into the regional power system, without additional transmission investment.

Two of the generation facilities proposed in this area are the Starbuck Power Project (near Starbuck, Washington), and the Wallula Power Project (near Wallula, Washington). These gas-turbine facilities would generate a total of 2,500-MW of power. The new transmission line would be necessary to allow the power from these facilities to integrate into the transmission system and would allow Bonneville to grant “firm” transmission service to these facilities. (Firm transmission service is reserved or scheduled availability of the transmission line for sending generated power for a specific term—usually a year or longer.) If either the Starbuck or Wallula generation projects fail to be built, there are other proposed facilities in the area that would be able to utilize the line.

Transmission Infrastructure

Portions of the Northwest transmission system are approaching gridlock. An adequate and affordable electric supply is not possible without sufficient transmission capacity. Bonneville has a number of transmission paths that experience chronic electrical congestion, which requires that Bonneville reduce the amount of power that is delivered on the system (curtailment of both firm power deliveries and economy energy). The amount of power loads (power being transmitted and sold) has been growing steadily at 1.8% annually, and the use of the transmission system is up by over 2% annually, but very few bulk grid transmission lines have been added in the last 15 years. Bonneville has kept up with increasing transmission demands through substation upgrades, conservation, and other non-wire solutions; however, the system is beyond its limits for these fixes.

Decisions to be Supported by the EIS

Bonneville will use the information contained in this environmental impact statement (EIS) and comments from the public to make the following decisions.

- Bonneville must decide whether or not to build the proposed McNary-John Day transmission line (see Chapter 2 for descriptions of the transmission line and short-line routing alternatives).
- If the decision is to build the new transmission line, Bonneville must choose among the short-line routing alternatives analyzed in this EIS (at the McNary Substation, the Hanford-John Day Junction, Corridor Mile 32, and Corridor Mile 35).
- If the decision is to build a new transmission line, Bonneville would determine the exact locations of the towers and access roads and chose among the mitigation measures identified in this EIS.

Purposes

While meeting the need to increase the capacity of the transmission system in this area, the proposed action has other purposes (or objectives). Bonneville intends to base its decisions on the following objectives:

- maintenance of transmission system reliability;
- consistency with Bonneville's environmental and social responsibilities; and
- cost and administrative efficiency.

Cooperating Agencies

The U.S. Army Corps of Engineers (Corps), the U.S. Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service (USFWS) and the Bureau of Indian Affairs (BIA) are cooperating agencies in the development of this EIS. The proposed transmission line would cross a Corps Wildlife Natural Area near the McNary Substation and would cross the Columbia River twice. (The Corps has permitting jurisdiction of crossings over navigable rivers. See permits and requirements in Chapter 4.) The proposed transmission line crosses three BLM parcels and two tribal allotments (the BIA is responsible for negotiating easements for tribal allotments). The USFWS manages the Umatilla Wildlife Refuge adjacent to the transmission line corridor and will make findings and opinions regarding impacts to threatened and endangered species. As cooperating agencies, the Corps, BLM, USFWS, and BIA will make sure that the EIS and the proposal meet their requirements for allowing easements or findings as appropriate. See Appendix A for correspondence with coordinating agencies.

Scoping and Major Issues

Early in this environmental process, Bonneville contacted people who may be interested in or affected by the proposed project to learn what issues should be studied in the EIS. Because these issues help define the scope of the EIS, this process is called “scoping.”

In scoping this EIS, Bonneville contacted people who lived along or near the proposed transmission line route, federal, state, and local agencies who manage lands or have other jurisdictions along the route, Indian tribes with interests in the area, and interest groups. Comments were sought and received in a number of ways:

- A Notice of Intent to prepare an EIS was published in the federal register May 2001;
- A letter, map, and comment form packet was mailed in May 2001 to about 420 people; and
- Two public scoping meetings were held—one in Paterson, Washington on May 23, 2001, and another in Roosevelt, Washington on May 24, 2001.

During scoping, Bonneville received about 350 comments. Most of the comments (45%) focused on potential impacts of the new transmission line. Bonneville also received many comments and questions on why it needs to build the line, alternatives to building the line, where the line would go, and what would it look like.

The three topics that drew the most comments about impacts included

- land use (passing through orchards and vineyards, cattle grazing, etc.),

- vegetation (mostly noxious weed concerns, some clearing concerns), and
- fire (concerns about workers starting brush fires).

Other comments on impacts involved cultural resources, social impacts, economic, noise, public health and safety, soils, visual, water, and wildlife. A letter was mailed (August 2001) to interested parties that summarized scoping comments and identified next steps in the EIS process.

See Appendix B for public involvement mailings and a summary of scoping comments for this project.

Other Projects or Documents Related

Below are brief descriptions of generation projects proposed in the area and a document incorporated by reference into this EIS.

To receive a copy of one of these documents or to be put on the mailing for a project, call Bonneville's toll-free document request line at 1-800-622-4520 and leave a message (please include the name of the project and a complete mailing address). If the project is posted on Bonneville's website, it can be accessed at www.efw.bpa.gov under the section on environmental planning/analysis.

Wallula-McNary Transmission Line Project and Wallula Power Project

The Wallula Power Project is a 1,300-MW natural gas-fired generation facility proposed by Newport Northwest, LLC (Newport Northwest) that would be located near Wallula in Walla Walla County, Washington. Newport Northwest has requested an interconnection and upgrade to Bonneville's transmission system; a new substation and a 35-mile transmission line coming into McNary Substation would be required. Bonneville proposes to execute an agreement with Newport Northwest to provide the interconnection and firm power transmission. A joint state and federal EIS is being developed on the project. The proposed McNary-John Day transmission line would allow electricity generated from the Wallula project to flow into the transmission system.

Starbuck-Lower Monumental Dam Transmission Line Project and Starbuck Power Project

The Starbuck Power Project is a 1,200-MW natural gas-fired generation facility proposed by Starbuck Power Company, LLC that would be located near the town of Starbuck in Columbia County, Washington. Starbuck Power Company has requested an interconnection and upgrade to Bonneville's transmission system (a 16-mile transmission line would be required). A joint state and federal EIS is being developed on the project.

The proposed McNary-John Day transmission line would allow electricity generated from the Starbuck project to flow into the transmission system.

Umatilla Generating Project

The Umatilla Generating Project is a 550-MW natural gas-fired generation facility proposed by Umatilla Generating Company, LP, that would be located about 4 miles southwest of the city of Hermiston near the existing Hermiston Generating Plant. The company has requested an interconnection and upgrade to Bonneville's transmission system into the McNary Substation that would allow firm power delivery to the wholesale power market. A draft EIS on this project was made available for public review on August 15, 2001.

Mercer Ranch

The Mercer Ranch Project is an 850-MW natural gas-fired generation facility proposed by Cogentrix Energy, Inc., that would be located adjacent to the proposed McNary-John Day transmission line in Benton County, Washington. A joint state and federal EIS is being developed on the project. The proposed McNary-John Day transmission line would allow electricity generated from the Mercer Ranch project to flow into the transmission system. As part of the Mercer Ranch Project, a new substation would be built next to the right-of-way described in this EIS, and the proposed McNary-John Day transmission line would go in and out of that substation. The potential impacts of building the substation would be analyzed in the Mercer Ranch Project EIS.

Wanapa Energy Center

Wanapa Energy Center is a 1,000-MW natural gas-fired power generation facility proposed by the Confederated Tribes of the Umatilla Indian Reservation (Umatilla Tribes) and others. The Wanapa Energy Center would be located on tribal-owned land in Umatilla County, Oregon, near McNary Dam. The Umatilla Tribes have requested interconnection with Bonneville's transmission system at McNary Substation. The Bureau of Indian Affairs has published a Notice of Intent to prepare an EIS for this project, and Bonneville will participate as a cooperating agency.

Cliffs Energy Project

Cliffs Energy Project is a 225-MW natural gas-fired power generation facility that would be located adjacent to the Goldendale Aluminum Company smelter near the proposed McNary-John Day transmission line in Klickitat County, Washington. Klickitat County prepared a state environmental review of the proposal.

Plymouth Generating Facility

The Plymouth Generating Facility is a 306-MW natural-gas-fired generation facility proposed by Plymouth Energy, L.L.C. that would be located near the town of Plymouth, Benton County, Washington. The company has requested an interconnection to Bonneville's transmission system that would allow firm power delivery to the wholesale power market. A joint state and federal EIS will be developed on the project.

Wind Projects

Some of the wind generation projects either being built or proposed in the general area include Stateline Wind Project (300-MW), Horse Heaven Hills (150-MW), Waitsburg (100-MW), Roosevelt (150-MW), Six Prong (150-MW), Columbia Wind Ranch (80-MW), Condon (50-MW), Summit Ridge (50-MW), Vansycle Wind Project, and Wheat Field (150-MW). The locations of these proposed wind projects is shown in Figure 1-1.

Bonneville's Vegetation Management Program

The vegetation management for this proposed project would be guided by the decisions and protocols developed in Bonneville's Transmission System Vegetation Management Program EIS (June 2000). The Vegetation Management EIS is incorporated by reference, and relevant information is summarized in this EIS. (See the section on Maintenance, Chapter 2, for more information on vegetation management for the proposed transmission line.)

How this EIS is Organized

Figure 1-2 shows how this EIS is organized. In addition to this chapter on purpose and need for action, there are chapters on the project proposal and alternatives; affects, consequences, and mitigation; and review and permits. This EIS also includes various reference and appendix materials.

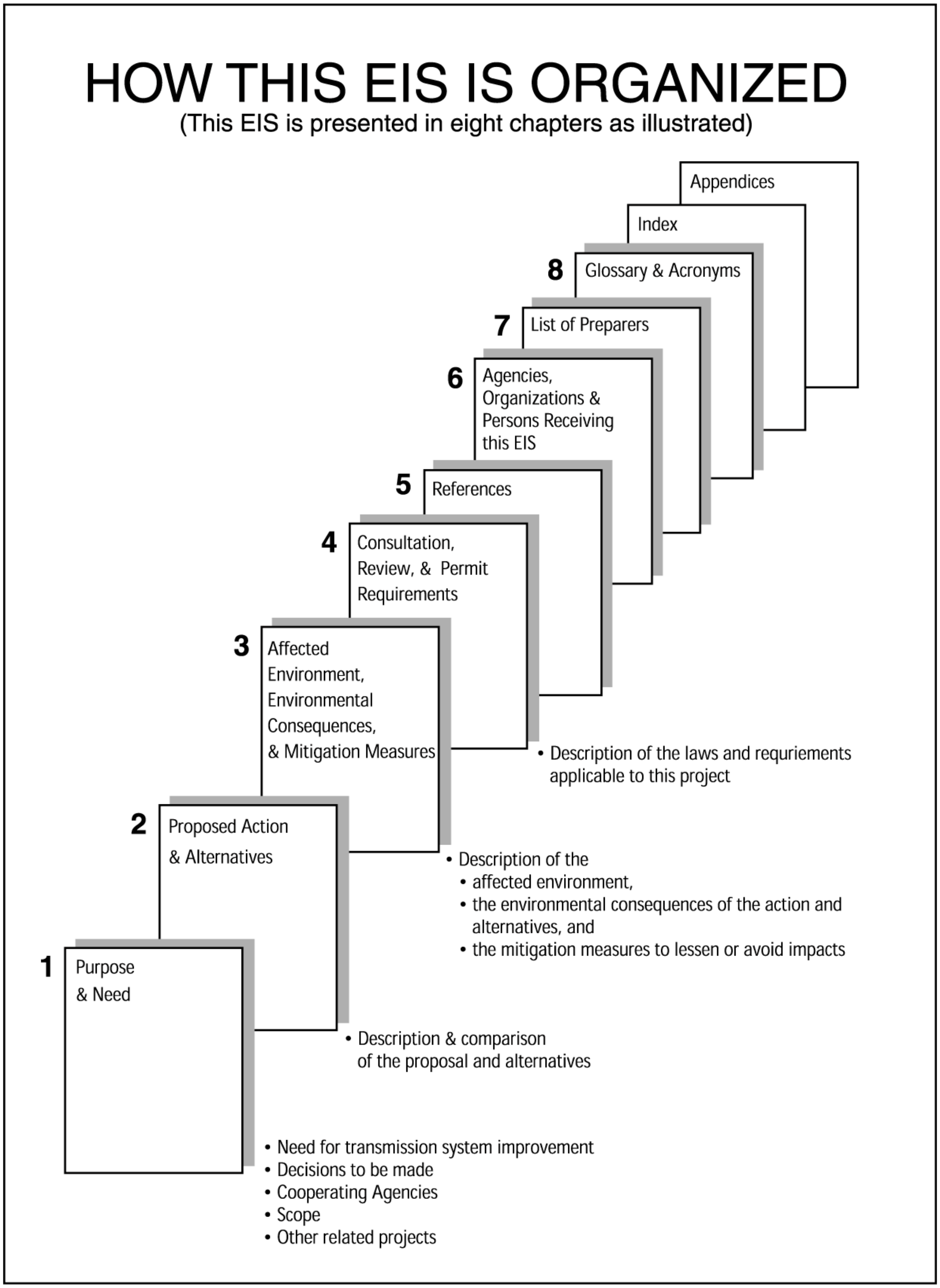

Figure 1-2: How this EIS is Organized

Chapter 2
Proposed Action and Alternatives

Chapter 2 Proposed Action and Alternatives

Proposed Action

Location

Bonneville proposes to construct a 500-kilovolt (kV) transmission power line from its McNary Substation to its John Day Substation, a distance of about 79 miles. The new line would begin at the existing McNary Substation in Umatilla City (Umatilla County, Oregon) near the Columbia River and cross the Columbia River into Washington between the McNary Dam and the Umatilla Bridge. The proposed line would then generally follow the Columbia River and State Route (SR) 14 west through Benton and Klickitat Counties. At the John Day Dam, the proposed line would cross back into Oregon and connect into the John Day Substation near Rufus (Sherman County, Oregon) (see Figure 2-1).

Existing Corridor

The proposed line would parallel existing transmission lines in an existing corridor that runs between the McNary and John Day Substations.

There are three existing transmission lines at the river crossing near McNary Substation that cross the river. The transmission line towers closest to the Umatilla Bridge are owned by Benton County Public Utility District (PUD). Benton County PUD is presently not using the towers but is retaining them for future use when they need to run a transmission line from Oregon to Washington. Bonneville proposes to buy these tower locations and replace them with new towers that can hold two lines (double-circuit towers).

As part of the tower location purchase, Bonneville would agree to provide Benton County PUD electrical service on the Washington side of the river as needed. The environmental review for that service would be done at the time the service is requested. The service may include utilizing the vacant side of the new towers (stringing a new line), or building a new switching station near the existing lines on the Washington side.

For most of the route in Washington, Bonneville already has existing right-of-way or easement available next to the lines. When Bonneville built the existing lines, extra right-of-way was acquired to accommodate potential future lines. In most areas, the existing right-of-way corridor is 500 feet wide, which is wide enough to accommodate the proposed line.

A right-of-way is an easement over land owned by someone else. Bonneville rarely owns the land under transmission lines.

The proposed line would be located on the north side of the existing corridor for most of the length. Just after corridor mile 23 the proposed line would have to cross under the existing 500-kV Ashe-Slatt transmission line. In order to have the proposed line cross under it, the Ashe-Slatt line would need a new tower just north of the crossing to lift the conductors up by about 10 feet for adequate clearance.

Mercer Ranch, just north of corridor mile 27 is a location being proposed for a new generation facility. If this facility is approved and built, a new substation would have to be constructed adjacent to the existing transmission line corridor. The proposed McNary-John Day transmission line would be built through this substation. (See the section on Other Projects or Documents Related to this Project, Chapter 1, for more information about the Mercer Ranch Project.) At around corridor mile 68, the new line would cross to the south side of the existing corridor and continue to the river crossing at John Day Dam.

The corridor mile numbers start at the McNary Substation (corridor mile 1) and proceed along the existing lines to the John Day Substation (corridor mile 79). Bonneville numbers the towers by the corridor mile and number of towers in that corridor mile (e.g., 8/3 means the third tower in corridor mile 8).

The new transmission line would cross the Columbia River into Oregon just south of the John Day Dam. One transmission line presently crosses the river at this point. The new line would be adjacent and just east of the existing line crossing. The new line would cross the river and proceed south, straight up into the hills above the railroad and Interstate 84 (I-84). The line would turn west and join a large corridor of seven other transmission lines and continue for about 3 miles into the John Day Substation. This new line would be located between existing lines on the north side of the corridor.

Along the majority of the existing corridor between the McNary Substation and the crossing at John Day Dam, there are two existing transmission lines; in some areas there are three existing lines. In those portions of the corridor where there are two existing lines, these include

- a 230-kV line with lattice steel towers about 80 feet tall, and
- a 345-kV line with lattice steel towers about 110 feet tall.

There are two sections of the corridor where a third transmission line has joined the corridor. These sections are

- corridor mile 23, the Ashe-Slatt/Marion double circuit 500-kV line (about 180 feet tall) that parallels the existing lines for about 4 miles; and
- corridor mile 68, the Hanford-John Day 500-kV line (about 145 feet tall) that parallels the existing lines for about 6 miles, until the river crossing.

Line Separation

If a proposed line (usually a 500-kV line, but in some cases a lower voltage line) is a key component to the main grid and is constructed next to an existing line that is also very important to the main grid, transmission line planners have to determine the likelihood and consequences of an outage that could affected both lines. The 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, and lightning strikes. These risks are lessened by separating the high-risk lines by 200 feet or more, preferably at least 1,000 to 1,500 feet (a span length).

For this project the proposed line would parallel existing 500-kV lines in a couple of locations and lower voltage lines for the entire length. Planners determined that the distance of the parallel to the 500-kV lines would be short and the risks for simultaneous outage low. The lower voltage lines are not considered important lines to the main grid. Therefore, the proposed line would be separated from the existing lines by the typical distance that insures that the conductors of the two lines would not swing into one another and that one tower could not fall into the adjacent line (about 150 feet).

New Easements

Some new right-of-way easements would need to be purchased adjacent to the existing corridor along approximately 14 miles of the route. The easements would give Bonneville the rights to construct, operate, and maintain the line in perpetuity. The new right-of-way easements would be needed in the following locations:

- from corridor mile 23 through 27, a 70-foot-wide right-of-way easement on the north side of the existing right-of-way;
- from corridor mile 43 through 47, a 140-foot-wide right-of-way easement on the north side of the existing right-of-way; and
- from corridor mile 69 through 75, a 200-foot-wide right-of-way easement, some of which would be on the north side and some on the south side of the existing right-of-way. See the discussion of the Hanford-John Day Junction Alternatives later in this chapter for more details.

Towers

The towers for the proposed new 500-kV line would be 145 to 165 feet tall lattice steel towers with spans of 1,150 to 1,500 feet between towers. The towers would be similar to the towers of the existing lines (see Figure 2-2). The towers would be made of galvanized steel and may appear shiny for two to four years before they dull with the weather. About 360 transmission towers would be needed to carry the wires (conductors) for the proposed transmission line, including about 20 towers in Oregon and 340 towers in Washington.

Bonneville would use two types of tower structures: tangent structures and dead-end structures. Tangent structures would be used on relatively straight stretches of line. Dead-end structures would be used where the line makes a sharp turn or when the conductor tension changes. Dead-end structures are much stronger (about double the thickness) than tangent structures, in order to hold the tension of the conductors.

Exact tower heights and spans along any line may change depending on the terrain, need for highway crossings, or other factors.

Tower Footings

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

- Plate footings are the most commonly used footing types. They consist of a 4-foot by 4-foot steel plate buried about 11 feet deep.

- Grillage footings are used to support heavier structures, such as dead-end towers. They are 12.5-foot by 12.5-foot, wielded steel I-beams buried about 15 feet deep.
- Rock anchor footings are used when a tower is built on solid bedrock. Holes are drilled into the bedrock and the steel anchor rods are secured within the hole with concrete. Then the tower footings are attached to the rods.

A trackhoe would be used to excavate an area for the footings. The excavated area would be at least 2 feet larger than the footings to be installed (if the soil is loose or sandy, then a wider hole may be necessary). Each tower would use an area of about .05 acre, with a temporary disturbance during construction of about 0.25 acre (equipment, soils, etc.). All of the soil and rock removed would be used to backfill the excavated area once the footings are installed.

Conductors

The wires that make up transmission lines are called conductors. The conductors carry the electrical current. There are three bundles of conductors making up a transmission line; each bundle consists of three conductor wires of 1.3 inches diameter. From a distance, a bundle looks like a single wire. The conductors for the proposed transmission line would be treated to reduce the shininess of the metal.

The three conductor bundles are attached to the towers using insulators (see Figure 2-3). 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 fiberglass and are nonreflective. In the past when glass insulators were used, the reflection of the sunlight made them visible from great distances.

For safety reasons, the National Electrical Safety Code establishes minimum conductor heights. For 500-kV lines (as is the proposed line), the conductor must be at least 35 feet from the ground. Clearances would be greater over highways, railroads, and river crossings.

Bus work is used when a conductor cannot be strung between towers. The electricity runs on a pipe set about 15 feet off the ground. For safety reasons, the area surrounding the two towers on either end of the bus work and the pipe is fenced and graveled (similar to a small substation). Like a substation, the area must be kept free of vegetation.

Two smaller wires (0.5-inch diameter), called overhead ground wires, would also be attached to the top of the transmission towers. Ground wires are used for lightning protection. The ground wires are strung from the top of one structure to the next. When lightning strikes, the ground wire takes the charge instead of the conductors. A series of wires, called counterpoise, is buried in the ground at each structure. These wires are used to establish a low resistance path to earth for lightning.

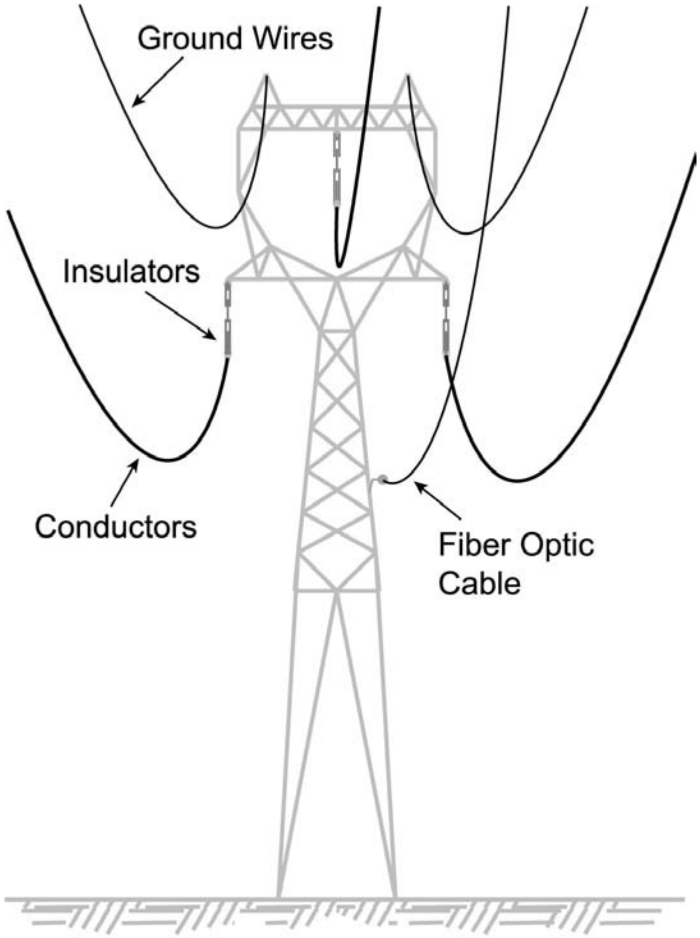

Figure 2-3. Conductors, Ground Wires, and Fiber Optic Cable

A fiberoptic cable would also be strung on the towers below the conductors (see Figure 2-3). The fiberoptic cable would have up to 72 fibers. The fiber would be used for communications as part of the power system. Fiberoptics technology uses light pulses instead of radio or electrical signals to transmit messages. This communication system can gather information about the system (such as the transmission lines in service and the amount of power being carried, meter reading at interchange points, status of equipment and alarms). The fiberoptic cable allows voice communications between power dispatchers and line maintenance crews and provides instantaneous commands that control the power system operations.

Tree Clearing

Most of the vegetation along the corridor is low-growing sagebrush or fields that are compatible with transmission lines. Tall trees cannot be allowed to grow under or near the lines because electricity can arc, which can start a fire or injure or kill someone nearby. The existing corridor does cross some windbreak trees, orchards, and tree farms that grow deciduous trees for paper products. About 25 acres of trees would need to be removed; a total of 50 acres would be permanently removed from cottonwood production. Some trees may also need to be removed between the McNary Substation and the river crossing.

Access Roads

Access roads are the system of roads that Bonneville's construction and maintenance crews would use to get to the towers or tower sites along the line. The roads are designed to be used by cranes, excavators, supply trucks, boom trucks, log trucks, and line trucks. Bonneville prefers road grades to be 15% or less depending on the erosion potential of the soil. Roads are graded to provide a 16-foot-wide travel surface (somewhat wider on curves), with about a 20-foot-wide total area disturbed (including drainage ditches).

Bonneville's road systems consist of a mix of permits or access road easements across public and private ownership. For this project, much of the transmission line corridor lies within 2 miles of public highways. Because the proposed transmission line would be next to existing lines, the proposed new line would utilize up to 90% of the existing 90 miles of access roads. Many of the access roads are approached from SR 14; there are 35 sites where Bonneville vehicles leave the highway directly onto an access road.

The new transmission line would require some upgrades of existing access roads, construction of new access roads and road spurs, and purchase of new easement.

- **Road upgrades.** Approximately 40 miles of existing access road would need to be reconditioned and widened. Roads would be graded, and rock would be used where the soil is unstable.

- **Spur roads.** About 270 short spur roads, each about 250 feet long, would be needed from an existing access road to a new tower. These spur roads would be within the existing right-of-way.

- **New roads.** About three miles of new road would need to be built from corridor mile 39 to 41 (4 miles east of Roosevelt). The terrain in this area is very steep. Because the new transmission line would be at a higher elevation than the existing lines, the grades of spur roads from the existing access road would be too steep. Instead, a parallel access road would be built at the elevation of the new towers in this section of line.

- **Easement purchases.** Bonneville proposes to purchase easements (rights for access) for up to 30 new access roads in areas off of the right-of-way. A majority of these easements would be for existing private roads (such as driveways or farm roads). In a few areas, Bonneville would need to buy an easement to build a new road.

- **New gates.** About 38 new swing gates would be installed with about 23 of these new gates replacing barbed-wire or broken gates. Bonneville, in coordination with landowners, gates the entrances to access roads to prevent public access to private lands and the transmission line right-of-way. There are also gates in fences that separate animals or denote property lines. Gate locks are coordinated with the landowners to ensure that both Bonneville and the landowner can unlock the gates.

Most access roads would be on the native surface (dirt roads or sparse vegetation). Many of the existing access roads and farm roads are made of compacted soils; in other areas they are naturally rocky. Some rock would need to be added in a few sandy locations. There would be no new road crossings of year-round streams, so no new culverts would be needed. Drain dips or water bars may be needed on a few access roads that cross drainages that carry seasonal runoff.

Staging Areas

Temporary staging areas would be needed along or near the proposed transmission line for construction crews to store materials and trucks. The contractors hired to construct the transmission line would be responsible for determining appropriate staging area locations. Often the contractors rent empty parking lots or already developed sites for use as staging areas. The contractors would also be responsible for working with state and local governments to obtain any required permits or environmental reviews for the staging areas.

Substation Work

The proposed line would come out of the McNary Substation and would enter into the John Day Substation. New equipment would be needed at each substation. At the McNary Substation (in Umatilla City, Oregon) the east side of the substation would require an expansion measuring 80 feet by 700 feet, about 1.3 acres (see Figure 2-4). The substation expansion would be on Bonneville property and would require some excavation and fill, although the ground is relatively flat in that area. This expansion would hold three new 500-kV bays in which the lines terminate. This equipment and expansion at the McNary Substation would be used for several projects besides the new McNary-John Day transmission line. Since the work on the other projects would occur at the same time, the entire expansion is explained here.

At the John Day Substation near Rufus, the line would terminate into a new 500-kV bay located within the existing substation fence. No expansion would be necessary.

The 500-kV-bay equipment to be installed in the substations includes the following.

- **Power circuit breakers.** A breaker is a switching device that can automatically interrupt power flow on a transmission line at the time of a fault, such as a lightning strike, tree limb falling on the line, or other unusual events. The breakers would be installed at the substation to redirect power as needed. Several types of breakers have been used in Bonneville substations over the years. The breakers planned for this project, called gas breakers, are insulated by special nonconducting gas (sulfur hexafluoride). These breakers would contain no oil, except a small amount of hydraulic fluid.

- **Switches.** These devices are used to mechanically disconnect or isolate equipment. Switches are normally located on both sides of circuit breakers.
- **Substation dead-end towers.** These are the towers within the substation where incoming or outgoing transmission lines end. Substation dead-ends are typically the tallest structure within the substation.
- **Substation fence.** A chain-link fence with barbed wire on top surrounds the substation for security and public safety.
- **Substation rock surfacing.** A 3-inch layer of rock, selected for its insulating properties, is placed on the ground within the substation to protect operation and maintenance personnel from danger during substation electrical failures.

Line Planning and Construction

To determine exact tower location along a transmission line right-of-way, Bonneville first lays large Xs (photograph panels with exact coordinates) on the ground and takes photographs of the route from an airplane. These photographs help crews survey the route previously laid out by engineers. The surveys are used for determining the profile of the ground. With the profile, engineers can determine where towers and access roads should be located, how tall towers should be, and how much right-of-way is needed. Engineers also use the environmental information and discussions with landowners to help determine tower and access road locations.

Next, the right-of-way is cleared of any vegetation that may hinder line safety or construction access (see the previous discussion of tree clearing for details). Access roads are built or upgraded.

Holes for tower footings are dug with a trackhoe and footings put in place at each tower site. Towers are 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 sky-crane helicopter. The towers are then bolted to the footings.

The conductor is strung from tower to tower through pulleys on the towers. A “sock line” is placed in the pulleys and pulled through by a helicopter much smaller than the sky-crane. The conductor is attached to the end of the sock line. Every 2 to 3 miles there is a conductor-tensioning site where trucks pull the conductor to the correct tension. The temporary conductor tensioning sites typically disturb an area of about 1 acre. The appropriate areas for conductor tensioning sites are determined by the construction contractor using environmental and land use information provided by Bonneville.

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 about once every 2 to 3 miles.

Construction Schedule and Work Crews

The proposed timeframe for construction would be a 1-year period from January 2003 to December 2003.

The line would be constructed by one or more construction crews. A typical transmission line construction crew for a 500-kV line consists of

- 50 to 60 construction workers,
- 20 vehicles (pickups, vans),
- 3 Manitex bucket trucks,
- 1 conductor reel machine,
- 3 large excavators,
- 1 line tensioner, and
- 1 helicopter.

A typical crew can usually construct about 10 miles of transmission line in 3 months. To meet the proposed construction schedule for this project, most likely up to three crews would work simultaneously on separate sections of line.

Maintenance

During the life of the project, Bonneville would perform routine, periodic maintenance and emergency repairs to the transmission line. For lattice steel structures, maintenance usually involves replacing insulators. Every 2 months, a helicopter would fly over the line to look for hot spots (areas where electricity may not be flowing correctly) or other problems indicating that a repair may be needed.

Vegetation is also maintained along the line for safe operation and to allow access to the line. The area along the McNary-John Day transmission line needs little vegetation maintenance because it has sagebrush and other low-growing vegetation. In orchards and vineyards, landowners are responsible for keeping the trees trimmed and the appropriate distance away from the conductors.

Bonneville's vegetation management would be guided by its Transmission System Vegetation Management Program EIS (see the section on Other Projects or Documents Related to this Project, Chapter 1 for more information). Bonneville uses an integrated vegetation management strategy for controlling vegetation along 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. Bonneville 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 herbicides.

Prior to controlling vegetation, Bonneville sends notices to landowners and requests 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 Bonneville's vegetation maintenance program. Bonneville works with the county weed boards and landowners on area-wide plans for noxious weed control.

Estimated Project Cost

The estimated cost for constructing the entire protect is $100 million.

Short-Line Routing Alternatives

This EIS addresses short-line routing alternatives at four locations along the project corridor, as described below. These four areas include:

- McNary Substation,
- Hanford-John Day Junction,
- Corridor Mile 32, and
- Corridor Mile 35.

McNary Substation Alternatives

The alternatives listed below are located between the McNary Substation and the Columbia River crossing. The proposed transmission line would exit the northeast side of the substation (facing the river) and head to the river crossing. This area is congested with transmission lines coming into the substation and abuts the Corps Wildlife Natural Area that runs along the river. (See Figure 2-4.)

Alternative A – Relocate Building

With this alternative, the transmission line would exit the northeast side of the substation, cross Third Street (which runs in front of the substation), and head west, adjacent to the road for about 2,400 feet, then turn north and cross the Corps Wildlife Natural Area to the river crossing. The new line would cross six transmission lines coming from McNary

Dam. Where the line runs along the road, there is a 2,000-square-foot Bonneville office building. The building would need to be relocated because the new 500-kV line would cross directly over the top of it, causing potential safety hazards. The building would be relocated somewhere adjacent to the substation within the Bonneville property line.

Alternative B – Cross Wildlife Area

With this alternative, the new transmission line would exit the northeast side of the substation, cross Third Street, and run northwest (gradually toward the river) behind the office building and across the Corps Wildlife Natural Area. This alternative may require removal of some cottonwood trees. The new line would also cross six lines coming from McNary Dam.

Alternative C – Bus Work in Wildlife Area

For this alternative, the transmission line would exit the northeast side of the substation, cross Third Street, then descend into bus work across the Corps Wildlife Natural Area behind the office building. The bus work would be about 2,000 feet long by 75 feet wide.

Hanford-John Day Junction Alternatives

At about corridor mile 68, the 500-kV Hanford-John Day transmission line joins the existing right-of-way from the north. It parallels the existing lines on the north side for the rest of the route. At corridor mile 70, the proposed line would be on the south side of the right-of-way through the remainder of the route. There is a 2-mile stretch where there are three alternatives for where to place the proposed line. (See Figures 2-5, 2-6, and 2-7.)

Alternative A – North Side

With this alternative, the proposed transmission line would stay in the same alignment paralleling the existing lines (see Figure 2-5). This would require moving the existing Hanford-John Day line 200 feet to the north. At corridor mile 70, the proposed line would cross to the south side of the corridor and the Hanford-John Day line would ease back into its alignment in the corridor.

Alternative B – South Side

With this alternative, the proposed transmission line would cross to the south side of the corridor just before the Hanford-John Day line enters the right-of-way. See Figure 2-6. The proposed line would stay on the south side through the rest of the route. For the first mile on the south side, the line would also be on the south side of the highway. Just before corridor mile 70, there is a house with a barn and a shed on the south side of the highway. This alternative would require the removal of the barn and shed, and may require the removal of the house.

Alternative C – South Side, Highway

This alternative is very similar to Alternative B; the proposed line would cross to the south side of the corridor and highway just before the Hanford-John Day line enters the right-of-way. This alternative differs from Alternative B in that the proposed line would stay on the south side of the highway until the existing lines cross the highway. This alternative would eliminate two highway crossings of the proposed line (see Figure 2-7). As with Alternative B, the barn and shed (and possibly the house) would need to be removed. With this Alternative C, the line would be about 35 feet closer to the house than with Alternative B.

Corridor Miles 32 and 35 Alternatives

The existing right-of-way crosses two lots that are owned by members of the Yakama Nation. The existing easements on these lands are due to expire in 2003. The remainder of the right-of-way easements are perpetual. On tribal lands, the initial easements were for 50 years. Because Bonneville does not know how the negotiations for extending the easements will go, it is considering two alternatives at each site: paralleling the existing lines across the tribal property or moving the entire corridor, its two existing lines, and the new proposed line off of tribal property. (See Figure 2-8.)

Corridor Mile 32 Alternatives

Alternative A – Parallel existing line across tribal allotment.

With this alternative, Bonneville would construct the proposed line across the tribal-owned property at corridor mile 32, paralleling the existing lines within the existing right-of-way. About 1,100 feet of conductor and perhaps one tower would be located on the property.

Alternative B – Move entire corridor off of tribal property.

With this alternative, the proposed line would be moved to skirt around the tribal-owned property. The other two existing lines would also be moved to avoid the property. This alternative would require one additional tower for the proposed line. For the existing lines, eight towers (four for each line) would be removed and ten new towers (five for each line) constructed for the reroute. New right-of-way would be purchased from the landowners.

Corridor Mile 35 Alternatives

Alternative A – Parallel existing line across tribal allotment.

With this alternative, Bonneville would construct the proposed line across the tribal-owned property at corridor mile 35, paralleling the existing lines within the existing right-of-way. About 500 feet of conductor would be located across the property.

Alternative B – Move entire corridor off of tribal property.

With this alternative, the proposed line would be moved to skirt around the tribal-owned property at corridor mile 35. The other two existing lines would also be moved to avoid the property. No additional towers would be required for this alternative (compared to Alternative A). For the existing lines, eight towers (four for each line) would be removed and eight new towers (four for each line) constructed for the reroute. New right-of-way would be purchased from the landowners.

No Action Alternative

The No Action Alternative would be to not build the proposed transmission line. If Bonneville did not build this line, new generation facilities in the area could not connect and send power over the transmission system.

Comparison of the Alternatives and Summary of Impacts

Table 2-1 compares the Proposed Action and the No Action Alternatives based on the purposes of the project described in Chapter 1.

Table 2-1: Comparison of the Proposed Action and No Action Alternatives

Purpose	Proposed Action	No Action
Maintain transmission system reliability	Constructing the proposed 500-kV transmission line would help ensure that present and forecasted power demands in the Pacific Northwest could be met without the risk of power interruptions due to demand becoming greater than the reliable capacity in the system. The proposed transmission line would also 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. The proposed line would also help Bonneville meet its statutory obligations to construct additions to the transmission system to integrate and transmit electric power from new generation sources, and to maintain the stability and reliability of the system 16 U.S.C., 838 (a), (b), and (c).	By not constructing the proposed transmission line, there would be increased risk of power interruptions occurring in the Pacific Northwest Service Area due to insufficient capacity in the grid as demand increases. Also, the ability for Bonneville to provide continuous electric service would be reduced should there be a failure in any of the other main transmission lines serving the region. Furthermore, by not constructing the line, Bonneville would not be meeting its statutory obligations as a federal agency.

Purpose	Proposed Action	No Action
Ensure consistency with environmental and social responsibilities	Although constructing the proposed transmission line would not be free of environmental impacts (see Table 2-2), siting the proposed line within an existing transmission corridor, and employing mitigation measures to protect resources and Best Management Practices during construction and operations would ensure consistency with Bonneville's environmental stewardship mandates. Also, the proposed transmission line would help Bonneville meet social responsibility obligations for providing safe and reliable electric service to the public in the Northwest.	If the line were not built there would not be any environmental impacts due to construction or operation. Some social impacts may occur due to not being able to meet electrical demands (such as possible higher electricity costs, or possible long term cutbacks on electrical consumption).
Provide cost and administrative efficiency	The proposed transmission line project would cost about $100,000 million. For a line of this length, utilizing existing right-of-way with a relatively direct route between the two substations, the proposed line provides cost and administrative efficiency.	No immediate costs would be involved if the line were not built.

Table 2-2 compares the short-line routing alternatives in terms of the purposes outlined in Chapter 1. Table 2-3, at the conclusion of this chapter, summarizes the impacts of the proposed action. Table 2-4 summarizes impacts of the short-line routing alternatives.

Table 2-2: Comparison of Short-Line Routing Alternatives

Alternative	Purposes		
	Maintain Transmission System Reliability	Ensure Consistency with Environmental and Social Responsibilities	Provide Cost and Administrative Efficiency
McNary Substation Alternatives			
A. Relocate administration building presently located on north side of substation adjacent to Wildlife Natural Area	Same as Alternative B; better than Alternative C	Slightly less impact than Alternatives B and C	Same as Alternative B; less than Alternative C
B. Cross Wildlife Natural Area; circumvent administration building on north side	Same as Alternative A; better than Alternative C	More impact than Alternative A; slightly more than Alternative C	Same as Alternative A; less than Alternative C
C. Place line in bus work at ground level on north side of administration building, inside Wildlife Natural Area	Least reliable; crossing under multiple lines, any failure of existing lines would cause outage of proposed line	More impact than Alternative A; slightly less than Alternative B	Most expensive, dead-end structures and bus equipment cost more

Alternative	Purposes		
	Maintain Transmission System Reliability	Ensure Consistency with Environmental and Social Responsibilities	Provide Cost and Administrative Efficiency
Hanford-John Day Junction Alternatives			
A. Move existing Hanford-John Day line north 200 feet to make room for new line on north side of corridor	Slightly less reliable than Alternatives B and C; next to existing 500-kV line, failure would cause larger outage	Less impact than Alternatives B or C	Most expensive; taking out and rebuilding short section of Hanford-John Day line
B. Place new line on south side of corridor	Same as Alternative C; better than Alternative A	More impact than Alternative A; slightly more than Alternative C	Less than Alternative A, more than Alternative C; more dead-end structures for angles
C. Place new line on south side of highway	Same as Alternative B; better than Alternative A	More impact than Alternatives A and C	Least expensive; straight line
Corridor Mile 32 Alternatives			
A. Keep existing and new lines on tribal land	Same as Alternative B	More impact than Alternative B	Less than Alternative B
B. Relocate existing and new lines away from tribal land	Same as Alternative A	Less impact than Alternative A	More than Alternative A
Corridor Mile 35 Alternatives			
A. Keep existing and new lines on tribal land	Same as Alternative B	More impact than Alternative B	Less than Alternative B
B. Relocate existing and new lines away from tribal land	Same as Alternative A	Less impact than Alternative A	More than Alternative A

Alternatives Considered but Eliminated from Detailed Study

During the scoping process, Bonneville consider a range of alternatives for the proposed action. Bonneville assessed whether the alternatives were reasonable and merited detailed study in this EIS. Alternatives that did not meet the need and purposes (see Chapter 1), including whether they were practical or feasible, or would obviously have greater adverse environmental impacts than the proposed action, were eliminated from detailed study. This section summarizes those alternatives considered but eliminated from detailed study in this EIS.

Oregon Route Alternative

Bonneville examined various ways to transmit power from east to west, including a new transmission line from the McNary Substation to the John Day Substation through Oregon. This Oregon routing alternative would have required the purchase of all new right-of-way for there is no existing vacant right-of-way available for a 500-kV line in this area of Oregon. The location of a line in Oregon could be adjacent to existing lines in some areas, but would mostly require the development of a new corridor where there are no existing transmission lines. In the areas where existing lines could be paralleled, there are many homes. The cost of constructing a new 500-kV line in Oregon would be considerably greater than the proposed route in Washington due to purchasing all new right-of-way, constructing a new access road system, and the mitigation measures that would be needed (particularly in areas with residences where new right-of-way would be purchased). The social and environmental impacts of an Oregon route would also be much greater with the relocation of residents, disruption of existing land uses, construction of new access roads (erosion, water quality), and potential vegetation clearing.

Because the proposed route and the short-line routing alternatives discussed in this EIS are mostly within existing right-of-way (purchased years ago with the construction of the existing lines), the land uses in the right-of-way are compatible with transmission line operation.

McNary Substation Southeast Alternative

In examining ways for the line to exit the McNary Substation and reach the river crossing, Bonneville considered exiting the southeast side of the substation. The line would run west along the back side of the substation, and turn north along the west side of the substation to the river crossing.

This alternative was eliminated from consideration for reliability reasons. The line would have to cross a number of transmission lines presently exiting the substation. These lines serve electric loads west and south of the McNary Substation. In the rare event that the proposed line fell, those existing lines would be put out of service, affecting a large number of customers.

Increased Capacity Line Alternative

During scoping, Bonneville was asked to consider all the generation projects being proposed in the area and construct the transmission line with a capacity to carry all the power that could be generated. The proposed line would have a capacity of 1,400 to 2,300 MW. The commentors requested that it be capable of carrying 5,000 MW or more. When transmission system planners consider integrating new generation they analyze the whole transmission system to determine what is needed to transmit a certain amount of energy. When considering the construction of new transmission lines, the planners have to consider the back-up line(s) if any component of the transmission system were to fail. There is sufficient back-up in the area for the proposed line. If the proposed line were to fail, then all the energy would flow over remaining lines (such as the existing McNary-Slatt 500-kV line and the McNary-Ross 345-kV line and several smaller capacity lines). If the proposed line were built to carry more energy and the line failed, the back-up lines would become overloaded and shut down. In order to maintain the reliability of a new line carrying 5,000 MW, a new second high voltage line would have to be built as a back-up. Rather than building two high voltage lines now, Bonneville's system planners will continue to evaluate the need for increased capacity as new generation facilities request interconnection.

Underground Transmission Line Alternative

During scooping a person suggested putting the transmission line underground. Bonneville considers, and at times has used, underground transmission cables for new lines. The cables used for undergrounding are highly complex in comparison to overhead lines. Even with current technologies, transmission cables exceed the cost of overhead lines by many times. For 500-kV lines, underground cable may be ten times as costly as overhead designs. Because of the cost, Bonneville uses underground cable in limited, special reliability, or routing situations, such as near nuclear power stations, at locations where high capacity lines must cross, at long bay crossings, or in urban areas. Transmission cables used by Bonneville are only at lower voltages and are short in comparison to typical overhead transmission lines. Bonneville's longest underground cable is a 8-mile-long 115-kV cable. Bonneville has no 500-kV underground cable in our system. The Bureau of Reclamation operates two 6,000-foot-long, 500-kV underground cables at Grand Coulee Dam. Underground cables are also much more difficult to maintain than overhead lines and take longer to repair.

Bonneville has kept abreast of transmission cable technologies. Cable technology has not advanced as quickly as the industry anticipated, nor have costs declined as expected. Cable remains a tool available for special situations, but because of its high cost it would not meet the purposes and need of this project.

Double Circuit Alternative

During scoping, it was requested that Bonneville take out one of the existing lines and put in a double circuit line (one set of towers to hold both the existing line and the proposed line). This alternative was eliminated due to costs. The transmission towers for a double circuit line are twice as much as for single circuit (the tower has to be twice as thick to carry the tension of two lines). The tower costs far outweigh any savings due to access road construction or right-of-way purchases. The overall cost of removing one of the existing lines and constructing a double circuit line would be much greater than constructing the proposed single circuit line. There would be less environmental impacts from the proposed line for some of the new access roads and spur roads would not be needed; however, all the access road upgrades would still be repaired. Visual impacts and land use would be less with less towers and no new right-of-way. Tower footing impacts (land use disturbance, vegetation removal, erosion potential) would be about the same as constructing the proposed line since the new towers would not be placed in the same locations as the ones removed. When towers are removed, in most cases the footings are cut off at ground level, leaving the underground portion in place. The new towers could not use the existing footings or be placed where old underground footing portions are located.

Table 2-3: Summary of Impacts and Mitigation Measures for the Proposed Action and No Action Alternative, p 1

Proposed Action		No Action
Potential Impact	**Mitigation Measures**	**Potential Impacts**
Land Use and Recreation		
▪ Temporary disturbance to upland bird hunting in project vicinity ▪ Approximately 47 acres impacted by new roads, 93 acres impacted by tower construction, and 25 acres of poplar trees cut and converted to agriculture compatible with the transmission line	▪ Locate towers and roads so as not to disrupt irrigation circles, where possible ▪ Locate structures and roads outside of agricultural fields, orchards, and vineyards, where possible ▪ Coordinate with landowners for farm operations, including plowing, crop dusting, and harvesting ▪ Redesign irrigation equipment and compensate landowner for additional reasonable costs where new right-of-way needs to be acquired ▪ Compensate farmers for crop damage and restore compacted soils ▪ Control weeds around the base of the towers ▪ Keep gates and fences closed and in good repair to contain livestock	▪ No impact
Geology, Soils, and Seismicity		
▪ Removal of vegetation and disturbance to underlying soils in an area of up to 222 acres ▪ Operation and maintenance activities could increase erosion potential along the project corridor	▪ Minimize vegetation removal ▪ Avoid construction on steep slopes where possible ▪ Properly engineer cut-and-fill slopes ▪ Install appropriate roadway drainage to control and disperse runoff ▪ Ensure graveled surfaces on access roads in areas of sustained wind ▪ Develop additional mitigation measures (using a certified engineer) between corridor miles 39 and 41 due to the presence of an active landslide in the vicinity of tower 40/3 ▪ Apply erosion control measures such as silt fence, straw mulch, straw wattles, straw bale check dams, other soil stabilizers, and reseeding disturbed areas as required ▪ Regularly inspect and maintain project facilities, including the access roads, to ensure erosion levels remain the same or less than current conditions	▪ No impact

Table 2-3: Summary of Impacts and Mitigation Measures for the Proposed Action and No Action Alternative, p 2

Proposed Action		No Action
Potential Impact	**Mitigation Measures**	**Potential Impacts**
Streams, Rivers, and Fish		
▪ Potential transport of sediment to fish-bearing waters ▪ Potential accidental spills of construction materials into waterways ▪ Potential dry wash crossing and culvert installation ▪ Potential blasting near fish-bearing waters ▪ Implementation of vegetation management techniques	▪ Use erosion control methods during construction (see mitigation measures for Geology, Soils, and Seismicity) ▪ Develop and implement a Spill Prevention and Contingency Plan ▪ Install water and sediment control at dry wash crossings and construct culverts per WDFW guidelines ▪ Avoid blasting within 200 feet of streams when salmon eggs or alevins are in gravels ▪ Follow BMPs defined in Vegetation Management Plan	▪ No impact
Vegetation		
▪ Proposed project would temporarily disturb 121 to 134 acres depending on the number and location of conductor tensioning sites ▪ Temporary impact to 24 to 27 acres of native plants and 4 acres of cryptogramic crusts; permanent impact to 12 acres of native plants and 2 acres of cryptogramic crusts ▪ Establishment of noxious weeds ▪ Vegetation loss due to fire	▪ Locate transmission line as close as possible to existing lines to minimize additional clearing ▪ Utilize existing access roads to reduce need for new access roads; limit construction equipment to designated construction areas ▪ Avoid placing towers in riparian zones ▪ Keep vegetation clearing to a minimum ▪ Reseed areas temporarily disturbed in higher quality shrub-steppe with native grasses and forbs ▪ Minimize disturbance to native species during construction to prevent invasion by nonnative species ▪ Conduct pre- and post-construction noxious weed surveys; enter into active noxious weed control programs ▪ Wash vehicles that have been in weed-infested areas ▪ Use certified weed-free mulch ▪ Equip all project vehicles with basic fire-fighting equipment, including extinguishers, shovels, and other equipment deemed appropriate	▪ No impact

Table 2-3: Summary of Impacts and Mitigation Measures for the Proposed Action and No Action Alternative, p 3

Proposed Action		No Action
Potential Impact	**Mitigation Measures**	**Potential Impacts**
Wildlife		
▪ Construction noise and activities would cause some wildlife to avoid areas of active construction ▪ Temporary impact to 24 to 27 acres of shrub-steppe habitat and permanent impact to 12 acres of shrub-steppe ▪ Potential for bird collisions with new transmission line, particularly where line would cross open water or wetlands	▪ Prior to construction, conduct raptor nest surveys of cliffs located within 0.25 mile of the right-of-way and in potential burrowing owl nesting habitat within the right-of-way ▪ If nests are found, follow the species-specific mitigation measures defined in the Wildlife section of Chapter 3 of this EIS ▪ Minimize the impact of shrub-steppe plant communities by clearing the least amount of vegetation necessary ▪ Minimize road construction in shrub-steppe areas with burrows (corridor miles 19, 21, 63, and 76) ▪ If deemed appropriate, install line markers in avian flight paths or migration corridors such as near crop irrigation circles and the Columbia River crossing ▪ For the McNary Substation Alternative, avoid placing towers and lines across wetlands to minimize risk of collisions	▪ No impact
Water Resources and Wetlands		
▪ Potential removal of wetland buffer vegetation at corridor mile 48, 50, and between corridor mile 71 and 74, with risk of increasing silt and sediment to wetlands ▪ Accidental spills of hazardous or toxic materials used or stored on the project site (fuels, lubricants, solvents)	▪ Locate structures, roads, and staging areas to avoid waters of the United States ▪ Avoid construction within designated Klickitat and Benton County, Washington wetland and stream buffers to protect potential groundwater recharge areas ▪ Use erosion control measures (see mitigations listed in the Soils, Geology, and Seismicity section) when conducting any earth disturbance within 100 feet of wetlands, or within the resource buffer as established by Benton and Klickitat Counties ▪ Place tower footings on upland basalt outcroppings and limit access road construction in wetlands complex and buffers between corridor miles 70 and 74, if possible ▪ Place tower footings and access roads within uplands within the wetland complex between corridor miles 48 and 50	▪ No impact

Table 2-3: Summary of Impacts and Mitigation Measures for the Proposed Action and No Action Alternative, p 4

Proposed Action		No Action
Potential Impact	**Mitigation Measures**	**Potential Impacts**
Water Resources and Wetlands		
	▪ Avoiding refueling and/or mixing hazardous materials where accidental spills could enter surface or groundwater ▪ Avoid mechanized land clearing within wetlands and riparian areas to avoid soil compaction from heavy machinery, destruction of live plants, and potential alteration of surface water patterns to reduce groundwater turbidity risk ▪ Anticipate and avoid, as required, contaminated soil and underground tanks during construction activities near pipelines and agricultural and other historic projects; anticipate and avoid orphaned wells, as required, particularly near the Washington communities of Plymouth, Paterson, Roosevelt, Sundale, and Towal ▪ Avoiding refueling and/or mixing hazardous materials where accidental spills could enter surface or groundwater ▪ Implement the Spill Prevention and Contingency Plan	
Cultural Resources		
▪ Disturbance of undiscovered hunter-fisher-gatherer resources or unrecorded cultural resources	▪ If archaeological or historic materials are discovered during construction, surface-disturbing activities at the site would cease, and Bonneville, State Historic Preservation Office, and tribal personnel would be notified to ensure proper handling of the discovery ▪ Locate structures, new roads, and staging areas so as to avoid known cultural resource sites and limit contractor access to cultural resource site sensitive information on a need-to-know basis ▪ The Umatilla Tribes CRPP identified ten TCP areas and recommends the presence of a tribal monitor during all ground disturbing activities; tribal consultation throughout the construction process (from the planning phase through the completion of the project); and collaboration between Jones & Stokes, Bonneville, and the CRC and the Board of Trustees to set up required consultation protocols on site mitigation and management ▪ The Umatilla Tribes would like Bonneville to ensure that the cultural and natural resources are protected as well as guaranteed traditional use of this area, in accordance with treaty reserved rights	▪ No impact

Table 2-3: Summary of Impacts and Mitigation Measures for the Proposed Action and No Action Alternative, p 5

Proposed Action		No Action
Potential Impact	**Mitigation Measures**	**Potential Impacts**
Visual Resources		
▪ Temporary alterations to viewscape from construction activities ▪ Change in viewscape; impacts would be greatest for residential viewers	▪ Site all construction staging and storage areas away from locations that will be clearly visible from SR 14 to the extent practical ▪ Provide a clean-looking facility following construction by cleaning-up after construction activities ▪ Keep the areas around the towers clean and free of debris	▪ No impact
Socioeconomics, Public Services, and Utilities		
▪ Potential benefit to local and regional economies through employment opportunities and purchase of goods and services ▪ Increased demand on local emergency response resources such as fire, police, and medical personnel and facilities ▪ Minor reduction on local taxing from any reduction in property values	▪ None required	▪ No impact
Transportation		
▪ Short interruptions of SR 14 traffic from construction activities ▪ Possible damage to farm roads during construction ▪ Potential for increased unauthorized access following project construction	▪ Coordinate routing and scheduling of construction traffic with state and county road staff and Burlington Northern Santa Fe Railway ▪ Employ traffic control flaggers and post signs warning of construction activity and merging traffic, when necessary for short interruptions of traffic ▪ Employ traffic control flaggers and signs warning of construction activity and merging traffic as required ▪ Repair any damages to local farm roads caused by project construction ▪ Install gates on access roads when requested by property owners to reduce unauthorized use	▪ No impact

Table 2-3: Summary of Impacts and Mitigation Measures for the Proposed Action and No Action Alternative, p 6

Proposed Action		No Action
Potential Impact	**Mitigation Measures**	**Potential Impacts**
Air Quality		
▪ Combustion pollutants from equipment exhaust and fugitive dust particles from disturbed soils becoming airborne	▪ Water exposed soil surfaces if necessary to control blowing dust ▪ Cover construction materials if they are a source of blowing dust ▪ Limit vehicle speeds along non-graveled roads to 25 mph ▪ Shut down idling construction equipment, if feasible	▪ No impact
Noise		
▪ Residents in the vicinity of the project site could experience construction noise (associated with grading and earthmoving activities, hauling of materials, and building of towers) above Washington and Oregon noise standards ▪ Potential radio and television interference	▪ All equipment will have sound-control devices no less effective than those provided on the original equipment ▪ No equipment will have an unmuffled exhaust ▪ No noise-generating construction activity will be conducted within 1,000 feet of an occupied residence between 10:00 p.m. and 7:00 a.m. ▪ Landowners directly impacted will be notified prior to construction ▪ Bonneville will take measures to restore reception to a quality of reception as good or better than before the interference	▪ No impact
Public Health and Safety		
▪ Health and safety risks for workers, farmers, aviators, and visitors	▪ Prior to construction, the contractor would maintain a safety plan in compliance with Washington and Oregon requirements; this plan would be kept onsite and would detail how to manage hazardous materials such as fuel, and how to respond to emergency situations ▪ During construction, the contractors would also hold crew safety meetings at the start of each workday to go over potential safety issues and concerns ▪ At the end of each workday, the contractor and subcontractors will secure the site to protect equipment and the general public ▪ As necessary, employees would be trained in tower climbing, CPR, first aid, rescue techniques, and safety equipment inspection ▪ To minimize the risk of fire, all highway-authorized vehicles would be fueled offsite; equipment not highway authorized would be fueled in accordance with regulated construction practices and state and local laws; helicopters would be fueled and housed at local airfields	▪ No impact

Table 2-3: Summary of Impacts and Mitigation Measures for the Proposed Action and No Action Alternative, p 7

<table>
<tr><th colspan="2">Proposed Action</th><th>No Action</th></tr>
<tr><th>Potential Impact</th><th>Mitigation Measures</th><th>Potential Impacts</th></tr>
<tr><td colspan="3">Public Health and Safety</td></tr>
<tr><td></td><td>

Helicopter pilots and the contractor would work with communities along the corridor to ensure public safety; contractors would also work with local crop dusters and agricultural businesses to minimize interruption in agricultural activity during construction
If blasting is required, a notice would be sent to residents in the affected area; a public meeting for residents and other interested parties would be held prior to blasting regarding the date and time of the blasting and to answer questions; during blasting, appropriate safety measures would be taken as required by state and local codes and regulations; all explosives would be removed from the work site at the end of the work day
If implosion bolts are used to connect the conductors, they would be installed in such a way as to minimize potential health and safety risks
Construction and operation/maintenance workers would need to be trained in what to do in the event of a chemical release from the Umatilla Army Depot
Operation and maintenance vehicles would be required to carry fire suppression equipment including (but not limited to) shovels and fire extinguishers
Drivers would be required to stay on established access roads and smoking would be prohibited
The corridor would be maintained to control tall grass that could potentially start fires via contact with hot vehicle parts; trees and other tall vegetation would be trimmed to Bonneville standards to avoid contact with transmission lines
Towers are not expected to exceed 200 feet in height; FAA laws would be followed regarding the placement of line markers to warn aircraft; Bonneville would submit locations and tower heights to FAA for review; requirements for markings and lighting would be addressed at that time
Because of the proposed transmission line’s proximity to agricultural fields, crop dusting pilots planning to enter the area would take suitable precautions to avoid collision with the proposed transmission lines

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Table 2-4: Summary of Impacts of Short-Line Alternatives, McNary-John Day Transmission Project

McNary Substation Alternatives			Hanford-John Day Junction Alternatives			Corridor Mile 32 Alternatives		Corridor Mile 35 Alternatives	
Alternative A	**Alternative B**	**Alternative C**	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative A**	**Alternative B**	**Alternative A**	**Alternative B**
Wildlife viewing temporarily obstructed; no impact to soils; some sedimentation to Columbia River and pond habitat; about 0.1 acre of trees in wetland; about 2 acres grassland removed for building relocation; about 2 acres marginal grassland habitat removed; no cultural resource impacts with mitigation; recreationists and travelers would have views of construction; no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	Wildlife viewing temporarily obstructed; no impact to soils; some sedimentation to Columbia River and pond habitat, though less ground disturbance than Alternative A, but closer to river; about 0.2 acre of willows in wetland removed; cottonwood trees and vegetation removed; bird nesting and ground dwelling animal habitat removed, increased risk of avian collisions; no cultural resource impacts with mitigation; recreationists and travelers would views of construction; no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	No recreation impacts anticipated; no impact to soils; slight increased (than Alternative A or Alternative B) sedimentation to Columbia River and pond habitat though ground disturbance and permanent surface of bus work; minor sediments to wetland; about 0.7 acre of grassland removed for bus work; negligible wildlife impacts; no cultural resource impacts with mitigation; recreationists, travelers, and residence would have views of bus work; no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	About 1.5 acres of grazing land disturbed; no impact to soils; no impact to fish/water; invasive *Ailanthus* sp. trees in wetland may be removed; sedimentation to small wetland; about 1.6 acres of vegetation impacted; negligible wildlife impacts; no cultural resource impacts with mitigation; views of line from highway and residence (less than Alternative B or C); no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	About 1.5 acres of grazing land disturbed, residence may need to be removed; no impact to soils; no impact to fish/water; trees in wetland may be removed, sedimentation to small wetland; about 1acre of vegetation impacted, 10 invasive *Ailanthus* sp. trees removed; loss of trees reduce bird nesting habitat; no cultural resource impacts with mitigation; views of line from highway and residence (more than Alternative A); no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise and corona noise; no specific health and safety impacts	About 1.5 acres of grazing land disturbed, residence may need to be removed; no impact to soils; no impact to fish/water; invasive ailanthus sp. trees in wetland may be removed; sedimentation and potential fill in small wetland; about 1acre of vegetation impacted, 10 invasive ailanthus sp. trees removed; loss of trees reduce bird nesting habitat; no cultural resource impacts with mitigation; views of line from highway and residence (more than Alternative A); no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise and corona noise; no specific health and safety impacts	About 0.8 acre of cropland removed from production; no impact to soils; no impact to fish/water; no wetland impacts; about .4 acres grazed shrub-steppe impacted; minor impacts to grazed shrub-steppe designated Priority Habitat by WDFW; no cultural resource impacts with mitigation; travelers on highway and agricultural workers would view line (less than Alternative B); agreement between tribes and Bonneville needed to cross tribal; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	About 0.6 acre of cropland; no impact to soils; no impact to fish/water; no wetland impacts; about 5.5 acres grazed shrub-steppe impacted; about 1 acre of marginal agricultural habitat removed; no cultural resource impacts with mitigation; travelers on highway and agricultural workers would view line (more than Alternative A); no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	About 0.8 acre of cropland removed from production; no impact to soils; slight sedimentation to Columbia River (less than Alternative B); no wetland impacts; no vegetation impacts; minor impact to heavily grazed shrub-steppe habitat; no cultural resource impacts with mitigation; travelers on highway and agricultural workers would view line (less than Alternative B); agreement between tribes and Bonneville needed to cross tribal; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts	About 0.6 acre of cropland; no impact to soils; slight sedimentation to Columbia River (more than Alternative A); no wetland impacts; about 5.5 acres grazed shrub-steppe impacted; minor impact to heavily grazed shrub-steppe habitat (more than Alternative A); no cultural resource impacts with mitigation; travelers on highway and agricultural workers would view line (more than Alternative A); no impact to socioeconomics; negligible transportation impacts during construction; minimal air quality impacts during construction/operation; construction noise; no specific health and safety impacts

Chapter 3
Affected Environment, Environmental Consequences, and Mitigation

Chapter 3
Affected Environment, Environmental Consequences, and Mitigation

Regional Setting

The proposed project corridor is located in the mid-Columbia River basin in eastern Oregon and Washington in four counties that border the Columbia River. It is part of an existing 500-foot-wide, 79-mile-long Bonneville corridor of transmission lines on lattice-steel towers.

Most of the land that is crossed by the corridor is privately owned, with small portions of the corridor crossing tribal, federal, and state lands. The eastern half of the corridor predominantly crosses irrigated cropland, while the western half mainly crosses horse and cattle rangeland of shrub-steppe and grasslands, interspersed with some pockets of irrigated and nonirrigated cropland. The corridor crosses approximately 61 utility lines, including gas, electric, fiber optic, telephone, irrigation, and water.

The following affected environment and environmental consequences discussions are based on the overall proposed route. Any differences in impacts of the short-line routing alternatives are given in tables toward the end of each resource discussion.

Land Use and Recreation

Affected Environment

Land Ownership and Uses within Project Corridor

The existing Bonneville corridor (the site for the proposed transmission line) crosses mostly private land (94% of lands crossed) as well as tribal, federal, and state lands in eastern Washington and Oregon bordering the Columbia River. The project corridor originates in Umatilla City, Oregon, crosses over Columbia River, travels west through

Benton and Klickitat Counties in Washington, crosses back over the Columbia River, and ends in Sherman County, Oregon.

At the McNary Substation, the proposed line would cross a Corps managed wildlife refuge. At corridor miles 32 and 35 the transmission line corridor crosses two tribal properties owned by members of the Yakama Nation. Over each property, between 500 and 1,100 feet of corridor crosses the land. Bonneville is considering moving the entire corridor off the tribal lands (see Corridor Miles 32 and 35 Alternatives, Chapter 2, for details). The Yakama Nation Reservation is located 25 miles north of the corridor.

The corridor also crosses property managed by the BLM (about 5 miles between corridor miles 36 through 42), and three properties managed by the Washington Department of Natural Resources (DNR) (about 1 mile at corridor mile 21, 1 mile at corridor mile 44, and 1 mile at corridor mile 67).

Land use within the corridor is primarily agriculture (irrigated cropland, dryland wheat farming, and grazing). Irrigated agricultural uses in the project corridor include poplar tree farms, orchards, and a variety of crops such as potatoes, corn, onions, carrots, and asparagus. Some crops change annually. There are approximately 1,409 acres of irrigated and non-irrigated cropland, 3,064 acres of grazing land, and 2 acres of substation/wildlife land use in the project corridor. There are no lands designated as prime farmland in the project corridor. Table 3-1 summarizes the land uses and the corresponding Bonneville structure numbers within the project corridor. Residential and industrial/commercial land is also adjacent to the corridor (see discussion in the following section on Land Uses Adjacent to Project Corridor).

Land Uses Adjacent to Project Corridor

The residential areas adjacent to the transmission line corridor are rural and of low density, with single-family houses, barns, and accompanying outbuildings. The residences are concentrated in the cities of Plymouth (structure 4/1), Paterson (structures 16/1 to 16/5), and North Roosevelt and West Roosevelt (corridor miles 48 and 49, respectively) in Washington and Umatilla City (corridor mile 1) and Rufus (corridor mile 78) in Oregon. In addition, single residences, small groupings of houses, or small farm complexes are located in the vicinity of structures 6/1, 7/2, 10/4, 22/3, 29/3, 30/1, 68/1, 68/5, and 69/4. Paterson Elementary School is located in the vicinity of structure 16/3.

Table 3-1: Summary of Land Uses within the Project Corridor by County and Structure Number

County	Land Use	Structure Numbers
Umatilla	Substation	McNary Substation
Benton	Irrigated cropland	6/3 to 6/11 14/2 to 16/3 18/2 to 20/3 21/5 to 27/1 28/3 to 29/1
	Grazing land	16/3 to 18/2 11/2 to 14/1 20/3 to 21/5 27/1 to 28/3
Klickitat	Grazing land	32/4 to 33/1 33/3 to 54/1 54/4 to 60/3 61/3 to 76/2
	Orchards and vineyards	30/1 to 32/4
	Vineyards only	33/1 to 33/3 54/1 to 54/4
	Dryland grain farming	60/3 to 61/3
Sherman	Grazing land	77/4 to 78/1
	Dryland grain farming	76/2 to 77/4
	Irrigated cropland	78/1 to John Day Substation

The industrial/commercial facilities near the project corridor include Watts Brothers Frozen Foods near structure 14/2; Paterson Onion near structure 17/5; a gravel quarry at 22/3; Mercer Ranch in the vicinity of corridor miles 28 and 29; Stimson Lane Wine and Spirits, Columbia River Farms, Central Services, and Columbia Water and Power District in the area between structures 31/4 to 33/3; McBride's Cattle and Quarter Horse Ranch and Alder Ridge Vineyard near structure 38/5; and the Goldendale aluminum plant, near structure 73/5.

The Portland District of the Corps has developed or is developing Columbia River Treaty Fishing Access Sites (CRTFAS) within the John Day/Lake Umatilla Project. The Corps has been authorized by Public Law 100-581 to acquire, develop, and transfer to the Bureau of Indian Affairs lands along the Columbia River on Bonneville, The Dalles, and John Day pools in support of treaty fishing of four treaty tribes. In general, Title IV of this Act provides that designated sites–also known as Section 401(a) sites–will be administered to provide access and facilities in support of treaty fishing use by these four treat tribes. Congress directed the Corps to provide over 20 sites in all, 14 of which are located at Lake Umatilla. Nine sites have been developed at Lake Umatilla and five more are in development planning stage, with construction expected in 2002-2003. Generally, once the sites are developed, they are transferred to Bureau of Indian Affairs and public use is no longer permitted. In a few cases, the tribes have agreed to share use and the Corps retains management provisions.

Utility Line Crossings

The project corridor crosses approximately 61 utility lines (e.g., gas lines, electric, fiber optic, telephone, irrigation, and water lines). The proposed transmission line would be located in the corridor with a number of existing Bonneville transmission lines: McNary-Horse Heaven No. 1 line and McNary-Ross No. 1 line from corridor mile 0 to 18; Horse Heaven-Harvalum No. 1 line and McNary-Ross No. 1 line from corridor mile 18 to 76; Ashe-Marion No. 2 line and Ashe-Slatt No. 1 line join with the proposed transmission line right-of-way from corridor mile 23 to 27; and Hanford-John Day No. 1 line joins with the project corridor at corridor mile 68 to the John Day Substation.

A Cascade Natural Gas 4- pipeline intersects the project corridor in the vicinity of structure 6/1. A PNW 20-inch gas pipeline crosses between structures 6/3 and 6/4. An El Paso Natural Gas Company 12-inch gas pipeline and 10-inch gas pipeline cross between structures 8/1 and 8/2. A PNW 26-inch gas pipeline crosses near structure 15/3.

Recreation

Formal recreational opportunities in the project vicinity are listed by county in Table 3-2. Informal recreational opportunities in the vicinity of the project corridor include upland bird hunting, with proper authorization, along certain areas of the corridor on the south side of SR 14 in Benton County and various water sports on the Columbia River along the entire length of the project corridor. SR 14 is designated as a Scenic and Recreation Highway by the state of Washington.

Table 3-2: Formal Recreational Sites in the Vicinity of the Project Corridor

Recreational Site	Proximity to Project Corridor	Amenities
Umatilla County, Oregon		
Umatilla Marina Park (leased to Port of Umatilla by the Corps)	Approximately 0.125 mile west of McNary Substation (corridor mile 1)	Boating, fishing, picnicking, swimming
Benton County, Washington		
Corps National Wildlife Area	Adjacent to McNary Substation (corridor mile 1)	Fishing, wildlife viewing, boating
McNary Park	Adjacent to McNary Substation (corridor mile 1)	Picnicking

Recreational Site	Proximity to Project Corridor	Amenities
Plymouth Park (owned by the Corps)	Approximately 1 mile south of project corridor (corridor mile 4)	Swimming, picnicking
Umatilla National Wildlife Refuge	Approximately 100 yards to 2 miles south of project corridor (corridor mile 11 to 28)	Wildlife viewing, hunting
Crow Butte State Park (leased to the State of Washington by the Corps)	Approximately 0.25 mile south of project corridor (corridor mile 28 to 30)	Boating, swimming, fishing, camping, picnicking
Crow Butte Fishing Access Site	Approximately 0.25 mile south of project corridor (corridor mile 28 to 30)	Columbia River Treaty Fishing Access Site (CRTFAS) (tribal access only)
Klickitat County, Washington		
Sundale Park	Approximately 0.25 mile south of project corridor (no view of project corridor) (corridor mile 54)	Picnicking, boat launch
Pine Creek Fishing Access Site	Approximately 1 mile south of project corridor (corridor mile 48)	CRTFAS (tribal access only)
Roosevelt Park (owned by the Corps)	Approximately 1 mile south of project corridor (no view of project corridor) (corridor mile 49)	Camping, windsurfing, swimming, picnicking
Roosevelt Fishing Access Site	Approximately 1 mile south of project corridor (no view of project corridor) (corridor mile 49)	CRTFAS (tribal access only)
Stonehenge	Approximately 6 miles west of John Day Dam	Photography, historical information
Maryhill State Park (leased to the State of Washington by the Corps)	Approximately 7 miles west of John Day Dam	Boating, swimming, camping, picnicking, windsurfing
Maryhill Museum of Art	Approximately 5 miles west of John Day Dam (limited views of corridor)	Picnicking, museum facilities
John Day Dam Cliffs Park (owned by the Corps)	Adjacent to John Day Dam (corridor mile 74)	Windsurfing, camping, fishing
Rock Creek Park (owned by the Corps)	Approximately 1 mile north of corridor (corridor mile 61)	Park is closed; no plans to reopen

Recreational Site	Proximity to Project Corridor	Amenities
Sherman County, Oregon		
John Day Recreation Area (also called Giles French Park; owned by the Corps)	Less than 0.5 mile west of John Day Dam (no view of project corridor)	Picnicking, windsurfing
Wildlife Viewing Area	Less than 0.5 mile west of John Day Dam	Wildlife viewing

Environmental Consequences—Proposed Action

Impacts During Construction

Land Use

Development of the proposed project would add an additional transmission line to the current land uses within the existing Bonneville transmission line corridor. These current land uses include irrigated and nonirrigated cropland, grazed and ungrazed shrub-steppe land, and transmission line facilities and substations (see Figure 3-1). The project would be consistent with the purpose and intent of the zoning and comprehensive plan designations for the City of Umatilla and Sherman County in Oregon and Benton and Klickitat Counties in Washington. The proposed project would be consistent with the Statewide Planning Goal 11 (Public Services and Utilities) guidelines for siting utility lines and facilities in existing public or private rights-of-way. Bonneville would strive to meet development regulations for Statewide Planning Goal 3 (Agricultural Lands).

In Umatilla County, the project corridor is not located within the City of Umatilla city limits, but it is located within the Urban Growth Boundary of the City of Umatilla under the jurisdiction of the Umatilla County Zoning Code (in a Joint Management Agreement between the City and the County) and the City of Umatilla Comprehensive Plan. In Umatilla County, the corridor is located on land designated as Recreation/Open Space and Public Facilities in the City of Umatilla Comprehensive Plan. Because the proposed transmission line is a public utility, and would not significantly affect recreation in this area, the proposed project would not be in conflict with the county's land use plan. The county's zoning designation for the project corridor is F1, Exclusive Farm Use. A noncommercial utility facility is permitted outright in the F1, Exclusive Farm Use zone (Section 3.012(5)), and the proposed action thus would not be inconsistent with this designation.

In Benton County, the corridor is zoned as Growth Management Act (GMA) Agriculture by the Benton County Zoning Ordinance (11.18.050) and the Benton County Comprehensive Plan. Utility corridors are an allowed use in this zone and plan designation, and the proposed transmission line thus would not be in conflict with the county's zoning ordinance or comprehensive plan. A portion of the corridor where it crosses the Columbia River also is located on land that is designated as Urban Environment by the Benton County Shoreline Management Master Plan. Utilities such as transmission lines are a conditional use in areas with this designation. Bonneville would comply to the maximum extent practicable with any general regulatory standards from the Shoreline Plan. Thus, the proposed action would likely not conflict with the County's Shoreline Plan (Shuttleworth pers. comm.).

In Klickitat County, the project corridor is located on land designated as Agricultural Forest and Rural Center by the Klickitat County Comprehensive Plan. The project corridor in Klickitat County is on land designated as Agricultural Forest, except for land around Roosevelt, which is designated as Rural Center. Utilities such as transmission lines are consistent with the policies of the land use designations of the Comprehensive Plan. The proposed action would therefore not conflict with the County's Comprehensive Plan. The majority of the corridor in Klickitat County is zoned as Extensive Agriculture by the Klickitat County Zoning Ordinance. The rest of the project corridor is located in land zoned as Open Space (near the river crossing), Industrial Park (Goldendale vicinity), and Rural Residential (near Roosevelt) (Frampton pers. comm.). Utilities such as transmission lines are conditional uses in the Open Space, Extensive Agriculture, and Rural Residential zones. Utilities are permitted outright in the Industrial Park zone.

When the project corridor crosses the Columbia River, it is located on land that is designated as an Urban/Industrial Environment of the shoreline area by the Klickitat County Shoreline Master Plan. Utilities such as transmission lines are permitted in areas with this designation. Bonneville would comply to the extent practicable with any general regulatory standards from the Shoreline Plan. Thus, the proposed action would not conflict with the County's Shoreline Plan.

In Sherman County, the project corridor is located on land designated as Exclusive Farm Use in the Sherman County Comprehensive Plan, and is zoned as Exclusive Farm Use, (EFU) F-1 by the Sherman County Zoning, Subdivision, and Land Development Ordinance. A noncommercial utility facility necessary for public service is a permitted use in this zone. The County Ordinance also identifies a Natural Hazards overlay zone for an area along the bluffs downstream from John Day Dam. The portion of the corridor that crosses the bluffs is located in this overlay zone. Utilities are a conditional use in the overlay zone. The transmission line would be located, constructed, and operated in a manner generally consistent with the relevant provisions of the Natural Hazard overlay zone.

See the section on State, Areawide, and Local Plan and Program Consistency, Chapter 4, for more information.

Temporary impacts on land use would be due to construction activities such as heavy equipment causing soil and crop disturbance, noise, and dust. The construction activities that could cause impacts would include placement of towers, access roads upgrades and construction, and conductor tensioning sites.

In areas of crop or grazing lands, the heavy machinery could damage crops and compact soils, causing a temporary loss of soil productivity. The damage would depend on the type of crop (whether it was a vineyard, orchard or annuals), the season (during summer growing season, harvest, or dormant winter), and if the land was in use or fallow.

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

Approximately 48 acres (12 acres in cropland and 35 acres in grazing land) would be impacted during the construction of the new access roads and spur roads (based on a 25-foot-wide construction area). Approximately 93 acres (29 acres of cropland and 64 acres of grazing land) would be temporarily impacted during the construction of the towers, based on an impact area of 0.25 acre per tower.

Approximately 25 acres of trees would need to be removed from the poplar tree farm (structures 21/5 to 23/3) in the vicinity of Glade Creek. A total of 50 acres would be removed from cottonwood production. Since the trees were grown to be harvested, the impact of the line may be that the trees would need to be harvested earlier than anticipated, thus losing some potential wood fiber. The tree farm would no longer be able to farm poplar trees in this area, because the trees grow tall and would be a threat to the safety and reliability of the line. (If a tree grows too close to power lines, electricity could arc over and cause an outage of the line and/or a fire.) The farmland could be used for low growing crops or orchards.

Conductor-tensioning sites, where the trucks pull the conductor to the correct tension, would also impact land use, although temporarily. The sites would be located along the project corridor every 2 to 3 miles, disturbing an area of about 1 acre. Total temporary impacts from the conductor-tensioning sites would be approximately 40 acres if spaced every 2 miles (14 acres in cropland and 26 acres in grazing land), or approximately 26 acres if every 3 miles (9 acres in cropland and 17 acres in grazing land).

During construction, livestock grazing, farming, and crop dusting in the corridor may have to be temporarily restricted in some areas to avoid conflicts between livestock or farm equipment and construction equipment. Potential impacts include cattle having to be segregated to avoid getting out.

Temporary staging areas will be determined by the contractor. These areas will likely be located in empty parking lots or on previously disturbed sites. In previously disturbed areas there would be no impacts of staging areas. If staging areas are not on empty parking lots, they would cause temporary vegetation and soil disturbance.

Recreation

None of the formal recreation facilities shown in Figure 3-1 would be disturbed during construction. Access to some of the sites may be delayed by construction traffic. Since distribution and selling of fish is an activity at some of the CRTFASs, access delay could potentially affect sales. Upland bird hunting may be temporarily disturbed in the project corridor in Benton County on the south side of SR 14, depending on the time of year when construction occurs. Construction of the project could encourage sightseeing by travelers on SR 14. Noise and/or dust would likely be noticeable by those travelers or recreationists in close proximity to the construction site(s).

Impacts During Operation and Maintenance

Land Use

The permanent project facilities (not including access roads) would occupy approximately 19 acres total (6 acres of irrigated and nonirrigated cropland and 13 acres of grazing land). New access roads would occupy a permanent footprint of approximately 48 acres (based on a 25-foot impact area). Table 3-3 identifies the land uses affected by the permanent project footprint.

The cropland no longer available for farm use would represent a small portion of the agricultural land in the project corridor and a negligible portion of agricultural land in each of the four affected counties (see Table 3-4).

Table 3-3: Acreage of Land Uses that Would Be Occupied by Permanent Project Facilities

Land Use	Acres Occupied by Permanent Project Facilities			
	Access Roads	Towers	Substations	Total Impacts
Cropland (irrigated and nonirrigated)				
Benton County	8.9	4.1	0	13.1
Klickitat County	2.3	1.2	0	3.5
Sherman County	0.8	0.4	0	1.2
Grazing Land				
Benton County	5.5	2.4	0	8.0
Klickitat County	29.2	9.5	0	39.1
Sherman County	0.8	0.1	0	0.9
Substation/Wildlife Area				
Umatilla County	0.5	0.4	2	3.0
Total	48	18.1	2	68.1

Table 3-4: Proportion of Agricultural Land in Each County that Would Be Occupied by Permanent Project Facilities

County	Total Agricultural Land in County (acres)	Agricultural Land Occupied by Permanent Project Facilities	
		Acres	Percentage
Benton	611,903	21.1	.003
Klickitat	588,732	42.6	.007
Sherman	425,036	2.1	.0005
Umatilla	1,345,097	23.0	.0002
Total, All Four Counties	2,970,768	88.8	.003

The proposed project would not appreciably disrupt the current and planned agricultural uses of the land in the four affected counties. To the extent possible, the transmission line facility would be constructed to avoid existing and proposed (if known) irrigation lines. In areas where new right-of-way needs to be acquired, if the irrigation equipment or layout needs to be redesigned because of the proposed transmission line, Bonneville would compensate the landowner for the additional reasonable costs. In areas, where the line construction would be within existing right-of-way, Bonneville would follow existing agreements made with the landowner and work with them to minimize the impact to the irrigation systems. In areas where new easement for the transmission line or access roads would have to be acquired, nonfederal landowners would receive compensation, based on market value, for the use of their property. Easements for access on existing roads where the property owner is the only user other than Bonneville, would be compensated at 50% of full fee value, or less than 50% if more than one landowner shares the road.

The tower spacing would allow for crop dusting to continue, and the project would not alter the existing gates and fences that cross the project corridor. Approximately 38 new swing gates would be installed, 23 of which would replace existing barbed-wire or broken gates. Gate locks would be coordinated with the landowner to ensure that both Bonneville and the landowner can unlock the gates. Access roads on private property would be accessible to the landowners.

Recreation

The proposed transmission line would be seen from the following recreation facilities: Umatilla Marina Park, McNary Wildlife Viewing Area, McNary Park, Plymouth Park, Umatilla National Wildlife Refuge, Crow Butte State Park, Crow Butte CRTFAS, Pine Creek CRTFAS, Stonehenge, Maryhill State Park, Maryhill Museum of Art, John Day Dam Cliffs Park, Rock Creek Park, and the John Day Viewing Area (see Visual Resources in this chapter).

Environmental Consequences—Short-Line Routing Alternatives

Table 3-5 summarizes the land use impacts associated with the short-line routing alternatives described in the Routing Alternatives section of Chapter 2.

Table 3-5: Impacts of Short-Line Routing Alternatives: Land Use and Recreation

Alternative	Impacts
McNary Substation Alternatives	
A. Relocate administration building presently located on north side of substation adjacent to Wildlife Natural Area	Wildlife viewing may be temporarily obstructed during construction.
B. Cross Wildlife Natural Area; circumvent administration building on north side	Wildlife viewing may be temporarily obstructed during construction.
C. Place line in bus work at ground level on north side of administration building, inside Wildlife Natural Area	No recreation impacts are anticipated.
Hanford-John Day Junction Alternatives	
A. Move existing Hanford-John Day line north 200 feet to make room for new line on north side of corridor	Approximately 1.5 acres of grazing land would be disturbed during construction. The permanent project facilities (towers and roads) would occupy approximately 0.25 acre of grazing land. No recreation impacts are anticipated.
B. Place new line on south side of corridor	Approximately 3.2 acres of grazing land would be permanently impacted (occupied by roads and towers) and about 0.5 acre of grazing land would be temporarily impacted during construction. No recreation impacts are anticipated. The occupants of the residence would be impacted by having their barn and shed removed. If the house requires removal, the residents would have to find new housing.
C. Place new line on south side of highway (occupied by roads and towers)	Approximately 3.2 acres of grazing land and 3.1 acres of cropland would be permanently impacted. Approximately 0.5 acre of grazing land would be temporarily impacted during construction. No recreation impacts are anticipated. Impacts to the residence would be the same as Alternative B, though the towers would be located about 35 feet closer to the house.

Alternative	Impacts
Corridor Mile 32 Alternatives	
A. Keep existing and new lines on tribal land	Approximately 0.6 acre of cropland would permanently impacted (occupied by roads and towers) and about 0.8 acre would be temporarily impacted during construction. No recreation impacts are anticipated.
B. Relocate existing and new lines away from tribal land	Approximately 1.8 acres of cropland would be permanently impacted (occupied by roads and towers) and about 2.25 acres would be temporarily impacted during construction. No recreation impacts are anticipated.
Corridor Mile 35 Alternatives	
A. Keep existing and new lines on tribal land	Approximately 0.8 acre of grazing land would be permanently impacted (occupied by roads and towers) and about 1.0 acre would be temporarily impacted during construction. No recreation impacts are anticipated.
B. Relocate existing and new lines away from tribal land	Approximately 1.5 acres of grazing land would be impacted (occupied by roads and towers) and about 2 acres would be temporarily impacted during construction. No recreation impacts are anticipated.

Mitigation

The following mitigation measures would help minimize land use impacts.

- Locate towers and roads so as not to disrupt irrigation circles, where possible.
- Locate structures and roads outside of agricultural fields, orchards, and vineyards, where possible.
- Coordinate with landowners for farm operations, including plowing, crop dusting, and harvesting.
- Redesign irrigation equipment and compensate landowner for additional reasonable costs where new right-of-way needs to be acquired.
- Compensate farmers for crop damage and restore compacted soils.
- Control weeds around the base of the towers.
- Keep gates and fences closed and in good repair to contain livestock.

Unavoidable Impacts Remaining after Mitigation

During construction, approximately 50 to 55 acres of irrigated and nonirrigated cropland and 116 to 125 acres of grazing land (shrub-steppe and grasslands) would be temporarily disturbed during construction.

Following construction, approximately 68 acres of irrigated and nonirrigated cropland and grazing land would be converted to transmission line facilities during the life of the project. This includes a small percentage of agricultural land in Benton and Klickitat Counties in Washington and Umatilla and Sherman Counties in Oregon.

Environmental Consequences—No Action Alternative

If the No Action Alternative was implemented, existing land uses in the project corridor would continue without influence from the proposed project.

Geology, Soils, and Seismicity

Affected Environment

Geology

The 79-mile corridor for the proposed transmission line is located within the western margin of the Columbia River plateau. The Columbia River plateau covers approximately 63,000 square miles throughout Washington, Oregon, and Idaho. The plateau is bordered by the Okanogan Highlands to the north, the Cascade Mountains on the west, the Clearwater Mountains on the east, and the Blue Mountains to the south.

The geology of the Columbia River plateau is dominated by the Columbia River Basalt group, a series of flood basalt flows that erupted during the Miocene epoch. Younger geologic units cover the basalt flows, consisting of alluvium, landslides, river terrace deposits, catastrophic flood deposits, and loess deposits. Within the 500-foot-wide project corridor evaluated for the project, the Columbia River Basalt Group is composed of three distinct formations (from oldest to youngest): Grande Ronde, Wanapum, and Saddle Mountains (Orr and Orr 1996).

For natural resources, the field investigations for this EIS focused on the existing 500-foot-wide Bonneville transmission line corridor following the path of the proposed transmission line. The detailed assessment of potential wildlife habitat, vegetation types, and other natural resources was focused within this 500-foot-wide corridor in order to focus the EIS assessment on areas where impacts are most likely to occur as a result of the project.

The project corridor and vicinity consist mainly of river terraces, ridges, bluffs, and volcanic tableland adjacent to the north bank of the Columbia River running parallel to SR 14. The corridor crosses numerous incised stream channels draining into the Columbia River. Based on the review of geologic maps and field observation, ridges, bluffs, and the inner gorge areas of the incised stream channels crossed by the project corridor are composed primarily of exposed basaltic bedrock covered with a generally thin layer of soil. Loess deposits of varied thickness cover the relatively flat stream terraces along the east portion of the study area through Klickitat County and across The Burn. The Burn is a geographical area (a plateau overlooking the Columbia River) south of Rock Creek.

Soils

Soils along the project corridor primarily consist of wind-blown loess deposits or glacial outburst flood sands and gravels underlain by basaltic bedrock. Most soils along the corridor are designated as suitable for rangeland, woodland, or wildlife, and some steeper areas may require complex conservation methods when used for cultivation. Small sections along the project corridor have soils considered prime farmland, including the soils underlying both the McNary Substation and John Day Substation. Table 3-6 describes soil types along the project corridor.

Seismicity

The project corridor and vicinity lie in a low earthquake hazard area (seismic zone 2B) recognized by the 1994 Uniform Building Code. Published geologic maps and field observation indicated five faults along the corridor (Phillips and Walsh 1987). These faults are probably inactive, with no known historic activity, meaning no recorded activity and no evidence of activity during the Holocene epoch (last 10,000 years). This does not mean that the faults would never again move, but the probability of these faults reactivating is low.

If a moderate or severe seismic event was to occur in the project vicinity, the ground movement would have the potential to cause impacts along the project corridor through mass wasting (landslides) in areas that have steep slopes. The likelihood of mass wasting event happening during a significant seismic event is increased in areas where historic quaternary period landslides are known to have occurred. Due to the generally arid conditions along the corridor, ground surface ruptures or ground liquefaction do not have as high of a potential to occur as mass wasting.

Table 3-6: Soil Types Along the Project Corridor

Corridor Mile	Soil Association	Characteristics
1 to 2	Quincy-Winchester-Burbank	Deep, excessively drained soils formed by loess deposits, flood gravels, or recent alluvium on river terraces. One soil of this association, Adkins fine sandy loam with gravelly substratum, is considered prime farmland and underlies the McNary switchyard (SCS 1988).
2 to 14	Quincy-Hezel-Burbank	Dry sandy to silty soils formed on river terraces or in dunes (SCS 1971). Some of these soils may be designated prime farmland.
14 to 48	Kiona-Bakeoven-Starbuck	Dry stony, very shallow to moderately deep rangeland soils with low water-retention properties.
48 to 57 and 60 to 70	Clerf-Bakeoven-Vantage	Dry, stony, and very shallow to moderately deep rangeland soils having slightly dark topsoil.
57 to 60 (The Burn)	Mikkalo-Bakeoven-Zen	Formed on highly dissected plateaus or eroded land surfaces. Include loessial soils 20 to 40 inches thick above the basaltic bedrock that are suitable for cultivation and shallow stony soils that are used for rangeland. No soils of this association are listed as prime farmland (www.wsu.edu, accessed August 24, 2001).
70 to 75 (Columbia River)	Kuhl-Badge-Lickskillet	Stony rangeland soils of shallow to moderate depth having slightly dark, humus-rich topsoil (KRC 1977).
75 to 79	Kuhl-Lickskillet-Wato	Stony to sandy soils of shallow to moderate depth formed by wind deposits on plateau tops and valley slopes. Two soils of this association are considered prime farmland. Wato very fine sandy loam is located on the south plateau overlooking the Columbia River crossing and is the soil type underlying the John Day Substation. The second soil type is Anders very fine sandy loam, located as one small area immediately east of the John Day Substation (SCS 1964).

A landslide area was observed in the vicinity of tower 40/3 during the field investigation conducted on May 23, 2001. Evidence that this landslide is recent and may continue include a barren vertical headwall scarp, open and acute tension cracks at the ground surface near both upper and lower access roads, and additional open tension cracks at the ground surface extending beneath the northwest footing of tower 40/3. Also, most of the area is not considered to be susceptible to liquefaction, which occurs primarily in weakly developed granular soils under saturated conditions.

Environmental Consequences—Proposed Action

Impacts During Construction

The basaltic bedrock underlying the project corridor is expected to provide a stable foundation for the proposed transmission towers.

Construction impacts would total 166 to 181 acres depending on the number and location of conductor tensioning sites. This temporary impact is projected to last up to one year and has the potential to increase the rate of erosion along the corridor. In areas along the corridor where quaternary period loess soils have developed as a result of wind deposition, removal of vegetation would likely increase the rate of wind erosion. Erosion rates would most likely return to their current level following construction if plants reestablished along the corridor, naturally, or through revegetation.

Approximately 78 acres of existing roads would be reconditioned and widened for the project. About 48 acres of spur roads and new roads would be constructed for the project. Additionally, between 26 and 39 acres would be disturbed (perhaps cleared of vegetation) for conductor-tensioning sites along the project corridor. Approximately 93 acres would be disturbed and cleared of vegetation to construct the 360 transmission towers anticipated along the project corridor. Up to 2 acres would be disturbed and cleared of vegetation for substation work at McNary. Additionally, approximately 25 acres of poplar trees would likely need to be removed west of Glade Creek due to safety protocols. A total of 50 acres would be removed from cottonwood production.

The removal of vegetation and disturbance of the underlying soils has the potential to increase the risk of erosion along the project corridor. Areas where a higher likelihood for increased rates of erosion to occur include the loose unconsolidated quaternary period loess soils. Areas where a higher likelihood for increased rates of erosion to occur include the loose unconsolidated quaternary period loess soils and dune fields. These unconsolidated materials are wind created and found as pockets along the project corridor in areas comprised of the Quincy-Winchester-Hezel-Burbank, Mikkalo-Bakeoven-Zen, or Kuhl-Lickskillet-Wato soil associations (see Table 3-6).

Impacts During Operation and Maintenance

Operation and maintenance activities could increase erosion potential along the project corridor. Anticipated erosion rates during operation and maintenance are expected to remain at or near current levels, once revegetation has occurred.

Environmental Consequences—Short-Line Routing Alternatives

None of the short-line routing alternatives proposed for the transmission line are expected to have unexpected or adverse impacts if the mitigation measures and best management practices listed for construction are implemented.

There are no impacts expected to geology and soils for the project alternatives with proper mitigation.

Mitigation

The following mitigation measures would help minimize impacts to soil and seismicity impacts.

- Minimize vegetation removal.
- Avoid construction on steep slopes where possible.
- Properly engineer cut-and-fill slopes.
- Install appropriate roadway drainage to control and disperse runoff.
- Ensure graveled surfaces on access roads in areas of sustained wind.
- Develop additional mitigation measures (using a certified engineer) between corridor miles 39 and 41 due to the presence of an active landslide in the vicinity of tower 40/3.
- Apply erosion control measures such as silt fence, straw mulch, straw wattles, straw bale check dams, other soil stabilizers, and reseeding disturbed areas as required (prepare a Stormwater Pollution Prevention Plan).
- Regularly inspect and maintain project facilities, including the access roads, to ensure erosion levels remain the same or less than current conditions.

Unavoidable Impacts Remaining after Mitigation

No unavoidable or adverse impacts to geology or soils are expected to remain following completion of the project if the mitigation measures and best management practices listed earlier are implemented.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, the potential impacts to geology and soils from the proposed project would not change from the current site conditions. No impact to geology and soils is predicted.

Streams, Rivers, and Fish

Affected Environment

A total of 15 streams, the Columbia River, and 146 dry washes cross the project corridor. Of the streams and river, 11 are considered fish bearing or potentially fish bearing and five are non-fish-bearing. Table 3-7 lists the streams crossed and the fish they may contain. Figure 3-2 shows the location of all streams and the river surveyed. Table 3-7 summarizes the streams intersected by the project corridor.

Table 3-7: Streams Intersected by the Project Corridor

Streams	Location	Fish Species Utilization[1]
Columbia River	between towers 2/2 and 2/3	steelhead trout Middle Columbia River (T) Snake River basin (T) Upper Columbia River (E) chinook salmon Upper Columbia River Spring (E) Snake River Spring/Summer (T) Snake River Fall (T) sockeye salmon Snake River (E)
Washington Streams		
Fourmile Canyon	between towers 6/2 and 6/3	non-fish bearing stream
Unnamed Tributary to Columbia River	between towers 13/1 and 13/2	non-fish bearing stream
Glade Creek	between towers 21/4 and 21/5	potential coho salmon (of the lower Columbia River/southwest Washington ESU) (C) and resident fish use
Unnamed Tributary to Glade Creek	between towers 22/5 and 23/1	potential coho salmon (C) and resident fish use
Dead Canyon	between towers 27/2 and 27/3	resident fish use
Alder Creek	between towers 33/3 and 33/4	potential steelhead trout (of the Middle Columbia River ESU) (T) and resident fish use
Pine Creek	between towers 41/5 and 42/1	potential steelhead trout (T) and resident fish use
Wood Gulch	between towers 48/3 and 48/4	steelhead trout (T) and resident fish use
Old Lady Canyon	between towers 52/5 and 53/1	non-fish bearing stream

Streams	Location	Fish Species Utilization[1]
Chapman Creek	between towers 54/2 and 54/3	chinook salmon (of the Middle Columbia River Spring-Run ESU) (NW), coho salmon (C), steelhead trout (T) and resident fish use
Rock Creek	between towers 61/3 and 61/4	chinook salmon (NW), steelhead trout (T), and resident fish use
JU Canyon	between towers 66/3 and 66/4	potential resident fish use
Oregon Streams		
Scott Canyon	between towers 97/4 and 98/1	potential resident fish use
Gerking Canyon	between towers 78/1 and 79/1	non-fish bearing stream

[1] Species Status Codes appear in parenthesis (i.e. T= threatened, E= endangered, C= candidate; NW= not warranted).
Source: Carlson pers. comm.; Dugger pers. comm.; Pribyl pers. comm.; NMFS 2001; SteamNet 2001; USFWS 2001; WDFW 2001; Lautz 2000.

Most of the streams within the project area flow toward the Columbia River and perpendicular to the project corridor. Floodplains are limited because of the deeply incised canyons with narrow valley floors. Several of the stream channels within the survey corridor also exhibit extensive downcutting, which is likely caused by a combination of natural processes and adjacent land use activities that increase the frequency, duration, and magnitude of high flows (Lautz 2000).

Downcutting, or channel incising is the severe erosion or scour of the channel such that the streambanks become vertical, or nearly so.

Streams crossing the project corridor are generally low gradient (less than at 5% slope), and have straight to meandering channel patterns. Peak stream flows occur in the spring during snowmelt and spring rains. Many of the streams surveyed are ephemeral and are completely dry during the summer months.

Those streams crossing the corridor east of Alder Creek generally have a higher percentage of fine materials in the streambank and bed, derived from gravelly alluvial deposits mantled by eolian sands (SCS 1988). These low-gradient streams generally have unstable streambanks resulting from the unstable soils. This increases the potential for these streams to deliver sediments downstream to the Columbia River if disturbed by natural or human events.

The streams west of Alder Creek generally have gravel and cobble substrates and are formed at the bottom of steep canyons, and have stable streambanks as a result of natural rock armoring and deep-rooted riparian vegetation.

Grassland and forbs are the dominant riparian vegetation along most of the streams intersected by the project corridor. These include Glade Creek, the unnamed tributary to Glade Creek, Dead Canyon, Wood Gulch, and Rock Creek. Alder Creek has riparian vegetation of mainly shrubs and seedlings, but only along that portion of the bank that is wetted during high flows. Wood Gulch has riparian vegetation that includes clusters of small trees, but these are not the dominant vegetation form. Upslope areas of Alder Creek are dominated by grassland/forb vegetation. Pine Creek has riparian vegetation that includes shrubs, seedlings, and small trees in wetted areas. Chapman Creek and JU Canyon have small trees in the riparian zone, and both are well shaded along the portions crossing the project corridor, while the upslope areas contain grass and forbs. Scott Canyon has mainly shrubs and seedlings in the riparian areas.

Five of the 11 fish-bearing streams identified along the project corridor were found to have water temperatures in excess of 64.4°F during the June 2001 field surveys. These conditions identify water quality in these streams as impaired under Section 303(d) of the Clean Water Act and may indicate problems for fish species. These five streams include Glade Creek, the unnamed tributary to Glade Creek, Dead Canyon, Alder Creek, and Rock Creek. At present, these streams are not 303(d) listed by the Washington State Department of Ecology (Ecology). Rock Creek was identified as a candidate for the 303(d) list in 1998, but was then excluded through a Memorandum of Understanding between Ecology and the Eastern Klickitat Conservation District (Lautz 2000). The midsection of the Columbia River—between McNary Dam and John Day Dam—is listed in both the Washington and Oregon 1998 303(d) lists for temperature, total dissolved gas, sediment bioassay, and arsenic levels.

There are several ways in which streams can be classified as fish bearing. All 11 streams identified as fish bearing meet the fish bearing classification based on the Ordinary High Wetted Width (3 feet in eastern Washington, provided the stream gradient does not exceed 20% for 160 meters or more). The Columbia River, Wood Gulch, Chapman Creek, and Rock Creek were also identified as fish bearing in the Priority Habitat Species database. Fish were observed in the Columbia River, Glade Creek, the unnamed tributary to Glade Creek, Dead Canyon, Alder Creek, Pine Creek, Wood Gulch, Chapman Creek, and Rock Creek. The Scott Canyon stream may potentially support resident trout game fish and dace (Pribyl pers. comm.), and is therefore considered fish bearing.

No stream crossing structures (culverts, bridges, or fords) are owned or maintained by Bonneville along the project corridor at any of the 11 fish-bearing or potential fish-bearing streams. A road crossing and culvert exist at the unnamed tributary to Glade Creek within the project corridor. The road is owned and maintained by Sandpiper Farms/Boise Cascade Tree Farm.

Essential Fish Habitat

The proposed action could affect two fisheries protected by the Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Act (16 U.S.C. 1855(b)): which includes the chinook and coho salmon fisheries. All streams identified as either fish bearing or potentially fish bearing in the project area are included in designated EFH for these two fisheries. Chinook salmon that utilize the streams intersected by the project corridor are not currently federally listed, while coho salmon are a candidate for federal protection. However, steelhead trout are federally listed as a threatened species, and occur, or are likely to occur in the same streams along the project corridor as chinook or coho salmon. Since steelhead trout are a federally listed species and their distribution overlaps with both chinook and coho, the analyses of current conditions and potential impacts to this species also serve to describe all potential impacts to EFH.

Listed Species

Based on information provided by the U.S. Fish and Wildlife Service (USFWS 2001), the following species which are listed under the Endangered Species Act are known to occur in the Columbia River, as they migrate upstream through the project area (NMFS 2001):

- Snake River spring/summer and fall chinook salmon (threatened),
- Upper Columbia River spring chinook salmon (endangered),
- Lower Columbia River coho salmon (candidate),
- Snake River sockeye salmon (endangered),
- Middle Columbia River steelhead trout (threatened),
- Snake River basin steelhead trout (threatened), and
- Upper Columbia River steelhead trout (endangered).

Three species of anadromous salmonids are known to occur in the fish-bearing streams crossed by the project corridor: chinook salmon, coho salmon, and steelhead trout.

Fall chinook salmon use the lower reaches of Rock Creek and Chapman Creek. Juvenile coho salmon have also been documented in the lower reaches of Chapman Creek. Potential coho salmon habitat has been identified in the lower portion of Glade Creek. Coho in this area are believed to be hatchery strays, but some minor wild breeding may also exist.

Rock Creek summer steelhead trout are the only anadromous salmonids indigenous to streams along the project corridor. Streams in the project area used by steelhead for spawning and rearing include the lower and middle reaches of Rock Creek, lower Chapman Creek, and lower Wood Gulch. There is potential spawning and rearing habitat present in Pine Creek and Alder Creek (Lautz 2000).

Pine Creek has barrier culverts at SR 14, which have been identified by the Washington Department of Fish and Wildlife and scheduled for repair during the 2003-2005 biennium (Cierebiej pers. comm.). All of the streams identified as fish bearing along the project corridor may support resident trout populations as well.

Bull trout and coastal cutthroat trout may also be present in some of the fish-bearing streams crossed by the project corridor. Bull trout are federally listed as a threatened species, and coastal cutthroat trout are proposed for listing (USFWS 2001). The Washington Department of Fish and Wildlife has conducted electrofishing surveys in the fish-bearing streams along the project corridor, but has not documented that either bull trout or coastal cutthroat trout are present. One cutthroat trout was documented in Luna Creek, a tributary to Rock Creek, but it is believed to be a hatchery planted resident (Dugger pers. comm.).

Non-Fish-Bearing Streams

Several non-fish-bearing streams that drain into the Columbia River exist within the project corridor (see Figure 3-2). These include the following streams on the Washington side, from east to west: Fourmile Canyon, the unnamed tributary to the Columbia River, Old Lady Canyon, and 2 unnamed tributaries to the Columbia River. On the Oregon side, Gerking Canyon is the only non-fish-bearing stream along the project corridor; it is located near the town of Rufus.

Non-Fish-Bearing Dry Washes

There are 146 non-fish-bearing dry washes that also cross the project corridor. Dry washes are defined as channels lacking any semblance of a riparian zone and are intermittent, primarily providing seasonal drainage off of hills (WDFW 2000). Most of the dry washes are located between Alder Creek and Wood Creek on the steep south-facing slopes of the Columbia River gorge, and drain into the Columbia River.

Floodplains

The McNary Substation and the towers spanning the Columbia River adjacent to the Umatilla Bridge occur within the 100-year floodplain of the Columbia River as it is designated on the Federal Emergency Management Administration map (FEMA 1998). The ancestral floodplain of the Columbia River is currently inundated by the pool of Lake Umatilla, which was created following the construction of John Day Dam in 1968.

The FEMA 100-year floodplain is not that relevant in this area because the lake pool level is controlled by John Day Dam 77 miles to the west of McNary Dam, and fluctuates seasonally to a maximum pool level of 276.5 feet above-sea-level (Burney and Associates 1999).

On this basis, a 100-year flood event would reach elevations of 279 feet above-sea-level near the McNary Substation. However, the McNary Substation is located at approximately 290 feet, while towers for the Columbia River crossing would range in elevation from 285 to 310 feet, all above maximum pool levels (McGowin pers. comm.).

The corridor crosses the Columbia River again immediately west of John Day Dam. The normal Columbia River pool level in this area (between John Day Dam and the Dalles Dam), is 165.8-feet above-sea-level (USGS 1971). If the river-crossing tower would be at or lower than 165.8 feet, appropriate fill permits would be obtained.

There are 100-year floodplains associated with many of the streams along the project corridor, and these are mostly confined to relatively narrow floodplains within steep, narrow canyons.

Environmental Consequences—Proposed Action

The construction and the operation and maintenance of the proposed project could potentially impact fish habitat through the transport of sediment (and hazardous materials) from construction sites to streams and the removal of riparian habitat.

With erosion and sedimentation, deposition of excessive fine sediment on the stream bottom eliminates habitat for aquatic insects, reduces the number and diversity of aquatic insects, reduces the amount and permeability of spawning gravel, and disrupts nutrient transport in the water column. Increases in fine sediments in low-velocity stream reaches can also completely cover suitable spawning gravel, cause channel braiding, increase width:depth ratios, increase incidence and severity of bank erosion, reduce pool volume and frequency, and increase subsurface flow. These changes can result in a reduction in the quality and quantity of spawning and rearing habitat (Meehan 1991).

Large woody debris from streamside trees and other riparian vegetation provides cover, habitat complexity, shade, and an insulating canopy that moderates water temperatures during both summer and winter. Riparian vegetation also provides a filter that reduces the transport of fine sediment to the stream and the roots provide streambank stability and cover for rearing fish (Meehan 1991).

All the rivers and streams crossed by the corridor would be spanned and no new road crossings of perennially flowing streams would be necessary.

Impacts During Construction

Riparian Vegetation

Four fish-bearing streams along the project corridor have riparian vegetation that includes clusters of small trees (diameter of 9 to 20.9 inches). These streams are Pine Creek, Wood Gulch, Chapman Creek, and JU Canyon (see Figure 3-2). In addition, JU Canyon's riparian vegetation also contains some large trees (diameter of 21 to

31.9 inches) (USFS 1998). Bonneville currently has transmission lines across these drainages along the project corridor, has maintained the riparian vegetation along these streams, and would continue to maintain the integrity of these riparian areas. In the deep gullies and canyons, the trees would also be left uncut, because the conductors would span these deeply incised stream channels at a height that would allow trees to grow under the lines. The remaining fish bearing streams along the project corridor have riparian vegetation consisting of shrub/seedling and grassland/forb communities, which would also be maintained, and not be removed.

Tree removal along the corridor could potentially occur at windbreaks for agricultural lands, orchards, and the Sandpiper Farms/Boise Cascade Tree Farm. Glade Creek and an unnamed tributary to Glade Creek intersect the project corridor in the area of the Sandpiper Farms/Boise Cascade Tree Farm. Boise Cascade has an approximate 6-year rotation on tree harvest (Boise Cascade 2001). The trees associated with the tree farm provide limited natural riparian functions such as filtering some run-off to the stream, however these trees do not provide such riparian functions as shade, which reduces summer water temperatures, or increasing habitat complexity through large woody debris recruitment to the stream.

Stream Crossings

No culverts would be installed at perennial streams along the corridor; therefore, fish access upstream of the project corridor would not be affected. Fords or culverts may be required at a few seasonal non-fish-bearing streams and dry washes. A constructed ford would be preferable to installing a culvert due to maintenance concerns and the potential for washouts associated with culverts. Culvert failures can cause significant sedimentation and degradation to fish habitat and water quality downstream. Therefore, any culverts installed in ephemeral streams would be designed and installed to accommodate flows associated with a 100-year flood event.

Tower Footings

Tower footings would be located on upslope areas and conductors would span all streams. Tower work would require the disturbance of soils, thus exposing them to the erosive forces of wind and rain, which could potentially transport sediments to all streams along the project corridor, as well as the Columbia River, and adversely affect fish and fish habitat. All streams would be equally susceptible. If areas cleared for tower footings were reseeded or naturally revegetated after construction, the potential for erosion and sedimentation would be less than if left as bare soil. Tower footings would be drilled where possible, although some areas may require blasting.

Detonating explosives adjacent to fish habitat could cause disturbance, injury, or mortality to fish and destruction or alteration of their habitat. To avoid impacts to fish and fish habitat, blasting should be avoided within 200 feet of fish-bearing streams.

Erosion potential would be greater if towers were sited in areas of steep hill slopes and dry washes. The steeper sloping areas along the corridor occur generally west of Glade Creek, with the greatest concentration occurring between Alder Creek and Wood Gulch. If a tower was sited at a dry wash the potential for delivery of fine sediments would be greater than most other locations because dry washes provide transport of surface waters during periods of precipitation and snow melt and typically drain to a larger stream. This increases the opportunity for sediments to be delivered to a fish bearing, or potentially fish bearing stream along the corridor. All of the dry washes along the corridor occur west of Alder Creek, with 66% occurring between Alder Creek and Wood gulch, and the remaining 34% occurring west of Wood Gulch.

Hazardous Materials

Construction of the proposed project would require the use of several common construction materials (e.g., concrete and paint) and petroleum products (e.g., fuels, lubricants, and hydraulic fluids) that could be toxic to fish and other aquatic organisms if spilled into or near streams.

Access Roads

The project would require approximately 40 miles of existing roads to be reconditioned and upgraded and 12.5 miles of new "spur roads" constructed from existing access roads. This new access and spur road construction would include the clearing and grading of an area 16 feet wide, with an approximate impact area 25 feet wide. The impact area may include hill slopes where spoils from cut-and-fill road construction may be sent down slope. Roads would be located on stable hill slopes and road gradients would not exceed 15% in areas with potentially unstable soils. Three miles of new access road would be constructed from corridor mile 39 to 41. This road would cross 16 dry washes, all draining to the Columbia River, 2,000 to 3,000 feet downstream.

Where access roads cross a dry wash, the road gradient should be 0% to avoid diverting surface waters from the channel. The construction of the new access road across dry washes could potentially affect the Columbia River fisheries from the occurrence of a catastrophic event such as mass wasting, or from less severe actions such as the delivery of fine sediment from the exposure of soils, or the potential that a spill of hazardous materials may enter surface waters flowing within the dry washes.

No fish-bearing streams would be crossed by the construction of new access roads and no existing access road currently crosses a fish-bearing or potentially fish-bearing stream that Bonneville owns and/or manages. An additional 0.5 to 1.0 miles of new access road and spur roads may also be constructed for Alternatives B and C of the Hanford-John Day Junction Short-Line Routing Alternatives, respectively. Please refer to Table 3-8 for potential impacts associated with these alternatives.

Staging Areas

Construction staging areas would be temporary and likely located in currently developed areas such as parking lots. If new staging areas, were created adjacent to fish bearing streams, or areas that drain directly to fish bearing streams, they could cause potential impacts associated with erosion, sedimentation, and hazardous material spills.

Floodplains

The work associated with the McNary Substation and the towers spanning the Columbia River adjacent to the Umatilla Bridge would occur within the FEMA-designated 100-year floodplain of the Columbia River. However, as stated earlier, the McNary Substation and the new towers are above the elevation of the 100-year flood event as designated by the U.S. Army Corps of Engineers, who can control the water level of the Columbia River via the dams.

The Columbia River crossing immediately west of John Day Dam would require the construction of a transmission tower on the lower banks of the north side of the Columbia River. The tower would be placed adjacent to the existing Columbia River crossing tower on a humanmade gravel berm at approximately 190-feet above-sea-level. The normal Columbia River pool level between John Day Dam and the Dalles Dam, approximately 24 miles to the west, is 160-feet above-sea-level (USGS 1971).

All other new access roads and towers would be installed outside the 100-year floodplains of other streams crossed and would create no impacts to the floodplains.

Impacts During Operation and Maintenance

Bonneville generally performs aerial inspections of transmission lines and access roads once a month. Maintenance of roads, towers, and vegetation could have minor impacts on fish or fish habitat; soils could be disturbed causing short-term sedimentation. Herbicide buffer zones and other mitigation measures would be used (consistent with Bonneville's Vegetation Management Program EIS [2000]) to prevent potential impacts associated with operational contamination.

Environmental Consequences—Short-Line Routing Alternatives

Table 3-8 summarizes the fisheries impacts associated with the short-line routing alternatives.

Table 3-8: Impacts of Short-Line Routing Alternatives: Fisheries

Alternative	Impacts
McNary Substation Alternatives	
A. Relocate administration building presently located on north side of substation adjacent to Wildlife Natural Area	Potential impacts include the delivery of fine sediments to the Columbia River and off-channel pond habitat connected with the Columbia River in the Corps Wildlife Natural Area (approximately 1,000 feet from the McNary Substation). With proper mitigation, potential impacts to fisheries in the Columbia River would be minor.
B. Cross Wildlife Natural Area; circumvent administration building on north side	Potential impacts would be the same as those for Alternative A. Alternative B would require the least amount of ground disturbance, but would be located closest to the Columbia River, especially the off-channel ponds (approximately 200 feet) located in the Corps Wildlife Natural Area. Therefore, this alternative could have a slightly greater potential impact.
C. Place line in bus work at ground level on north side of administration building, inside Wildlife Natural Area	Potential impacts would be the same as those for Alternative A. Some trees would be removed as part of this alternative. However, since these trees are approximately 1,000 feet from the Columbia River, no impact to fish or fish habitat is anticipated. The bus work would also require the clearing of an area 2,000 feet in length by 75 feet in width, which would be permanently surfaced with gravel. The permanent surfacing of the bus station area with gravel could potentially result in a slight increase of run-off and fine sediment transport to the Columbia River from precipitation and/or snow melt due to the replacement of the vegetation that currently exists in this area which provides soil stability and absorption of run-off. Potential impacts to fish and fish habitat would be minor
Hanford-John Day Junction Alternatives	
A. Move existing Hanford-John Day line north 200 feet to make room for new line on north side of corridor	No fish bearing, or potentially fish bearing streams occur in the area of the Hanford-John Day junction. The Columbia River is approximately 2,000 feet to the south of this area. Two dry washes drain a hillslope to the north of this area, with an additional three dry washes located between structures 68/6 and 70/5, where the potential impacts of the proposed three alternatives for this area would no longer occur. The junction is located on a large flat plateau above the Columbia River. It would be unlikely that construction of any of the 3 Hanford-John Day alternatives would affect fish or fish habitat within the Columbia River, due to the topography and distance from the Columbia River.
B. Place new line on south side of corridor (occupied by roads and towers)	Same as Alternative A.
C. Place new line on south side of highway	Same as Alternative A.

Alternative	Impacts
Corridor Mile 32 Alternatives	
A. Keep existing and new lines on tribal land	The Columbia River is approximately 3,000 feet to the south, Alder Creek is approximately 3,000 feet to the west, and a dry wash is located approximately 1,000 feet to the north of this location. Therefore, the construction of either of the two Corridor Mile 32 alternatives would not likely affect fish or fish habitat in either the Columbia River or Alder Creek.
B. Relocate existing and new lines away from tribal land	Same as Alternative A.
Corridor Mile 35 Alternatives	
A. Keep existing and new lines on tribal land	The Columbia River is located approximately 1,500 feet to the south of corridor mile 35. One dry wash is located in this area, which drains to the Columbia River. Potential for delivery of fine sediment to the Columbia River would be greater with Alternative B (relocating the line), than with Alternative A due to a greater area of ground disturbance.
B. Relocate existing and new lines away from tribal land	Same as Alternative A.

Mitigation

The following mitigation measures would minimize potential impacts to streams and fisheries habitat from possible erosion and clearing of vegetation.

- Place towers outside of stream riparian areas and utilize natural landscape features to span the conductor over existing shrub and tree riparian zones and avoid cutting.
- Place new access roads outside of stream riparian areas, where possible.
- Construct fords instead of culverts at access road crossings of dry washes or seasonal streams if possible. If culverts are required, design and install to accommodate flows associated with a 100-year flood event.
- Preserve existing vegetation where practical, especially next to intermittent and perennial streams.
- Avoid construction within the 200-foot designated stream buffers in Klickitat and Benton Counties, Washington.
- Maximize the use of existing roads, minimizing the need for new road construction.
- Avoid tower or access road construction on potentially unstable slopes where feasible.

- Use erosion control methods during construction (see mitigation measures for Geology, Soils, and Seismicity, Chapter 3), to minimize transport of sediments to streams via runoff.
- Install appropriate water and sediment control devices at all dry wash crossings, if necessary.
- Reseed disturbed areas following construction where appropriate.
- Construct any required culverts using Washington Department of Fish and Wildlife culvert installation guidelines. Methods may include avoiding installation during periods of flow, armoring streambanks near the culvert entrance and exit, installing culverts on straight sections of stream to ensure unimpeded flow, and following the contour of the stream channel.
- Repair existing road failures and drainage devices between corridor mile 33 to 47 to reduce potential impacts to dry washes.
- Avoid blasting during periods when salmonid eggs or alevins are present in gravels.
- Avoid blasting within 200 feet of fish-bearing or potentially fish-bearing streams.
- Develop and implement a Spill Prevention and Contingency Plan to minimize the potential for spills of hazardous material including provisions for storage of hazardous materials and refueling of construction equipment outside of riparian zones, spill containment and recovery plan, and notification and activation protocols.
- Keep vehicles and equipment in good working order to prevent oil and fuel leaks.
- Return staging areas to pre-construction condition.

Unavoidable Impacts Remaining after Mitigation

Unavoidable impacts remaining after mitigation include the creation of unvegetated disturbed areas associated with new access and spur roads, tower sites, and bus work. The exposed soils are susceptible to erosion, and thus, the transport of sediment to streams could potentially occur. Also, roads are more susceptible to catastrophic events such as land slides and mass wasting events. Such actions would be unlikely to occur because roads would be designed and sited appropriately (i.e. not on unstable soils, steep hillslopes, or in drainages). Also, based on the location of these areas there would be a small likelihood of affecting fish or fish habitat.

Environmental Consequences—No Action Alternative

The No Action Alternative would result in no changes to the existing corridor, and aquatic habitats would not be affected in the project vicinity. Therefore, no impacts to fish or fish habitat would occur as a result of the No Action Alternative.

Wetlands and Groundwater

Affected Environment

The proposed project lies within the Columbia River basin province of eastern Washington and Oregon, in the rainshadow of the Cascade Mountains, one of the driest regions of the Pacific Northwest. Most water features in the project area are ephemeral or intermittent streams and seasonal wetlands because of low annual precipitation and common drought during the summer. Shrub-steppe and grassland vegetation are present on a diverse landscape that includes flat buttes, rolling hills, basalt cliffs, terraces, and barren rock outcroppings interspersed with vegetated wet areas.

Typically, the area receives approximately 8 inches of precipitation annually. Most precipitation falls as light showers or snowfall in the winter (SCS 1972). Winter months are cold with daily temperatures averaging between 34°F and 40°F. Summers are hot and dry with average daily high temperatures ranging between 80°F and 88°F (WRCC 2001). Drought periods during the summer months are not uncommon, with occasional thunderstorms bringing isolated heavy rains.

Wetlands

Wetlands are not common within the dry shrub-steppe desert areas of eastern Oregon and Washington along the Columbia River that make up most of the project corridor. A total of 25 wetlands totaling 45 acres were identified within the project corridor (Figure 3-2).

These wetlands are generally supported by water sources associated with riparian areas, seasonal spring seeps, shallow depressions fed by precipitation, and surface runoff. Wetland sizes range from narrow riparian fringes 5 to 10 feet wide, to large wetland complexes covering 5 to 10 acres. Wetland soils are often formed in gravelly alluvial deposits mantled by windblown sand (SCS 1988, Franklin and Dyrness 1973).

Most wetlands along the project corridor are dominated by grasses, sedges, and rushes. These wetlands often begin at the edge of a creek's Ordinary High Water Mark and extend within the active floodplain of the creek. However, the riparian wetland plant communities often include some deciduous trees and shrubs. Common plant species associated with the riparian wetlands in this area include Russian olive, mountain alder, black cottonwood, small-fruited bulrush, reed canarygrass, common cattail, and sedge (see Appendix C for common and scientific plant names).

Wetland plant community types referred to in this section are based on the U.S. Fish and Wildlife Service wetland classification system (Cowardin et al. 1979) and include palustrine open water, palustrine scrub-shrub, palustrine forested, and palustrine emergent (see Glossary for definitions). The types of wetlands identified within the project corridor are described below.

Near the McNary Substation, there is a large wetland complex associated with the floodplain of the Columbia River. This wetland is composed of palustrine open water, palustrine scrub-shrub, palustrine forested, and palustrine emergent communities and is associated with several large ponds that were built adjacent to the south bank of the Columbia River. Common tree and shrub species found within this wetland area include Pacific willow, Russian olive, and cottonwood. Reed canarygrass dominates the herbaceous layer.

Near corridor miles 48 to 50, there is a large depressional wetland complex associated with alkali saltgrass communities on saline-alkali soils. These wetlands are formed as water runoff collects at the base of nearby slopes while ponding and rapid evaporation leave crusted salt grains covering the soil surface. These wetlands are often fringed by greasewood communities common to saline-alkali upland soils.

Between corridor miles 71 and 75, there are several palustrine emergent wetlands located in depressions among rock outcroppings. These seasonally wet wetlands are formed on shallow soils over basalt. This wetland hydrology is mainly provided by rainwater that flows over the soil surface. However, several seasonal spring seeps also contribute water to these wetlands. The seeps are associated with groundwater discharge areas on hills and at the base of hills, frequently where the topography changes slope. These seeps are often perennially saturated to the soil surface. Many of these seeps are hydrologically isolated from other surface waters, but the more extensive seeps can form long stringer wetlands that connect to perennially flowing surface waters. Common wetland plant species associated with these wetlands include alkali saltgrass, bottlebrush squirreltail, Douglas's sedge, Baltic rush, red fescue, and tall wheatgrass.

Groundwater

Groundwater is generally available in large quantities in the Columbia Plateau Province from the basalt bedrock (see the section on Geology, Soils, and Seismicity). Multiple aquifers occur at varying depths as a result of contacts between the numerous basalt flows underlying the region; together these aquifers are referred to as the Columbia River Basalt Group. Other aquifers occur locally in glacial outburst deposits over basalt and in recent alluvium adjacent to the larger tributaries of the Columbia River. Loess soils, which frequently cover the basalt in the project area, do not yield appreciable quantities of water to wells, but may develop hydric conditions as described in the section on Wetlands above.

Aquifer recharge occurs primarily by precipitation through direct infiltration and seepage from the numerous intermittent streams along the corridor. Some recharge may occur from the spray irrigation of orchards and other agricultural crops using well water, but this is negligible relative to recharge from irrigation canals elsewhere in eastern Washington and eastern Oregon. Groundwater flow in the province is generally to the southwest. Flow rates are generally slow due to low hydraulic gradients, but can be rapid in the highly permeable interflow zones between various basalt formations. Groundwater contributes to the baseflow of 15 perennial and intermittent streams that cross the project alignment, and supports five springs within 1 mile of the alignment west of corridor mile 55.

Groundwater is commonly used for both domestic consumption and irrigation. Groundwater quality is generally good, although hardness and dissolved iron and manganese concentrations can be high in some areas. In some areas of the Columbia River Basalt Group, deeper well boreholes have interconnected the layered aquifers, allowing upper layers to commingle with the lower layers, and providing a potential conduit for contaminant migration to deeper aquifers. It is not known how common this may be along the corridor.

Because of the large size and complexity of aquifers in the Columbia River Basalt Group, no sole source aquifers have been designated in the project area. A sole source aquifer, one that is the principal source of more than 50% of the drinking water supply consumed in the area overlying the aquifer, is provided regulatory protection under the Safe Drinking Water Act of 1974 (EPA 2001).

Environmental Consequences—Proposed Action

Direct and indirect impacts to wetlands and groundwater could occur during construction, operation, and maintenance activities for the proposed 500-kV transmission line and associated structures. The proposed transmission line right-of-way would cross valleys, depressions, stream channels, wetlands, and springs. For the majority of the right-of-way, conductors would span wetlands, and new structures and new access roads would be sited to avoid sensitive water resources.

Impacts During Construction

Wetlands

Of the 45 acres of wetlands located within the project corridor, less than 0.5 acre of wetland would likely be filled to construct the proposed project. Three main wetland complexes contain 73% of the wetlands located within the construction corridor: at the wildlife refuge near McNary Substation, corridor mile 1; the Roosevelt Grade Road from corridor mile 48 to 50; and in the basalt outcroppings east of Harvalum Substation at corridor mile 71 to 75. The other 27% of the wetlands are predominantly riparian wetlands associated with the floodplains of perennial streams. The construction of new access roads in association with the Hanford-John Day Alternatives B and C would potentially fill 0.1 acre of emergent wetlands. The wetlands are associated with a constructed stock pond fed by a well. The construction of an access road through this wetland would destroy emergent vegetation and divert surface flows, potentially affecting hydrological patterns within the greater wetland area.

Vegetation would be hand cleared within wetlands for McNary Substation Alternative B where the line would cross the wildlife refuge. This wetland consists of a narrow, 100-foot band of willow trees, a portion of which would need to be removed if the conductor span is to cross to the east of the existing administration building. Cutting this band of willow trees could permanently change this forested wetland and buffer to an adjacent Sitka willow shrub wetland. With invasive species including indigo bush and reed canarygrass already within this wetland, it is possible that the clearing of forested species would promote the expansion of these invasives as well. The removal of forested vegetation would also decrease evapotranspiration rates, and increase soil and water temperatures due to the lack of shading.

Most wetlands within the construction corridor are dominated by low-growing grass and grass-like vegetation and shrubs which are generally compatible with the vegetation height requirements for conductor clearance, and therefore, would not need to be cut.

Construction of access roads or towers located adjacent to wetlands may require removal of wetland buffer vegetation, the Roosevelt Grade Road at corridor mile 48 to 50 and the basalt outcroppings at corridor mile 71 to 74. Wetland buffer widths for these wetlands extend 75 to 200 feet from the wetland edge. The width of the wetland buffer is based upon the wetland rating as defined in the Klickitat County Critical Areas Ordinance. The quality of vegetation of the wetland buffers in these areas is marginal; the areas are mostly used for grazing, and are dominated by invasive weeds such as cheatgrass. However, the reduction of vegetated buffers adjacent to wetlands would reduce overland flow and increase the likelihood of silts and sediments entering wetland surface waters, thus decreasing water quality. Impacts would be even less if the removal of the vegetation was done by hand such that the roots were left intact. With the roots in place, the soils would be less likely to erode and the plants could resprout, recreating the vegetative buffer.

The wetlands could also be impacted by the construction activities of the towers or access roads adjacent to and within these three wetland complexes. If not mitigated the impacts could include increased sedimentation that would enter surface waters, as well as smother wetland plants. Oils and pollutants from machinery could also enter surface water, potentially effecting fish or wildlife species. The construction of roads and tower pads could also alter overland flow patterns, thereby increasing or decreasing wetland hydroperiod which would change wetland plant communities, as well as water dependent fish and wildlife species.

Groundwater

The potential for impacts on groundwater is minor due to the use of construction techniques that avoid trenching and drilling. Potential groundwater impacts that could occur during construction are identified in Table 3-9.

Most refueling and equipment maintenance would be done at staging areas that would be located at least 100 feet from streams and wetlands, with spill containment and clean up provided. As a result of best management practice implementation, groundwater quality impacts would be minor and limited to the construction window.

Table 3-9: Potential Construction Impacts on Groundwater

Construction Activity	Impact Mechanism	Potential Impact
Refueling, equipment maintenance, location of staging areas	Hazardous material spills and leaks	Local groundwater contamination
Road construction and maintenance, vegetation removal, soil disturbance	Erosion and Sedimentation	Increased groundwater turbidity
Road construction	Excavation of contaminated soils and structures, and abandoned wells	Reductions in groundwater quality; risk to drinking water
Road construction	Interception of subsurface flows	Local modification of hydrology and water quality in wetlands and streams

Erosion in areas of soil disturbance and vegetation removal could result in increased groundwater turbidity. This impact would be greatest where new spur roads and new access roads would be constructed. The potential for impacts would be less likely with the reconditioning of existing roads. Interception of groundwater seeps in road cutbanks could also alter the hydrology or water quality of adjacent wetlands and streams. Use of erosion control measures in all areas where soils are exposed during construction is expected to minimize the transport of sediment to groundwater recharge areas, including intermittent streams. These construction impacts would therefore be minor and temporary in duration.

Contaminated soils and underground structures may exist as remnants of earlier road, pipeline, power line, and agricultural projects along the alignment. Excavation of contaminated soils, primarily during road construction, could mobilize contaminants into a previously uncontaminated groundwater body. In addition, abandoned or orphaned wells could be disturbed, providing a direct pathway for contaminants to flow to an underlying aquifer. These impacts would be minimized with the mitigation measures described later in this section.

Impacts During Operation and Maintenance

Impacts of the operation and maintenance of the proposed line would be due to the use of access roads for tower maintenance and vegetation clearing within the transmission line corridor. This could potentially introduce sediment into wetlands through surface runoff, potentially affecting water quality. If vegetation treatment would be required (i.e. for noxious weed control), appropriate buffers would be used to keep herbicides out of wetlands, springs, or wells.

Operational impacts on groundwater would be limited to chronic conditions that may have developed during construction despite implementation of preventive and corrective best management practices. New, maintained roads could continue to interrupt groundwater flow paths, and incidental aquifer contamination could persist. The risk of these impacts is considered minimal or negligible.

Environmental Consequences—Short-Line Routing Alternatives

Table 3-10 summarizes the water resources and wetland impacts associated with the short-line routing alternatives.

Table 3-10: Impacts of Short-Line Routing Alternatives: Wetlands and Groundwater

Alternative	Impacts
McNary Substation Alternatives	
A. Relocate administration building presently located on north side of substation adjacent to Wildlife Natural Area	Approximately 0.1 acre of willow and Russian olive trees within a palustrine forested wetland would be removed to allow for conductor. These impacts to wetlands would permanently change the wetland vegetation community from forested to shrub dominant.
B. Cross Wildlife Natural Area; circumvent administration building on north side	Approximately 0.2 acre of willows within a palustrine forested wetland would be removed to allow conductor clearance. This impact to wetlands would permanently change the wetland vegetation community from forested to shrub dominant.
C. Place line in bus work at ground level on north side of administration building, inside Wildlife Natural Area	Sedimentation impacts to wetlands and water resources are expected to be minimal or negligible with implementation of appropriate mitigation. This impact to wetlands would permanently change the wetland vegetation community from forested to shrub dominant.
Hanford-John Day Junction Alternatives	
A. Move existing Hanford-John Day line north 200 feet to make room for new line on north side of corridor	No wetland resources would be spanned by this alternative. Impacts to adjacent wetlands and water resources are expected to be negligible with implementation of appropriate mitigation measures.
B. Place new line on south side of corridor (occupied by roads and towers)	An emergent wetland would be spanned by the transmission line corridor. Construction of access roads would potentially fill approximately 0.1 acre of wetland. If new access roads are not necessary, impacts to wetlands and water resources are expected to be negligible with implementation of appropriate mitigation measures.
C. Place new line on south side of highway	Same as Alternative B.

Alternative	Impacts
Corridor Mile 32 Alternatives	
A. Keep existing and new lines on tribal land	No wetland resources are adjacent to this alternative. Therefore, impacts to wetlands and water resources are expected to be negligible with implementation of appropriate mitigation measures.
B. Relocate existing and new lines away from tribal land	Same as Alternative A.
Corridor Mile 35 Alternatives	
A. Keep existing and new lines on tribal land	No wetland resources are adjacent to this alternative. Therefore, impacts to wetlands and water resources are expected to be negligible with implementation of appropriate mitigation measures.
B. Relocate existing and new lines away from tribal land	Same as Alternative A.

Mitigation

The following mitigation measures would minimize wetland and groundwater impacts.

- Locate structures, new roads, and staging areas so as to avoid waters of the U.S., including wetlands.
- Avoid construction within designated Klickitat and Benton Counties, Washington wetland and stream buffers to protect potential groundwater recharge areas (Klickitat County Critical Areas Ordinance; Benton County Code Title 15).
- Avoid mechanized land clearing within wetlands and riparian areas to avoid soil compaction from heavy machinery, destruction of live plants, and potential alteration of surface water patterns to reduce groundwater turbidity risk.
- Anticipate and avoid, as required, contaminated soil and underground tanks during construction activities near pipelines and agricultural and other historic projects. Anticipate and avoid orphaned wells, as required, particularly near the communities of Plymouth, Paterson, Roosevelt, Sundale, and Towal.
- Use erosion control measures (see mitigations listed in the Soils, Geology, and Seismicity section) when conducting any earth disturbance within 100 feet of wetlands, or within the resource buffer as established by Benton and Klickitat Counties.
- Avoiding refueling and/or mixing hazardous materials where accidental spills could enter surface or groundwater.
- Using existing road systems, where possible, to access tower locations and for the clearing of the transmission line alignment.

- Avoid construction on steep, unstable slopes if possible.
- Place tower footings on upland basalt outcroppings and limit access road construction in wetlands complex and buffers between corridor miles 70 and 74, if possible.
- Place tower footings and access roads within uplands within the wetland complex between corridor miles 48 and 50.
- Avoid placing towers and roads that would necessitate the cutting of the palustrine-forested wetland near the McNary Substation (Alternative B).

Unavoidable Impacts Remaining after Mitigation

A small amount of forested wetland vegetation would be removed with the short-line McNary Substation Alternatives A, B, and C. This would not result in a loss of wetland area; however, it would permanently change the wetland vegetation community from forested to shrub dominant.

In locations where new access roads and towers are sited, impervious surface area will increase and surface hydrology patterns may be altered. This could slightly increase the volume and affect the timing of surface runoff, which in turn could cause minor increases in erosion and sedimentation in adjacent wetlands and streams. Minor amounts of fuel and oils could spill and potentially enter surface waters from the operation of maintenance vehicles within the transmission line corridor.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, the existing transmission corridor would remain as at present. Potential impacts to wetlands and groundwater resources along the corridor associated with the proposed project would not occur.

Vegetation

Affected Environment

The vegetation in this area is influenced by the topography, climate, and soils of the region. The proposed transmission line project lies within the Columbia River basin province of eastern Washington and Oregon (Franklin and Dyrness 1973). This is an area within the rainshadow east of the Cascade Mountains, in a portion of eastern Washington and Oregon that is too arid to support natural upland forest (Daubenmire 1970).

The area is characterized by flat buttes, rolling hills, basalt cliffs, terraces, and scablands including rock outcroppings interspersed with wet areas. Portions of the project corridor cross irrigated agricultural cropland, particularly in the eastern half of the corridor. Cattle rangeland is prevalent along the western half of the corridor.

Shrub-steppe communities dominated by bunchgrasses and sagebrushes dominate the dry, rocky areas of central and eastern Washington (Franklin and Dyrness 1973). Within the corridor, shrub-steppe and mixed grasslands are the most common plant communities, comprising approximately 61% of the corridor.

Other vegetation communities present include agricultural areas, scabland/lithosol (shallow soils) communities, riparian corridors, and ruderal communities in developed areas. Past disturbance of the corridor has influenced the types of plant communities present. Throughout the study area, the invasive species cheatgrass is at least codominant in most of the plant communities.

The distribution of plant communities along the corridor is shown in Figure 3-3. The seven major plant communities identified along the corridor are described below.

Grazed Shrub-Steppe

Grazed shrub-steppe communities are the most prevalent vegetation in the project corridor, dominating the central and western portions of the corridor (approximately 38%) (Figure 3-3).

These communities are dominated by shrubs and grasses and have been disturbed by human activities, especially grazing of livestock, and include big sagebrush, gray rabbitbrush, and a mixture of grasses including bluebunch wheatgrass, needle and thread grass, and Idaho fescue. Cheatgrass, a nonnative, invasive grass, also dominates the community and is, in fact, the most prevalent grass found. Total grass coverage ranges from 80% to 60%. Shrub coverage ranges from 10% to 35%. A number of forbs are occasionally present in these communities, including western yarrow, silky lupine, fiddle-necks, rosy pussytoes, hairy milkvetch, and several buckwheat and fleabane species. Forb coverage is generally under 5%. Refer to Appendix C for a list of plant scientific names.

Shrub-Dominated Shrub-Steppe

Portions of the shrub-steppe communities along the project corridor tend to have a higher coverage of shrub species, apparently because they have been less disturbed. These portions are located between structures 3/2 and 4/1 and between structure 20/4 and Glade Creek (Figure 3-3). The largest examples of shrub-dominated shrub-steppe communities are found from I-82 west to Plymouth Road, and from structure 19/1 west to Glade Creek. Shrub-dominated communities cover approximately 3% of the corridor.

The shrub-dominated communities are differentiated from grazed shrub-steppe communities by taller, denser shrub coverage, higher species diversity, greater coverage of intact cryptogamic crusts, and a lower percentage of invasive species. Therefore, these areas represent a more native shrub-steppe community than the grazed and otherwise disturbed shrub-steppe found elsewhere along the project corridor.

The shrub-dominated communities have the same vegetation as the shrub-steppe described above, but there is more big sagebrush and gray rabbitbrush, and in addition the communities have bitterbrush, green rabbitbrush, and grasses, bottlebrush squirreltail, and Sandberg's bluegrass. Cheatgrass is present, but reduced in coverage relative to the grazed shrub-steppe areas. Forb coverage is similar to the grazed shrub-step, with more species present, including prickly-pear cactus and Carey's balsamroot.

Grasslands

Grassland communities are present throughout the project corridor but most prevalent at each end of the corridor, and in the west-central portion of the corridor. Overall, grassland communities comprise approximately 20% of the project corridor.

Mixed grasses, both native and nonnative, dominate the grassland communities. These communities are similar to shrub-steppe, with a greatly reduced coverage of shrub species. Shrub species in grasslands comprise less than 10% of the cover and in many areas are not present at all.

Species dominance within a given area of grassland varies over the length of the project corridor. The dominant species tend to be one or more of the following: bluebunch wheatgrass, Idaho fescue, foxtail barley, needle and thread grass, bottlebrush squirreltail, and Sandberg's bluegrass. Invasive nonnative species—including cheatgrass, bulbous bluegrass, and medusa-head wild rye—are also present in most of the grassland communities along the project corridor, and are often among the dominant species.

Agriculture

Agriculture is dominant in the eastern half of the project corridor and in small pockets to the west, accounting for approximately 31% of the agricultural vegetation along the corridor. Several types of agricultural vegetation occur, including irrigated grain fields, row crops, cottonwood plantations, and fruit orchards. Crop irrigation circles in wheat and other grain production along with row crops are the most common of these agricultural activities, and are most prevalent between structures 14/5 and 32/4. Cottonwood plantations in several stages of production are found immediately west of Glade Creek (structure 21/5). Apple and other small-tree fruit orchards are located on either side of Chapman Creek (structures 54/1 to 54/4).

Scablands/Lithosol Communities

Much of the project corridor (particularly the western half) has shallow soils (lithosols). Numerous rock outcrops and exposed basalt surfaces are located along the route. However, a portion of the corridor (approximately 5 miles between structures 70/1 and 74/1) is noticeably more exposed, with soils shallower than those along most of the remainder of the corridor. In this area, referred to as scabland, a mosaic of small but distinct grassland, wetland, and shrub-steppe communities is present. Many of these communities include the same plant species found in the grassland and shrub-steppe communities, but the grassland communities tend to dominate. Typical grasses include foxtail barley, bluebunch wheatgrass, Sandberg's bluegrass, and squirreltail bottlebrush. Cheatgrass (an invasive nonnative) is the dominant grass present. Patches of shrub-steppe dominated by both gray and green rabbitbrush are found where the soils are deeper. The small depressional emergent wetlands present are dominated by soft rush and bulrush species.

Riparian Areas

Most of the larger streams crossed by the project corridor have narrow and sloping riparian areas dominated by shrubs and small trees. Shrub species found in these riparian areas include smooth sumac, red elder, nootka rose, and pearhip rose. Tree species include red alder, cottonwood, willows, and occasionally black locust.

At Alder Creek (structure 33/3), the entire riparian zone is dominated by indigo bush, a Benton County Class B-Designate noxious weed. Indigo bush is minor or absent in the riparian zones of the other drainages crossing the corridor.

Small groves of up to 20 trees are scattered near the west end of the project corridor. Trees in these small wooded areas consist of black locust and tree-of-heaven.

Special-Status Plants

Threatened, Endangered, and Other Sensitive Species

The U.S. Fish and Wildlife Service has identified one federally listed threatened species (Utes ladies' tresses) and one candidate plant species (northern wormwood) as having potential habitat present within the project corridor. Neither species was found during field surveys conducted in July 2001.

Washington State Sensitive Species

The Washington Natural Heritage Program (WNHP) has identified potential habitat in or adjacent to the project corridor for two state sensitive plant species (Pauper's milkvetch and Snake River cryptantha) between structures 47/1 and 48/3. Both species occur in dry, open, flat, or sloping areas in stable or stony soils, where the overall cover of vegetation is relatively low. Pauper's milkvetch is also associated with big sagebrush-bluebunch wheatgrass shrub-steppe communities.

Neither plant species was found during field surveys conducted in July 2001. However, the field surveys verified that favorable habitat for both species is present in the WNHP-identified areas, between structures 47/1 and 48/2.

Potential habitat for a third state sensitive species, Piper's daisy, has also been identified by WNHP approximately 2 miles north of the project corridor, at structures 33/4 to 35/3. The field surveys of the project corridor found no Piper's daisy individuals or populations.

Noxious Weed Species

Noxious Weeds

Staff from the Klickitat County Weed Board conducted surveys along the project corridor for noxious weeds between July 31 and August 28, 2001. The surveyors noted occurrences of noxious weeds along the route, and recorded the number of the nearest tower to the noxious weeds population.

The results of the noxious weed survey indicate that diffuse knapweed (*Centaurea diffusa*) is by far the most prevalent noxious weeds occurring on the corridor. Diffuse knapweed populations occur in 55 of the corridor miles (70%) on the route. In 48 of these corridor miles, diffuse knapweed was found near at least three of the five or six towers typically located in a corridor mile. In the remaining 24 corridor miles, occurrences of diffuse knapweed are more isolated. Diffuse knapweed is most prevalent near the east end of the corridor, between corridor miles 1 and 20. Another concentration of diffuse knapweed was found between corridor miles 42 and 50.

Ten additional noxious weeds were located during the survey. None was found as frequently or as widespread as diffuse knapweed. Of the ten additional species found, yellow starthistle (*Centaurea solstitialis*) was the most prevalent. Yellow starthistle populations were found in portions of 15 of the corridor miles (19%). In six of these corridor miles, yellow starthistle populations were found near at least three of the towers within the corridor mile. Occurrences in the other nine corridor miles were isolated. Yellow starthistle is most prevalent between corridor miles 54 and 58.

Puncture vine (*Tribulus terrestris*) and kochia (*Kochia scoparia*) populations were found in 12 of the corridor miles (15%). In approximately half of these occurrences for each species, populations were found consistently through most of the corridor mile. The other corridor miles had more isolated occurrences.

White top (*Cardaria draba*) was found near most towers between corridor miles 49 and 51. An additional isolated occurrence of white top was noted near tower 69/3. Spotted knapweed (*Centaurea maculosa*), perennial pepperweed (*Lepidium latifolium*), rush skeletonweed (*Chondrilla juncea*), Canada thistle (*Cirsium arvense*), Indigo bush

(*Amorpha fruticosa*), and Russian knapweed (*Centaurea repens*) were also located at isolated points along the route.

No noxious weeds were found between corridor miles 34 through 42, 64 through 66, and 70 through 71.

A summary of locations of noxious weeds within McNary-Ross transmission line corridor mile is presented in Table 3-11.

Table 3-11: Locations of Noxious Weed Species Along the Project Corridor

Species Name	Common Name	McNary-Ross Corridor Miles	
		Major Occurrences[1]	Isolated Occurrences[2]
Centaurea diffusa	Diffuse knapweed	1-20; 27; 29; 37; 42-50; 53; 62-63; 67; 71-74;	31; 38; 39; 51; 55; 58; 60
Centaurea solstitialis	Yellow starthistle	54-58; 69	2; 51-53; 60; 71; 72-74;
Tribulus terrestris	Puncture vine	6; 10; 24-26	8; 9; 30-33; 54
Kochia scoparia	Kochia	27; 48-50; 68; 74	14; 16-18; 22; 26
Centaurea maculosa	Spotted knapweed	none	17-20
Lepidium latifolium	Perennial pepperweed	none	1; 11; 21; 45; 46; 48; 53; 71
Chondrilla juncea	Rush skeletonweed	69	4; 13; 27; 43; 58; 62;
Cirsium arvense	Canada thistle	none	21; 22; 24; 27; 28; 73; 74
Cardaria draba	White top	49-51	69
Amorpha fruticosa	Indigo bush	none	33
Centaurea repens	Russian knapweed	53	27

[1] Major occurrences are corridor miles with populations found near at least three of five towers within that corridor mile.
[2] Isolated occurrences are corridor miles with populations found near one or two of five towers within that corridor mile.

Environmental Consequences—Proposed Action

Summary of Project Impacts

The proposed transmission line expansion would result in both permanent and temporary impacts to vegetation within the project corridor. Permanent impacts would total approximately 68 acres. Permanent impacts are those actions that result in the removal and loss of vegetation through construction and operation and maintenance of new facilities, and that do not allow for reestablishment of the preconstruction cover type. There are 3 sources of permanent impacts: operation of new towers, new access road operation and maintenance, and substation expansion. The permanent impacts to each vegetative cover type resulting from each of these actions are summarized in Table 3-12. Criteria used to determine permanent impact acreages are described later in this section.

Temporary impacts would total 166 to 181 acres, depending upon the number and location of conductor tensioning sites. Temporary impacts are those actions that result in disturbance to vegetation during construction of the facilities, but do not result in permanent removal of vegetation, or preclude reestablishment of the preconstruction cover type.

Table 3-12: Permanent Impacts to Vegetation (acres)

Vegetation Cover Type	Total Acres in Project Area	Percent Cover in Project Area	Permanent Impacts from Tower Construction	Permanent Impacts from Road Operation & Maintenance	Substation Impacts	Total Permanent Impacts
Agricultural	1,409	31	5	12	0	17
Grassland	900	20	4	8	2	14
Grazed Shrub-Steppe	1,700	38	7	23	0	30
Riparian	38	1	0	0	0	0
Scabland/Lithosol Communities	294	7	1	3	0	4
Shrub-dominated Shrub-Steppe	132	3	1	2	0	3
Total	4,473	100	18	48	2	68

There are three sources of temporary impacts: work areas around tower sites, new access road construction, and conductor tensioning sites. The temporary impacts to each vegetative cover type resulting from each of these actions are summarized in Table 3-13. Criteria used to determine temporary impact acreages are described later in this section.

Impacts During Construction

Impacts during construction would potentially be caused by placement of towers, expansion of the McNary Substation, and construction of new access roads and conductor tensioning sites. In each of these activities, potential impacts to vegetation include removal or trampling and soil compaction from crew activity and construction equipment. These impacts would be most pronounced on native plant communities that are more susceptible to the introduction of nonnative weedy species (noxious weed species) that can replace native grasses, forbs and/or shrubs.

Table 3-13: Temporary Impacts to Vegetation (acres)

Vegetation Cover Type	Total Acres in Project Area	Percent Cover in Project Area	Temporary Impacts from Tower Construction	Temporary Impacts from Road Construction[1]	Conductor Tensioning Site Impacts[2]	Total Temporary Impacts
Agricultural	1,409	31	28	12	7-15	47-55
Grassland	900	20	19	8	5-6	32-33
Grazed Shrub-Steppe	1,700	38	36	23	11-16	70-75
Riparian	38	1	0	0	0	0
Scabland/Lithosol Communities	294	7	7	3	2	12
Shrub-dominated Shrub-Steppe	132	3	3	2	0-1	5-6
Total	4,473	100	93	48	26-39	166-181

1 Temporary road impacts include new spur roads and a 3-mile segment between corridor miles 39 and 41. Temporary roadway impacts are based on a 50-foot construction corridor. The central 16 feet of the temporary roadway corridor would become a permanent impact.

2 The range given for conductor tensioning site impacts is based on 3- and 2-mile intervals, respectively.

Construction of New Access Roads

The construction of a new 3-mile-long access road, and 270 (250-foot-long) spur roads would result in 48 acres of temporary impacts to vegetation communities on the proposed route. The permanent impacts are discussed in the following section on Impacts During Operations and Maintenance. The various vegetation communities temporarily impacted by construction of new access roads are presented in Table 3-13.

Of the area temporarily impacted, approximately half is in the grazed shrub-steppe vegetative cover type. Temporary disturbance from new access road construction is not likely to noticeably alter the species composition of this cover type, because it is already dominated by those invasive species favored by disturbance.

Grassland, scabland/lithosol, and shrub-dominated shrub-steppe communities would have somewhat lower acreages of temporary impacts from new access road construction. These cover types would recover more slowly from the temporary disturbance and would likely see increases in percent cover of invasive and/or disturbance-favored species such as cheatgrass. The recovery of agricultural areas from the temporary disturbance from new access road construction would depend on the timing of replanting of the areas, and on local crop management practices such as hydroseeding of exposed soils.

Regrading of Existing Roads

In some places, the existing access roads would be graded. In places where the soil is unstable, rock would be laid on the road. The roads are largely devoid of vegetation and are dominated by cheatgrass in those places where vegetation grows between the road tracks. Placement of rock on the roads would result in up to 78 acres of permanent disturbance. This activity would be restricted to areas that have been previously disturbed, and that do not support vegetation communities. As a result, the impact would not result in additional disturbed area or contribute to further loss of vegetation communities.

Conductor Tensioning Sites

Conductor tensioning sites would be placed at approximately 2- to 3-mile intervals. Each site would result in a 1-acre temporary impact to existing vegetation due to heavy equipment driving over the area. The ranges of temporary impact acreages are in Table 3-13. Temporary impacts associated with conductor tensioning sites are located primarily in the grazed shrub-steppe, agricultural, and grassland cover types. As with new access road construction, temporary disturbance from conductor tensioning is not likely to noticeably alter the species composition of the grazed shrub-steppe cover type, because it is already dominated by those invasive species favored by disturbance. Similarly, recovery of agricultural areas will follow local management practices. Grassland, shrub-dominated shrub-steppe, and scabland/lithosol cover types would likely see an increase in disturbance-favored species. Conductor tensioning sites would not impact riparian cover type areas.

Impacts to Trees

The proposed transmission line corridor has few areas with dense concentrations of trees. One notable exception is the cottonwood farm west of Glade Creek. This area is included under the agricultural cover type because it is an irrigated, managed site dedicated to production of a marketable product that is grown on a regular, repeated interval. The cottonwoods reach heights of up to 60 feet at their harvest age. This height exceeds allowable tree heights for safe operation of the transmission line. As a result, cottonwood production will be discontinued under the proposed transmission line. This will result in the permanent loss of 50 acres of trees along the project corridor.

Trees in other portions of the project area are restricted to small clumps and wind breaks scattered in a few locations along the route. Total removal of trees from these sites would be less than 1 acre. Complete removal of trees from these scattered sites would have a minimal impact on the remaining vegetation communities. The trees present in these isolated stands are too few in number and too sparse in distribution to support communities of shade-dependent shrub and herb species. Instead, grasses typical of the majority of the route grow near and under the trees. These grass species would not be impacted by the removal of trees, and would likely expand their coverage. On this route, removal of trees would probably favor increased dominance by cheatgrass.

Removal of trees from wind breaks would affect any species (e.g., orchard trees) being protected from the wind.

Impacts During Operation and Maintenance

Impacts to vegetation communities during operation and maintenance of the proposed transmission line would result from operation and maintenance of the existing and new access roads, the transmission line towers, and the expanded substation. These are permanent impacts. Impacts to specific vegetative cover types resulting from operation and maintenance are summarized in Table 3-12.

Operations and Maintenance of New Access Roads

Operations and maintenance of new access roads would result in the permanent alteration of 48 acres of existing vegetation communities in the proposed roadbeds. This figure is based on an assumption of 270 new access roads, each about 250 feet long, with a 25-foot width. In areas where cut or fill activities are required to build or support the roadbed, or at corners in roads, the permanent impact width would be wider.

Impacts to local vegetative cover types during operation and maintenance of the access roads include continued disturbance and compaction of soils and the potential for spreading noxious weed species. An additional potential impact to local vegetation would be the risk of fire from vehicles driving along the access roads, particularly during dry periods.

A noxious weed survey has been conducted along the proposed corridor. The results of the survey will be used to determine where noxious weed control measures along the access roads are most important to control those species and contain their spread.

The risk of fire caused by vehicles would be minimized through the practice of standard precautions in high-risk areas (see the Mitigation portion of this section).

If fire were to occur within the right-of-way or adjacent areas, it would have a limited, temporary effect on most of the vegetation communities present. Vegetation removed by fire would regenerate naturally in the grassland and shrub-steppe communities. Species composition in these regenerated communities would be more or less the same, with grass species returning to maturity within 1 to 2 years, and shrub species maturing within 5 years.

In economic terms, fire in agricultural vegetation communities could result in financial losses to the landowner. Ecologically, fire damage in these communities would be limited to the loss of vegetation for one season, with replanting likely in the following year.

Fire damage in lithosol vegetation communities could result in expansion of non-vegetated, bare rock areas. The shallow soils over bedrock in these communities are stabilized by vegetation. Loss of the vegetation could lead to the loss of soils in some areas.

Fire in the cottonweed plantation would result in losses of trees. Replacement of mature, harvestable trees would take 7 to 10 years. Fire loss of trees in hedgerows and isolated patches elsewhere on the alignment would take longer to replace. Tree species identified on the right-of-way would take approximately 25 years to regenerate to mature individuals.

Impact acreage from access road operation would be highest in the grazed shrub-steppe cover type. Ten acres of this cover type would be converted to roadbed. Many of the existing two-track roadbeds in this cover type, and throughout the route, are dominated by low cheatgrass. As such they have a close affinity to the surrounding degraded shrub-steppe, even while converted to access roads. Impact acreage within higher quality vegetation communities (such as shrub-dominated shrub-steppe) are lower, but would result in the creation of new edge communities and a permanent avenue of invasion for nonnative and/or disturbance-favored species.

Tower Operation and Maintenance

The proposed line would require the placement of 360 steel lattice towers. Each tower would take up approximately 0.05 acre. Of the towers to be placed, approximately 144 would be placed in grazed shrub-steppe vegetative cover, 118 would be placed in agricultural cover, 75 would be in grasslands, 26 would be in scabland/lithosol communities, and 11 would be in shrub-dominated shrub-steppe cover. No towers would be placed in riparian communities. Acreages permanently impacted by tower placement are presented in Table 3-12.

Tower operation is regarded as a permanent impact to vegetation communities, because it requires the removal and displacement of existing vegetation and results in the compaction of soils. However, the grassland and grazed shrub-steppe communities would likely return to and recover at least some of the area beneath the towers within 1 to 5 years of construction. Shrub-dominated shrub-steppe and scabland/lithosol communities may also return to portions of the areas under towers, but over a longer time period, and with more intensive management. Based on conditions observed at existing towers, it is likely that a combination of native and nonnative species would establish around the towers. Nonnatives commonly observed around towers include cheatgrass, medusa-head wild rye, and bulbous bluegrass. Native species seen around existing towers include bluebunch wheatgrass, big sagebrush, and gray rabbitbrush. Agricultural cover types would not return to the areas under new towers.

Expansion of Substation

The proposed expansion of the McNary Substation would result in the loss of approximately 2 acres of mixed native/nonnative grassland communities. The proposed installation of additional equipment at the John Day Substation would be completed within the existing substation yard, and would not result in additional impacts to existing vegetation.

General Effects on Native Plant Communities

Addition of a new transmission line adjacent to the existing lines would widen the overall corridor. Widening of the transmission line corridors occasionally requires clearing of a broad swath of upright woody vegetation. This creates long stretches of edge conditions, which favor colonization by invasive species. However, most of the existing McNary-John Day corridor is located in open, grassy or shrub-steppe areas with varying degrees of prior disturbance. As a result, the creation of additional edge conditions will be restricted to tower areas and new access roads. Tree removal would be restricted to a few isolated clumps of trees and would not involve removal of trees across the entire corridor width.

The project is not likely to adversely affect any federal or state-listed sensitive plant species, since none are likely to occur within the project area. Construction would temporarily disturb soils, creating opportunities for colonization by noxious weeds or other undesirable plants.

Plant species that would be affected by the project would include those listed in the Affected Environment section and in Appendix C. Grazing and agriculture have previously disturbed most of the proposed transmission line route. The invasive annual cheatgrass is the dominant species along much of the route. However, there are portions of the route that are dominated by native grasses and shrubs. These higher quality shrub-steppe communities are more vulnerable to the types of construction, operation, and maintenance activities required for the project.

The proposed project would result in the temporary removal of 34 to 37 acres of native plants and approximately 6 acres of cryptogamic crusts. Permanent project impacts would require the removal of approximately 16 acres of native plant species, and 2.5 acres of cryptogamic crusts.

Both native plant species and cryptogamic crust estimated coverages are highest in the shrub-dominated shrub-steppe communities. This vegetative cover type has approximately 65% cover of native plant species, and 20% cover of cryptogamic crusts. The areas of permanent and temporary impacts in this vegetative cover type are relatively small, and losses of native plant species and cryptogamic crusts are, therefore, small.

The estimated temporary and permanent removal of native plants and cryptogamic crusts within each vegetation cover type is summarized in Tables 3-14 and 3-15.

Table 3-14: Estimated Temporary Impacts to Native Plants and Cryptogamic Crusts by Cover Type

Vegetation Cover Type	Total Acres in Project Area	Total Temporary Impacts (acres)	Estimated Percent Cover of Native Plants in Cover Type	Estimated Temporary Impacts to Native Plants in Cover Type (acres)	Estimated Percent Cover of Cryptogamic Crusts in Cover Type	Estimated Temporary Impacts to Cryptogamic Crusts in Cover Type (acres)
Agricultural	1,409	47-55	0	0	0	0
Grassland	900	32-33	25	8	0	0
Grazed Shrub-Steppe	1,700	70-75	30	21-23	5	4
Riparian	38	0	20	0	0	0
Scabland/Lithosol Communities	294	12	15	2	10	1
Shrub-dominated Shrub-Steppe	132	5-6	65	3-4	20	1.0-1.2
Total	4,473	166-181	--	34-37	--	6.0-6.2

Table 3-15: Estimated Permanent Impacts to Native Plants and Cryptogamic Crusts by Cover Type

Vegetation Cover Type	Total Acres in Project Area	Total Permanent Impacts (acres)	Estimated Percent Cover of Native Plants in Cover Type	Estimated Permanent Impacts to Native Plants in Cover Type (acres)	Estimated Percent Cover of Cryptogamic Crusts in Cover Type	Estimated Permanent Impacts to Cryptogamic Crusts in Cover Type (acres)
Agricultural	1,409	17	0	0	0	0
Grassland	900	14	25	4	0	0
Grazed Shrub-Steppe	1,700	30	30	9	5	1.5
Riparian	38	0	20	0	0	0
Scabland/Lithosol Communities	294	4	15	1	10	0.4
Shrub-dominated Shrub-Steppe	132	3	65	2	20	0.6
Total	4,473	68	-	16	-	2.5

In addition to the loss of native plants that grow in these communities, the cryptogamic crusts often found on the surface of shrub-steppe community soils would be disturbed.

Loss of the cryptogamic crusts could result in an increase in soil erosion and decreased soil nutrient and water retention. Reestablishment of the cryptogamic crust component in higher quality shrub-steppe is a long-term process, and can take from 7 to 100 years, depending on the complexity of the species association within a given area of cryptogamic crust (PALS 1997).

Removal or disturbance of higher quality shrub-steppe communities along the project corridor would be a notable impact for the following reasons.

- Disturbance of these areas would provide an opportunity for invasion by cheatgrass and other nonnative species. Adjacent grasslands provide a seed source for cheatgrass invasion. Moreover, cheatgrass has a competitive advantage over native bunchgrasses, which are an important component of shrub-steppe associations in the project area.
- Restoration of native shrub-steppe communities would require long-term intensive maintenance to control invasive species.
- Restoring the native shrub and grass component of the higher quality shrub-steppe would be only one component of recovering these communities. Restoration of the cryptogamic crust component and support for the animals that utilize shrub-steppe communities would be long-term processes tied to reestablishment of the shrub-steppe.

Environmental Consequences—Short-Line Routing Alternatives

Table 3-16 summarizes the vegetation impacts associated with the short-line routing alternatives.

Table 3-16: Impacts of Short-Line Routing Alternatives: Vegetation

Alternative	Impacts
McNary Substation Alternatives	
A. Relocate administration building presently located on north side of substation adjacent to Wildlife Natural Area	Approximately 2 acres of permanent impact to grassland communities for the new location of building.
B. Cross Wildlife Natural Area; circumvent administration building on north side	Cottonwood trees and some vegetation would be removed for tower sites and conductor clearance. These cottonwoods are somewhat unique given the dry conditions that prevail over most of the route. The are supported by a local seep. Since the seep will not be altered, similar moisture-dependent woody species will likely regenerate in the areas where cottonwoods are cut.

Alternative	Impacts
C. Place line in bus work at ground level on north side of administration building, inside Wildlife Natural Area	Approximately 0.7 acre of permanent impact to grassland communities for construction, operation and maintenance of 1,600 feet of bus work.
Hanford-John Day Junction Alternatives	
A. Move existing Hanford-John Day line north 200 feet to make room for new line on north side of corridor	Less than 1 acre of temporary construction impacts for six relocated towers, 1.2 acres of temporary impacts from new access road construction, and 0.6 acre of permanent impact from new access road operation and maintenance.
B. Place new line on south side of corridor (occupied by roads and towers)	0.5 acre of temporary construction impacts for up to two additional towers; 0.1 acre of permanent impacts for two additional towers ; 3.1 acres of impacts resulting from construction and operation and maintenance of new access roads; removal of up to 12 trees-of-heaven (*Ailanthus altissima*).
C. Place new line on south side of highway	0.5 acre of temporary construction impacts for up to two additional towers; 0.1 acre of permanent impacts for two additional towers ; 6.2 acres of impacts resulting from construction and operation and maintenance of new access roads; removal of up to 12 trees-of-heaven (*Ailanthus altissima*)
Corridor Mile 32 Alternatives	
A. Keep existing and new lines on tribal land	0.75 acre of temporary construction impacts for three new towers; 0.15 acre of permanent operation and maintenance impacts for three new towers; 0.42 acre of impacts resulting from construction, operation and maintenance of new access roads to three new towers. All impacts would occur in agricultural land.
B. Relocate existing and new lines away from tribal land	2.25 acres of temporary construction impacts for nine new towers; 0.5 acre of permanent operation and maintenance impacts for nine new towers; 1.26 acres of impacts resulting from construction, operation and maintenance of new access roads to nine new towers. All impacts would occur in agricultural land.
Corridor Mile 35 Alternatives	
A. Keep existing and new lines on tribal land	1.0 acre of temporary construction impacts for four new towers; 0.2 acre of permanent operation and maintenance impacts for four new towers; 0.57 acre of impacts resulting from construction, operation and maintenance of new access roads to four new towers. All impacts would occur in grazed shrub-steppe.
B. Relocate existing and new lines away from tribal land	2.0 acres of temporary construction impacts for eight new towers; 0.4 acre of permanent operation and maintenance impacts for eight new towers; 1.14 acres of impacts resulting from construction, operation and maintenance of new access roads to eight new towers. All impacts would occur in grazed shrub-steppe.

Mitigation

The following measures would help minimize potential impacts to vegetation along the proposed transmission line corridor.

- Locate the proposed transmission line adjacent to the existing corridor to minimize additional clearing.
- Utilize the existing access road system to the extent possible to reduce the need for new access roads.
- Keep vegetation clearing to the minimum required to maintain safety and operational standards.
- Avoid construction activities or permanent tower or access road siting in native shrub-dominated shrub-steppe communities, if possible.
- Reseed areas temporarily disturbed in higher quality shrub-steppe with native grasses and forbs (if recommended by local county) and salvage topsoil and bunchgrass plant material. Reseeding should occur at the appropriate planting season. Reseed all disturbed areas with seeds recommended by the local county.
- Equip all vehicles with basic fire-fighting equipment including extinguishers, shovels, and other equipment deemed appropriate for fighting grass fires.
- Avoid tree removal to the extent possible.
- Limit construction equipment to tower sites, access roads, and conductor tensioning sites.
- Minimize disturbance to native species to the extent possible during construction to prevent invasion by nonnative species.
- Conduct a pre-construction and a post-construction noxious weed survey to determine if construction contributed to the spread of noxious weed populations.
- Enter into active noxious weed control programs with land owners/mangers or county weed control districts where activities may have caused or aggravated an infestation.
- Wash vehicles that have been in weed-infested areas (removing as much weed seed as possible) before entering areas of no known infestations.
- Use certified weed-free mulching.

Unavoidable Impacts Remaining after Mitigation

Construction of new towers, access roads, and substation structures would disturb small areas of native plant communities and would create conditions favoring displacement of those communities by nonnative plant species. Small segments of native plant communities may be permanently lost as a result of these disturbances. In locations where access roads, towers, and substation structures are built, future colonization and development of those areas by native grassland or shrub-steppe communities would not be likely.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, vegetation in the project area would not be disturbed by the proposed transmission line construction. The 68 acres of permanent vegetation impacts and the 166 to 181 acres of temporary vegetation impacts would not occur. The existing transmission line corridor would remain at its present width, with no additional area that would likely become dominated by invasive species. Continued impacts associated with operation and maintenance of the existing lines would remain.

Wildlife

Affected Environment

This section provides information regarding federally listed species, avian groups, game species, other common wildlife species, and habitat types that are either known to occur or may occur in the project vicinity. A complete list of common and scientific wildlife names is located in Appendix D.

Habitat and Occurrence of Sensitive-Status Species

Sensitive-status species potentially occurring within the corridor and project vicinity are listed in Table 3-17. Sensitive-status species include those that are

- federally listed as threatened or endangered,
- candidates for federal listing,
- considered species of concern by the U.S. Fish and Wildlife Service,
- listed as threatened or endangered by the state of Washington,
- candidates for listing in Washington State,
- Washington State priority species, and
- listed by the state of Oregon as threatened, endangered, or sensitive.

Federally Listed Species

The U.S. Fish and Wildlife Service has identified the bald eagle as the only listed wildlife species known to occur in the project vicinity. A winter foraging and roosting area is located approximately 2,300 feet south of the corridor on an island in the Columbia River near the town of Paterson. During field surveys in February 2001 and October 2001, bald eagles were detected in the vicinity of Rock Creek and near McNary Dam. However, no bald eagle nesting or roosting habitat occurs in the project corridor based on Washington Department of Fish and Wildlife Priority Habitats Species data and results of field surveys.

The U.S. Fish and Wildlife Service has also identified the spotted frog and the Mardon skipper butterfly as candidate wildlife species potentially occurring in the project vicinity. Potential habitat for spotted frogs occurs in wetlands and stream margins along the corridor. Habitat for the Mardon skipper consists of native prairie vegetation such as Idaho fescue and blue violet. No habitat was found within the project corridor for Mardon Skipper.

Sensitive-Status Species

Habitat for 29 different state-listed species occurs within or near the corridor. Habitat for these species varies from grazed and nongrazed shrub-steppe, agricultural lands, grasslands, cliffs, and riparian areas (see Table 3-17).

Table 3-17: Sensitive Wildlife Species Potentially Occurring in the Project Corridor and Project Vicinity

Common Name	Habitat Type[1]	Sightings or Recordings in Project Vicinity	Washington State Rank	Oregon State Rank	Federal Status
Western burrowing owl	F, B	X	Candidate	State critical	Species of concern
Bald eagle	F	X	Threatened	Threatened	Threatened
Golden eagle	F, B	X	Candidate	None	None
Ferruginous hawk	F, B	X	Threatened	State critical	Species of concern
Prairie falcon	F, B	X	Monitor	None	None
Merlin	F, B		Candidate	None	None
Northern goshawk	F	X	Candidate	State critical	None
Peregrine falcon	F		Endangered	Endangered	Species of concern
Western meadowlark	F, B		None	State critical	None

Common Name	Habitat Type[1]	Sightings or Recordings in Project Vicinity	Washington State Rank	Oregon State Rank	Federal Status
Loggerhead shrike	F, B		Candidate	Sensitive	Species of concern
American white pelican	F	X	Endangered	State vulnerable	None
Harlequin duck	F		Species of concern	Status unclear	Species of concern
Long-billed curlew	F		None	State vulnerable	None
Sandhill crane	F		Endangered	Sensitive	None
Sage thrasher	F, B		Candidate	Sensitive	None
Oregon vesper sparrow	F, B		Candidate	State Critical	Species of concern
Sage sparrow	F, B		Candidate	State critical	None
Streaked horned lark	F, B		Candidate	Sensitive	Species of concern
Black-tailed jackrabbit	F, B	X	Priority	None	None
Pygmy rabbit	F, B		Endangered	State vulnerable	Possible emergency listing
Western pocket gopher	F, B		Candidate	None	Species of concern
Woodhouse's toad	F, B	X	None	Sensitive	None
Northern leopard frog	F, B		Endangered	Sensitive	None
Oregon spotted frog	F, B		Endangered	Sensitive	Candidate
Painted turtle	F, B		None	Sensitive	None
Western rattlesnake	F, B		None	Sensitive	None
Striped whipsnake	F, B		Candidate	None	None
Sagebrush lizard	F, B		None	Sensitive	Species of concern
Mardon skipper	None		Endangered	None	Candidate

[1] F: foraging; B: breeding
[2] Observed during site surveys or recorded on Priority Habitat Species maps in the project vicinity.

Waterfowl

By definition, waterfowl include ducks, geese, and swans (order Anseriformes).

The Columbia River basin is a wintering and breeding area for waterfowl. Waterfowl rest during migration and forage in wetlands, agricultural fields, and other open water bodies. Shallow wetlands are located near streams crossed by the project corridor. Waterfowl also feed in agricultural fields near Paterson (Haines pers. comm.). Open water habitat occurs within the project corridor at the major stream crossings shown on Figure 3-4. However, the most extensive open water habitat occurs in the vicinity of the existing transmission lines at Rock Creek (corridor mile 61) and the Columbia River crossings at McNary and John Day Dams. Waterfowl use these areas for feeding and loafing, but to a lesser degree than at the Umatilla National Wildlife Refuge and agricultural fields.

Much of the shoreline of the Columbia River in the project vicinity has been altered by construction of roads and other developments in the riparian area. However, mainstem dams and other impoundments along the Columbia River have created some wetlands that are attractive to waterfowl, notably those at the Umatilla National Wildlife Refuge located 0.1 to 4 miles south of the project corridor from corridor mile 11 to 28. This refuge is a migratory stopover for geese, mallards, green-winged teal, northern pintail, cinnamon teal, northern shoveler, gadwall, American widgeon, bufflehead, and common golden-eye. The harlequin duck, a federal species of concern, is a rare winter visitor.

Raptors

Raptors (such as hawks, eagles, falcons, and owls) use grasslands, cliffs, and agricultural lands. They forage along the edges of fencerows, over grassy areas, across ruderal areas (lands used for agriculture or grazing), and near open water. Such habitats are relatively common in the project vicinity. Sensitive-status raptors known to occur in the project vicinity include bald eagle, western burrowing owl, golden eagle, goshawk, prairie falcon, osprey, peregrine falcons, and merlin.

The only raptors known to nest within 0.25 mile of the project corridor are red-tail hawk, prairie falcon and the burrowing owl. Red-tail hawks, a state-monitor species in Washington, nest in large trees, transmission line structures, and rocky cliffs (Bechard et al. 1990). Red-tail hawks are known to have nested in transmission line towers at corridor miles 21, 35 and 41.

Prairie falcons, a state-monitor species, nest on rocky outcrops (and transmission towers) and forage on small mammals in shrub-steppe habitats. Prairie falcons were found nesting on cliffs adjacent to the project corridor at corridor miles 55 and 66.

Burrowing owls inhabit the shrub-steppe lands throughout eastern Washington. Factors important to good burrowing owl habitat include openness, short vegetation and burrow availability (Plumpton and Lutz 1993). Burrowing owls are tolerant of humans and occur in agricultural areas, provided natural areas with burrows are available (WDFW 2000). Burrowing owls depend on burrows created by ground-dwelling mammals, such as ground squirrels, badgers and marmots. Burrowing owls nest in the utility line corridor near corridor mile 19.

Golden eagles, a state-monitor species, require large open areas for feeding. Nests are usually located on cliffs or large trees (Anderson and Bruce 1980), but can also be found on transmission lines (Steenhoff 1993). Human disturbance is thought to be a major factor in golden eagle nest failure (Rodrick 1991). A golden eagle nest site, discovered in 1995, was located 0.6 mile from the corridor in the vicinity of the Goldendale aluminum plant. No nesting activity was detected during surveys conducted in February 2001.

Ferruginous hawks, a federal species of concern, are also associated with shrub-steppe in eastern Washington and Oregon. Their distribution and abundance are generally limited by the availability of nest sites and prey abundance (WDFW 1993). Most nest sites occur on cliffs, although artificial structures such as power line towers are also used for nesting and perching (Steenhoff 1993). The ferruginous hawk is known to avoid areas with agricultural machinery, and areas with over 50% of the land in cultivation (Gilmer and Stewart 1983, Bechard et al. 1990). The nearest known ferruginous hawk nest is located approximately 1 mile north of the project corridor at mile 13.

Peregrine falcons nest on cliffs near abundant sources of prey (Ratcliffe 1993). During helicopter surveys conducted for another project, a pair of peregrine falcons were detected in the vicinity of Rock Creek (Jones & Stokes 1995). No nests were detected in the vicinity of Rock Creek (corridor mile 61) during nest surveys conducted in spring 2001 as a part of the McNary-John Day study. During the nonbreeding season, peregrine falcons generally follow the movements of shorebirds and waterfowl and have been reported to move through eastern Washington from late November through January (Ennor 1991). Likely peregrine falcon foraging habitat includes waterfowl areas between the McNary Dam and Paterson, open water near Rock Creek, and the two Columbia River crossings.

A juvenile northern goshawk was detected by Washington Department of Fish and Wildlife biologists in the vicinity of the tree farm just west of Glade Creek near corridor mile 21 (PHS 2001). This tree farm is harvested every 6 to 10 years and would not be expected to provide nesting habitat for northern goshawk (Bevis pers. comm.). The northern goshawk is primarily found in forested areas of Washington, but could migrate through the project vicinity.

Merlin, a state candidate species, are occasional winter visitors at the Umatilla National Wildlife Refuge. Merlins nest in trees near open grasslands, forest edges, cliffs or lakeshores (Bechert and Ball 1983, Trimble 1975) and feed on small mammals, reptiles birds and insects. Scattered groves of trees provide nest structure in grassland habitats devoid of cliffs.

Shorebirds and Other Water Birds

Shorebirds are long-billed, flocking, highly migratory birds of the order Charadriiformes that inhabit shore and some upland habitats. Other water birds include loons (order Gaviiformes), grebes (order Podicipediformes), pelicans (order Pelecaniformes), herons (order Ciconiiformes); cranes, rails, and coots (order Gruiformes). Species of all of these groups of birds occur in the Columbia River basin.

Few wetlands are located within the project corridor, however mainstem dams and other impoundments along the Columbia River in the project vicinity have created wetlands attractive to shorebirds for foraging and breeding. The only sensitive-status shorebird known to occur in the project vicinity is the long-billed curlew. Long-billed curlew nest in grasslands and spend the winter near swamps and river systems. Long-billed curlew were detected at Glade Creek by Washington Department of Fish and Wildlife biologists (PHS 2001) and are common visitors to the Umatilla National Wildlife Refuge (see Chapter 5 References for website address).

American white pelicans, a state-listed bird, are known to forage on islands located about 3 miles south of the project corridor. Pelicans are commonly seen in the wildlife refuge in summer through fall, and were observed during the spring 2001 surveys flying east of Paterson.

The sandhill crane is also an occasional spring and fall visitor to the Umatilla National Wildlife Refuge. Other common shorebirds known to frequent the refuge include the greater and lesser yellowlegs, western sandpipers, and killdeer.

Shorebirds may also use habitats along the corridor near Chapman Creek, Rock Creek, Alder Creek, Glade Creek, Wood Gulch, Pine Creek, JU Canyon, and wetlands near the Goldendale aluminum plant at the west end of the corridor. Killdeer were observed at Pine Creek during the spring 2001 surveys.

Passerines

Passerines include birds commonly referred to as perching birds or songbirds, which are the largest wildlife group inhabiting the project corridor and vicinity. This group includes state priority species, the sage thrasher, sage sparrow, and loggerhead shrike. These birds are associated with habitats containing dense sagebrush, which occurs only in a few areas along the project corridor.

The project corridor also contains potentially suitable habitat for the streaked horned lark and western meadowlark. Other more common passerines expected to occur along the corridor include song sparrows, brown-headed cowbirds, white-crowned sparrows, and Brewer's blackbirds. These species are adapted to the open cropland, grasslands, grazed shrub-steppe, and shrub-steppe habitats that occur along the corridor. Passerines likely use the riparian shrub and small-tree habitats along Glade Creek, Alder Creek, Pine Creek, Chapman Creek, JU Canyon, Rock Creek, and Wood Gulch.

Mammals

Mule deer occur across a wide range of vegetation types, from shrublands to desert scrub (Wallmo 1981). However, most deer activity would occur in riparian areas where shrubs and topography provide food and hiding cover, respectively (Hamlin and Mackie 1989). Mule deer fawning areas consists of low shrubs and small trees on benches or slopes within 600 feet of water (Thomas 1976). Mule deer are known to occur in the Rock Creek watershed (PHS 2001) and in the Umatilla National Wildlife Refuge (Caballero pers. comm.). The primary mule deer concentration area is more than 2 miles north of the crossing location at Rock Creek (PHS 2001).

Other mammals known or expected to occur in the project corridor and vicinity include the black-tailed jackrabbit and white-tailed jackrabbit. Habitat occurs in the corridor for sensitive-status pygmy rabbit, western pocket gopher, Washington ground squirrel, and sagebrush vole.

During the spring 2001 surveys, four areas with burrows were identified in shrub-steppe habitat within the project corridor. Mammals known to use burrows include the pygmy rabbit, Washington pocket gopher, and Columbian and Townsend's ground squirrel. The pygmy rabbit is a species currently under review for federal listing, and is the only rabbit known to excavate their own burrows. A historical detection of pygmy rabbit occurred about 0.5 mile south of the corridor near corridor mile 62 (PHS 2001). Pygmy rabbits are associated with deep soils and feed on sagebrush (Nowak 1983).

The Western pocket gopher is an herbivore that consumes grasses and forbs and burrows in friable soil to nest (Ingles 1965). The Townsend's ground squirrel is common in sagebrush, rather rare in bitterbrush, and may invade croplands of alfalfa and grain in spring and winter. Like the pygmy rabbit and western pocket gopher, it excavates long burrows in sandy friable soil in shrub habitat (Whitaker 1980). The Washington ground squirrel is absent from the north side of the Columbia River.

Other common mammals expected to occur in the project corridor and vicinity include coyote, fox, badger, cottontail, skunk, and mice. Cougar may also occasionally move through the corridor to feed on deer, particularly in winter. Most wildlife activity likely occurs on uncultivated lands, although waterfowl, mice, deer, and voles are also known to feed in the irrigated areas.

Amphibians

Habitat for amphibians occurs in wetlands and riparian zones of the streams along the project corridor and vicinity. Woodhouse's toad is a sensitive status amphibian species known to occur in the project vicinity near Rock and Alder Creeks. Great Basin spadefoot were detected in the western portion of the corridor (Klickitat County) by Jones & Stokes biologists in 1995 and are to be expected near wetlands and springs. Northern leopard frogs were historically reported south of the project corridor, but recent surveys have failed to detect them (McAllister 1999). The nearest known Oregon spotted frog population is 32 miles northwest at Conboy National Wildlife Refuge.

Reptiles

There have not been any reports of sensitive-status reptiles in the project vicinity; however, suitable habitat is present for the following species.

The painted turtle is a state-sensitive in Oregon, but is not considered state-sensitive in Washington. Painted turtles have not reported in the project area, but could occur based on habitat and historic range. This species occurs within or near open water wetlands or slow-moving river bodies or slack-water areas of rivers. Such habitat occurs at the Corps Wildlife Natural Area. Because they lay their eggs in upland sites as far as several hundred feet from bodies of water (Nussbaum et al. 1982), they are susceptible to land use activities that cause disruption of their egg sites.

The western rattlesnake is not known to occur in the project area, but may occur within the project area occur based on habitat and historic range. This species occurs in many areas of eastern Washington and inhabits rocky slopes, sagebrush flats, grasslands, and juniper woodlands, all of which are prevalent in the project area. They are most common near den areas, which are normally south-facing rocky slopes that are not shaded by vegetation.

The striped whipsnake has not been reported in the project area, but it may occur based on habitat and historic range. The striped whipsnake occurs in grasslands, sagebrush flats and dry rocky canyons. Habitat for the striped whipsnake occurs in grasslands, sagebrush flats or dry rocky canyons, habitats that are prevalent throughout the project area.

The sagebrush lizard has not been reported in the project area, but may occur based on habitat and historic range. Sagebrush lizards are commonly found in sagebrush and juniper forests of the Columbia River basin, with detections occurring in Klickitat and Benton Counties.

Other species of snakes and lizards not classified as sensitive are expected to inhabit grassland, rocky outcrops, and shrub-steppe along the project corridor.

Habitat Types and Special Habitat Types

The five habitats present within or near the project corridor and project vicinity include ruderal areas (made up of grazed shrub-steppe, agricultural lands, and grasslands), cliffs, shrub-dominated shrub-steppe, stream riparian zones, and tree stands. These are described below.

Ruderal

Ruderal lands (those areas utilized for agriculture, grazing, grasslands, and irrigated cropland), include vegetation communities that are fairly typical of the Columbia River basin. The eastern half of the corridor, from corridor mile 1 to 48, passes through flat, mostly cultivated croplands and grasslands interspersed with native grazed shrub-steppe. Center pivot irrigation circles near Paterson have been planted with corn to attract waterfowl and are designated hunting areas.

Rock Outcrops/Cliffs

Outcrops and cliffs are primarily located outside the corridor along and near the western half of the project west of the town of Roosevelt. Rock outcrops and cliffs provide habitat for hawks and other birds to nest and perch. The outcrops and cliffs also provide roosting habitat for bats and habitat for mammals and reptiles.

Prairie falcons, ferruginous hawks, and golden eagles are known to nest on rock outcrops in the general project vicinity. Red-tailed hawks and turkey vultures were observed near cliffs and rock outcrops during spring 2001 field surveys. Cliff areas (shown in Figure 3-4) are located within 0.25 mile of the project corridor at corridor miles 3, 40, 55, 56, 57, 72, and 73.

Shrub-Steppe

Prior to European settlement shrub-steppe was the dominant vegetation type in the project vicinity. Historical conversion of land to agriculture has resulted in fragmentation of the shrub-steppe communities. Today, only isolated remnants of quality shrub-steppe exist along the project corridor and project vicinity (see Figure 3-4).

Shrub-steppe (even when fragmented) provides essential habitat for many native and sensitive-status birds such as sage sparrow, vesper sparrow, sage thrasher, and loggerhead shrike, as well as raptors. Four priority species inhabit shrub-steppe in the project vicinity—the ferruginous hawk, golden eagle, burrowing owl, and prairie falcon, and other species rely on this habitat seasonally, particularly during winter.

Riparian

Most stream valleys along the project corridor are dry draws. However, shrubs or small trees occur in the riparian zones of Glade Creek, Alder Creek, Pine Creek, Wood Gulch, Chapman Creek, and JU Canyon (see Figure 3-4). Passerines, deer, and waterfowl are known to use these riparian habitats. Long-billed curlew, great blue heron, coyote, and deer are known to forage in the Glade Creek riparian area. Eagles and other raptors occasionally forage in the waterfowl use areas near the Columbia River. No hawk, bald eagle, or great blue heron nesting habitat occurs in riparian areas within the project corridor.

Benton County has identified five streams within the project vicinity as Conservation Reserve Areas. Conservation Areas are areas recognized in the Benton County Comprehensive Plan as areas of high wildlife value. The County requires that a "Site Analysis" be prepared for regulated developments or activities in Fish and Wildlife Conservation areas shown on Map 13 of the Benton County Comprehensive Plan. The Conservation Reserve Area includes the Columbia River, Fourmile Canyon, Bing Canyon, Glade Creek, and Dead Canyon. Of these five riparian corridors, only Glade Creek supports shrubs or small trees within the immediate riparian zone.

Tree Stands

Trees are scarce along the project corridor, and in the project vicinity, except for a few scattered stands, cottonwood tree plantations or individual trees associated with homes or farms. Black locust and tree-of-heaven are the most common species at these scattered sites. These upland trees provide habitat for nesting and roosting birds and bats and provide forage for browsing mule deer.

Four areas of woodland have been identified within the project corridor (Figure 3-4).

- A cottonwood plantation near Glade Creek (corridor mile 21.5) that is harvested every 10 years, and provides short-term breeding and cover habitat for passerines or hawks.
- A grove of tree-of-heaven and black locust provides habitat for tree-nesting birds located at structure 69/4 (near the west end of the line).
- A small woodland near corridor mile 55 consisting of 50-foot-tall acacia and locust trees that provides nesting habitat for passerines.
- A stand of cottonwood trees, located north of the McNary Substation in the Corps' wildlife viewing area.
- A row of poplars, perpendicular to the project corridor, just east of Chapman Creek (corridor mile 54).

Environmental Consequences—Proposed Action

Impacts to wildlife could result from construction and operation of the proposed transmission line and associated facilities. These impacts could be temporary or permanent and include loss of habitat and disturbance to wildlife.

Impacts During Construction

During construction, wildlife may be impacted by noise and human presence that cause disturbance to foraging and breeding behavior. Additionally, construction would cause disturbance to and the modification of vegetation and soils that would result in loss of habitat. Temporary construction impacts would be associated with noise and human presence such as tower installation activities involving the use of heavy equipment, helicopters, and blasting, explosive couplers, and high levels of human activity around the construction site; construction of the substation addition and roads; clearing rights-of-way; and pulling conductors. Table 3-13, in the Vegetation section, presents the temporary impacts to wildlife habitat (based on vegetation type) associated with construction.

Permanent construction impacts would occur when an area is modified and maintained in the modified state. The removal of vegetation and replacement with towers or roads would result in the permanent loss of habitat. Table 3-12, in the Vegetation section, identifies the wildlife habitat (based on vegetation type) and acres to be permanently removed by the proposed action.

Threatened and Endangered Wildlife

The project is not likely to adversely affect the bald eagle, the only federally listed threatened or endangered species known to occur in the area. Because no bald eagle nests or typical nesting habitat are located within 0.5 mile of the right-of-way, and the nearest bald eagle roost/concentration area is greater than 2,300 feet from the right of way, construction activities are not expected to have any affect at this location.

Noise impacts from blasting along the right-of-way are unlikely to affect bald eagles at the roost site. In a study of wintering bald eagle response to military activities at Fort Lewis, Washington, Stalmaster and Keiser (1997) reported that, although some sensitive eagles left the area during firing, most were not overly disturbed by artillery and small arms fire. Habituation to regular events and the need for food and habitat in the area caused the eagles to be tolerant of firing exercises. Heavy artillery impacts as close as 0.6 mile were tolerated, but low (less than 1,000 feet) helicopter overflights and close boat encounters (less than 300 feet) caused the eagles to flush. The military activity at Fort Lewis was not disruptive to preclude high eagle use of the area.

The primary potential impact of construction activities would be to eagles foraging on the Columbia River in the area of construction. Dispersing juveniles, immatures, and adults may pass through the project area on their way to feeding areas. Based on known patterns of use, bald eagles would most likely be attracted to waterfowl and fish prey resources at the waterfowl areas near the town of Paterson, the Umatilla National Wildlife Refuge, and the areas immediately downstream of McNary Dam where waterfowl congregate in the tailrace of the dam. Bald eagles occasionally occur in the winter, but not in regular concentrations (PHS 2001), at the Umatilla National Wildlife Refuge (PHS 2001), Rock Creek (Jones & Stokes field data), and the Corps Wildlife Natural Area (Caballero pers. comm.).

Few trees in the project corridor representing potential eagle perching habitat would be removed by the proposed project. Several 40- to 50-foot cottonwoods located near the

Corps Wildlife Natural Area at the McNary Substation may need to be removed under the McNary Substation Alternative B to facilitate transmission line clearance. These trees are located approximately 700 feet from the ponds adjacent to the McNary switchyard, and 1,400 feet from the river. Potential perch trees are not a limiting factor along the river at this location, as there are cottonwoods located adjacent to the McNary switchyard and on the north side of the river.

Impacts to Other Special Status Wildlife

Some sensitive species (i.e., those species of concern to the agencies but not protected under the ESA) and habitats would be impacted by habitat removal and temporary disturbance during construction. These impacts could include modification or loss of habitat, including loss of nests or dens, and temporary displacement of wildlife during construction. Impacts would be limited to the site of construction activities, with negligible effects on local or regional populations.

Raptor Nesting

Construction of the proposed project could impact raptor nesting activities particularly near cliffs or rocky outcrops. As a general rule, nests within 0.25 mile are most vulnerable to abandonment or diminished nest success. There are six known raptor nests within 0.25 mile of the corridor: the burrowing owl nest at corridor mile 19; red-tail hawk nests at corridor miles 21, 35 and 41; and prairie falcon nest at corridor miles 55 and 66. If construction were to occur in these areas, impacts to raptors could include direct loss of nests, disturbance of nest sites leading to abandonment or reduced productivity, temporary displacement, temporary and/or permanent habitat loss.

Temporary disturbance would be caused by activities such as road and tower building construction near known burrowing owl burrows. Owls could be flushed from their nests, and road construction or tower erection in burrow areas could cause burrow abandonment and loss of recruitment for the year. An incremental amount of burrowing owl habitat could be lost from access roads and towers.

Mitigation measures could include shifting road locations to avoid activity burrowing owl burrow areas identified during pre-construction field surveys.

There would be no impact to known golden eagle, ferruginous hawk, and peregrine nest sites since all known sites are greater than 0.5 mile from the proposed corridor.

Because there is no suitable nesting habitat within the project corridor, goshawk would not be expected to nest in the project corridor.

Waterfowl

Noise and human disturbance from construction activity would be temporary and result in no permanent displacement of waterfowl from feeding or breeding areas. Habitat at the Umatilla National Wildlife Refuge occurs over 1,000 feet south of the proposed corridor, and the primary feeding habitat for American white pelican occurs over 3 miles south of the project area. Displacement of waterfowl would be temporary and would be limited to the duration of construction since wetland and stream-side vegetation used by these birds would remain relatively undisturbed. Construction of access roads, conductor tensioning sites, and tower sites may result in the loss of up to 4 acres of agricultural lands used by waterfowl near Paterson.

See the Wetlands section of this chapter for a discussion on potential impacts to wetlands. Impacts associated with waterfowl collision are discussed later in the section on Impacts Associated with Operations and Maintenance.

Shorebirds and Other Waterbirds

Impacts to shorebirds and other water birds from construction would be similar to those defined above for waterfowl.

Passerines

Construction activities would have both a short-term and long-term impact on habitat used by passerines. Vegetation clearing in uplands for roads, the McNary Substation expansion, and tower sites would result in the temporary (see Table 3-13) and permanent (see Table 3-12) loss of grazed shrub-steppe, shrub-steppe, and grassland, the primary habitat used by passerines. Of the 80 to 87 acres of those habitat types to be impacted during construction, 36 acres will be permanently converted to structures or roads.

Mammals

Deer would be temporarily disturbed by construction noise and activity. Clearing of upland trees and shrubs will remove an incremental amount of forage for mule deer that use the project area. The primary mule deer concentration area is greater than 2 miles north of the crossing location at Rock Creek (see Figure 3-4). Impacts to fawning habitat are not expected since their primary habitat, riparian vegetation, would not be removed, and no new roads would be built near Rock Creek.

As with any activities involving ground disturbance, construction of the project would impact ground-dwelling small mammals.

Amphibians and Reptiles

Impacts to amphibians would be low since only approximately 0.1 acre of wetland may need to be filled, and the wetland is a stock watering pond with emergent vegetation that has been heavily trampled by cattle.

Impacts to reptiles as a result of project construction activities would occur within the construction area. Rock piles in uplands inhabited by reptiles may be impacted by clearing for roads and tower sites. The reptiles that would most likely be impacted by the project would be the Striped whipsnake, a state-monitor species, and the western rattlesnake. These two snakes inhabit grasslands, shrub-steppe, and dry rocky canyons

(Shaw and Campbell 1974), habitats that are relatively common in the project vicinity. Potential impacts would include the temporary abandonment of suitable habitat as a result of disturbance, and/or the permanent loss of habitat due to the road and/or tower placement. Approximately 38 acres of potentially suitable habitat (9 acres of grassland and 29 acres of grazed shrub-steppe scabland and shrub-dominated shrub-steppe) would be permanently converted to roads or towers (Table 3-12).

Most dry rocky canyons would be spanned, which would limit the habitat loss for northern sagebrush lizard, a federal candidate species.

Impacts to Habitats

The habitats along the corridor are the same as the vegetation communities discussed in the section on Vegetation: agriculture, grasslands, grazed shrub-steppe, riparian, scabland/lithosol, and shrub-dominated shrub-steppe. Cliffs and trees are included as subcategories to those habitats.

With the exception of the cottonwood farm west of Glade Creek, existing vegetation communities along the corridor are compatible with transmission line clearance requirements. The project will require the construction of approximately 3 miles of new access road and 270 short (each approximately 250 feet in length) spur roads, which would remove vegetation and wildlife habitat. The habitats that would be permanently impacted include agriculture, grasslands, grazed shrub-steppe, scablands, shrub-dominated shrub-steppe, and trees.

Between 31 and 39 acres of agricultural lands would be temporarily disturbed as a result of road and tower construction. Clearing of agricultural lands such as corn, alfalfa, and undisturbed patches between crop circles for roads and towers may result in some temporary impact to waterfowl and small mammals using the agricultural lands.

Cliffs

Cliffs, considered priority habitats by Washington Department of Fish and Wildlife, would not be directly altered during or after construction. Cliffs located within 0.25 mile of the project corridor occur at corridor miles 3, 55, 56, 57, 72, and 73.

Riparian

Riparian corridor, also considered Priority Habitat by Washington Department of Fish and Wildlife, would be spanned by the proposed project, thereby would not be impacted. As previously mentioned, some vegetation in dry washes (not considered riparian vegetation by WDFW definition) would be impacted by road construction; however, these areas do not represent sensitive wildlife habitat.

Shrub-Steppe

Shrub-steppe is common in the project vicinity, but only a few areas were identified as high quality shrub-steppe. Because it is low growing, shrub-steppe vegetation types are compatible with power line clearance requirements. Construction of the project would result in the permanent loss of 23 acres of grazed shrub-steppe and 2 acres of shrub-dominated steppe habitat (see Table 3-12).

Access Roads

Approximately 48 acres of vegetation would be would be temporarily removed in the construction of new roads, primarily in agricultural, grassland, and grazed-steppe habitats (see Table 3-12). Construction of new roads would disturb wildlife associated with those habitats. Disturbance from road construction would result from use of heavy equipment and use of the roads following construction. Conversion of irrigated croplands to roads would not have a measurable impact to food resources for waterfowl because of the prevalence of the croplands in the project area.

Substation

The proposed expansion of the McNary Substation would result in the loss of approximately 2 acres of grassland, which currently provides marginal habitat for small mammals and birds. The impact of this conversion would be minor since the site is disturbed and is adjacent to the existing substation.

Conductor Tensioning Sites

Temporary impacts to 26 to 39 acres of agriculture, grassland, grazed shrub-steppe, scabland and shrub-dominated shrub steppe habitat, would result from conductor tensioning (see Table 3-13). Each conductor-tensioning-site would temporarily impact about 1 acre of vegetation. Most construction impacts will occur in grazed shrub step and agricultural lands.

Impacts During Operation and Maintenance

Potential operation and maintenance impacts include impacts to threatened and endangered species, bird collisions with power lines, and avoidance of areas by wildlife due to such activities as road or vegetation maintenance and repair of towers, helicopter flights for line surveys, and replacement of insulators. Operational impacts would be less intense than during construction. However, a low level of human activity would persist permanently in association with operations and maintenance activities. Because of the existing lines within the right-of-way, there would only be an incremental increase in the operation and maintenance activities along the corridor; therefore, only an incremental increase in the impacts associated with those activities.

Threatened and Endangered Species

Operations and maintenance activities are not likely to adversely affect nesting or wintering bald eagles. The closest known nests are over 2.5 miles from the proposed project corridor nests, and no trees suitable for nesting occur in the corridor.

The nearest bald eagle concentration site is located 2,300 feet south of the right-of-way (PHS 2001). Bald eagles using this area 2,300 feet south of the right-of-way are unlikely to be affected by maintenance activities occurring in the corridor.

Maintenance of the transmission line near the McNary Substation would require the occasional removal or pruning of cottonwoods to ensure that clearance height is maintained. Bald eagles would be attracted to waterfowl and fish prey resources in the project vicinity, particularly between McNary and Paterson, where waterfowl concentrate. Bald eagles may use towers as roost sites, yet may also be susceptible to strikes with the power line (Harmata et al. 1999).

Impacts during operation and maintenance would be limited to bird collisions with power lines and potential disturbance of roosting or foraging due to maintenance activities.

Bird Collisions with Transmission Lines

Collisions typically occur in locations where conditions combine to create a high potential for birds striking lines (Avian Power Line Interaction Committee 1994). Three factors contribute to this potential; the type of power lines, the amount of use of the area by birds, and the inherent tendency of a species to collide with overhead wires.

Type of Power Lines

Because the new line would be placed within a corridor with existing lines the potential impact may be less than if the new line were placed where there is no existing line. Research has shown that location of transmission lines influences bird collision risks, and that installing new transmission lines adjacent to existing lines may reduce the risk of collisions (Thompson 1978, Avian Powerline Commission Meeting 1994, Larson pers. comm., Bevanger 1994). Other research has shown that installing the tower and lines near the base of taller features such as cliffs may also minimize impacts (Thompson 1978, Avian Powerline Interaction Commission 1994).

The proposed action for this project would include construction of the new line adjacent to existing lines. The proposed line would also be located between the existing line and cliff features on the north side of the Columbia River. These two measures will minimize the risk of bird collision associated with the installation of the proposed transmission line.

Some bird mortality is known to exist from collisions with the existing transmission lines (Browers pers. comm.). Waterfowl strikes have been reported near Crowe Butte Island, but overall, the number of waterfowl killed by wire strikes is very small compared with the total regional population (Willdan Associates 1982). A bald eagle was found under the lines near the McNary Dam, suggesting it struck power lines.

When there are multiple lines within a corridor, birds are more likely to strike a conductor (wire) if the conductor heights vary. Multiple conductors at different heights creates a “fence” effect, a larger area in which the bird most avoid. The proposed line would add to an existing fence effect. The existing 230-kV and 345-kV towers are 80 feet and 110 feet tall respectively, and have a flat configuration (the three conductors on the towers are strung at the same height). In areas where there is an existing 500-kV line, the towers are about 180 feet tall and the conductors are stacked (various heights). For the proposed line, the towers would be about 145 feet tall, and the conductors would have a delta configuration (one conductor higher than the other two). Please see Chapter 2, Figure 2-2 for tower configurations. Birds tend to be more likely to strike ground wires. Ground wires are much smaller in diameter than conductors and span the top of the tower to protect the line from lightning strikes. The existing lines in the corridor have ground wires for a mile on either side of the Horse Heaven Substation west of Paterson. The proposed line would have two ground wires the length of the line. These ground wires would increase the fence effect and contribute to potential bird strikes. Please see Chapter 2, Figure 2-3 for the location of the ground wires on the tower.

Amount of Use

In general, the more birds that fly in an area, the greater the risk of collisions with power lines. The areas of highest concern are where lines span bird flight paths, including river valleys, wetland areas, lakes and narrow corridors such as passes that connect two valleys. Transmission lines between waterfowl feeding and roosting areas would also be hazardous to waterbirds (McNeil 1983).

The proposed line would cross few areas of open water or wetlands and would run primarily through upland grazed shrub-steppe and croplands. One area of high seasonal bird use is the Umatilla National Wildlife Refuge, located between 0.1 and 4 miles south of the project vicinity between corridor miles 11 and 28. Waterfowl use the area during the fall and typically fly from the Toppenish Creek area to the north (Haines pers. comm.) as well as from other locations (Browers pers. comm.). This area would represent the highest risk areas for avian collisions because of the high seasonal use and the species involved.

Other areas of potential collision risk would occur where lines cross center pivot irrigation circles planted with corn to attract waterfowl and located north of the Umatilla National Wildlife Refuge, near Crowe Butte Park, and at the Rock Creek and the Columbia River crossing, particularly at McNary Dam. Waterfowl and raptors flying up the Columbia River may strike the lines crossing the Columbia River. A portion of the proposed transmission line would be located between open water loafing areas on the Columbia River and the center pivot irrigation-feeding habitat. As a result, some additional mortality would be expected to occur in that vicinity.

Species Risk of Collision

Migratory waterfowl have the highest incidence of mortality from collision with transmission lines, particularly near wetlands, feeding areas, or open water (Stout 1976). Such collisions primarily occur in low visibility conditions (Arend 1970, Anderson 1978, Avery et al. 1980, Brown et al. 1985, Fannes 1987). In a study of waterfowl mortality in Illinois, between 0.2 and 0.4% of the maximum number of ducks present near a power plant were killed each fall (Anderson 1978). Mallards and blue-winged teals were found to be most vulnerable to collisions. Fourteen duck species accounted for 44% of the 4,100 birds that collided with power lines in a wetland in Montana (Malcolm 1982). In a survey of birds flying past a 138-kV power line spanning the Mississippi, no birds were killed and waterfowl were observed to fly at least 50 feet from the power lines (Fredrickson 1983). In a survey in Oregon, 60 birds of 13 species were found dead beneath a 230-kV line in 89 days; however, an estimated 354,000 birds moved past the lines in 179 days; of which over 85% were observed to fly above the conductors (Lee 1978). Migratory waterfowl, including mallards and blue-winged teal, use the area along the proposed line describe above and could be impacted by the addition of the proposed line.

American white pelicans that feed on islands 3 miles south of Paterson are known to nest on Crescent Island approximately 20 miles northeast of the project corridor. Mortality from collision with of pelicans power lines has been reported elsewhere (Brown 1993, Crivelli 1988).

Raptor collisions with overhead wires would be expected; however, collision with overhead transmission line wires is not a major cause of mortality in raptors. Raptors keen eyesight and tendency not to fly in inclement weather may contribute to the relatively low numbers of collisions reported (Olendorff and Lehman 1986), and therefore any raptor collisions would not be at levels that would change local breeding populations or distributions.

Some level of ongoing waterfowl and perhaps raptor and pelican mortality would be expected to occur as a result of the installation of the new transmission lines, however, the mitigation measures discussed later in the Mitigation section can be applied to minimize that potential impact.

Avoidance of Areas by Wildlife

Wildlife may avoid the proposed transmission facilities because of human use such as maintenance or because of the presence of the structures. Deer would temporarily avoid areas with human activity, while bird responses to power lines may vary by species. For example, waterfowl may avoid habitat areas with transmission lines above them (Willard 1982). On the other hand, raptors are often attracted to transmission towers to use them as nesting sites (Bechard 1990). Other species such as songbirds may be attracted to the shrub-steppe or grassland vegetation corridors that are undisturbed by agricultural uses or residential uses occurring in rights-of-ways.

Because of the temporary nature of maintenance activities, the noise, and human disturbance, impacts from those activities would be minor and of short duration.

Impacts to Habitat

Long-term impacts to habitat resulting from operation and maintenance activities would be minor, because most vegetation communities (habitats) are compatible with transmission line clearance requirements, so little long-term vegetation maintenance would be required.

Environmental Consequences—Short-Line Routing Alternatives

Table 3-18 summarizes the wildlife impacts associated with the short-line routing alternatives.

Table 3-18: Impacts of Short-Line Routing Alternatives: Wildlife

Alternative	Impacts
McNary Substation Alternatives	
A. Relocate administration building presently located on north side of substation adjacent to Wildlife Natural Area	About 2 acres of marginal grassland habitat would be permanently lost due to the relocation of the building. There would be more impacts to small mammals and birds due to conversion of grassland to a developed site.
B. Cross Wildlife Natural Area; circumvent administration building on north side	Potential impacts to palustrine forested wetland dominated by willow, reed canarygrass and with some cottonwoods; would include the modification or permanent loss of nesting habitat for nesting passerine birds. Willows and cottonwoods would need to be cut to ensure adequate line clearance. There would also be an increased risk of waterfowl and water bird collisions due to the close proximity of the power line with waterfowl use areas on the wildlife refuge. Other impacts would include removal of grass and shrubs and ground compaction for towers and access roads, resulting in a loss of passerine nesting areas, and habitat for ground dwelling mammals, amphibians, and birds.
C. Place line in bus work at ground level on north side of administration building, inside Wildlife Natural Area	Crosses north end of wildlife area, but close to road. Negligible wildlife impacts.

Alternative	Impacts
Hanford-John Day Junction Alternatives	
A. Move existing Hanford-John Day line north 200 feet to make room for new line on north side of corridor	Temporary disturbance of 1.0 acre to grazed shrub-steppe from relocating four towers and construction new access road. Permanent impact of 0.2 acre to grazed shrub-steppe. Close to highway. Negligible wildlife impacts.
B. Place new line on south side of corridor (occupied by roads and towers)	Temporary disturbance of 0.5 acre of grazed shrub-steppe for tower construction and permanent loss of 3.2 acres of grazed shrub-steppe for towers and access roads. Low impact to wildlife, because the line would be close to highway and through habitat of marginal wildlife value. Loss of 10 to 12 'tree of heaven' and black locust trees would incrementally reduce habitat for tree-nesting birds.
C. Place new line on south side of highway	Same temporary impacts as Alternative B and permanent loss of 6.3 acres of grazed shrub-steppe for towers and access roads. Low impact to wildlife because shrub-steppe habitat heavily grazed. Loss of tree habitat same as Alternative B.
Corridor Mile 32 Alternatives	
A. Keep existing and new lines on tribal land	No priority species documented in the area; however, this are of shrub-steppe is designated as Priority Habitat by WDFW. Grazing and fire have degraded the shrub-steppe habitat in this area, but passerines, mammals, reptiles and raptors may still nest, den, or feed in this area. Habitat quality is low as a result of disturbance from grazing, predominance of cheatgrass, and lack of continuity with other areas of shrub steppe. Potential impacts would include shrub and ground disturbance, but these would be negligible because of the degraded condition of the shrub-steppe in this area and the prevalence of this habitat type in the project area. See Vegetation section for mitigation measures.
B. Relocate existing and new lines away from tribal land	Temporary disturbance of about 0.9 acre of agricultural lands (vineyards) having low wildlife value. As with Alternative A, this alternative would also cross shrub-steppe designated as Priority Habitat and potential impacts to wildlife habitat would be negligible due to the degraded condition and prevalence of this habitat type in the project area.
Corridor Mile 35 Alternatives	
A. Keep existing and new lines on tribal land	Negligible impacts to wildlife because line would be located in heavily grazed shrub-steppe which is marginal habitat..
B. Relocate existing and new lines away from tribal land	Same as Alternative A1, except more heavily grazed shrub-steppe habitat would be removed.

Mitigation

The following mitigation measures would be employed to minimize potential impacts to wildlife along the proposed transmission corridor.

Threatened, Endangered or Other Sensitive Species

- Prior to construction, conduct raptor nest surveys (for existing and new nests) of cliffs located within 0.25 mile of the right-of-way (corridor miles 3, 54, 56, 57, 72, 73). See potential mitigation measures below for specific species.
- Between January 1 and July 30, avoid using helicopters within 0.25 mile of cliffs identified as Priority Habitat by the Washington Department of Fish and Wildlife (use ground-based equipment near cliffs.
- Avoid blasting cliffs identified as Priority Habitat by Washington Department of Fish and Wildlife and consult with the Washington Department of Fish and Wildlife or Oregon Department of Wildlife regarding measures to minimize nest disturbance on a site-by-site basis if nests are found.
- If bald eagle nests are found on the cliffs, restrict construction during nesting season (January 1 through July 15).
- **Mitigation for burrowing owls.** If possible, avoid disturbance within 160 feet of occupied burrows during the non-breeding season of September 1 through January 31 or within 250 feet during the breeding season of February 1 through August 31.
- **Mitigation for peregrine falcon.** If possible, avoid disturbance within 0.25 mile of any active nests during the breeding season (March through June).
- **Mitigation for prairie falcon.** If possible, avoid construction activities between February 15 and July 15 within 0.25 mile of active nests.
- **Mitigation for red-tail hawk.** If possible, avoid construction activities within 320 feet between February 15 and July 15.
- **Mitigation for other raptors.** Consult with Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife.

Avian Collisions

- If deemed appropriate, install line markers in avian flight paths or migration corridors, such as near crop circles in the vicinity of the town of Paterson (north of the Umatilla National Wildlife Refuge) and at the Columbia River crossings.
- For the McNary Substation Alternative, avoid placing towers and lines across wetlands to minimize risk of bird collision.

Shrub-Steppe Dependent Wildlife

- Minimize the amount of shrub-steppe plant communities removed by clearing only the amount of vegetation necessary to prepare tower footings or build roads.
- Minimize road construction in shrub-steppe areas with burrows. Burrows were found in the field near corridor miles 19, 21, 63, and 76.

Riparian Dependent Wildlife

- Span riparian corridors to minimize removal of shrubs or trees within riparian areas.

Unavoidable Impacts Remaining after Mitigation

Construction of new towers, access roads and substation structures would remove wildlife habitat and impact local populations of wildlife species. Other local populations of wildlife would be temporarily displaced during the construction phase. There would also be an incremental increase in the risk of avian collisions, particularly at the river crossings and at waterfowl feeding areas near Paterson. An incremental increase in disturbance to wildlife above existing conditions, would result from operations and maintenance.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, wildlife and wildlife habitats will not be altered. Agricultural lands would continue to be managed for crop production. The shrub-steppe lands to the east would continue to be used as grazing lands.

Cultural Resources

Affected Environment

The 79-mile portion of project corridor that lies within Oregon and Washington State is within the Mid-Columbia Study Unit. The Mid-Columbia Study Unit is one of fourteen study units designated by the Office of Archaeology and Historic Preservation (OAHP) to identify, evaluate, and protect cultural resources throughout Washington State and the region (Galm et al. 1987).

Archival records indicate ten known archaeological sites along the corridor. Near the corridor, there are at least 70 additional archaeological sites recorded within a 1-mile radius of the proposed transmission line. Of these 70 sites, 26 (37%) are underwater behind the John Day Dam.

Historical data demonstrate continuous use of the Mid-Columbia Study Unit from the time of the first Euro-American exploration through the arrival of a trans-continental railroad, a state highway system, and construction of two federal dams.

Please see Heritage Conservation, Chapter 4 for a description of the laws and regulations regarding cultural resources.

Human Occupation

Human occupation can be broken down into four geographically and temporally designated periods (or study units):

- the Paleo-Indian Study Unit - spanning the time from the first human occupation of Washington to 8,000 years Before Present (B.P.);
- the Early Period (8,000 to 4,000 B.P.);
- the Middle Period (4,000 to 2,500 B.P.); and
- the Late Period (2,500 to 250 B.P.) (Galm et al. 1987).

These last three periods are based on major environmental fluctuations, mainly precipitation and temperature variations as described below.

The cultural chronology over the last 10,000 years for the Mid-Columbia Study Unit is a complicated concept in typology and academic discourse. For the purpose of this section, the below mentioned chronology and terminology is adopted from the Resource Protection Planning Process (RP3) document by Galm et al. (1987).

Cultural periods and their corresponding names are reflective of many factors. Periods were determined by environmental fluctuations (e.g., altithermal) observed in the natural history record. Labels (e.g., Vantage, Tucannon, Cayuse) were ascribed to sites or artifact collections dating them to an environmental period; thereby defining a phase or component within a large block of time.

Altithermal—the term used to identify the dry postglacial period extending from 7500 to 4000 years ago, during which time temperatures were believed to be distinctly higher than present temperatures. The term can also be used relating to any time period or climate characterized by high or rising temperatures.

Aquatic exploitation—fishing and/or gathering of food resources from water, in this case, from the Columbia River.

Early Period (8,000 to 4,000 B.P.) (Vantage, Cascade, Canyon)

This period corresponds with the warm dry temperatures of the Altithermal. The sites are primarily open camps, with some rockshelter, usually located on river terraces near the confluences of major streams and their tributaries. Sites are small, less than 200 square meters, and reflect brief occupancy, although some are reoccupied throughout the period.

Middle Period (4,000 to 2,500 B.P.) (Frenchman Springs, Tucannon)

This period corresponds to wetter, cooler conditions with increased terrestrial and aquatic resources. Significant changes in artifact assemblages and settlement patterns occur linked to better environmental conditions and consequent increase in human populations. Sites are larger than in the preceding period. Pithouses appear for the first time in small aggregates, aligned lineally along the Columbia usually near the mouths of large, low drainage basins. Intensive upland gathering and aquatic exploitation is indicated. The upland gathering seems primarily oriented toward root collection in the interior basin.

Late Period (2,500 to 250 B.P.) (Harder, Cayuse, Wildcat)

This was a period of increasing aridity, though not comparable to the Altithermal. Because of reduced terrestrial and aquatic resources, cultures increased storage technology and moved settlements seasonally. The largest number of sites and the largest sites belong to this period. Housepits appear by the hundreds in villages along the Columbia at the confluences of major tributaries. These housepits are aligned parallel to the river. Some houses have dense occupation debris and many floor levels (indicating long term occupancy and frequent reoccupation), but most houses have only minimal occupation debris.

There are many site varieties from this period, including pithouse villages, root gathering and processing camps, fishing stations, quarries, hunting camps, small foraging camps, etc. Quarries, hunting camps, and root camps are found in areas of rocky soil in foothills and around lakes, and the central basin is utilized for the first time in this period. Most other sites are found in close proximity to riverine environments. Most sites exhibit some form of food storage facilities such as pits. Settlement patterns are linked to fishing, upland root collecting, and hunting sites organized around a winter village, an ethnographically recognizable pattern.

The project area, in paralleling and crossing the Columbia River, transects a region with a high density of hunter-fisher-gatherer archaeological sites. These sites reflect a 10,000-year history providing evidence for archaeologies understanding of the region's cultural chronology.

There exists a high probability for unknown archaeological sites to be within or near the project area based on the recorded evidence. The waters behind the John Day Dam inundated the majority of known archaeological sites. Remnants of the larger villages and sites were further disturbed during construction of the regional railroad and highway systems.

Tribal Oral History

The project corridor passes through and is adjacent to terrain sacred to several Native American tribes. Archaeological sites discovered during the last century document locations that are held as traditional use areas of the Cayuse, Umatilla, Walla Walla, Yakama, and Western Columbia River Sahaptins (Tenino) groups. Many archaeological sites correspond to ethnographic place names.

Jones & Stokes, on behalf of Bonneville, contracted with the Confederated Tribes of the Umatilla Indian Reservation (herein after referred to as the Umatilla Tribes), Confederated Tribes of the Warm Springs Reservation Oregon (herein after referred to as the Warm Springs Tribes), and the Yakama Nation to provide the oral history of the project vicinity. The oral history provided by the Umatilla Tribes is summarized below.

Confederated Tribes of the Umatilla Indian Reservation

There are numerous archaeological sites in the project vicinity. The John Day Reservoir is an area of cultural importance to the peoples of the Umatilla Tribes. In 1999, the Cultural Resources Protection Plan (CRPP) conducted a baseline cultural resources data recording project of the John Day Reservoir. The CRPP gathered data of known archaeological sites and recorded many new sites and isolate finds (Dickson 1999).

> *Overall, there are ten Traditional Cultural Properties (TCPs) in the project vicinity. These large TCPs are large, include a vast area, and overlap each other. The Umatilla Tribes believes that the entire stretch of the Columbia River is sacred. Sacred in the sense that the spirits of our ancestors still reside within the rivers and lands that surround the river and its tributaries. This is the place our ancestors lived and traveled to and the activities that were carried out at these locations are places that would be considered sacred. Today, tribal descendents have the inherited responsibility to protect these areas for our future generations as our ancestors did for us in our lifetime.*
>
> *The Umatilla Tribes believes that a TCP reflects a significant area that is traditionally and culturally important to the people of the Umatilla Tribes, traditional in the sense that is connected to our beliefs, customs, and practices that have been passed down through the generations. It is cultural in the sense that it is related to our traditions, beliefs, practices, lifeways, arts, crafts, and social institutions of our people. Therefore, we will identify below why these areas along the project corridor are considered a TCP to the peoples of the Umatilla Tribes.*

- Traditional Cultural Property 1 – *Ímatalam*
- Traditional Cultural Property 2 – Irrigon/Umatilla National Wildlife Refuge
- Traditional Cultural Property 3 – *Táwash*
- Traditional Cultural Property 4 – Boardman/Umatilla National Wildlife Refuge Area
- Traditional Cultural Property 5 – Crow Butte/Alderdale Area
- Traditional Cultural Property 6 – Pine Creek/Hurlburt Flats Area
- Traditional Cultural Property 7 – *Sáq'aluksi/Nishxúwawi*
- Traditional Cultural Property 8 – Sundale/Blalock Canyon Area
- Traditional Cultural Property 9 – *Q'míl/Sháxuwi*
- Traditional Cultural Property 10 – *T'at'alíyapa*

The CRPP's greatest concern is burial sites. There is potential to encounter burial sites within the project area. Therefore, the CRPP recommends that a CRPP tribal monitor be present during all ground disturbing activities.

The Umatilla Tribes CRPP recommends not nominating the ten TCP areas to the National Register of Historic Places. This is due to the sensitive issues of publicizing culturally sacred areas.

Recent Recorded History

The project vicinity has a rich and varied history of human activity that reflects many of the central themes of the history of the American West. Fur trappers, explorers, overland emigrants, soldiers, cattlemen, sheepmen, miners, homesteaders, townsmen, and lumbermen have all left their mark on the area. The history of the proposed project area is too broad a subject for the scope of this EIS. For a comprehensive discussion, albeit dated, of the history of the Mid-Columbia Study Unit see Meinig (1968).

Meriwether Lewis and William Clark led the first recorded Euro-American expedition into Benton and Klickitat Counties. The explorers camped at present-day Wishram in October of 1805. There, they traded with the Native Americans and replenished supplies before resuming their task of charting the region around the Columbia River as it flowed to the Pacific Ocean. For the next 50 years, the only Euro-Americans in the Mid-Columbia Study Unit were adventurers, fur trappers, and traders. Euro-American settlement did not commence until the late 1850s. However, once begun, the region grew rapidly. Many towns in central Klickitat County were platted during this period, prompting the territorial legislature to establish the area as a county in 1859.

A sketch of several historic place names along the McNary to John Day Transmission project corridor is provided below. The information is taken from *Washington Place Names* compiled by Gary Fuller Reese of the Tacoma Public Library's Northwest Room/ Special Collections (Tacoma Public Library 2001).

Plymouth is a community near the Columbia River opposite Umatilla, Oregon in south-central Benton County. The name was chosen because of a huge basalt rock that projects into the river. The name suggested by the railroaders was Gibraltar, but patriotic settlers settled on the American name for the famous rock in Massachusetts. The Native American name for the locality is said to be "So-loo-sa."

Whitcomb is a settlement a mile and a quarter north of the Columbia River on the south side of Canoe Ridge in southwest Benton County. The original name, Luzon, was changed to the present name at the suggestion of two landowners, James A. Moore and G. Henry Whitcomb, in honor of the latter. The Luzon Land Company platted a 40-acre townsite in February 1909. A post office was established in 1910 and was closed in 1934.

Carley was a railroad station north of the Columbia River directly south of Canoe Ridge in southwest Benton County. It was on a site settled in 1904 by Myron E. Carley who was an inventor and had a machine shop. Other family members had a store and post office that operated until September 1941. Officials of the Spokane, Portland & Seattle Railway, in honor of Mr. Carley, named their railroad station after him.

Paterson is on the north bank of the Columbia River on a south slope of Paterson Ridge directly upstream from Blalock Island in southwest Benton County. The name of Henry T. Paterson, a pioneer settler, was applied to the settlement, the ridge, and to nearby the springs. The Paterson ferry operated during the major Columbia River flood of 1948 and offered the only crossriver passage for many miles up- and downstream.

Paterson Ridge is north of the Columbia River and runs southwest to northeast above Blalock Island. It is divided by Glade Creek that runs from the north joining the Columbia River near the community of Paterson. The ridge is approximately 30 miles south of Prosser and is in a vineyard and orchard area.

Dead Canyon is in northeast Klickitat County. It runs southeasterly through the southwest corner of Benton County and terminates on the north bank of the Columbia River near Crow Butte. Local residents applied the name of Dead Horse Canyon in the winter of 1886-1887, when hundreds of horses and cattle starved or were frozen to death in the canyon. Within recent years, cartographers have dropped the "Horse" from the place name.

Alder Creek rises in the east central region of Klickitat County and flows south and east 10 miles to the Columbia River at Alderdale. It was named for the many alder trees along portions of its course.

McCredie is a community on the north bank of the Columbia River 39 miles east of Goldendale in southeast Klickitat County. It was named by Spokane, Portland & Seattle Railway officials for Judge W.W. McCredie of Vancouver, Washington.

Moonax is a small community on the north bank of the Columbia River 34 miles east of Goldendale in southeast Klickitat County. The name evidently goes back to the Lewis and Clark expedition, which found a pet woodchuck in an Native American camp. The Indian name for woodchuck is Moonax.

Sundale began as a railroad station 25 miles east-by-south of Goldendale on the Columbia River in southeast Klickitat County. The name was chosen by L.W. Hill and C.M. Levy, officials of Spokane, Portland & Seattle Railway.

Chapman Creek rises near the Oak Grove district in east central Klickitat County and flows southeasterly 10 miles to the Columbia River at Sundale. It was named for Eldon Chapman, postmaster of Six Prong (a historic community within Klickitat County) in the early 1900s.

Towal is 12 miles southeast of Goldendale near the north bank of the Columbia River in southcentral Klickitat County. The railway station at this point was named for To-whal or Too-wal, a Native American inhabitant of the region.

Cliffs was a railroad station on the north bank of the Columbia River, 5 miles east of Maryhill in south-central Klickitat County. The Spokane, Portland & Seattle Railway named their station Cliffs for a series of cliffs along the river.

The history of modern transportation to and through the project area is linked to the construction of the Burlington Northern Santa Fe Railway and SR 14. Completed in 1908, the Spokane, Portland & Seattle Railway was built by James J. Hill. The Spokane, Portland & Seattle Railway main line cost millions of dollars and provided an integral link for the people of Portland and Spokane.

Due to dam construction along the Columbia River, the original railroad bed was moved to its current location in the 1960s. In 1970, Spokane, Portland & Seattle Railway merged with Great Northern, Northern Pacific, and Chicago, Burlington & Quincy railroads to form the Burlington Northern Santa Fe Railway (Wood and Wood 1974).

SR 14 began as Secondary State Highway (SSH) 8E in 1937 commencing at the junction of Primary State Highway (PSH) 8 (currently signed US 97) between Maryhill and Goldendale. In 1943, the US 97 portion of SSH 8E was transferred to the Maryhill to Kennewick branch of PSH 8. In January 1964, PSH 8 was reposted as SR 12. When US 12 was extended into Washington State in 1967, SR 12 was reclassified as SR 14. When I-82 was completed from Plymouth to the Kennewick area in the mid-1980s, and US 395 was rerouted along this section of SR 14, I-82 exit 131 at Plymouth became the eastern terminus of SR 14. SR 14 is now 180 miles long stretching from Vancouver, Washington to Plymouth, Washington.

Federal dam construction during the 1950s and 1960s radically changed the Mid-Columbia River basin. The McNary Dam, completed in 1953, and the John Day Dam, completed in 1968, contributed greatly to the region's power supply and built environment.

Field Surveys

The project corridor (including access roads) was surveyed for the presence of cultural resources. In September 2001, 25 miles of the corridor was surveyed by Jones & Stokes archaeologists and two Umatilla Tribes cultural resource specialists. In late November and early December 2001, the remaining 54 corridor miles was surveyed by Jones & Stokes. A resurvey of the 54-mile stretch may be conducted with the Yakama Nation pending a contract with the Yakama Nation.

Field Survey Results

Of the 10 previously recorded sites situated within or adjacent to the corridor, eight were reidentified in the field. The remaining two previously recorded sites were not relocated. A total of 14 cultural resource sites were newly identified during the field surveys. An additional 12 isolate finds were also documented.

Isolate find—A site is a location where human activities once took place and left some form of material evidence. For Washington State, the definition of an archaeology site is based on the ratio of 10 artifacts/10 square meters. An isolate find is a prehistoric, ethnohistoric, and/or historic object found at a specific location in densities below 10 artifacts/10 square meters. Examples of an isolate find could include a projectile point, a low-density lithic scatter, historic revolver and ammunition, and automotive parts.

Site Descriptions

The following are very brief site descriptions; to protect the cultural resource integrity of the sites, locations of the sites are not provided.

Site A is a small historic dump associated with local road construction. The site contains historic bottles, ceramics, and automotive parts.

Site B is a hunter-fisher-gatherer lithic (i.e., chipped stone, raw material, projectile points) procurement area. The site contains a moderate to heavy density of cultural artifacts. No diagnostic artifacts were identified.

Site C is a hunter-fisher-gatherer lithic scatter within a Bonneville access road. The site contains a low density of cultural artifacts. No diagnostic artifacts were identified.

Site D is a hunter-fisher-gatherer lithic scatter. The site contains a low density of cultural artifacts. Recent farming and ranching activities disturbed the portion of the site discovered. The site is adjacent to a Bonneville access road. No diagnostic artifacts were identified.

Site E is a hunter-fisher-gatherer lithic scatter. The site contains a low to moderate density of cultural artifacts. No diagnostic artifacts were identified.

Site F is a rock cairn (a small grouping of rocks stacked in a linear or circular manner) adjacent to an existing transmission tower along the McNary to Ross No. 1 power line. This circular arrangement consists of approximately 30 rocks next to a larger natural exposure of the same basaltic rock.

Site G is an ethnographic/ethnohistoric cemetery.

Site H is a hunter-fisher-gatherer camp and lithic procurement area. The site contains a high density of cultural artifacts including diagnostic stone tools. There is an existing Bonneville access road that traverses the site boundaries.

Site I is a hunter-fisher-gatherer lithic scatter and procurement area. The site contains a high density of cultural artifacts and raw stone material. Diagnostic stone tools were identified with the exposed cultural deposits.

Site J is a historic homestead situated between two proposed McNary-John Day towers. Half-exposed rock foundations indicated the presence of two possible habitation areas. Interior walls within the rectilinear structures were noted, as were discreet activity areas (e.g., a hearth) located within the absent walls. Other items of note include a refuse midden, a privy, and a collapsed red brick oven.

Site K is a hunter-fisher-gatherer multiple component site. The site covers a large area along the corridor and has a high density of cultural artifacts. There are several diagnostic stone tools manufactured from different types of raw stone material.

Site L is a hunter-fisher-gatherer lithic procurement site. The site is exposed in a road cut along the project corridor and contains a moderate density of raw stone material and a low density of cultural artifacts.

Site M is a potential traditional cultural property associated with a basalt lava tube.

Site N is a hunter-fisher-gatherer lithic procurement area. The site is an exposed outcropping of raw stone material with evidence of recent mechanized disturbance. There is a moderate density of cultural artifacts intermixed with a large quantity of naturally fractured raw stone material.

Previous Cultural Resources Studies

Over 600 archaeological sites are recorded within the Mid-Columbia Study Unit (Galm et al. 1987). These sites have been documented as a result of the last 100 years of archaeological surveys and fieldwork along the Columbia River and then subsequently along the shores of the John Day Reservoir (Lake Umatilla). Spanning from the Euro-American exploration of the Columbia River by Lewis and Clark in 1805 to the Smithsonian Institute River Basin Surveys during the early and mid-1900s and through recent federal undertakings that necessitated cultural resources assessments, a rich picture of the culture history devolution has been developed for the Mid-Columbia Study Unit.

The cultural resource studies of the John Day Reservoir can be divided into three periods (Dickson 1999). The first period of investigation extended from 1886 to 1958. During the second period (1958 to 1969), the University of Oregon's David Cole and others excavated sites ahead of the rising waters behind the John Day Dam. The third period covers the last 32 years (1969 to present) of research along the shoreline of the reservoir in an effort to document and/or salvage sensitive resources that were/are being impacted within the lake's fluctuation zone. (Dickson 1999).

There have been four cultural surveys along various parts of the McNary-John Day Transmission Line corridor for construction of other lines or tower relocations. Surveys were also conducted near and around the town of Roosevelt with the development of the Rebanco Regional Landfill.

Recent cultural resource work in the area continues to be driven by the economic growth and development of the Mid-Columbia Region. Wind power projects, cellular tower sitings, and upgrades to existing utility corridor facilities constitute the majority of projects that might impact sensitive sites and resources. The focus of work along the shoreline of Lake Umatilla remains the paramount issue in the on-going preservation of the Mid-Columbia's cultural resources.

The archaeological database in the McNary to John Day Transmission Line corridor includes a wide range of resource types in a variety of settings. All hunter-fisher-gatherer villages and campsites are near water sources such as springs, streams, or the Columbia River. Special purpose sites, such as plant gathering/processing stations, can occur in areas away from water. Hunter-fisher-gatherer rock features and natural silica rock outcrops have been documented throughout the region on steep slopes and the near-vertical faces and horizontal flow tops of basalt outcrops. Hunter-fisher-gatherer campsites and low-density lithic scatters are common on alluvial floodplains in the narrow stream valleys that dissect the massive basalt-flow landforms north of the Columbia River.

Based on an assessment of environmental characteristics such as distance to water, type of substrate, landform type, and amount of previous disturbance, as well as the distribution patterns of recorded sites along the McNary to John Day Transmission Project corridor, the proposed transmission line is in a high probability area for hunter-fisher-gatherer resources. The project is near and crosses many water sources and appears to have unique habitats for economically useful plants, for example, the extensive basalt outcrops that are prime *Lomatium* habitat.

> *Lomatium—Within the project area there exist microenvironments that support different species of plant based primarily on local hydrology, geology, and sun exposure. Lomatium habitat can be considered a microenvironment within the greater sage vegetation zone. Lomatium, referred to in English by Sahaptin native speakers as "Indian celeries," comes in many shapes and sizes. The plant produces edible sprouts, stems, and shoots and would be harvested seasonally. Lomatium habitat in the project area constitutes portions of talus slopes and rocky lowlands along streams and creeks.*

For the most part, the corridor is probably too far from the pre-inundation shoreline of the Columbia River for a village or camp to be affected but hunter-fisher-gatherer groups certainly used the corridor prior to Euroamerican contact. Hunting and plant collecting parties more than likely passed through the area on their way from the Columbia River to uplands and canyons east and west of the corridor. But, this type of land use pattern would leave only a few scattered lithic artifacts across a large area and would be difficult to detect even using state-of-the-art archaeological field techniques.

Environmental Consequences – Proposed Action

Impacts During Construction

Potential impacts to cultural resources could occur during construction of the proposed project without appropriate mitigation measures. Tower construction (see Chapter 2) would be limited to a relatively small area adjacent to existing transmission line towers. Road construction and improvements are the most likely activities to disturb unknown cultural resources. Cultural resource monitors could be provided, as necessary, to observe ground-disturbing activities associated with road improvements in areas of previously documented cultural sites.

Transmission towers and access roads would be sited so as to avoid the known cultural resource sites along the corridor. Of the 14 cultural resource sites found, 12 require avoidance and two sites require avoidance. Cultural resource monitors should be present when construction excavation and/or ground disturbing activities take place in and around archaeological sites. A monitor's presence would ensure proper handling of sensitive cultural resources if unearthed. Of the ten previously documented cultural resource sites along the corridor, nine require avoidance and one site requires avoidance plus a cultural resource monitor during construction excavation.

The project corridor transects the ancient lands of many Columbia River basin tribes. Bonneville has consulted with the Umatilla Tribes, Warm Springs Tribes, and the Yakama Nation on this project implementing the principles and protocols set forth in their 1996 Programmatic Agreement (see Appendix A, Agency Correspondence and Policies.

Impacts should not occur to unknown sites with appropriate procedures to stop construction activities and determine appropriate protective measures (e.g., avoidance) if artifacts are found (please see Mitigation Measures).

Impacts During Operation and Maintenance

No impacts to cultural resources are anticipated during the continuing operation and maintenance of the proposed McNary-John Day 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.

Environmental Consequences of Short-Line Routing Alternatives

There are no significant cultural resources in the areas of the short-line routing alternatives; impacts are not expected for any of the alternatives.

Mitigation

The following mitigation measures would minimize impacts to significant cultural resources:

- Locate structures, new roads, and staging areas so as to avoid known cultural resource sites.
- Utilize existing access road system to the extent possible to reduce the need for new access roads.
- Limit construction equipment to tower sites, access roads and conductor tensioning sites.
- Limit the number of contractors to cultural resource site sensitive information on a need-to-know basis.

- Continue consultation with the Umatilla Tribes and the Yakama Nation to determine appropriate tribal monitoring for ground disturbing activities.
- Continue consultation with the Umatilla Tribes and the Yakama Nation to set up consultation protocols on site mitigation and management.
- Continue consultation with the Umatilla Tribes and the Yakama Nation to ensure that the cultural and natural resources are protected.
- Stop all construction activities in the immediate area should any previously unknown artifacts be identified during construction until the resource can be evaluated by an archaeologist meeting the Secretary of the Interior's Qualifications Standards for Archaeology (48 FR 44738-39). Prehistoric site indicators include, but are not limited to, chipped stone, obsidian tools and tool manufacture debitage (waste flakes), grinding implements such as mortars and pestles, and darkened soil that contains organic remains of food production such as animal bone and shellfish remains. Historic site indicators include, but are not limited to, ceramic, glass, wood, bone, and metal remains.
- If previously unknown artifacts are identified during construction, contact representatives of the affected tribes.
- For previously unknown artifacts, identify type and significance of discovered resource for determining if avoidance is necessary, depending on the type and significance of any discovered resource, procedures may include testing the site with shovel test probes to determine site boundaries and any possible subsurface components. If results of the shovel test probes determine the presence of an extensive subsurface component, move structure location to a suitable location that avoids the site. Alternatively, develop and implement a full data recovery program for the site in consultation with the affected tribes and the Oregon and Washington State historic preservation officers.
- Stop construction in the area immediately should human remains and/or burials be encountered. Secure the area, placing it off limits for anyone but authorized personnel.

Unavoidable Impacts Remaining after Mitigation

Impacts to cultural resources would be mitigated following the procedures specific in 36 CFR 800. Cultural sites identified during fieldwork would be avoided, where feasible. Bonneville would determine mitigation measures in consultation with the Washington Office of Archaeological and Historic Preservation, Oregon State Historical Preservation Office, the Advisory Council of Historic Properties, the affected Native American tribes, and the private landholders. If a large number of sites cannot be avoided, a programmatic agreement among the aforementioned parties may be developed.

If cultural resources, either archaeological or historical materials, are discovered during construction, further surface-disturbing activities in that area would cease and appropriate Bonneville personnel would be notified immediately by their construction contractor to assure proper handling of the discovery by a qualified archaeologist. In absence of a programmatic agreement, any discovered cultural resources could be subject to mitigation through data recovery.

Environmental Consequences – No Action Alternative

Under the No Action Alternative, cultural resources in the project area would not be disturbed by the proposed transmission line construction. The existing transmission line corridor would remain at its present width, with no additional disturbance to known or previously undocumented cultural resources. Continued impacts associated with operation and maintenance of the two existing lines would remain.

Visual Resources

Affected Environment

The approach taken in evaluating potential visual impacts of the proposed project follows the visual impact assessment methods developed by the U.S. Forest Service and the Bureau of Land Management. The affected environment and visual impacts of the proposed project was evaluated by assessing the visual quality of the project corridor, viewer sensitivity, and the visibility of the towers and transmission line as seen from sensitive viewpoints.

Visual Quality

In this evaluation, visual quality is described as the visual patterns created by the combination of rural landscapes and developed features in the project vicinity. Visual quality in the study area was assessed using the following descriptions.

- **Rural landscapes.** These landscapes exhibit reasonably attractive natural and developed features/patterns, although they are not visually distinctive or unusual within the region. The landscape provides positive visual experiences such as the presence of natural open space interspersed with existing agricultural areas (farms, fields, etc.).
- **Scenic/distinctive landscapes.** These exhibit distinctive and memorable visual features (such as landforms, rock outcrops, streams/rivers, scenic vistas) and patterns (vegetation, open space) that usually occur in an undisturbed rural setting but may also be found in an urban setting.

The visual quality of the project corridor is predominantly rural, with a few low-density settlement areas, including Umatilla City, Plymouth, Paterson, Roosevelt, and Rufus. In addition, there are single houses, small groupings of houses, and small farm complexes scattered along the corridor outside of these settlements.

The first 32 miles of the project corridor landscape is composed of relatively flat landscapes dominated by wheat fields and crop irrigation circles, changing to hilly/canyon-like shrub-steppe grazing land from corridor mile 32 westward. Along SR 14, there are intermittent views of the Columbia River to the south, Mt. Hood (50 miles) to the southwest, and Mt. Adams (60 miles) to the northwest of the project corridor. The highway (SR 14) is designated as a Scenic and Recreation Highway by the state of Washington.

The natural and rural landscape features and patterns in the project corridor are reasonably attractive and interesting, although the project corridor lacks unique or distinctive features that would attract viewers. However, there are unique features (Mt. Hood, Mt. Adams, Columbia River) that are visible from areas along the project corridor. Landscape alterations in the vicinity of the project corridor are numerous and include power lines on wood poles and steel-lattice towers, roads, buildings, and fences all situated in a random pattern.

Viewer Sensitivity

Viewer sensitivity, in this evaluation, is described as a combination of viewer type, viewer exposure (number of viewers and view frequency), view orientation, view duration, and viewer awareness/sensitivity to visual changes in the project vicinity. The types of viewers in the project vicinity are described below.

Residences and Passive Recreational Viewers

Residences and in the project vicinity are considered to have high visual sensitivity. The visual setting may in part contribute to these viewers' enjoyment of the experience. Such viewers may potentially see the transmission line project facilities often and for long periods.

Residences are located in Plymouth, Paterson, and North and West Roosevelt in Washington, and Umatilla City and Rufus in Oregon, as well as single or small groups of houses along the corridor. People in residences located close to the project corridor (at corridor miles 1, 4, 6, 7, 10, 16, 22, 29, 30, 48, 49, 68, 69, and 78) would be the most visually sensitive.

Highway and Local Travelers and Recreationists

Highway and local travelers along the project corridor are considered to have moderate visual sensitivity. The number of such viewers and frequency of their views would vary depending on their location. Recreationists in the project vicinity are considered to have comparatively high visual sensitivity because the visual setting may in part contribute to the viewers' enjoyment of the experience.

Because of the topography, views of the project corridor are intermittent for travelers, especially west of corridor mile 32. At that point, the viewscape changes from relatively flat terrain to more hills and canyons. Viewers include travelers on SR 14 and SR 221 in Washington; I-82 and US 97, which cross the Columbia River at the east and west ends of the corridor, respectively; US 730 and I-84 in Oregon; and county roads along the project corridor.

The proposed transmission line would be seen from the following recreation facilities: Umatilla Marina Park, McNary Wildlife Viewing Area, McNary Park, Plymouth Park, Umatilla National Wildlife Refuge, Crow Butte State Park, Crow Butte CRTFAS, Pine Creek CRTFAS, Stonehenge, Maryhill State Park, Maryhill Museum of Art, John Day Dam Cliffs Park, Rock Creek Park, and the John Day Viewing Area.

Other Viewers

Agricultural workers are located in Benton and Klickitat Counties in Washington and Sherman County in Oregon and are considered to have moderate visual sensitivity. Agricultural workers would likely be engaged in work-related activities but would be able to view the proposed project site for longer periods.

Commercial workers along the project corridor—such as those working at dams, wineries, processing plants—are considered to have low visual sensitivity. Compared with other viewer types, the number of viewers with low sensitivity would be relatively small and the duration of their view would be short. Activities of these viewers would typically limit their awareness of the visual setting immediately outside the workplace. In addition, landscaping, the topography, or adjacent buildings may screen their views. See the section on Land Use and Recreation, Chapter 3, for a detailed listing of industrial/commercial facilities near the project corridor.

Sensitive Viewpoints

Sensitive viewpoints include residences in Umatilla City and Rufus, Oregon (at the east and west ends of the corridor, respectively) and in Plymouth, Paterson, and Roosevelt, Washington. There are also small groupings of houses and small farm complexes scattered along the corridor outside of these settlements.

Other sensitive viewpoints include segments of SR 14 where the project corridor is in close proximity to the highway (particularly corridor miles 1 through 16 and where the corridor crosses SR 14 at corridor miles 13 and 70) and from various recreational sites in relatively close proximity to the project corridor.

For this segment, viewers include travelers on SR 14, agricultural workers and industrial workers, recreationists at Crow Butte State Park, tribal members at the Crow Butte CRTFAS, and residents near structures 22/3, 29/3, and 30/1.

Environmental Consequences—Proposed Action

Potential visual impacts include temporary visual changes during construction and the overall permanent visual changes caused by the presence of the towers and the transmission lines. Visual quality and viewer sensitivity are combined to determine visual impacts. The most visually sensitive viewers are residents in the towns of Plymouth, Paterson, and North and West Roosevelt in Washington and Umatilla City and Rufus in Oregon, as well as individual houses/farm complexes along the project corridor. Overall, because of the existing transmission lines, the development of the new line would add humanmade elements to the corridor but would not substantially change the current visual quality.

Impacts During Construction and Operation and Maintenance

Impacts during construction and operations and maintenance have been combined because they would be relatively the same, except during construction when equipment would also be part of the viewscape. Construction activities would occur over a 1-year period, mostly during daylight hours (between dawn and dusk). During construction of the proposed transmission facility, construction equipment (cranes, trackhoes, excavators, supply trucks, boom trucks, log trucks, and lines trucks) and sky-crane helicopters would be used to install and transport facility components. Construction crews would be working in localized areas of the corridor, so views of the construction sites would be dependent on the topography of the surrounding areas.

Construction sites would be visible from a distance in Benton County, Washington from I-82 through corridor mile 13. As the line moves further away from SR 14 and as the topography changes to hills and canyons, views would be intermittent and sites would not likely be seen from a distance due to the topography. Installation of the towers by sky-crane helicopters would likely be visible from a distance regardless of the location in the corridor. Temporary staging areas, which are often located in empty parking lots or already developed sites, would be located along or near the line for construction crews to store materials and trucks and would be visible to those in the immediate vicinity

The proposed towers and transmission lines, which would be located in an existing Bonneville transmission line corridor and would be spaced to match the existing spans and towers in the corridor where possible, would be visible for some distance. The galvanized steel towers would appear shiny for 2 to 4 years before they dull with the weather, and the transmission line wires would be treated to reduce the shininess of the metal. Because of the existing transmission lines in the corridor, and several existing humanmade elements in the viewscape, including buildings, fences, and other power lines on wood poles the new line would contribute to the degradation of the natural visual quality of the area, but would not be out of context.

Photosimulations have been prepared depicting views of the proposed transmission line from two typical viewscapes: (1) relatively flat, agricultural terrain and (2) canyonlike terrains along the corridor. The photosimulations are presented as Figures 3-5 and 3-6.

Residences

Residences in Umatilla City would probably not notice the McNary Substation expansion or the new line leaving the substation because their views would be partially obstructed by the existing substation and several transmission lines that originate at or leave the substation.

The flat terrain in Plymouth between structures 4/1 and 4/4 would provide residents relatively unobstructed views of the proposed transmission line, especially for residences located close to the existing transmission line corridor (closest resident is about 500 feet). However, for some residents the new line would be obstructed by other humanmade objects such as buildings or other transmission lines, and the existing lines would between the new line and the residents. The new line would add more humanmade elements to the landscape.

In Paterson at corridor mile 16, orchards, farm buildings, and other transmission lines could partially obstruct some residents' views of the new transmission line, depending on their location. In North Roosevelt and West Roosevelt (corridor mile 48), the hilly terrain would partially obstruct some residents' views, again depending on location. In West Roosevelt, the hills would provide a backdrop for the towers, causing them to blend into the landscape. In these communities, the new line would add more humanmade elements to the landscape.

Residences located at corridor miles 1, 4, 6, 7, 10, 16, 22, 29, 30, 48, 49, 68, 69, and 78 would see the new line. The corridor crosses over to the south side of SR 14 in the vicinity of the residence located in corridor mile 69 near structure 4. (See Hanford John-Day Junction Alternatives for impacts to this resident.)

In Rufus, the transmission line would be seen on the ridgeline above the town. However, the new line would be in a corridor with six existing lines, so the addition of the new line may not be noticeable.

Travelers and Recreationists

Views of the proposed line would be more likely in the relatively flat terrain of Benton County, and only intermittent in Klickitat County due to the hills and the canyons. Views in Umatilla and Sherman County, Oregon, would be obstructed by existing transmission lines, towers, and substations.

Local or business travelers and recreationists would have views of the proposed line as they travel along SR 14 (Benton and Klickitat Counties in Washington), I-82 (Umatilla County, Oregon and Benton County, Washington), I-84 (in Morrow, Gilliam, and Sherman Counties, Oregon), US 730 (Morrow and Umatilla Counties, Oregon), SR 221 (in the vicinity of Paterson, Washington), or along the county roads. Travelers along SR 14 would be closest and would have the longest duration views (unobstructed and obstructed) of the proposed line. While the corridor is on the north side of SR 14, it would not interrupt the travelers view of the Columbia River. The corridor would also not interrupt views of Mt. Hood or Mt. Adams. It would, however, add more humanmade elements to the rural landscape.

Travelers on I-82, which runs north-south through Washington and Oregon across the Columbia River in the vicinity of the McNary Substation (Figure 3-7), would have relatively unobstructed views of the substation and approximately the first half-mile of the proposed line. However, since the substation expansion would be small relative to the existing substation , the expansion may not be noticeable, The new line would replace existing towers at the Columbia River crossing in this location. The new structures would be bigger and may be seen more easily than the existing.

Travelers and recreationists traveling west on SR 14 from I-82 would be close to the corridor and would have unobstructed views of the proposed line through corridor mile 16. In the vicinity of structure 13/5, travelers would see the corridor crossing to the north side of SR 14. The relatively flat foreground is predominantly composed of crop irrigation circles and farmland on a plateau above the Columbia River. Existing transmission lines interrupt the viewscape, which lacks a distinct background.

At corridor mile 16, the proposed line would move farther north (about 0.5 to 0.75 miles north) from SR 14 through gently rolling hills, and views of the line would become intermittent. Between corridor miles 16 and 32, the project corridor is somewhat parallel to and runs about 0.5 to 0.75 mile to the north of SR 14. It continues to pass through orchards and cropland through corridor mile 32, except for a small segment of high-quality shrub-steppe near Glade Creek (corridor mile 21, near structure 21/5). At approximately corridor mile 32 (Benton and Klickitat Counties border) and through the end of the corridor (roughly the western half of the corridor), the proposed line would traverse up and down the deeply incised canyons, becoming visible along the ridgelines at certain locations and disappearing completely in the canyons at other locations. The shrub-steppe landscape is dominated by basin big sagebrush, which is punctuated by the gray-greens of gray rabbitbrush, green rabbitbrush, bluebunch wheatgrass, and nonnative cheatgrass. At certain points along the western half of the corridor, the line would be close to SR 14 and a traveler would have unobstructed views of the line.

Travelers on SR 221 would have unobstructed views in the vicinity of Paterson. The new line would add more humanmade elements to the viewscape. In the vicinity of Roosevelt, Washington, the proposed line would be located adjacent to SR 14 but would blend into the background of the canyons. Here, the project corridor is located at the base of the light brown hills, which serve as a background that masks the existing metal-lattice towers and power lines. Unobstructed views of the proposed line would also be possible near structure 1 in corridor mile 70 as the line crosses to the south side of SR 14. The proposed line crosses to the Oregon side across the Columbia River near corridor mile 74, and views would be reduced as the line moved farther away from SR 14.

The corridor crosses the Columbia River into Sherman County, Oregon, just west of the John Day Dam at corridor mile 76. The 500-kV Hanford-John Day transmission line spans the Columbia River on 180-foot-tall towers just downstream of John Day Dam. On the Oregon side of the Columbia River, between structures 96/2 and 97/4, the 500-kV line crosses dryland grain farmland and irrigated cropland at 99/1 and joins several transmission lines heading west to the substation.

Travelers on SR 97, which runs north-south through Washington and Oregon across the Columbia River in the vicinity of the John Day Dam, would have limited views due to the highway's distance (approximately 8 miles) from the project corridor.

Travelers on I-84 and US 730 would have intermittent and diminished views of the proposed line, due to the line's distance from I-84 (approximately 2 miles) and US 730 (varies from approximately 1 to 6 miles). The towers of the proposed line would blend into the background of the brown hills, making it difficult for travels to see the towers from distances of a mile or more.

Various county roads would provide unobstructed and partially obstructed views of the proposed line at specific locations along the project corridor, especially along the roads leading to Plymouth, Paterson, and North and West Roosevelt in Washington. In these areas, the new line would add to the humanmade elements in the rural landscape.

Recreationists in proximity to the proposed line would likely be engaged in focused activities but would potentially have unobstructed views of long duration, depending on their location and the topography.

Recreationists at the Corps Wildlife Natural Area, McNary Park, and the Umatilla Marina Park, all in Oregon, would be able to see the new line; however, the existing substation and power lines would already be in these recreationists viewscape. The new line would add more humanmade elements to their viewscape.

Recreationists at Plymouth Park in Plymouth, Washington would be able to see the new line, but their existing viewscape includes buildings and power lines on wood poles and steel-lattice towers. Recreationists at Crow Butte State Park would have views of the new line from the north side of the park. The new line would add more elements to the humanmade landscape.

Depending on their location, recreationists on the Columbia River between corridor miles 32 and 75 could have views of the new line. In this area, the hilly terrain blocks views of the new line as the corridor moves up and down the canyons. The new line would add to the humanmade elements. Recreationists at the John Day Recreation Area and Wildlife Viewing Area would have views of the new river crossing near the John Day Dam looking north across the Columbia River.

Other Viewers

Agricultural workers who would have views of the proposed line would be located primarily in Benton County, where most of the irrigated cropland along the project corridor is located. Agricultural workers would be engaged in focused activities, but their views could be of long duration. The relatively sparse vertical elements in the viewscape would provide unobstructed views of the proposed line. The agricultural workers in Sherman County, Oregon, would have partially obstructed views due to their proximity to the network of transmission lines and towers leading into and out of the John Day Substation.

Commercial workers along the corridor would have obstructed and unobstructed views of the proposed line (depending on their location), and their activities would limit their duration of views. Workers at Watts Brothers Frozen Foods would have views of the corridor around corridor mile 13. Views would be most apparent from parking lots or when the workers are outside of buildings. Humanmade elements in the viewscape include existing transmission lines on wood poles and steel-lattice towers, buildings, and fences.

Environmental Consequences—Short-Line Routing Alternatives

Table 3-19 summarizes the visual resources impacts associated with the short-line routing alternatives.

Table 3-19: Impacts of Short-Line Routing Alternatives: Visual Resources

Alternative	Impacts
McNary Substation Alternatives	
A. Relocate administration building presently located on north side of substation adjacent to Wildlife Natural Area	Recreationists at the Corps Wildlife Natural Area and travelers on I-82 and US 730 would have partially obstructed or unobstructed views of construction, depending on their location.
B. Cross Wildlife Natural Area; circumvent administration building on north side	Recreationists at the Corps Wildlife Natural Area and travelers on I-82 would potentially have obstructed views of the proposed line.

Alternative	Impacts
C. Place line in bus work at ground level on north side of administration building, inside Wildlife Natural Area	Recreationists at the Corps Wildlife Natural Area and travelers on I-82 and US 730 would have partially obstructed or unobstructed views of construction, depending on their location. Residences on DeVore Road would have views of the bus work, but the existing substation and power lines would partially obstruct their views.
Hanford-John Day Junction Alternatives	
A. Move existing Hanford-John Day line north 200 feet to make room for new line on north side of corridor	This would be on the opposite side of existing lines and, therefore, less visible from SR 14 and from the residence at corridor mile 69.
B. Place new line on south side of corridor (occupied by roads and towers)	Travelers on SR 14 and recreationists on the Columbia River would have obstructed views of the new line and would have lines on both sides of the road. Location of the new line may require the Goldendale Aluminum guesthouse, presently unoccupied, to be removed.
C. Place new line on south side of highway	Travelers on SR 14 would have views of lines on both sides of the road. Location of the new line may require the house to be removed.
Corridor Mile 32 Alternatives	
A. Keep existing and new lines on tribal land	Travelers on SR 14 and agricultural workers would have partially obstructed views due to the topography.
B. Relocate existing and new lines away from tribal land	Agricultural workers would have partially obstructed views due to the topography. Travelers on SR 14 would be closer to the transmission lines.
Corridor Mile 35 Alternatives	
A. Keep existing and new lines on tribal land	Travelers on SR 14 and agricultural workers would have partially obstructed views due to the topography.
B. Relocate existing and new lines away from tribal land	Agricultural workers would have partially obstructed views due to the topography. Travelers on SR 14 would be closer to the transmission lines.

Mitigation

The following mitigation measures would help minimize visual impacts.

- Site all construction staging and storage areas away from locations that would be clearly visible from SR 14 as much as practical.
- Provide a clean-looking facility following construction by cleaning-up after construction activities.
- Keep the areas around the towers clean and free of debris.

- Provide regular maintenance of the access roads and fences within and leading to the corridor.

Unavoidable Impacts Remaining after Mitigation

The proposed transmission line would be a readily visible part of an existing Bonneville transmission line corridor for residents, travelers on SR 14 and the surrounding county roads and highways, agricultural workers, recreationists, and commercial workers. Depending on the viewer's location in the viewscape, views of the proposed line and towers would be completely obstructed, partially obstructed, or unobstructed.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, the visual quality and sensitivity of the viewers along the existing Bonneville corridor would not be influenced by the proposed project. Viewers would continue to see the existing transmission lines and towers in the existing Bonneville transmission line corridor.

Socioeconomics, Public Services, and Utilities

Affected Environment

The study area for this section covers six counties, four of which are where the proposed project would be located. The other two counties, Franklin County in Washington and Wasco County in Oregon, are less likely to be affected, but were also included in the population, employment, and housing analyses because they could potentially provide and house part of the construction workforce.

Population Growth

In 2000, the six-county study area had a population of 307,256 people. Benton County, Washington, was the most populated with 142,475 people and Sherman County, Oregon, was the least populated with 1,934 people.

Overall, the study area experienced a 2.3% average annual increase in population from 1990 to 2000, somewhat greater than the average annual increases for Washington and Oregon (2.1% and 2.0%, respectively). The counties with the greatest increases in average annual growth for that period were Franklin County (3.2%) and Benton County (2.7%) in Washington, and Umatilla County (1.9%) in Oregon. Unlike the rest of the study area, Sherman County experienced virtually no population change (0.08%) from 1990 to 2000.

The growth experienced in the 1990s reversed the stagnant annual average population growth in the study area, 0.3%, occurring during the 1980s.

Employment

In 2000, Oregon's three-county study area employment was 42,135 people, of that the average annual agricultural employment was 4,350. In 1999, Washington's three-county study area total employment (including agriculture) was 87,627 and of this total, agriculture, forestry, and fishing accounted for 11,241 people.

Oregon

The data for agricultural employment in Oregon was based on the Current Population Survey (an annual survey of households in Oregon) and was therefore not combined in a table with the nonagricultural employment, which is based on the 1987 Standard Industrial Classification (SIC) manual. In 2000, the annual average agricultural employment in Sherman County was 250 people, Umatilla County was 2,380 people, and Wasco County was 1,720 people, while it was 52,700 in the state of Oregon. All data was obtained from the Oregon Employment Department.

In 2000, employment in the agricultural sector was roughly 10.3% of the combined study area counties (when agriculture and nonagriculture data are combined). Specifically, agricultural employment was roughly 26.7% in Sherman County, 15.6% in Wasco County, and 7.8% in Umatilla County.

The remaining approximately 90% was nonagricultural employment in the three-county area in 2000. The primary nonagricultural employment sectors in the combined three-county area were wholesale and retail trade (25.8%), government (25.6%), services (20.6%), and manufacturing (14.6%). Employment in all other sectors was less than 6% each.

Specifically, the primary nonagricultural employment sectors in Sherman County were wholesale and retail trade (45.3%), government (42.3%), and services (5.8%), similar to Umatilla and Wasco Counties. In Umatilla County, government employment was 25.1%, wholesale and retail trade was 24.9%, and services was 19%. Manufacturing in Umatilla County was 15.7%. In Wasco County, the primary sectors were wholesale and retail trade (27.0%), government (26.0%), services (24.5%), and manufacturing (12.6%). All other employment sectors in Wasco County were less than 4% each. The distributions are relatively similar to the state of Oregon (see Table E-1 in Appendix E).

The 2000 average annual unemployment levels in Sherman, Umatilla, and Wasco Counties were 5.7%, 6.4%, and 6.5%, respectively, somewhat greater than the state's 2000 annual average unemployment rate of 4.9%.

Washington

In 1999, agriculture, forestry, and fishing made up approximately 13.0% of the employment of the combined study area in Washington. The primary employment sectors in the 3-county study area combined were services (24.9%); government (17.6%); retail trade (16.4%); agriculture, forestry, and fishing (13%); and transportation and public utilities (10.1%). All other sectors are less than 10% each.

Specifically in 1999, Franklin County's primary employment sectors were agriculture, forestry, and fishing (23.1%); services (20.8%); government (18.3%); and retail trade (12.6%). All other employment sectors were less than 8% each. This differs slightly from Klickitat County, where the primary sectors were government (27.3%); manufacturing (23.0%); agriculture, forestry, and fishing (14.6%); and retail trade (11.0%); with all other sectors representing less than 10% each. In Benton County, the primary sectors were services (27.3%), retail trade (18.0%), government (16.1%), and transportation and public utilities (12.6%), with all other sectors representing less than 10%. This is somewhat similar to the state of Washington, where services (26.9%), retail trade (17.9%), government (17.0%), and manufacturing (13.6%) in 1999 were the primary sectors, with all other sectors representing less than 6%. Agriculture, forestry, and fishing in the state of Washington in 1999 was 3.4%.

The 1999 average unemployment level in Benton County was 5.6%, slightly higher than the state's average of 4.7%, while the unemployment levels in Klickitat and Franklin Counties in 1999 were 9.5% and 9.6%, respectively.

Environmental Justice

Federal Agencies are required to consider impacts on minority and low-income populations (Executive Order 12898).

The race distribution for Sherman and Umatilla Counties and the state of Oregon is included in Table E-1 in Appendix E. Sherman County's minority population is 6.4%, less than the state's population of 13.4%. Umatilla's minority population is slightly higher than the state's at 18%. Only 6 miles of the project corridor are located in Umatilla and Sherman Counties in Oregon.

The distribution of races in Benton and Klickitat Counties is compared to the state of Washington in Table E-2 in Appendix E. The category of "two or more races" in the 2000 census data addresses the issue of avoiding double-counting individuals, who might be of two different races (e.g., Hispanic and American Indian). Benton and Klickitat Counties have slightly lower minority populations (13.7% and 12.4%, respectively) than the state of Washington (18.2%).

The U.S. Census Bureau follows the Office of Management and Budget's Statistical Policy Directive 14 to determine poverty status based on income level. Poverty status can be used as a measure of low income for environmental justice analyses. Poverty thresholds do not vary geographically, but do vary according to size of family unit. In 1990 the poverty thresholds varied between $6,652 (one person) to $26, 848 (nine or more persons). The number of people below the poverty level in 1990 was 11.1% in Benton County and 17.0% in Klickitat County, higher than the 10.9% in Washington, and 9.9% in Sherman County and 16.5% in Umatilla County, compared to 12.4% in Oregon. (2000 county-level poverty status data are not yet available).

Housing

Within the six-county study area there were 9,370 vacant housing units in 2000.

In general, the study area shows a moderate to high vacancy rate, with vacancy rates for the individual counties within the study area ranging from 5.5% in Benton County to 14.8% in Sherman County. Table E-3 in Appendix E compares the total number of housing units in the six-county study area to the number of vacant units.

> *Vacancy rates from 5% to approximately 7% typically reflect relatively few actual vacancies and are likely a result of people in transition between housing units. Vacancy rates of 7% to 10% reflect a moderate number of available housing units, and 10% or greater vacancy rates reflect a relatively high number of available units.*

Lodging and Parks

In addition to the vacant housing units in the study area, there are 40 hotels and motels with more than 1,650 rooms/beds in communities surrounding the project corridor (see Table E-4 in Appendix E). These rooms/beds are located in Goldendale, Kennewick, and Pasco, Washington, and Hermiston, Wasco, Rufus, and The Dalles, Oregon. (MSN SuperPages web site)

Within the study area there are also state parks and recreational facilities, some of which have overnight camping facilities.

Schools

Within the study area, there are 14 elementary/primary schools, six middle schools, and seven high schools in Umatilla, Rufus, Moro, and The Dalles in Oregon, and Benton, Paterson, Plymouth, Prosser, Roosevelt, and Goldendale in Washington. The school enrollment varies from 12 to 827 students.

Services and Utilities

The following sections detail the public services that serve the area of the project corridor. (Franklin and Wasco Counties are not included in this discussion because they are not crossed by the proposed transmission line.)

Fire and Medical Services

In the vicinity of the McNary Substation where the project begins, Fire District 7 provides coverage for unincorporated Umatilla County near and including the City of Umatilla, Oregon. This district is staffed by one part-time firefighter, one full–time firefighter, and 28 volunteers. There are two fire stations within Fire District 7, each with seven vehicles including brush trucks, haulers, and a command vehicle. Each fire station has an aid vehicle that serves Good Shepard Hospital (49 beds) in Hermiston, Oregon. The district responded to approximately 360 emergency calls last year. (Stokoc pers. comm.)

The Benton County Fire Department, District 6 provides service along the project corridor from the McNary Dam to the Klickitat County border. There are approximately 30 volunteers and a full-time chief. They have approximately 18 vehicles distributed among four stations, with the main station located in Paterson. Types of vehicles include water trucks, bulldozers, and Class A engines (structural pumper). Fire District 6 has two ambulances with crews that are Intermediate Life Support (ILS) certified paramedics, and helicopter emergency airlift capability out of Moses Lake (Harris pers. comm.). They also provide ambulance service for parts of Klickitat County along the project corridor. Emergency cases are transported to the nearest facility that can handle the situation. Nearby hospitals are located in Hermiston, Oregon (Good Shepherd Hospital, 49 beds), in Richland, Washington (Kadlec Hospital, 153 beds), and in Kennewick, Washington (Kennewick General Hospital, 71 beds). Fire District 6 responded last year to approximately 145 emergency calls.

Klickitat County, to the west of Benton County, has three fire districts—Districts 7, 9, and 10—that cover the project corridor along SR 14. Fire District 9, which is staffed by 30 volunteers, provides service for people in the Roosevelt area of Klickitat County. Their emergency medical technicians provide aid service and they can transport emergency cases (with permission) to Goldendale (Klickitat Valley Hospital, 31 beds) or to the nearest hospital. They responded to between 20 and 25 emergency calls last year. They have approximately nine vehicles, comprised of engines, an aid car, tanker, and wildfire rigs. (Wright pers. comm.) Districts 7 and 10 are of similar size.

In the vicinity of the John Day Substation at the western terminus of the project, in Sherman County, Oregon, the fire districts are staffed by volunteers. The Rufus Volunteer Fire Department deals with fires within the city limits, and the North Sherman Fire District provides service in north Sherman County in the Wasco area. However, it is common for more than one district to respond to the same call (for example, Rufus and North Sherman could both respond to fires in the project corridor).

There are between 10 and 12 volunteers at the North Sherman Fire District, and two of those volunteers are dispatchers. Their vehicles include one rescue rig, one engine, one tender/tanker, one Osh Kosh truck, two brush rigs, and one command vehicle (a Ford Ranger pickup). They have two ambulances stationed in the town of Moro. They transport emergency cases to Mid Columbia Hospital (49 beds) in The Dalles. They responded to approximately 118 emergency calls last year. (Southerland pers. comm.)

Police Services

The Umatilla County sheriff's office and the Oregon State Police patrol unincorporated Umatilla County, including the McNary Substation. The Corps provides security at the dam. The main sheriff's office is in Pendleton. On an average day they have four to five deputies working in the field. Other duty officers include the sheriff, undersheriff, two detectives, and a sergeant. There are also two officers who work strictly on domestic violence cases. The sheriff's office has 34 vehicles which include search and rescue vehicles, ambulances, patrol vehicles, a transport vehicle, and two boats. Four snowmobiles are also used for winter snow trail patrols. Last year they responded to 9,556 emergency calls. (Leblanc and Lieuallen pers. comms.)

Police service for the project corridor in Benton County would be provided by the Benton County sheriff's office located in Kennewick. The sheriff's office has four detectives, two traffic officers, two civil officers, and eight patrol officers. The sheriff's office has approximately 44 patrol cars, two boats for its marine patrol along the Columbia River, and an airplane (P. and M. Hart pers. comm.). The sheriff's office responded to between 17,000 and 18,000 calls last year.

The Klickitat County sheriff's office patrols all of Klickitat County, except the cities of Goldendale, White Salmon, and Bingen. They generally have three to six people on duty during the day and two to three deputies on duty at night. Their staff includes two detectives, the sheriff, the undersheriff, and the deputies. They have 29 vehicles, two boats (not currently in service), and two jet skis. They also have a marine patrol staffed by three deputies (Paisley pers. comm.).

The Sherman County sheriff's office is located in the city of Moro. A sheriff and three deputies patrol all of Sherman County in conjunction with the Oregon State Police. They have six vehicles and one boat that is used in the summer for marine patrols. Last year they responded to approximately 400 calls of which 200 received actual case numbers. There are no city police in Sherman County (McAllister pers. comm.).

Environmental Consequences—Proposed Action

Potential socioeconomic impacts of the proposed transmission line are addressed in the following sections.

Impacts During Construction

The proposed timeframe for construction would be a 1-year period from January to December.

The project would be constructed by one or more construction crews. A typical transmission line construction crew for the 500-kV line would likely consist of up to 60 construction workers.

The typical crew would likely construct about 10 miles of line in 3 months. To meet the proposed construction schedule for this project (1 year), two or more crews would work simultaneously on separate sections of the 79-mile-long transmission line.

For this EIS discussion it is assumed that three crews would work on the line, with one crew working at each end and one crew working in the middle, heading west. The middle section of the project corridor heading west is a very rocky area with difficult terrain and geological features that are expected to slow down installation time.

In the following paragraphs, the potential construction impacts are described for population, employment, housing, community services, utilities, and property.

During the 1-year construction period, approximately 180 workers would be required to complete the project, assuming three crews are mobilized at the start of the construction period. Of these crews, one would likely be stationed out of the Umatilla and Hermiston area (Umatilla County) and the other two would likely be stationed either in Goldendale (Klickitat County) or in the Biggs, Wasco, or Rufus area (Sherman County). Franklin and Wasco counties—which have relatively large metropolitan areas including Pasco (Tri-Cities Area) and The Dalles—could also provide workers and attract workers to stay there during construction.

Table E-5 in Appendix E shows the worker availability in the communities within the study area where potential construction workers might originate. Whether Bonneville's construction contractors would hire local workers or bring in their own workforce for the project is unknown. Based on the data collected, there are potentially more than 400 (as of 1999/2000) unemployed workers available in the six-county study area with the skills required to perform the construction tasks for the proposed transmission line.

Assuming one-third of the construction work force is hired from local communities (60 people), that means that 120 workers will come in from outside the project area. There would be potential positive impacts to employment in the surrounding area if local people are employed for the project. A potential temporary increase in spending on goods and services in the study area would also occur. The potential influx of workers from outside the project area would create a temporary increase in population.

There would likely be an adequate number of rental units and hotel/motel rooms available for the workers who may migrate into the study area. In addition to the over 9,000 vacant housing units in the study area, there are 40 hotels and motels with over 1,600 rooms/beds potentially available within commuting distance to the three work zones for the project.

Also, the state parks and RV facilities in the project vicinity would provide construction workers with additional accommodations. Therefore, no adverse impacts to housing in the study area are expected, and the influx of workers would create modest economic benefits to the area.

Schools are not expected to be impacted. In general construction crews coming from outside of the project area do not tend to bring families with them, so there would be no additional children enrolled in local schools.

The risk of fire along the project corridor would increase during construction of the proposed transmission line. However, there are volunteer fire units in the area to help combat fires and additional units could be brought in from surrounding areas if the need arises.

No impact to electrical services, water and sanitary sewer systems, or solid waste disposal are expected occur during construction because no new housing would be built to house construction workers.

Property Impacts

Most of the right-of-way along the existing corridor is wide enough to accommodate the proposed transmission line. However there are a few locations where Bonneville would have to acquire easements from landowners. These locations total about 14 miles of the 79-mile line. In addition, it is anticipated that some access road easements would need to be acquired. Bonneville would pay market value to nonfederal landowners for any new easements required for the project, and the market value would be established through an appraisal process.

The easements required for the project may encumber the right-of-way area with land use limitations. The easement specifies "the present and future right to clear the right-of-way and to keep the same clear of all trees, whether natural or cultivated, and all structure supported crops, other structures, trees, brush, vegetation, fire and electrical hazards, except non-structure supported agricultural crops less than 10 feet in height." The landowner may grow most crops or graze livestock. Special written agreements may be entered into between Bonneville and the landowner to allow ornamental or orchard trees and structure-supported crops. Heights of the trees/crops and access would be controlled to maintain safe clearance for the transmission lines.

The impact of introducing a new right-of-way easement for transmission towers and lines along the corridor would vary depending on the placement of the right-of-way in relation to the property's size, shape, and location of existing improvements. The transmission line could diminish the utility of a portion of the property if the line effectively severed this area from the remaining property (called "severance damage").

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.

With regard to access roads, if Bonneville acquires an easement on an existing access road along the project corridor and the landowner is the only other user, market compensation would likely be 50% of full fee value or something less than 50% if other landowners share the access road use. If Bonneville acquires an easement for the right to construct a new access road for the project, and the landowner would get equal benefit and use of the access road, market compensation would likely be 50% of full fee value. If the landowner has little or no use for the new access road to be constructed, market compensation for the easement would likely be close to full fee value. Along much of the corridor where there are existing easements, land use limitations have already been in place.

If the new transmission line crossed a portion of a property in agricultural use such as pasture or cropland, little utility would be lost between the towers, but 100% of the utility would be lost within the base of the tower. Towers may also present an obstacle for operating farm equipment and controlling weeds at tower locations. To the extent possible, the new transmission lines and towers would be designed to minimize the impact to existing and proposed (if known) irrigation systems. In areas where new right-of-way needs to be acquired, if the irrigation equipment or layout needs to be redesigned because of the proposed transmission line facility, Bonneville would compensate the landowner for the additional reasonable costs. In areas, where the new construction would be within existing right-of-way, Bonneville would follow existing agreements made with the landowner and work with them to minimize the impact to the irrigation systems.

Environmental Justice

Minority and low-income populations would not be disproportionately affected by the proposed project because the project would occur entirely within or adjacent to an existing Bonneville transmission line corridor. The population that would be crossed by the line are a mix of income levels and there are no minority groupings. Individuals from these populations may experience positive benefits if they become part of the construction workforce.

Impacts During Operation and Maintenance

During operation of the project, no impacts are expected to housing, schools, or water and sanitary sewer systems, and only minor adverse impacts could occur to emergency services, due mainly to the risk of fire. Positive benefits include increased service capacity for the Bonneville transmission grid.

Property Values

The proposed transmission line is not expected to have long-term impacts on property values in the area. Zoning is the primary means that most local governments use to protect property values. By allowing some uses and disallowing others, or permitting them only as conditional uses, conflicting uses are avoided.

As a result of the proposed project, some short-term adverse impacts on property values (and salability) might occur on an individual basis. These impacts would be highly variable, individualized, and unpredictable.

Property Tax Impacts

The proposed action would have no direct beneficial effect on the local taxing districts because Bonneville, as a federal agency, is exempt from local taxes. Conversely, the proposed action could have a minor but negative impact on local taxing authorities if any properties are devalued as a result of limits the proposed easement might impose on the highest and best use of a parcel. Offsetting any such decrease, however, could be the increase in the amount of taxes collected by the taxing authorities as a result of the increase in development that might be enabled by the additional supply of power.

Environmental Consequences—Short-Line Routing Alternatives

In general, socioeconomic impacts would be the same for all the short-line routing alternatives described in Chapter 2, with the exception of possible use of tribal lands for the Corridor Mile 32 Alternatives and Corridor Mile 35 Alternatives routings. If Bonneville wishes to cross tribal lands in these areas, they would reach an agreement with the tribes about compensation for the use of tribal property, which would be a positive impact. No impacts from the other short-line routing alternatives are expected.

Mitigation

See the Land Use section at the beginning of Chapter 3 for mitigation measures for agricultural uses. No additional mitigation measures are required.

Unavoidable Impacts Remaining after Mitigation

No impacts are anticipated during construction or operations on schools; housing; electrical, water and sanitary sewer systems; or minority and low-income populations. Minor adverse impacts could occur to emergency services, mainly due to risk of fire. Modest economic benefits could include increased employment in the area, local purchase of goods and services, and increased service capacity for the Bonneville transmission grid.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, there would not be opportunity to hire people from the area to work on the project, nor would there be an increase in goods and services and lodging revenues from workers staying in the area during construction.

Transportation

Modes of transportation identified for this analysis include

- roads in the general project vicinity,
- road systems that would be used by project personnel during project construction, operation, and maintenance,
- regional roads that would likely be used for transportation equipment and components,
- railroads,
- barges on the Columbia River, and
- local airports.

Affected Environment

Roads

Equipment and component parts for the project (such as transmission tower sections) are likely to come from all over the world. The main ports of entry for the parts would be Seattle, Washington, and Portland, Oregon. The parts would likely travel by truck to the project via I-5. I-5 provides access across the Columbia River and connects with SR 14 in Vancouver, Washington, and with I-84/US 30 in Portland, Oregon. East-west access on the south (Oregon) side of the Columbia for the project is provided by I-84/US 30. The Bonneville right-of-way and SR 14 follow the north (Washington) side of the Columbia River for more than 80% of the project length. If parts are trucked from the east, they would likely be transported via I-90, connecting to I-82/SR 97 near Ellensburg, connecting to the project site via SR 97 near Goldendale or I-82/SR 12 on east past the Tri Cities via I-82/US 295 into Hermiston.

Two bridges provide access across the Columbia River within the project area. Approximately 8 miles west of the John Day Dam, US 97—the 2-lane Biggs Rapid Bridge—crosses the river. At the eastern end of the project near Plymouth, I-82/US 395—a 4-lane divided bridge—also crosses the river.

In addition to SR 14 and I-84/US 30, likely roadway travel routes in the project vicinity (from east to west) include I-82/US 395, US 730, SR 221, and SR 97. South of the Columbia River I-82 joins with I-84/US 30. North of the Columbia River at McNary Dam, I-82/US 395 travels north toward the Tri Cities area, Washington. US 730 provides northeast access to the project area from Boardman Junction (I-84/US 30) toward and adjacent to the Columbia River until Umatilla, Oregon. SR 221 travels north from Paterson and eventually joins with I-82/SR 12, which provides access to the Tri Cities area and Yakima, Washington. US 97 provides north access to Toppenish and the Yakima Valley, Washington, while US 97 provides south access to Bend, Oregon.

Figure 3-7 shows the major regional and local transportation facilities serving the project area and the average daily traffic volumes for the roads serving the project vicinity. Load restrictions on area roadways are discussed in Chapter 4.

Data were obtained from the Washington State Department of Transportation and the Oregon Department of Transportation.

Railroads

Bonneville could choose to utilize the Burlington Northern Santa Fe Railway that follows SR 14 and the project corridor to transport materials.

Barges

The Columbia River could also be utilized to transport equipment and components via barge. As shown on Figure 3-7, there are ports in the project vicinity at Umatilla, Morrow, and Arlington.

The Port of Morrow and Port of Umatilla would be able to assist in the import or export of materials for Bonneville.

The Port of Morrow has three solid waste barges and two to three export barges scheduled per week. Weight constraints for the containers are rated at 40 to 45 tons (Gordon pers. comm.).

The Port of Umatilla has three barges scheduled per week consisting of refrigerated container barges. There are 100 receptacles on the dock and sometimes they are full. Storage is available and they have the capacity for 80 containers at 60,000 to 68,000 pounds each. Annually this port has 5,000 to 5,500 imports and exports. A Burlington Northern Santa Fe Railway run comes from the Hinkle switchyard to the port once a day (Chris, Inc. 2001).

The Port of Arlington is a grain barging facility with tie-ups and is open Tuesdays and Thursdays.

Air Transport

There are seven airports and landing strips of various sizes in the project vicinity (see Figure 3-7). From east to west, these facilities include

- Hermiston Airport (Hermiston, Oregon) located approximately 8 miles south of the Columbia River at the Plymouth bridge crossing;
- Umatilla Airport (Umatilla County, Oregon) located approximately 10 miles south of the Columbia River near the Benton, Morrow, and Umatilla county lines;
- Columbia Crest Winery Airport (Benton County) located 1 mile north of the project corridor near Paterson;
- Boardman Flight Strip (Morrow County, Oregon) located approximately 5 miles south of the corridor near Crow Butte;
- Arlington Municipal Airport (Arlington, Oregon) located approximately 2 miles from the project corridor on the south side of the Columbia River;
- A small landing strip near the John Day Dam on the south side of the Columbia River in Sherman County, Oregon; and
- Goldendale Airport located just north of Goldendale off US 97, approximately 15 miles from the corridor.

Environmental Consequences—Proposed Action

Impacts During Construction

Transportation impacts during the 12-month construction period are anticipated to be minimal. During project construction, heavy and light vehicles would access the corridor, and equipment and components would be transported to the project site via trucks, along the routes previously described in the Affected Environment section.

There are numerous transportation options for getting equipment to the project sites. Highway SR 14 in combination with local roads and the access road system provide adequate pathways for getting materials and workers to the project with minor impacts to existing traffic flows.

Bonneville would use up to 90% of the existing 90 miles of access roads along the corridor. Many of the access roads are approached from SR 14; there are 35 sites where Bonneville vehicles leave the highway directly to access roads. Staging areas would be set up along or near the corridor for construction crews to store materials and trucks.

It will not be necessary to close SR 14 or the Burlington Northern Santa Fe Railway during construction. However, the contractor would work with both the highway department and the railroad regarding schedule. There may be short interruptions of SR 14 traffic when trucks cross the road or there is blasting (to protect cars from flying debris). If the railroad needs to be crossed, the contractors would appropriately time the crossing to avoid interrupting train service.

Impacts During Operation and Maintenance

Transportation impacts during operation and maintenance of the transmission line would be negligible. Operation and maintenance traffic would normally consist of personnel vehicles and project pickup trucks. On infrequent occasions, larger equipment, such as flatbed trucks or a crane, may be required to replace or repair the transmission line and towers.

Environmental Consequences—Short-Line Routing Alternatives

Transportation impacts for the various short-line routing alternatives would not differ from those discussed above.

Mitigation

The following mitigation measures would help minimize transportation impacts.

- Coordinate routing and scheduling of construction traffic with state and county road staff and Burlington Northern Santa Fe Railway.
- Employ traffic control flaggers and post signs warning of construction activity and merging traffic, when necessary for short interruptions of traffic.
- Repair any damage to local farm roads caused by the project.
- Install gates on access roads when requested by property owners to reduce unauthorized use.

Unavoidable Impacts Remaining after Mitigation

Potential unavoidable transportation impacts could consist of minor delays and interruptions in local traffic during construction.

Environmental Consequences—No Action Alternative

No impacts on existing transportation facilities would occur if the proposed project is not constructed.

Air Quality

Affected Environment

Air quality along the 79-mile corridor is regulated by the Washington Department of Ecology (Central Region and Eastern Region), the Benton Clean Air Authority, and the Oregon Department of Environmental Quality. Each of the agencies has regulations minimizing windblown fugitive dust from all industrial activities including construction projects. None of the agencies regulate the operation of electrical transmission lines or electrical transformers.

There are no major industrial facilities along the corridor and no significant existing air quality problems. Local air pollutant emissions are limited mainly to windblown dust from agricultural operations and tailpipe emissions from traffic along state highways and local roads.

The agencies operate a relatively small number of ambient air quality monitoring stations throughout Washington and Oregon. Monitoring stations are generally placed where the agencies anticipate air quality problems. The nearest monitoring stations are in Washington at Wallula, Kennewick, and Goldendale. Based on available data from those monitoring stations, the agencies acknowledge that air quality along the transmission line corridor complies with all regulatory limits for ambient air concentrations. The project area has been designated by the agencies as having “attainment” status.

There are a few areas in Washington and Oregon that have been designated as “nonattainment” with respect to air quality standards, but the 79-mile corridor is not in any of those areas. Air quality permitting requirements for attainment areas are relatively straightforward compared to the requirements for nonattainment areas. For this project Bonneville would not be required to conduct a “conformity analysis” to quantify emissions during construction and operation, and Bonneville would not be required to offset emissions generated during operation and maintenance.

Environmental Consequences—Proposed Action

Impacts During Construction

Air quality impacts associated with the construction of the proposed transmission line and associated facilities would be minimal. The primary type 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 construction crew (50 to 60 workers) could construct about 10 miles of line in 3 months. Construction equipment would consist of

20 vehicles (pickups, vans), three bucket trucks, one conductor reel machine, three large excavators, one line tensioner, and one helicopter.

The amount of pollutants emitted from construction vehicles would be relatively small and similar 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.

Construction activities that could create dust include access road improvements and construction, and work area clearing and preparation. 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.

Impacts During Operation and Maintenance

Air quality impacts during operation and maintenance of the project would be negligible. Operation and maintenance vehicles would mainly use access roads with native surfaces, causing dust particles to be stirred up. Quantities of potential emissions would be very small, temporary, and localized.

Environmental Consequences—Short-Line Routing Alternatives

Air quality impacts for the various short-line routing alternatives would not differ from those identified above.

Mitigation

The following mitigation measures would help to control dust and reduce emissions.

- Water exposed soil surfaces if necessary to control blowing dust.
- Cover construction materials if they are a source of blowing dust.
- Limit vehicle speeds along dirt roads to 25 miles per hour.
- Shut down idling construction equipment, if feasible.

Unavoidable Impacts Remaining after Mitigation

Unavoidable impacts from the project include low levels of combustion pollutants and dust from vehicles during project construction and maintenance.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, potential impacts to air quality associated with the proposed project would not occur. Minor releases of combustion byproducts and fugitive dust associated with maintenance of the existing project corridor would continue.

Noise

Affected Environment

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 transmission line wires. 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 during wet weather. Conductors can be wet during periods of rain, fog, snow, or icing. Such conditions are expected to occur infrequently 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 3-20 shows typical noise levels for common sources expressed in dBA.

Table 3-20. Common Noise Levels

Sound Level, dBA*	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

* Decibels (A-weighted)
Sources: Adapted from Bonneville 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_{25} refers to a particular sound level that is exceeded 25% of the time.

Along the corridor of the proposed 500-kV transmission line, existing noise levels vary with the proximity to existing transmission lines and the proximity to other noise-generating activities. Most of the proposed corridor is near highways or freeways, so it is expected that existing fair weather noise levels are already mainly characterized by traffic noise. In addition, the proposed line would parallel existing lines for most of its length. During foul weather, these lines would be the principal source of background noise both near highways and in the more remote areas of the corridor far from highways.

The Washington Administrative Code (WAC 173-60) and the Oregon Administrative Rules (OAR 340-35) specify noise limits according to the type of property where the noise would be heard (the "receiving property"). Transmission lines are classified as industrial sources for purposes of establishing allowable noise levels at receiving property. Bonneville has established a design criterion for corona-generated audible noise from transmission lines of 50 dBA for the L_{50} (foul weather) at the edge of the right-of-way. Both the states of Washington and Oregon have interpreted this criterion to meet their respective noise regulations.

Environmental Consequences—Proposed Action

Impacts During Construction

Sources of noise associated with construction of the proposed project include

- construction of access roads and foundations at each tower site,
- erection of steel towers at each tower site,
- helicopter assistance during tower erection and stringing of conductors,
- potential blasting, and
- potential use of implosive couplers for conductor splicing.

Access roads and foundations at each tower site would be installed using conventional construction equipment. Table 3-21 summarizes noise levels produced by typical construction equipment that would likely be used for the proposed project.

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.

Table 3-21. Construction Equipment Noise Associated with the Proposed Project

Type of Equipment	Maximum Level (dBA) at 50 Feet
Road Grader	85
Bulldozers	85
Heavy Trucks	88
Backhoe	80
Pneumatic Tools	85
Concrete Pump	82
Crane	85
Combined Equipment	89
Source: Thalheimer 1996.	

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 3-22 shows the estimated construction noise levels at various distances from the construction site.

Table 3-22. Construction Noise in the Vicinity of a Representative Construction Site

Distance from Construction Site (feet)	Hourly Leq (dBA)
25	83
50	89
100	83
200	77
400	71
800	65
1600	59
Note: 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 This calculation does not include the effects, if any, of local shielding or atmospheric attenuation.	

Although daytime construction activities are excluded from noise regulations, for this evaluation it was assumed that construction noise levels exceeding the Washington state limits for permanent industrial operations would constitute a temporary (several days at most), environmental impact. The Washington noise limit for noise levels at residential areas caused by permanent daytime industrial operations is 65 dBA. Construction noise levels would exceed Washington Department of Ecology daytime industrial operations limits at distances up to 400 to 800 feet from construction activity.

Residential land use adjacent to the transmission line corridor is of low density and consists of single-family houses and houses with barns and accompanying outbuildings. The residences are concentrated in the cities of Plymouth (corridor mile 4, structure 4/1), Paterson (corridor mile 16, structures 16/1 to 16/5), and North Roosevelt and West Roosevelt (corridor miles 48 and 49, respectively) in Washington, and the cities of Umatilla (corridor mile 1) and Rufus (corridor mile 78) in Oregon. Single residences, small groupings of houses, or small farm complexes are located in the vicinity of structures 6/1, 7/2, 10/4, 22/3, 29/3 by Crow Butte Park, 30/1, 68/1, 68/5, and 69/4. Of these homes, approximately 19 could be affected by noise from construction of the proposed project.

These 19 homes would be within approximately 600 feet of construction activity and may experience noise levels at or above 65 dBA. If helicopters are used to install the towers, a wider range of residences could be affected.

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 Table 3-22. However, Bonneville'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 over several weeks and several sites.

A loaded cargo helicopter flying 250 feet away produces roughly 95 dBA, which is the same amount of noise produced by a diesel locomotive 100 feet away (Helicopter Association International 1993). Homes within approximately 1 mile of the helicopters would be exposed to temporary noise levels above 65 dBA. However, helicopters operated during the daytime to support construction activity are exempted from Washington state noise regulations.

Possible occasional midday blasting might be required at some tower sites in rocky areas where conventional excavation of tower footings was not 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 may also be used to hook conductors together. This disturbance would be localized to the immediate area.

Impacts During Operation and Maintenance

Noise impacts during operation and maintenance of the proposed project would be negligible. About every two months, a helicopter will fly the line to look for any problems or repair needs. When and if these needs arise, 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 by 3 dBA or less. A 3 dBA increase is barely discernible.

For most of the corridor (73 miles), the edge of right-of-way foul-weather noise levels would meet or be below 50 dBA (Bonneville's standard). In some locations, the edge-of right-of-way noise levels would exceed 50 dBA (up to 54 dBA).

There is one building, a residence, near the Hanford-John Day Junction between corridor miles 69 and 70 in the area where the noise levels could be above 50 dBA (52 dBA). The Hanford-John-Day Junction Alternative A-North Side would not increase the existing noise levels on the south side of the right-of-way where the residence is located. Alternative B-South Side and Alternative C-South Side, Highway would increase the noise levels at the edge of the right-of-way near the house. The increase would be about 2 dBA, an increase that is barely discernable.

There is a short section of corridor between miles 65 and 67 where the proposed line would be on the opposite side of the highway from the existing lines. In this location, the corona-generated noise of the existing lines does not contribute much to the background noise, so that the new line would increase existing noise levels by about 5 dBA (for a total of 47 dBA) at the edge of the right-of-way. However, there are no residences or other buildings in this area.

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.

No transformers are being added to the existing McNary and John Day Substations. Noise from the existing substation equipment and transmission lines would remain the primary source of environmental noise at these locations. The large-diameter tubular conductors in the station do not generate corona noise during fair weather; 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 Federal Communications Commission, Chapter 4 for further discussion).

Environmental Consequences of Short-Line Routing Alternatives

The Hanford-John Day Junction Alternatives are the only short-line routing alternatives that differ in potential noise impacts.

Alternative A noise impacts would not differ from those described earlier in this discussion.

Alternatives B and C would cause an additional disturbance at the house in the vicinity of tower 69/4. This guest house is owned by the Goldendale Aluminum Plant and is occupied part-time. There is a possibility that the house may need to be removed (see Chapter 3, Land Use Section). This house is approximately 20 to 30 feet from the corridor and would be impacted by construction noise. At a distance of 25 feet noise levels are expected to be 83 dBA_{Leq} (Table 3-23).

Mitigation

To reduce the potential for temporary, adverse noise impacts during construction, the following measures would be incorporated into contract specifications.

- All equipment to have sound-control devices no less effective than those provided on the original equipment.
- No equipment to have an unmuffled exhaust.
- Construction activities would be limited to daytime hours.
- No noise-generating construction activity to be conducted within 1,000 feet of a residential structure between the hours of 10:00 p.m. and 7:00 a.m.
- Landowners directly impacted along the corridor will be notified prior to construction activities.

Unavoidable Impacts Remaining after Mitigation

Potential unavoidable noise impacts include increased sound levels experienced by area residents within 400 to 800 feet from construction activities during construction of the project. In the short section where the proposed line would be on the opposite side of the highway from the existing lines, the audible noise levels during foul weather would be increased above background levels. In other sections with parallel lines, any increase in audible noise at the edge of the right-of-way would be barely discernible, if at all.

Environmental Consequences—No-Action Alternative

Under the No-Action Alternative, existing background noise levels in the project vicinity would continue without influence of the proposed project.

Public Health and Safety

Affected Environment

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 electrical shocks, fires, and electric and magnetic fields related to transmission facilities or construction activities.

Potential hazards along the corridor include fire (both natural and human-caused), existing overhead transmission line crossings, and natural gas pipeline crossings.

The Federal Aviation Administration 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.

Within Umatilla County, Oregon, there is a chemical weapons stockpile. The Umatilla Army Depot stores mustard “blister” agents and nerve agents. The eastern portion of the project corridor lies within zones where an emergency preparedness program applies in case of an emergency at the stockpile (see Chapter 4 for details).

Transmission lines, like all electric devices and equipment, produce electric fields and magnetic fields (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 electric and magnetic fields depends on the design of the line and on distance from the line. Field strength decreases rapidly with distance.

Electric and magnetic fields are found around any electrical wiring, including household wiring and electrical appliances and equipment.

Throughout a home, the **electric field** strength from wiring and appliances is typically less than 0.01 kilovolts per meter (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 except for the 5-milliampere criterion for maximum permissible shock current from vehicles. Oregon has a 9-kV/m limit on the maximum field under transmission lines. Washington has no electric-field limit. Bonneville 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.

Average **magnetic field** strength in most homes (away from electrical appliances and home wiring, etc.) is typically less than 2 milligauss (mG). Very close to appliances carrying high current, fields of tens or hundreds of milligauss are present. Typical magnetic field strengths for some common electrical appliances are given in Table 3-23. Unlike electric fields, magnetic fields from outside power lines are not reduced in strength by trees and building material. 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. The states of Washington and Oregon do not have magnetic field limits. Bonneville does not have a guideline for magnetic field exposures.

Table 3-23: Typical Magnetic Field Strengths
(1 foot from common appliances)

Appliance	Magnetic Fields (mG)[1]
Coffee maker	1-1.5
Electric range	4-40
Hair dryer	0.1-70
Television	0.4-20
Vacuum cleaner	20-200
Electric blanket[2]	15-100

mG = milligauss
[1] The magnetic field from appliances usually decreases to less than 1 mG at 3 to 5 feet from appliances.
[2] Values are for distance from blanket in normal use (less than 1 foot away).
Source: Miler 1974; Gauger 1985

Environmental Consequences—Proposed Action

Potential health and safety risks associated with the project include those that could affect construction workers, operation and maintenance personnel, crop dusters, other agricultural workers, and others who have occasion to enter the project corridor.

Impacts During Construction

During construction and installation of the towers and conductor/ground wires, 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 towers or access roads, and other risks associated with working near high-voltage lines. There is also a potential for fire during refueling of hot equipment such as trackhoes and bulldozers that cannot be taken off-site for refueling. Connection of conductors may be accomplished using implosion bolts, which could be a source of injury to construction personnel. In addition, there are potential safety issues with more traffic on the highways and roads in the project area during construction.

Impacts During Operation and Maintenance

With the addition of the proposed transmission line, there will be slight additional risks for fire and injuries as maintenance workers and vehicles travel along the corridor to perform required maintenance.

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 Bonneville 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 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. Bonneville provides a free booklet that describes safety precautions for people who line or work near transmission lines. (See Appendix F, Living and Working Safely Around High Voltage Power Lines).

Possible effects associated with the interaction of electric and magnetic fields 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.

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. Transmission lines are designed so that the electric field will 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 Bonneville. The proposed line would meet the Bonneville electric-field guidelines of 9-kV/m maximum on the right-of-way and 5 kV/m at the edge of the right-of-way.

Magnetic fields are subject to controversy. Although there have been decades of research, the issue of whether there are long-term health effects associated with transmission-line fields remains somewhat controversial. Magnetic fields are most in question as possible sources of long-term effects, although studies sometimes lump the two (electric and magnetic) fields together. In recent years, considerable research on possible biological effects of electric and magnetic fields has been conducted. A review of these studies and their implications for health related effects is provided in Appendix G. In addition, the Department of Energy provides a booklet on this topic (Questions and Answers about EMF). Scientific reviews of the research on EMF health effects have found that there is insufficient evidence to conclude that EMF exposures lead to long-term health effects. However, some uncertainties remain for childhood exposures at levels above 4 mG.

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 79-mile-long corridors in which the proposed line would be built is sparsely populated. There are about 40 structures within 400 feet of either side of the right-of-way edge.

Bonneville has predicted the magnetic fields of the proposed and existing transmission lines. The field levels from the existing and proposed lines change along the corridor, depending on how many lines are in the corridor, where they are located relative to one another, and the width of the right-of-way. For this project there are six different line configurations (Configurations 1, 2, 3, 4, 4A, and 4B).

A majority of the proposed line magnetic field levels would be those shown for Configuration 1 (see Figure 3-8), with an increase of about 12 mG at the edge of the right-of-way on the north side. (The 12 mG value is for maximum current and minimum line height above ground in the worst case scenario. The values would be less for average current and with higher line heights above the ground.) The magnetic fields on the south side of the right-of-way would not change. This configuration is in all the locations where the proposed line would parallel the two existing lines on the north side. Within this configuration there are about 13 structures (combination of residences and out buildings) within 400 feet of the north edge of the right-of-way.

About 4 miles of the right-of-way are represented in Configuration 2 (see Figure 3-9), with an increase of about 76 mG on the north edge of the right-of-way. The magnetic fields on the south edge of the right-of-way would not change. This configuration would be located where the Ashe-Slatt 500-kV line parallels the right-of-way (corridor miles 23 through 27). There are no homes or buildings on the north side of the right-of-way in this area.

About 3 miles of the right-of-way would be represented in Configuration 3 (see Figure 3-10), with an increase of about 76 mG on the south edge of the right-of-way and 16 mG on the north edge. This configuration would be located where the proposed line is on the opposite side of the highway from the existing lines, corridor miles 65 through 67. There are no residences or buildings in this area.

About 7 miles of the right-of-way would be represented in Configuration 4 (see Figure 3-11), with an increase of about 75 mG on the south edge of the right-of-way. The magnetic fields on the north edge of the right-of-way would not change. This configuration would be located where the Hanford-John Day 500-kV line is in the right-of-way and the proposed line moves to the south side of the corridor. There are no residences or buildings on the south side of the corridor in this area (see Configurations 4A and 4B for the first mile of the Hanford-John Day Junction).

The Hanford-John Day Junction Alternative A-North Side would be represented in Configuration 4A (see Figure 3-12). This 1-mile section would have a magnetic field increase of about 80 mG on the north edge of the right-of-way. The magnetic fields on the south edge of the right-of-way would not change. There are no buildings or residences on the north side of the right-of-way in this area.

The Hanford-John Day Junction Alternative B-South Side and Alternative C-South Side, Highway would be represented in Configuration 4B (see Figure 3-13). This 1-mile section would have a magnetic field increase of about 78 mG on the south edge of the right-of-way. The magnetic fields on the north edge of the right-of-way would not change. There is a house close by on the south side of the right-of-way in this area.

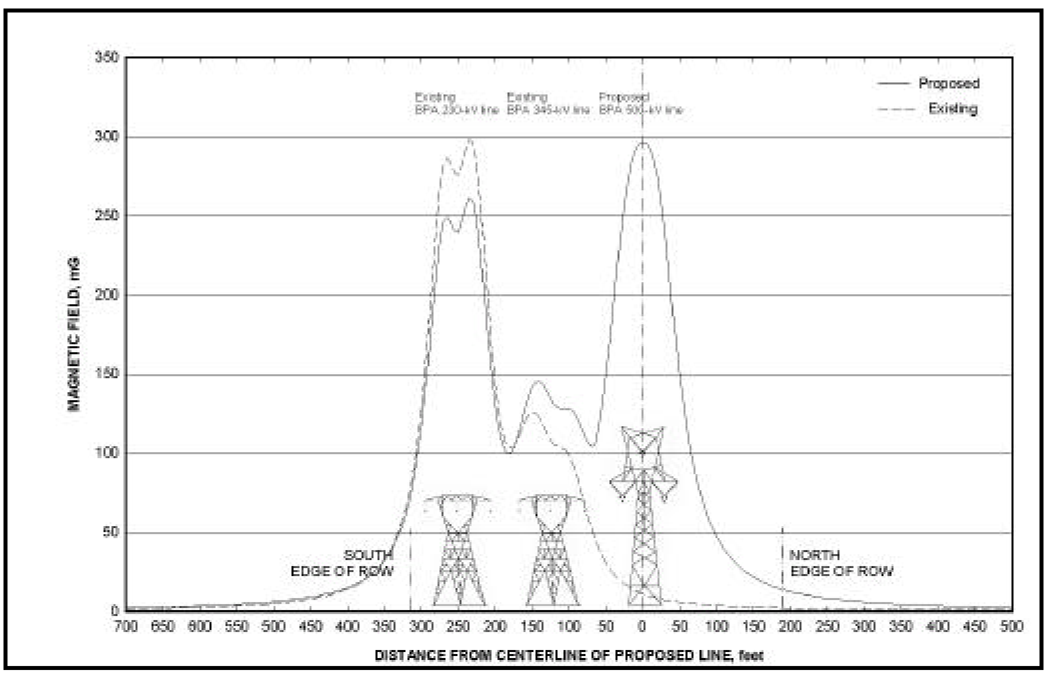

Figure 3-8: Right-of-Way Configuration 1
(majority of the right-of-way)

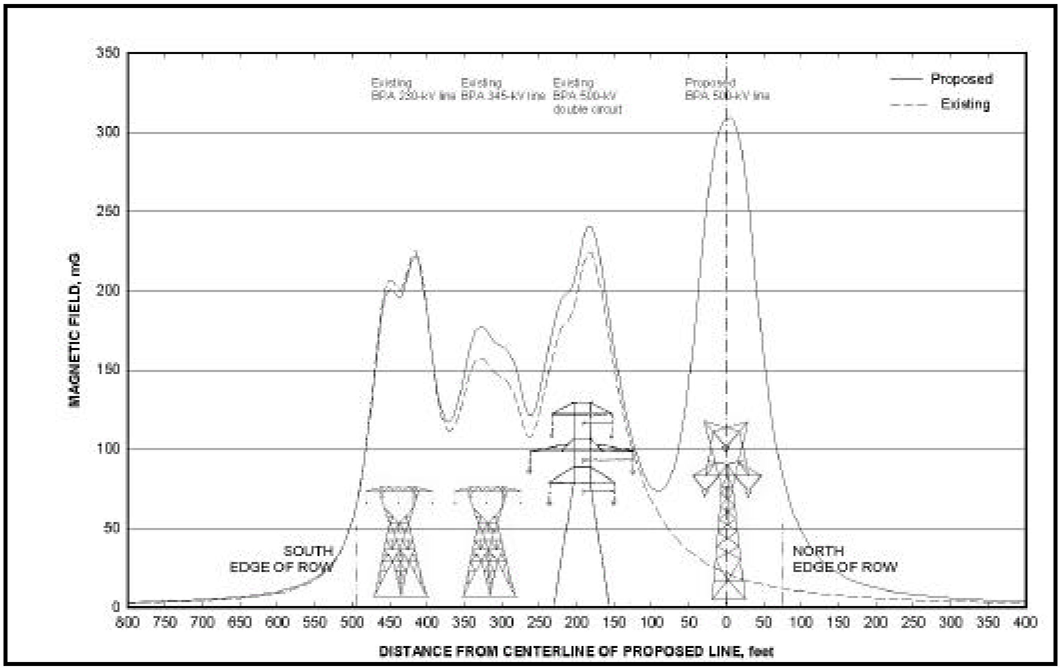

Figure 3-9: Right-of-Way Configuration 2
(about 4 miles of right-of-way where Ashe-Slatt line would parallel)

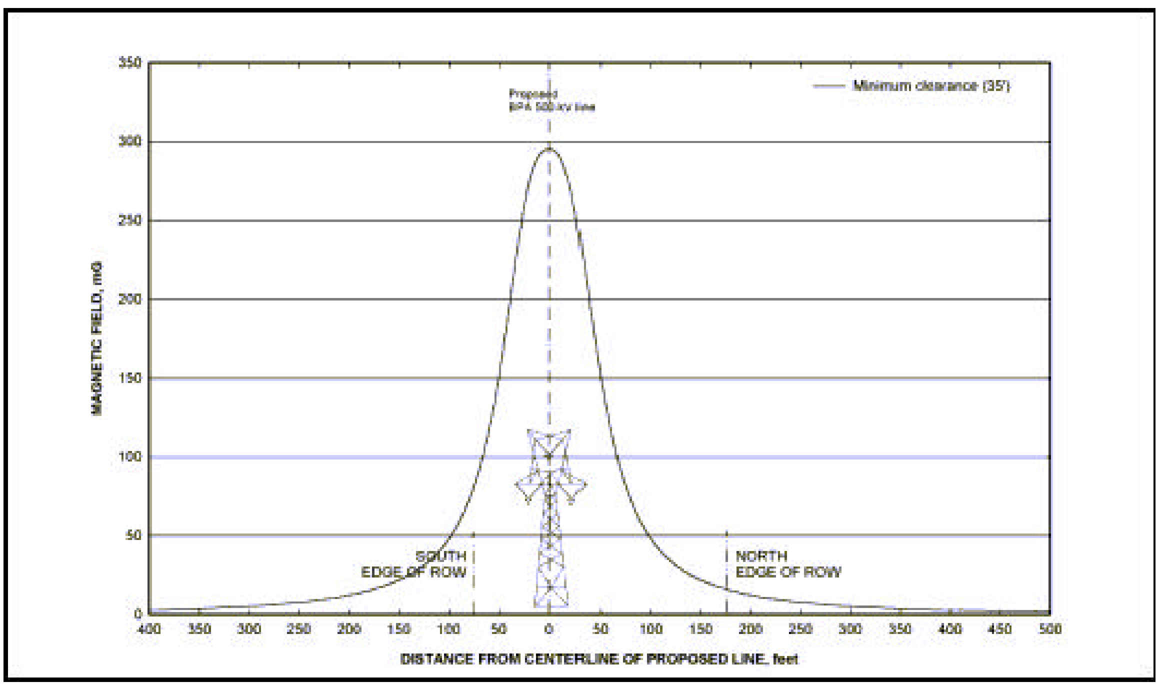

Figure 3-10: Right-of-way Configuration 3
(about 3 miles of right-of-way between corridor miles 65 and 67)

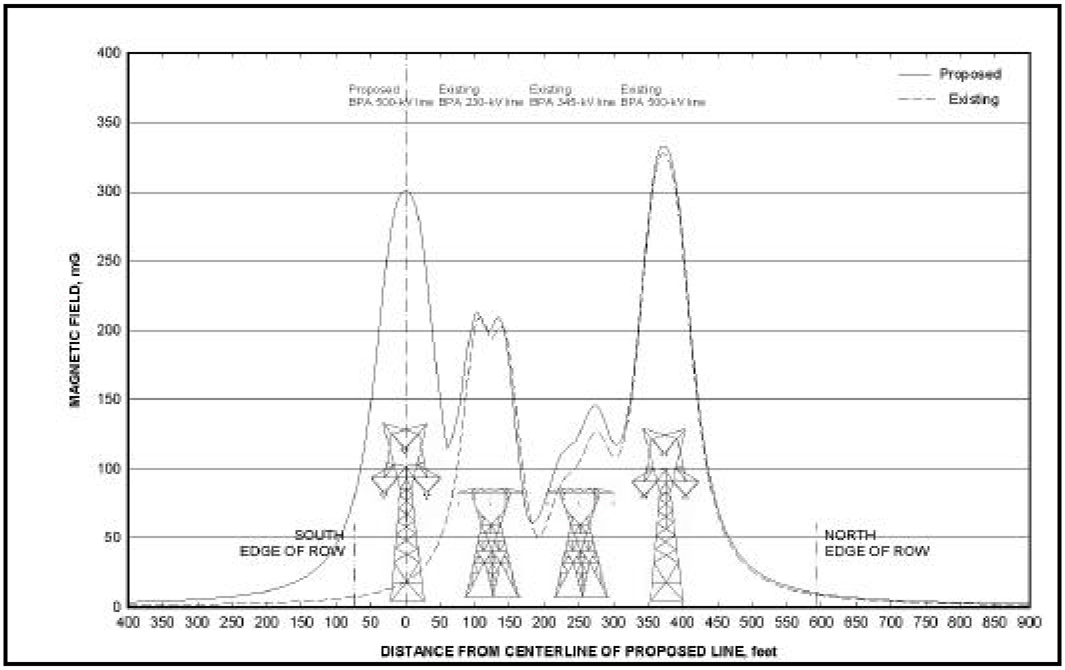

Figure 3-11: Right-of-Way Configuration 4
(about 7 miles of right-of-way where Hanford-John Day would parallel)

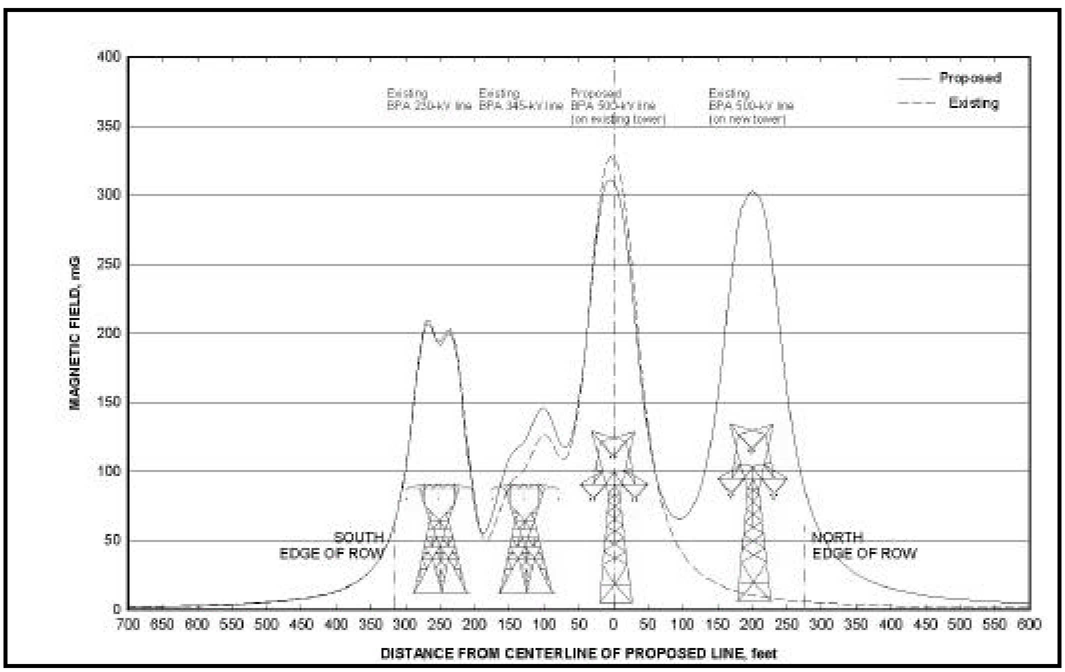

Figure 3-12: Right-of-Way Configuration 4A
(Hanford-John Day Junction Alternative A-North Side)

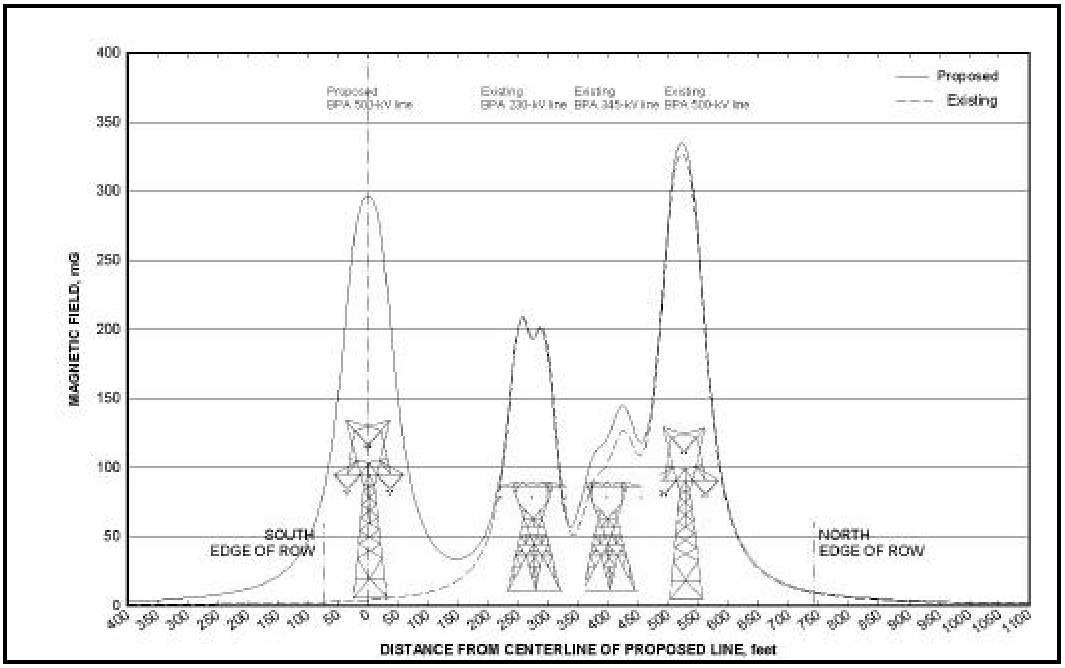

Figure 3-13: Right-of-Way Configuration 4B
(Hanford-John Day Junction Alternative A-North Side and Alternative C-South Side)

Magnetic fields from transmission and distribution facilities can also cause distortion of the image on video display terminals and computer monitors. Interference from transmission line magnetic fields is generally not a problem at distances greater than 200 to 250 feet from a line.

Environmental Consequences of Short-Line Routing Alternatives

There are no differences in potential health and safety impacts from the McNary Substation Alternatives, the Corridor Mile 32 Alternatives, and the Corridor Mile 35 Alternatives. The differences between magnetic fields of the Hanford-John Day Alternatives are discussed above.

Mitigation

The following mitigation measures would help minimize potential health and safety risks.

- Prior to starting construction, contractor would prepare and maintain a safety plan in compliance with Washington and Oregon 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.

- During construction, the contractors would also hold crew safety meetings at the start of each workday to go over potential safety issues and concerns.
- At the end of each workday, the contractor and subcontractors will secure the site to protect equipment and the general public.
- Employees would be trained, as necessary, in tower climbing, cardiopulmonary resuscitation, first aid, rescue techniques, and safety equipment inspection.
- To minimize the risk of fire, fuel all highway-authorized vehicles off-site. Fueling of construction equipment that was transported to the site via truck and is not highway authorized would be done in accordance with regulated construction practices and state and local laws. Helicopters would be fueled and housed at local airfields or at staging areas.
- Helicopter pilots and contractor take into account public safety during flights. For example, flight paths could be established for transport of project components in order to avoid flying over populated areas or near schools (Helicopter Association 1993).
- Provide notice to public of construction activities, including blasting.
- Take appropriate safety measures for blasting consistent with state and local codes and regulations. Remove all explosives from the work site at the end of the workday.
- If implosion bolts are used to connect the conductors, install in such a way as to minimize potential health and safety risks.
- Inform construction and operation/maintenance workers that there is a Umatilla Army Depot emergency preparedness program in the event of a chemical release.
- Operation and maintenance vehicles would carry fire suppression equipment including (but not limited to) shovels and fire extinguishers.
- Stay on established access roads during routine operation and maintenance activities.
- Keep vegetation cleared according to Bonneville standards to avoid contact with transmission lines.
- Submit final tower locations and heights to the Federal Aviation Administration for review and potential marking and lighting requirements.
- Construct and operate the new transmission line to meet the National Electrical Safety Code.
- During construction, follow Bonneville specifications for grounding fences and other objects on and near the proposed right-of-way

Unavoidable Impacts Remaining after Mitigation

Potential unavoidable public health and safety risks include accidental fire that may occur during construction and operation and maintenance, the use and accidental release of hazardous materials, and accidental injury. Nuisance shocks may occur infrequently under the proposed line.

Environmental Consequences—No Action Alternative

Under the No Action Alternative, the proposed transmission line would not be built and the potential increased health and safety risks associated with the proposed transmission line project would not occur.

Cumulative Impacts

"Cumulative impact" is the impact on the environment which results from the incremental impact of an action—such as this proposed action—when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can also result from individually minor, but collectively significant actions, taking place over a period of time (40 CFR 1508.7). In the following paragraphs, the existing development along the project corridor and the reasonably foreseeable future developments planned for the area are described in order to provide a context in which to assess the incremental effects of the proposed action.

Existing Development

Although much of the project corridor has remained as undeveloped rangeland during the last century, interspersed (mainly rural) development has steadily occurred along the corridor. Development continues in present times and will continue in the future. However, it is unlikely that the area along the project corridor would become urbanized in the foreseeable future.

The primary economic base of the project area and the main type of development along the corridor has been and continues to be agricultural-based industry. This includes large cereal grain farms, irrigated row crop farms, and specialty crop enterprises such as orchards and vineyards, all mainly located along the more flat eastern half of the corridor. Along the more hilly western half of the corridor, the main type of development has been the establishment of large land holdings used for cattle and horse grazing.

Other types of development that have occurred along the project corridor include

- the major hydropower dams, electrical generating facilities, and distribution systems at McNary and John Day at opposite ends of the corridor;

- the electrical transmission lines and corridors that have been developed along and across the corridor, to convey power to and from the Bonneville power grid;
- the electrical distribution systems built to provide local power in the project area;
- the numerous underground and surface utility lines that traverse the existing project corridor;
- a variety of agricultural processing plants located along the eastern portion of the corridor;
- the Roosevelt Regional Landfill at Roosevelt; and
- the Goldendale Aluminum Manufacturing Plant located near the John Day Dam.

Transportation infrastructure has also developed in the project area over the last 100 years, in the form of local, county, and state roads (such as SR 14), the Burlington Northern Santa Fe Railway paralleling SR 14 and the Columbia River, the movement of barges along the river, and several rural airports.

Accompanying the agri-business, industrial, and infrastructure development in the project area have been cities, towns, villages, and other residential communities. The largest community along the corridor is the City of Umatilla (population 3,046), adjacent to the McNary Substation. The other communities located along the corridor (Plymouth, Paterson, Roosevelt, and Rufus) have considerably smaller populations, ranging from 79 to 295. The other residents of the project area occupy farmsteads and scattered individual or small cluster dwellings in the unincorporated areas of the four counties encompassing the existing project corridor.

Recreation sites (parks and marinas) have also developed in the project area, mostly associated with opportunities along the Columbia River. Examples include Crow Butte and Maryhill State Parks, and marinas at Rufus and Umatilla.

Future Development

Potential developments that may occur in the reasonably foreseeable future in the project area include

- a gas-fired electrical generation facility near the Goldendale aluminum plant;
- a gas-fired electrical generation facility near Starbuck;
- several wind power electrical generation projects in Klickitat County;
- two gas-fired electrical generation facilities in Umatilla County;
- a gas-fired electrical generation facility at Mercer Ranch in Benton County;
- a gas-fired electrical generation facility near Wallula; and

- additional conversion of selected areas of existing grazing and crop land into specialty crops such as vineyards.

Assessment of Incremental Effects of the Proposed Action

Although the potential environmental impacts associated with the proposed McNary-John Day transmission line would not be significant, the implementation of the proposed action would contribute incrementally to the environmental impacts that are already occurring due to present development and activities in the project area, combined with the impacts that would likely occur from the future developments planned in the area. In the following paragraphs, potential incremental cumulative effects from the proposed action are discussed for those environmental resources where impacts could occur.

Land Use

The majority of land in the project area is zoned for agricultural use. Changes in the types of agricultural uses would not create cumulative impacts to land use; however, changes from agricultural to nonagricultural uses, should they occur, would take agricultural land out of production. Limited development in the near future would not likely create negative cumulative impacts due to the large amount of agricultural land in the area. Cumulative impacts to land use would only be expected if nonagricultural development occurred in agricultural lands at a rapid pace over the next several years.

Geology and Soils

Soil loss through both wind and water erosion has increased throughout the project area as a result of past and present development actions. Practices inducing soil loss include construction of roads and other development, the expansion of towns and cities, and the conversion of native lands to crop and grazing land. The proposed action would incrementally increase the potential for soil erosion in the project area.

Fish

Potential cumulative impacts to fish and other aquatic resources from past, present, and future development in the watersheds along the existing project corridor include the loss of riparian habitat, increased sediment loading, increased stream temperatures, pollution from herbicide and insecticide use, changes in peak and low stream flows, fragmentation of fish habitat, decreases in streambank stability, and altered nutrient supply. Due to the linear nature of the proposed project, and thus the relatively small area of impact within individual watersheds along the corridor, and because no alteration to fish habitat is anticipated to occur because of this project, incremental cumulative impacts from the construction of this project would be negligible.

Vegetation

Native plant communities are being lost in the project area because of past and current development and actions, and these trends will likely result in the further reduction of native plant communities. The actions associated with the proposed project would contribute incrementally and in a relatively minor way to the continuing of loss of native vegetation communities.

Wildlife

The proposed project would also add incrementally to the potential disturbance to raptor, passerine, and deer foraging habitat that is already occurring due to existing human alteration of the landscape.

Because power lines have already been developed along the project corridor, the risk of avian collisions with power lines (albeit minor) has already been introduced, and the proposed new line would slightly increase the risk. However, because the new line would be placed within an existing corridor already containing the same potential risk, the impact would be less than if the new line were placed in an area where there are no existing lines.

Wetlands and Water Resources

Wetland and water resources are being impacted and lost in the project area because of past and current development and activities, wetlands filled or segmented, and sedimentation of streams due to construction or agricultural operations. Agricultural activities are becoming more intensive, with expansion into more irrigated and less dry-land crop management practices. These trends could result in the further degradation and reduction of wetlands and water resources in the area. Although the actions associated with this project would not result in the permanent loss of any wetlands or waters of the U.S., indirect impacts from construction of the transmission line and access roads would contribute incrementally (albeit slightly) to the cumulative degradation of wetlands and water resources in the area.

Cultural Resources

Cultural resources in the project area have been and are being affected because of past and current development and activities. Potential adverse effects on area cultural resources include disturbance of cultural sites, increased likelihood of vandalism, reduction of the cultural integrity of certain sites, and increased encroachment on cultural sites.

Development of the proposed action would contribute incrementally (albeit slightly) to these cumulative effects on cultural resources in the area.

Visual Resources

Existing and future development increases humanmade elements in the rural landscape of the project area, adding vertical elements such as farm/agricultural buildings, fences, and signs to the natural terrain. Since the land in the project area is comprised mainly of agricultural uses, these humanmade elements are an expected component of the rural landscape.

Impacts to visual resources potentially increase when industrial facilities not related to agriculture are constructed in a rural landscape. The proposed transmission line would therefore contribute incrementally to potential cumulative impacts on visual resources in the project area.

Socioeconomics

Development of the proposed line could contribute incrementally to a positive cumulative impact on the economy in the project area from a potential reduction in unemployment, and revenues from increased spending on accommodations, goods, and services during construction. There appears to be sufficient vacant rental dwellings and available temporary housing, hotel/motel, and RV units in the project area to accommodate potentially overlapping construction schedules between the proposed project and other anticipated developments.

Public Health and Safety

There would be an overall increase in risk of fire and injury to the public and to project Potential unavoidable public health and safety risks include accidental fire that may occur during construction and operation and maintenance, the use and accidental release of hazardous materials, and accidental injury. Nuisance shocks may occur infrequently under the proposed line.

Short-Term Use of the Environment and the Maintenance and Enhancement of 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. A good example of this are the existing lines. These lines were built in the early 1950s. The affected environment has recovered since then and while there is never complete recovery, the long-term productivity of the affected environment has not been significantly altered. Likewise, if the proposed line were removed and the affected areas restored, little change in the long-term environmental productivity would occur.

Irreversible or Irretrievable Commitments of Resources

The irreversible commitment of resources is the use of nonrenewable resources such as minerals and 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 use aluminum, steel, wood, gravel, sand, and other nonrenewable material to construct steel towers, conductors, insulators, access roads, and other facilities. The line would also require some petroleum-based fuels for vehicles and equipment and steel for structures. 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.

Chapter 4
Consultation, Review, and Permit Requirements

Chapter 4 Consultation, Review, and Permit Requirements

This chapter addresses federal statutes, implementing regulations, and Executive Orders potentially applicable to the proposed project. This draft EIS is being sent to tribes, federal agencies, and state and local governments as part of the consultation process for this project.

National Environmental Policy Act

This EIS has been prepared by Bonneville pursuant to regulations implementing the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq.), which requires federal agencies to assess the impacts that their actions may have on the environment. Bonneville's proposal to construct the 79-mile transmission line requires that we assess the potential environmental effects of the proposed project, describe them in an EIS, make the EIS available for public comment, and consider the impacts and comments when deciding whether to proceed with the project.

Threatened and Endangered Species and Critical Habitat

The Endangered Species Act of 1973 (16 U.S.C. 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 act is administered by the U.S. Fish and Wildlife Service and, for salmon and other marine species, by the National Marine Fisheries Service. The act defines procedures for listing species, designating critical habitat for listed species, and preparing recovery plans. It also specifies prohibited actions and exceptions.

Section (7a) 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 Endangered Species Act and the federal regulations on endangered species coordination (50 CFR Section 402.12) require that federal agencies prepare biological assessments addressing the potential effects of major construction actions on listed or proposed endangered species and critical habitats.

Bonneville requested information on the occurrence of listed species in the project corridor and vicinity; letters from U.S. Fish and Wildlife Service and National Marine Fisheries Service are included in Appendix A. Oregon Department of Fish and Wildlife staff were also interviewed for information on special-status species. The U.S. Fish and Wildlife Service identified several terrestrial and aquatic species as potentially occurring in the project area.

Jones & Stokes biologists conducted field surveys of the project corridor during summer 2001.

Potential impacts to Threatened and Endangered plant, animal, and fish species are discussed in Chapter 3 in the sections Streams, Rivers and Fish; Vegetation; and Wildlife.

Fish and Wildlife Conservation

Fish and Wildlife Conservation Act and Coordination Act

The Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901 et seq.) encourages federal agencies to conserve and promote the conservation of nongame fish and wildlife species and their habitats. In addition, the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) requires federal agencies undertaking projects affecting water resources to coordinate with the U.S. Fish and Wildlife Service and the state agency responsible for fish and wildlife resources.

Mitigation measures designed to conserve fish, wildlife, and their habitat are listed in Chapter 3 in the sections Streams, Rivers and Fish; Vegetation; and Wildlife. Standard erosion control measures would be used during construction to control sediment movement into streams, protecting water quality and fish habitat.

Essential Fish Habitat

Public Law 104-297, the Sustainable Fisheries Act of 1996, amended the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). This established new requirements for Essential Fish Habitat descriptions in federal fishery management plans and required federal agencies to consult with National Marine Fisheries Service on activities that may adversely affect Essential Fish Habitat. The Magnuson-Stevens Act requires all fishery management councils to amend their fishery management plans to describe and identify Essential Fish Habitat for each managed fishery. The Pacific Fishery Management Council has issued such an amendment in the form of Amendment 14 (1999) to the Pacific Coast Salmon Plan. This amendment covers Essential Fish Habitat for all fisheries under NMFS jurisdiction that would potentially be affected by the proposed action. Specifically, within the area of the proposed project these are the chinook and coho salmon fisheries. Essential Fish Habitat includes all streams, lakes, ponds, wetlands, and other currently viable water bodies and most of the habitat historically accessible to salmon. Activities above impassable barriers are subject to the consultation provisions of the Magnuson-Stevens Act.

Under Section 305(b)(4) of the act, National Marine Fisheries Service is required to provide Essential Fish Habitat conservation and enhancement recommendations to federal and state agencies for actions that adversely affect Essential Fish Habitat. Wherever possible, National Marine Fisheries Service uses existing interagency coordination processes to fulfill Essential Fish Habitat consultations with federal agencies. For the proposed action, this goal would be met by incorporating Essential Fish Habitat consultation into the Endangered Species Act Section 7 consultation process. See the Streams, Rivers and Fish section of Chapter 3 for discussion on essential fish habitat for this project.

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.

The proposed project may impact birds. Potential impacts to migratory birds of special concern are discussed in the Wildlife section in Chapter 3. Bonneville would ensure appropriate mitigation measures are employed to minimize the risk of bird mortality.

Bald Eagle and Golden Eagle Protection Act

The Bald Eagle Protection Act prohibits the taking or possession 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). Because a small number of both bald and golden eagles may reside within foraging distance of the proposed project, there is a remote possibility some mortality could result to either bald and/or golden eagles. However, because the act only covers intentional acts, or acts in “wanton disregard” of the safety of bald or golden eagles, this project is not viewed as subject to its compliance.

For further discussion regarding potential impacts to eagles, see the Wildlife section of Chapter 3. Potential impacts to bald and golden eagles will be further addressed in the biological assessment prepared for this project as required under the Endangered Species Act.

Responsibilities of Federal Agencies to Protect Migratory Birds

Executive Order 13186 directs each federal agency that is taking actions which may negatively impact migratory bird populations to work with the U.S. Fish and Wildlife Service 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. Bonneville is part of the Department of Energy, is cooperating with the department in developing a memorandum of understanding with the U.S. Fish and Wildlife Service to comply with this mandate.

Heritage Conservation

Regulations established 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);
- Section 106 of the National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. 470 et seq.), as amended;
- Archaeological Data Preservation Act (ADPA) 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.); and
- Executive Order 13007 Indian Sacred Sites.

For this project, Bonneville has undertaken the Section 106 consultation process with the State Historic Preservation Officer for both Washington and Oregon, the Advisory Council on Historic Preservation, and the affected Native American tribes. For this project, the Confederated Tribes of the Umatilla Indian Reservation; the Confederated Tribes of Warm Springs, Oregon; and the Yakama Nation were consulted. Bonneville's 1996 government-to-government agreement with 13 federally-recognized Native American Tribes of the Columbia River basin identifies the roles and responsibilities of both parties and 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) may be determined to be eligible for inclusion on the National Register of Historic Places. In carrying out its responsibilities under Section 106, Bonneville is required to consult with any Native American Tribe that attaches religious and 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 lands or for projects that receive federal funding. 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 Tribal individual determined to be an 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 and 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 Cultural Resources section in Chapter 3 of this EIS discusses cultural resources along the project corridor, potential impacts, and mitigation measures to protect archaeological and historic resources.

State, Areawide, and Local Plan and Program Consistency

The Council on Environmental Quality regulations for implementing NEPA require EISs to discuss possible conflicts and inconsistencies of a proposed action with approved state and local plans and laws.

The project corridor crosses through four counties: Benton and Klickitat Counties in Washington and Umatilla and Sherman Counties in Oregon. Of the 79-mile corridor, 72 miles are located in the state of Washington: 27 miles in Benton County and 45 miles in Klickitat County; and 7 miles are in Oregon: 1 mile in Umatilla County, and 6 miles in Sherman County.

Land Use Planning Framework

The state and local land use planning framework for the proposed project includes the following regulations:

- City of Umatilla Comprehensive Plan;
- Umatilla County Zoning Code;
- Benton County Zoning Ordinance (BCC Title 11);
- Benton County Shoreline Management Master Plan;
- Benton County Comprehensive Plan;
- Klickitat County Comprehensive Plan;
- Klickitat County Shoreline Master Plan;
- Klickitat County Zoning Ordinance (No. 62678);
- Sherman County Zoning, Subdivision, and Land Development Ordinance;
- Oregon Statewide Planning Goal 11 (Public Facilities);
- Oregon Statewide Planning Goal 3 (Agricultural Lands);
- Oregon Administrative Rules; and
- Washington Administrative Codes.

Please see the Land Ownership and Uses within Project Corridor section of Chapter 3 for a discussion on whether the proposed action is consistent with the state and local plans. The proposed project would be undertaken solely by Bonneville, which is a federal entity. Pursuant to the federal supremacy clause of the U.S. Constitution, Bonneville is not obligated to apply for local development or use permits in such circumstances. Therefore, Bonneville would not make formal application to any of the local jurisdictions for permits such as conditional use permits or shoreline development permits. However, Bonneville 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 these permits. (Bonneville would apply for county shoreline permits if the provisions of the Federal Water Pollution Control Act apply, such as for discharges into waters of the U.S.)

Critical Areas Ordinances

The project corridor falls within Seismic Zone 2B of the 1997 Uniform Building Code. The counties in Oregon do not have critical areas ordinances that would address potential geologic hazards in the project site and project corridor. There are no specific requirements or guidelines issued by the counties with respect to geologic conditions. Current Oregon building codes are specified in Oregon Regulatory Statute (ORS) 455.010 through 455.895. Geologic hazard regulations are overseen by the Oregon Department of Land Conservation and Development, as defined in ORS 660.015.

Klickitat and Benton Counties in Washington have critical areas ordinances that pertain to geologically hazardous areas. Klickitat County's critical areas ordinance provides standards for classification and designation of significant geologically hazardous areas and guidance for reducing or mitigating hazards to public health and safety. Benton County's critical areas ordinance addresses minimum setbacks for development within or adjacent to a geologically hazardous area. See the Geology section of Chapter 3 for further discussion of geology and soils.

Transportation Permits

Width and/or height restrictions occur on SR 14 at the Cook-Underwood Tunnels (Skamania County, Washington), the Hood River/White Salmon toll bridge (Klickitat County, Washington), the Lyle Tunnel (Klickitat County, Washington), and the I-205 to US 97 junction at Maryhill (Klickitat County, Washington). Trucks traveling westbound toward the project corridor on SR 14 will likely pass through most of these areas. The Columbia River bridges also have load weight and size restrictions.

The construction contractor and transmission line facilities manufacturers would consult with the Oregon and Washington Departments of Transportation as well as the Benton, Klickitat, Umatilla, and Sherman Counties Public Works Departments. Necessary permits for transportation of large loads on the roadways would be secured as required. See the Transportation section in Chapter 3 of this EIS for further discussion of transportation issues.

Coastal Zone Management Program Consistency

As an agency of the federal government, Bonneville follows the guidelines of the Coastal Zone Management Act (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 state management programs. The proposed project is not in the coastal zone, nor would it directly affect the coastal zone.

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. Regulations are provided through 10 CFR 1022.12, and Federal Executive Orders 11988 and 11990. Portions of the proposed project fall within the 100-year floodplain of the Columbia River as mapped by the Federal Emergency Management Agency. There are 15 streams that cross the proposed transmission line corridor and flow toward the Columbia River. These streams range from having deeply incised channels to low gradient, meandering channel patterns. Associated floodplains are generally limited to narrow riparian fringes. A total of 25 wetlands (45.0 acres) are present within the proposed transmission line corridor, of which 0.2 acre is located where either construction or operations activity would occur. If a wetland of over 0.10 acres would have to be filled (which is unlikely), appropriate permits from the Corps would be sought. Streams, floodplains, and wetlands are discussed in Chapter 3 of this EIS.

Farmlands

The Farmland Protection Policy Act (7 U.S.C. 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 nonagricultural 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.

There are no lands designated as prime farmland within the proposed right-of-way. Please see the Land Ownership and Uses within Project Corridor section of Chapter 3 for more discussion on impacts to agricultural lands.

Recreation Resources

None of the project components would interrupt formal existing recreation facilities. Upland bird hunting may be interrupted in the project corridor in Benton County, Washington during construction.

Global Warming

The proposed project would not generate emissions of gases (such as carbon dioxide) that contribute to global warming. The proposed project would clear 54 acres of grassland, agricultural and shrub-steppe vegetation, and an additional 25 acres of mature hardwood trees. A total of 50 acres would be removed from mature hardwood production. The removal of these trees and plants would result in a net reduction in the collectors of carbon in the project area. However, because the amount of clearing would be relatively small, and because low-growing vegetation would regrow in cleared areas, the proposed project's contribution to global warming would be negligible.

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 U.S. No work associated with the proposed project would occur in such water bodies. However, the proposed project includes conductors that would span the navigable waters of the Columbia River, a "water of the United States" as defined in the Rivers and Harbors Act. Overhead utility lines constructed over Section 10 waters require a Section 10 permit.

Permit for Discharges into Waters of the United States

The Clean Water Act (33 U.S.C. 1251 et seq.) regulates discharges into waters of the U.S.

Section 401 of the Clean Water Act, the State Water Quality Certification program, requires that states certify compliance of federal permits and licenses with state water quality requirements. A federal permit to conduct an activity that results in discharges into waters of the U.S., including wetlands, is issued only after the affected state certifies that existing water quality standards would not be violated. Bonneville is not expecting any discharges into waters of the U.S.

Section 402 of the act authorizes storm water discharges associated with industrial activities under the National Pollutant Discharge Elimination System (NPDES). For Washington, EPA has a general permit authorizing federal facilities to discharge storm water from construction activities disturbing land of 5 acres or more into waters of the U.S., in accordance with various set conditions. Bonneville 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 Storm Water Pollution Prevention (SWPP) plan.

Section 404 requires authorization from the Corps in accordance with the provisions of Section 404 of the Clean Water Act when there is a discharge of dredged or fill material into waters of the U.S., including wetlands. Bonneville does not expect any waters (including wetlands) to be impacted by access road or tower construction. Water bodies/wetlands field surveys would ensure that full compliance with the Clean Water Act. If there would be potential impacts, authorization would be sought from the Corps and the appropriate state and local government agencies in Washington and Oregon.

Please see the Wetlands and Groundwater section of Chapter 3 for further discussion of potential wetland impacts for the project.

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. Bonneville 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.

Permits for Right-of-Way on Public Lands

The proposed project crosses mostly privately owned land, with some Tribal, state, and federal land. Bonneville would obtain easements and permits as appropriate for public lands.

Air Quality

The Clean Air Act as revised in 1990 (PL 101-542, 42 U.S.C. 7401) requires EPA and 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 Oregon Department of Environmental Quality, the Washington Department of Ecology (Central Region and Eastern Region), and the Benton Clean Air Authority. Each of those agencies has regulations requiring all industrial activities (including construction projects) to minimize windblown fugitive dust. None of those agencies regulate the operation of electrical transmission lines or electrical transformers.

The General Conformity Requirements of the Code of Federal Regulations 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 RCW-Washington Clean Air Act and Chapter 173-400 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 (AGC, Fugitive Dust Task Force). Benton County Clean Air Authority adheres to an Urban Fugitive Dust Policy and Oregon Revised Statutes (ORS) Chapter 468A outline Air Pollution Control.

Air quality impacts of the proposed project would not be significant, as discussed in the Air Quality section in Chapter 3 of this EIS.

Noise

The Noise Control Act of 1972 as amended (42 U.S.C. 4901 et seq.) sets forth a broad goal of protecting all people from noise that jeopardizes their health or welfare. It places principal authority for regulating noise control with states and local communities. Noise standards applicable to the proposed project are established under ORS Chapter 467 (Noise Control) and the Oregon Administrative Rules (OAR) Division 35 (Noise Control Regulations). Responsibility for enforcement of applicable regulations is assigned to the local sheriff's department. The Oregon Department of Environmental Quality provides assistance and guidance as required.

The allowable hourly noise levels under state law, and potential noise impacts associated with the project, are described in the Noise section in Chapter 3 of this EIS.

Hazardous Materials

The Spill Prevention Control and Countermeasures Act, Title III of the Superfund Amendments and Reauthorization Act, and the Resource Conservation and Recovery Program potentially apply to the proposed project, depending on the exact quantities and types of hazardous materials stored onsite. Regulations would be enforced by the Oregon Department of Environmental Quality, Oregon Department of Health, and the Washington Department of Ecology. In addition, development of a Hazardous Materials Management Plan in accordance with the Uniform Fire Code may be required by the local fire district. Small amounts of hazardous wastes may be generated (paint products, motor and lubricating oils, herbicides, solvents, etc.) during construction or operation and maintenance. These materials would be disposed of according to state law and Resource Conservation and Recovery Act.

In response to the 1989 passage of Public Law 99-145, which mandated the destruction of certain types of chemical warfare agents throughout the U.S., Congress identified the need to upgrade emergency preparedness in cities and counties surrounding chemical stockpiles in the unlikely emergency resulting from storage or subsequent destruction. Within Umatilla County, Oregon, there is a chemical weapons stockpile. The Umatilla Army Depot stores mustard "blister" agents and nerve agents. The eastern portion of the project corridor lies within zones where an emergency preparedness program applies in case of an emergency at the stockpile. For this reason the Oregon's Chemical Stockpile Emergency Preparedness Program was begun. The area surrounding the depot is divided into zones and sectors. The Immediate Response Zone covers an 8-mile radius from the depot; the Protective Action Zone covers a 20-mile radius from the depot; the Marine Safety Zone covers the Columbia River approximately 20 miles above and below McNary Dam. The majority of the proposed transmission line lies within the Protective Action Zone in Benton County with a small area around the McNary Substation in the Immediate Response Zone and the Marine Safety Zone (CSEPP 1999).

Environmental Justice

In February 1994, Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations, was released to federal agencies. This order states that federal agencies shall identify and address as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income population. (Minority populations are considered members of the following groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic if the minority population of the affected area exceeds 50%, or is meaningfully greater than the minority population in the project area.)

The proposed project has been evaluated for potential disproportionately high environmental effects on minority and low-income populations (see the Socioeconomics section of this EIS in Chapter 3). There would not be a human health or environmental impact on minority and low-income populations from the proposed project.

Notice to the Federal Aviation Administration

As part of the transmission line design, Bonneville seeks to comply with Federal Aviation Administration procedures. Final locations of structures, structure types, and structure heights would be submitted to the Federal Aviation Administration for the project. The information includes identifying structures taller than 200 feet above ground and listing all structures within prescribed distances of airports listed in the Federal Aviation Administration airport directory. Bonneville also would assist the Federal Aviation Administration in field review of the project by identifying structure locations. The Federal Aviation Administration would then conduct its own study of the project and make recommendations to Bonneville for airway marking and lighting. General Bonneville policy is to follow Federal Aviation Administration recommendations.

Federal Communications Commission

Federal Communications Commission regulations require that transmission lines be operated so that radio and televisions reception would not be seriously degraded or repeatedly interrupted. Further, Federal Communications Commission regulations require that the operators of these devices mitigate such interference. Bonneville would comply with Federal Communications Commission requirements relating to radio and television interference from the proposed transmission line if any such interference occurs. While none of the proposed alternatives are expected to increase electromagnetic interference above existing levels, each complaint about electromagnetic interference would be investigated.

Chapter 5
References

Chapter 5
References

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Billings, Susan . Air specialist. Department of Ecology, Central Regional Office. August 17, 2001 – personal communication.

Browers, Howard. Refuge biologist. U.S. Fish and Wildlife Service. 2000 – multiple conversations.

Caballero, Andy. Interpretive specialist. U.S. Army Corps of Engineers, McNary Wildlife Natural Area. September, 2000 – personal communication.

Carlson, Dennis. Fishery Biologist. National Marine Fisheries Service. December 12, 2001 – electronic mail communication.

Chris, Inc. Barging company contracted by the Port of Umatilla. September 18, 2001 – telephone conversation with receptionist.

Cierebiej, Susan. Biologist. Washington Department of Fish and Wildlife. August 27, 2001 – personal communication.

Clucas, Larry. City administrator. City of Umatilla. October 23, 2001 – telephone conversation.

Cranston, Mark. Environmental health specialist. Benton-Franklin Health Department. October 26, 2001 – telephone conversation.

Dugger, Carl. Area Habitat Biologist. Washington Department of Fish and Wildlife. September 4, 2001 – personal communication.

Frampton, Brian. Assistant planner. Klickitat County Planning Office. August 23, 2001 and October 22, 2001 – telephone conversations.

Gorden, Carl. Tidewater. Barging contractor for Port of Umatilla. October 23, 2001 – telephone conversation.

Haines, Tracey. Yakama National Wildlife Biologist. September 25, 2001 – personal communication.

Hanrahan, Patrick. Oregon Department of Environmental Quality. August 15, 2001 – electronic mail response to information request.

Harris, Bill. Chief. Benton County Fire District 6. August 30, 2001 – telephone conversation.

Hart, Marsha. Benton County Sheriff’s Office. August 22, 2001 – telephone conversation.

Hart, Paul. Captain. Benton County Sheriff’s Office. August 22, 2001 – telephone conversation regarding sheriff’s office staff, equipment, and calls.

LaRiviere, Paul. Habitat biologist. Washington Department of Fish and Wildlife. 2000 – personal communication.

Leblanc, Susan. Umatilla County Sheriff's Office. August 28, 2001 – telephone conversation.

Lieuallen, Kathy. Umatilla County Sheriff's Office. August 28, 2001 – telephone conversation.

Macnab, Georgia. Planner. Sherman County Planning Office. August 23, 2001 and October 22, 2001 – telephone conversations.

Mcallister, Shirlee. Sherman County Sheriff's Office. August 28, 2001 – telephone conversation.

McGowin, Ken. Portland District Corps of Engineers, Hydraulics, Hydrology & Geotechnical Design Branch. October 16, 2001 – telephone interview.

Mees, Phil. Senior planner. Benton County Planning Office. August 22, 2001 – telephone conversation.

Paisley, Jennifer. Records Division, Klickitat County Sheriff's Office. August 28, 2001 – telephone conversation.

Perry, Patty. Planner. Umatilla County Planning Office. August 22, 2001 – telephone conversation.

Pribyl, Steve. Bioloigst. Oregon Department of Fish and Wildlife. June 14, 2001 – personal communication.

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Shuttleworth, Michael. Senior planner. Benton County Planning/Building Department. October 19, 2001 – telephone conversation.

Southward, Sue. Captain. North Sherman County Fire District. September 5, 2001 – telephone conversation.

St. Clair, John. Air quality specialist/engineer. Benton Clean Air Authority. August 15, 2001 – electronic mail response to information request.

Stokoc, Marcia. Fire District 7, City of Umatilla. August 23, 2001 – telephone conversation.

Wright, Jim. Chief. Klickitat County Fire District 9. September 5, 2001 – telephone conversation.

Chapter 6
Agencies, Organizations, and Persons Receiving this EIS

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Agencies, Organizations, and Persons Receiving this EIS

The project mailing list contains about 500 potentially interested or affected landowners; tribes; local, state, and federal agencies; utilities; public officials; interest groups; businesses; special districts; libraries and the media. They have 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

Bureau of Land Management
Corps of Engineers
Fish & Wildlife Service
National Marine Fisheries Service
Environmental Protection Agency
Bureau of Indian Affairs

Tribes or Tribal Groups

Burns Paiute Tribe
Confederated Tribes of Umatilla
Confederated Tribes of Warm Springs
Nez Perce Tribe
Shoshone Bannock Tribes of Fort Hall
Yakama Indian Nation

State Agencies, Oregon

Department of Fish and Wildlife
Department of Transportation
Department of Water Resources

State Agencies, Washington

Department of Ecology
Department of Fish and Wildlife
Department of Natural Resources
Department of Transportation

Public Officials, Oregon

Federal Congressional

US House of Representatives, Greg Walden
US Senate, Gordon Smith
US Senate, Ron Wyden

Governor

John A Kitzhaber

State Senator and Representatives

Greg Smith
Bob Jensen
Ted Ferrioli
David Nelson

Public Officials, Washington

Federal Congressional

US House of Representatives, Richard Hastings
US Senate, Maria Cantwell
US Senate, Patty Murray

Governor

Gary Locke

State Senator and Representatives

Jim Honeyford
Bruce Chandler
Barb Lisk

Local Governments, Oregon

Cities

Arlington
Boardman
Umatilla
Morrow
Sherman
Umatilla

Counties

Gilliam

Local Governments, Washington

Cities

Goldendale
Prosser

Counties

Benton
Klickitat

Special Districts

Klickitat County Utility District
Northern Wasco Utility District
Sherman County Soil & Water Conservation District
Umatilla County Soil & Water Conservation District
Umatilla County Special Library District

Businesses

Aero Power Services
Columbia Gorge Economic Development Association
Glahe & Associates
Jim Deason, Attorney at Law
Jones & Stokes Associates Inc.
Weyerhaeuser Paper Company
Ruen Yeager & Associates Inc.

Utilities

Klickitat County PUD
Umatilla Electric Coop
Wasco Electric Coop

Libraries

Arlington Public Library
Oregon Trail Public Library
State of Oregon Library
The Dalles Wasco County Public Library
Umatilla Public Library

Interest Groups

Lower Columbia Basin Audubon Society
Nature Conservancy
Oregon Chapter Sierra Club
Oregon Trout
Pacific Northwest Electric Power & Conservation Planning Council
Port of Umatilla 1940 Industrial Development
Rebound
Roosevelt Community Council
Sierra Club Northwest
Trout Unlimited Blue Mountain 619

Media

East Oregonian (Pendleton)
Goldendale Sentinel (Goldendale)
Hermiston Herald (Hermiston)
Prosser Record Bulletin (Prosser)
Tri-Cities Herald (Pasco)

Chapter 7
List of Preparers

Chapter 7
List of Preparers

The McNary-John Day Project EIS is being prepared by Bonneville with the technical assistance of environmental consultants. Individuals responsible for preparing the draft EIS, along with their affiliation, experience, and education, are listed below in alphabetical order.

Ravi Aggarwal—Systems Planner. Responsible for technical system planning studies. Education: MBA (2003); B.S. Electrical Engineering. Experience: Electrical transmission operations and planning. With Bonneville since 1991.

Theresa Berry—Project Engineer. Responsible for design of transmission line facilities. Education: B.S. Civil Engineering. Experience: Substation, electrical equipment foundation, and transmission line design. With Bonneville since 1991.

Bonnie Blessing—Biologist. Responsible for wildlife section of EIS. Education: B.S. Microbiology/Immunology. Experience: Wetland and stream surveys, habitat assessment, field surveys for fish and wildlife, and watershed and wetland rehabilitation. With Jones & Stokes since 1998.

T. Dan Bracken—Principal, T. Dan Bracken, Inc. Responsible for section on electrical effects of proposed action. Education: B.S. Physics; M.S. and Ph.D. Physics. Experience: Twenty-seven years experience undertaking research on and characterization of electric and magnetic field effects from transmission lines.

David Broadfoot—Project Manager. Responsible for EIS project management. Education: B.A. Biology; M.S. Ecology. Experience: Twenty years of experience in land use planning and environmental analysis; land use, public policy, and regulatory support for NEPA and SEPA documents; land use and environmental permit applications; and design and implementation of public involvement and education programs. With Jones & Stokes since 1999.

Jeannie Brush—Land Use Planner. Responsible for coordination of built environment EIS team for land use/recreation, visual resources, socioeconomics, transportation, and public health sections of EIS. Education: B.A. Art History; Master of Community and Regional Planning (M.C.R.P.); M.S. Historic Preservation. Experience: Five years of experience in planning, permitting, cultural resources management, and historic preservation. With Jones & Stokes since 1999.

Jason Cooper—Cultural Resource Specialist. Responsible for cultural resources field surveys, tribal coordination, cultural resource section of EIS. Education: B.A. History; M.A. Anthropology/Archaeology. Experience: Ten years of experience in archaeology and cultural resource inventory, with expertise in chipped stone technologies. With Jones & Stokes since 2000.

Laurens Driessen—Project Manager. Responsible for project management of transmission line portion of the project. Education: B.S. Civil Engineering. Experience in facility siting and project management. With Bonneville since 1969.

Marc Egli—Geologist. Responsible for geologic field mapping, evaluation of potential adverse geologic conditions, aerial photo analysis and report review for the EIS. Education: B.A. Geology; six years graduate studies in Geology. Experience: Twenty-one years on geologic, hydrogeologic and geotechnical projects. With GeoEngineers, Inc. since 2000.

Jamie Gray—Environmental Planner. Responsible for transportation, air quality, and noise sections of EIS. Education: B.A. Environmental Policy. Experience: Two years of experience in environmental planning and policy analysis, transportation, air, noise, socioeconomics, and impact assessments. With Jones & Stokes since 1999.

Jon Ives— Wildlife Biologist. Responsible for senior review of wildlife section of EIS. Education: M.S. Wildlife Biology; B.B.A. Wildlife Management. Experience: Twenty-seven years experience in natural resource inventories, wildlife biology and habitat assessment, and impact analysis. With Jones & Stokes since 1973.

Alan Johnson—Environmental Specialist. Responsible for geology section of EIS. Education: B.A. Environmental Studies. Experience: Natural resource monitoring and surveying, aerial photography and map interpretation. With Jones & Stokes since 2000.

Daniel Jones—Wetland Ecologist and Botanist. Responsible for vegetation section of EIS. Education: B.S. Botany/Plant Pathology; M.S. Biology/Ecology. Experience: Twelve years experience in wetland delineation, vascular and nonvascular plant taxonomy, fungal taxonomy, aerial photo interpretation, vegetation sampling methodology, NEPA and permitting. With Jones & Stokes since 2000.

Linda Krugel—AICP, Planning Consultant, Krugel and Associates. Responsible for public involvement. Education: B.S. Related Arts, M.S. City Planning, M.S. Public Administration. Experience: Policy development and public involvement. Contractor to Bonneville since 1984.

Stacy Mason—Environmental Coordinator. Responsible for EIS coordination and development. Education: B.A. Aquatic Biology. Experience: Environmental analysis, cultural resources. With Bonneville since 1988.

Galan McInelly—Geologist. Responsible for review of geology section of EIS. Education: B.S. Geology; M.S. Geology. Experience: Seventeen years of experience as a geologist on hydrogeologic, environmental and geotechnical projects. With GeoEngineers, Inc. since 1989.

Thomas Noland—Environmental Specialist. Responsible for visual resources and socioeconomics section of EIS. Education: B.S. Zoology. Experience: Two years experience in land use, permitting, visual analyses, socioeconomics, and impact analysis. With Jones & Stokes since 2000.

Leroy Sanchez—Visual Information Specialist. Responsible for graphic design. Education: Graphics Design. Experience: EIS graphics coordination. With Bonneville since 1978.

John Soden—Wetland Biologist. Responsible for coordination of natural resource EIS team, water resources, and wetland sections of EIS. Education: B.S. Environmental Policy and Assessment; M.S. Forestry. Experience: Six years experience in delineating and assessing aquatic resources, resource inventory and classification, riparian and wetlands research, impact assessment, and permitting assistance. With Jones & Stokes since 1999.

Chris Soncarty—Fisheries Biologist. Responsible for fish/streams section of EIS. Education: B.S. Environmental Science, Salmonid Biology. Experience: Five years of experience in salmonid habitat assessment, stream typing, riparian habitat assessment, barrier culvert assessment, and fish surveys. With Jones & Stokes since 2000.

James Wilder—Air/Noise Specialist. Responsible for air quality and noise sections of EIS. Education: B.S. Civil Engineering; M.S. Air Resources Engineering. Experience: Twenty-three years of experience in air quality and noise control engineering, facility design, preconstruction permitting, environmental impact assessments, and operational compliance monitoring. With Jones & Stokes since 2001.

Douglas Wittren—GIS Analyst. Responsible for geographic coordination, special analysis and cartographic support. Education: B.S. Earth Sciences, M.S. Geography. With Bonneville as a contractor and employee since 1992.

Marion Wolcott—Realty Specialist. Responsible for property value analysis. Education: B.S. Forest Management. Experience: Forestry appraisal and project coordination. With Bonneville as a contractor and employee since 1985.

Chapter 8
Glossary and Acronyms

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Glossary and Acronyms

Glossary

Alluvial fan: a fan-shaped geological deposit consisting of material deposited by a moving stream and which radiates downslope from the point where the stream emerges from a narrow valley onto a plain.

Alluvium: sediments deposited by a river anywhere along its course; also called alluvial deposit.

Altithermal: the dry postglacial period extending from 7500 to 4000 years ago, during which time temperatures were believed to be distinctly higher than present temperatures. The term can also be used relating to any time period or climate characterized by high or rising temperatures.

Anadromous: fish that hatch rear in fresh water, migrate to the ocean (salt water) to grow and mature, and migrate back to fresh water to spawn and reproduce.

Aquatic exploitation: the fishing and/or gathering of food resources from water, in this case, from the Columbia River.

Armoring: to give protection using a surface layer of gravel in a river bed preventing erosion of the material below.

Average daily traffic: the total number of cars passing over a segment of roadway, in both directions, on a typical day. In this report, all average daily traffic volumes are two-way counts at the indicated locations.

Best management practices: a practice or combination of practices that is 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.

Burn, The: a geographical area between Rock Creek and Chapman Creek in southeastern Washington characterized by an elevated plateau.

Cairn: a small grouping of rocks stacked in a linear or circular manner.

Combustion pollutants: gases or particles that come from burning materials.

Compaction: the result of rolling, tamping, or use of heavy equipment on soil. Soils become hardened, difficult to cultivate, and impermeable to air and water.

Corridor: a strip of land forming a passageway for transportation or utility facilities.

Cryptogamic crust: a fragile layer: a thin crust made up of mosses, lichens, algae, and bacteria.

Cultural resources: a general term frequently used to refer to a wide range or archeological sites, historic structures, museum objects, and traditional cultural places.

Cumulative impacts: the impact on the environment which results from the incremental impact of the action when added to the past, present, and reasonably foreseeable future actions, regardless of who or what undertakes such actions.

Decibel (dB): a unit of sound measurement. In general, a sound doubles in loudness for every increase of ten decibels.

Diagnostic artifacts: an artifact that maintains a distinguishing mark or displays a certain characteristic that allows the object to be placed with some certainty into a chronological period.

Double-circuit towers: towers that can hold two transmission lines

Downcutting: when streams cut channels down into the rock, steepening valley walls. Downcutting typically produces narrow valleys.

Dry wash: a streambed that carries water only during and immediately following rainstorms.

Electrofishing: employing an electric current to attract or stun fish in order to take a census of a population.

Endangered species: (see Threatened and endangered species)

Eolian sands: sands that are the product of wind erosion.

Ephemeral stream: a channel that carries water only during and immediately following rainstorms. Sometimes referred to as a dry wash.

Ethnographic: dealing descriptively with specific cultures, especially those of nonliterate people or groups.

Ethnohistoric: pertains to the study of development of past cultures and lifeways prior to contact with European explorers.

Exceedence levels (L levels): refers to the A-weighted sound level that is exceeded for a specified percentage of the time during a specified period. Thus, L_{10} refers to a particular sound level that is exceeded 10% of the time.

Fiberoptic cable: a fiberoptic technology using light pulses instead of radio or electrical signals to transmit messages.

Fish-bearing stream: any water that has fish presence, or is utilized by fish, even if for only one day a year.

Floodplain: that portion of a river valley adjacent to the stream channel that is covered with water when the stream overflows its banks during flood stage.

Ford: a shallow place in a stream, river, etc., where one can cross by wading or by riding on horseback, in an automobile, etc.

Fugitive dust: any solid particulate matter that becomes airborne, other than that emitted from an exhaust stack, directly or indirectly as a result of the activities of people.

Geologic unit: geologic units are physiographic units and rock lithology or coarse stratigraphy of exposed bedrock.

Glacial outburst flooding: a hydrological phenomenon that refers to the sudden release of water stored in glaciers.

Herbaceous: plants whose growing stems possess little or no woody tissue.

Herbicide: a chemical substance used to kill, slow, or suppress the growth of plants.

Housepits: is an aboriginally excavated house floor.

Hydroperiod: within wetlands, the hydroperiod is the duration of soil saturation or inundation.

Indigenous: existing naturally in a region, state, country, etc.

Insulators: bell-shaped devices that prevent the electricity from jumping from the conductors to the tower and going to the ground.

Irreversible commitment of resources: the use of nonrenewable resources such as minerals and petroleum-base fuels. Irretrievable commitments of resources cause the lost production or use of renewable resources such as timber or rangeland.

Isolate finds: a singular artifact (e.g., projectile point, historic bottle, or 1922 Model T) or a grouping of artifacts that do not meet a specific density ratio to be classified as a site.

Liquefaction: the fluid-like behavior of soils during a seismic event.

Lithic: being made of stone.

Lithosol: a group of shallow soils lacking well-defined horizons and composed of imperfectly weathered fragments of rock.

Loess: an unstratified usually buff to yellowish brown loamy deposit found in North America, Europe, and Asia and believed to be chiefly deposited by the wind.

Lomatium: within the project area there exist microenvironments that support different species of plant based primarily on local hydrology, geology, and sun exposure. Lomatium habitat can be considered a microenvironment within the greater sage vegetation zone. Lomatium, referred to in English by Sahaptin native speakers as "Indian celeries," comes in many shapes and sizes. The plant produces edible sprouts, stems, and shoots and would be harvested seasonally. Lomatium habitat in the project area constitutes portions of talus slopes and rocky lowlands along streams and creeks.

Midden: the layer of soil which contains the byproducts of human activity as the result of the accumulation of these materials on their living surface. For prehistoric sites, a layer of soil that was stained to a dark color by the decomposition of organic refuse which also contained food bones, fragments of stone tools, charcoal, pieces of pottery, or other discarded materials. For historic sites, a similar layer of soil but with appropriate historic material remains often in a much thinner deposit.

Miocene epoch: a subdivision of geologic time within the Tertiary Period, between approximately 26 and 7 million years ago.

Mitigation measures: steps taken to lessen the impacts of proposed activities on a specific resource. Measures may include reducing the impact, avoiding it completely, or compensating for the impact.

Native plant/native species: species of plants, animals, or birds that originated in a given ecological area. Native plants or species are often best adapted to a given area.

Nonnative species: species that have migrated or have been imported to an ecological area. Nonnative plants or species may compete for space and nutrients with a (more desirable) native species.

Noxious weeds: plants that are injurious to public health, crops, livestock, land, or other property.

Ordinary high water mark (OHWM): an elevation that marks the boundary of a lake, marsh, or streambed. It is the highest level at which the water has remained long enough to leave its mark on the landscape. Typically, it is the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial.

Outage: interruption of the power flow such that electric facilities stop operating.

Perennial streams: a watercourse that flows throughout a majority of the year in a well-defined channel.

Pithouse: a semi-subterranean "earth-lodge" dwelling. Usually consisted of an earth-covered log framework roof over a circular to rectangular structure.

Power circuit breakers: a breaker is a switching device that can automatically interrupt power flow on a transmission line at the time of a fault, such as a lightning strike, tree limb falling on the line, or other unusual events. The breakers would be installed at the substation to redirect power as needed.

Prime farmland: land that has the best combination of physical characteristics for producing food, feed, forage, fiber and oilseed crops and is also available for these uses.

Privy: an outdoor bathroom facility.

Raptor: a bird of prey.

Right(s)-of-way: 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, and so on.

Riparian areas: vegetated ecosystems along a water body through which energy, materials, and water pass. Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent water body. These systems encompass wetlands, uplands, or some combination of these two land forms; they do not in all cases have all of the characteristics necessary for them to be classified as wetlands (Mitsch and Gosselink, 1986; Lowrance et al., 1988).

Ruderal: growing where the natural vegetation cover has been disturbed by humans.

Scabland: elevated land that is essentially flat-lying and covered with basalt and has only a thin soil cover, sparse vegetation, and usually deep, dry channels.

Scoping: an early opportunity for the public to tell a federal agency what issues they thing are important and should be considered in the environmental analysis of a proposed federal action.

Sensitive species: those plants and animals identified by the Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trend in populations or density and significant or predicted downward trend in habitat capability.

Shrub-steppe: is the largest natural grassland in North America. It extends from southeastern Washington and eastern Oregon, through Idaho, Nevada, and Utah, and into western Wyoming and Colorado. Shrub-steppe lands are covered with grasses and shrubs, the most common of which is sagebrush.

Substation dead-end towers: these are the towers within the substation where incoming or outgoing transmission lines end. Substation dead-ends are typically the tallest structure within the substation.

Substation fence: a chain-link fence with barbed wire on top surrounds the substation for security and public safety.

Substation rock surfacing: a 3-inch layer of rock, selected for its insulating properties, is placed on the ground within the substation to protect operation and maintenance personnel from danger during substation electrical failures.

Switches: these devices are used to mechanically disconnect or isolate equipment. Switches are normally located on both sides of circuit breakers.

Threatened and endangered species [birds/animals/plants]: the Endangered Species Act provided a means to identify, list, and protect certain species whose low population numbers made them vulnerable to extinction. Endangered species are those species officially designated by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service that are in danger of extinction through all or a significant portion of their range; threatened species are those so designated that are likely to become endangered within the foreseeable future through all or a significant portion of their range. Both species are protected by Federal law.

Turbidity: the extent to which a body of water is muddy or cloudy with particles of sediment stirred up or suspended in it.

Wetlands: an area where the soil experiences anaerobic (no oxygen) characteristics because water inundates the area during the growing season. Indicators of a wetland includes types of plants, soil characteristics, and hydrology of the area.

Woody debris: materials left over from cutting or harvesting, such as limbs of branches of a tree. Woody debris may be placed in stream channels to slow and divert water flow and improve habitat for fish.

Acronyms

B.P.	Before Present
BLM	U.S. Bureau of Land Management
BPA	Bonneville Power Administration
Corps	U.S. Army Corps of Engineers
CRPP	Cultural Resources Protection Plan
dB	decibel
dBA	decibel A-weighted scale
DNR	Washington Department of Natural Resources

Ecology	Washington State Department of Ecology
EFH	Essential Fish Habitat
EFU	Exclusive Farm Use
EIS	environmental impact statement
ESU	Evolutionarily Significant Unit
GMA	Growth Management Act
GPS	Global Positioning System
ILS	Intermediate Life Support
kV	kilovolts
kV/m	kilovolts per meter
L levels	exceedence levels
L_{eq}	equivalent sound level
mG	milligauss
MW	megawatts
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
OAHP	Office of Archaeology and Historic Preservation
OAR	Oregon Administrative Rules
PSH	Primary State Highway
PUD	Public Utility District
RP3	Resource Protection Planning Process
SIC	Standard Industrial Classification
SSH	Secondary State Highway
TCP	Traditional Cultural Properties
Umatilla Tribes	Confederated Tribes of the Umatilla Indian Reservation
USFWS	U.S. Fish and Wildlife Service

UTM	Universal Transverse Mercator
WAC	Washington Administrative Code
WARC	Washington Archaeological Research Center
Warm Springs Tribe	Confederated Tribes of the Warm Springs Reservation Oregon
WNHP	Washington Natural Heritage Program

Appendix A
Agency Correspondence and Policies

Appendix A
Agency Correspondence and Policies

- Letter Regarding Threatened and Endangered Species
- Email Regarding Species List Concurrence
- BPA Tribal Policy, April 1996

BPA Tribal Policy

April 1996

It is the entire government, not simply the Department of Interior, that has a trust responsibility with Tribal governments. And it is time the entire government recognized and honored that responsibility.

President Bill Clinton, in the Memorandum to the Heads of Executive Departments and Agencies, April 29, 1994

We must: Respect the values, religions and identity of Native Americans; improve the Federal government's relationship with the Tribes and become full partners with the Tribal nations; and position American Indians and Alaska Natives to compete economically as we move into the 21st century.

Former Energy Secretary Hazel R. O'Leary, in her remarks to Tribal leaders at the National Congress of American Indians Executive Council Winter Session, February 27, 1996.

BPA will develop a format for a government-to-government relationship with the Tribes.

Administrator Randy Hardy, to thirteen Indian Tribes, October 13, 1993

When Bonneville Power Administrator Randy Hardy signed the BPA Tribal Policy in April 1996, he reaffirmed the trust relationship between BPA as a federal agency and the 13 federally recognized tribes in the Columbia River Basin, as well as the other Northwest Indian tribes.

BPA's Tribal Policy responds to a memorandum issued by President Clinton to the heads of the executive department. In that memorandum, the President made trust responsibility and tribal relations the responsibility of all federal departments and all federal employees.

Following is the full text of BPA's Tribal Policy.

Purpose and Objectives

The purpose of this policy is to outline the foundation of BPA's Trust responsibility as a Federal agency and to provide a framework for a government-to-government relationship with the thirteen Federally recognized Columbia Basin Tribes (Tribes).

General Principles

The principles set forth below follow the Department of Energy's American Indian Policy (DOE Order No. 1230.2 (Apr. 8, 1992) and serves as guidelines to BPA and the Tribes throughout the development of their government-to-government relationships.

I. BPA recognizes that a trust responsibility derives from the historical relationship between the Federal government and the Tribes as expressed in Treaties, statutes, Executive Orders, and Federal Indian case law. Using these legal underpinnings, BPA and the Tribes will work cooperatively to arrive at an understanding of how the trust responsibility applies to a government-to-government relationship.

II. BPA commits to a government-to-government relationship with the Tribal governments and recognizes the unique character of each Tribe. Tribal governments have the primary authority and responsibility for many reservation affairs, and may be co-managers of natural resources within their respective ceded, treaty, or usual and accustomed areas.

   A. BPA fully respects Tribal law and recognizes Tribal governments as sovereigns.

   B. In keeping with the principle of self-government, BPA recognizes, where appropriate, the legal authority of Tribal governments for making Tribal decisions which may affect Indian and non-Indian peoples and Tribal cultural and natural resources both on and off-reservation.

   C. BPA will consult with the Tribal governments to assure that Tribal rights and concerns are considered prior to BPA taking actions, making decisions, or implementing programs that may affect Tribal resources.

III. The objectives outlined below define BPA's policy regarding the requirement for consultation with Tribal governments and are intended to assure that Tribal rights and interests are protected in all BPA decisions.

   A. The objectives of consultation include:

      1. Assure that Tribal policy makers and elected officials understand the technical and legal issues necessary to make informed decisions;

      2. Improve policy-level decision making of both the Tribes and BPA;

      3. Encourage Tribal implementation of fish and wildlife measures BPA funds;

      4. Protect Tribal lifestyles, culture, religion, economy;

      5. Encourage compliance with Tribal laws;

      6. Comply with Federal Indian law, statutes, and policy;

      7. Improve the integrity and longevity of decisions;

8. Strive to develop and achieve mutually agreeable decisions reflecting a consensus.

B. BPA will consult with Tribal governments by deliberating, discussing, or seeking the opinion of the Tribes when a proposed BPA action may affect the Tribes or their resources. BPA will solicit Tribal opinions and study them before taking an action that may affect the Tribes or their resources.

C. BPA will strive to differentiate between technical and policy issues, allowing for proper technical level and then policy level consultation. Technical level consultations should generally include the development, analysis, and review of information and the preparation of technical reports and recommendations. Consultation should result in a common understanding of the technical and legal issues that affect or are affected by a decision. BPA will strive to resolve such issues and arrive at a decision that responds to the Tribal concerns expressed.

D. Where BPA and one or more of the Tribes address issues of common concern, BPA will endeavor to use consultation to try and reach decisions that are compatible and mutually agreeable with the Tribal interests.

IV. BPA will seek mutually beneficial business partnerships with the Tribal governments through its various programs, pursuant to its authorities.

V. BPA recognizes it has mutual concerns and goals with the Tribes regarding the long term quality of life and natural resources in the Pacific Northwest and that both BPA and the Tribes have decisions to make regarding those resources. BPA will respect the authority of the Tribes to manage natural resources and respect their decisions regarding those resources. BPA will involve the Tribes in the beginning of its planning and management activities of water resources, fish and wildlife resources and other natural resources to achieve mutually beneficial results.

VI. BPA recognizes mutual respect between governments must be rooted in the individual working relationships of its members. BPA will enhance cultural awareness among its staff and will seek other opportunities to establish consistent individual working relationships between BPA and Tribal staff at all levels.

VII. BPA recognizes the importance of cultural resources to Native Americans and will respect Tribal values. BPA recognizes that the Tribes include as cultural resources such things as distinctive shapes in the landscape, natural habitats for subsistence or medicinal plants, traditional fisheries and wildlife, sacred religious sites, and places of spiritual renewal. BPA will work with the Tribes to identify important cultural resources for the purposes of inventory, protection, and mitigation where appropriate.

VIII. BPA will protect cultural resources by fulfilling its obligations as a Federal trustee, as required under terms of a treaty, and as required by the American Indian Religious Freedom Act (as amended), the Native American Graves Protection and Repatriation Act, the Native American Free Exercise of Religion Act, the National Historic Preservation Act, the Archaeological Resources

Protection Act and other applicable laws and regulations. Prior to taking actions that may have an impact on cultural resources, BPA will consult with potentially affected Tribes.

IX. To facilitate a government-to-government relationship, BPA will work cooperatively with each Tribe to develop points of contact and specific lines of communication.

A. Within the limits of its legal authority, BPA will not change this policy without advance notice and consultation with the Tribes.

B. BPA will make its best efforts to ensure that if future changes in its organization nullify any part of the policy, then BPA will promptly consult with the Tribes and revise the policy accordingly.

C. Successful implementation of this policy requires commitment throughout BPA's chain of command. BPA managers and staff will be accountable for creating and maintaining a mutually beneficial government-to-government relationship with the Tribes.

Signed: ____

Randall W. Hardy, *(Date)*
Chief Executive Officer/Administrator
Bonneville Power Administration

Tribal Communication Team

Darrell Eastman - Confederated Tribes of the Umatilla Indian Reservation; Confederated Tribes of the Warm Springs Reservation; Yakama Indian Nation; and Nez Perce Tribe. Darrell is located in Portland and can be reached at 503-230-3869.

Robert Shank - Confederated Tribes of the Colville Reservation; Spokane Tribe of Indians; Kootenai Tribe of Idaho; Coeur d'Alene Tribe; and Kalispel Tribe. Burns-Paiute Tribe; Shoshone-Paiute Tribe; Shoshone-Bannock Tribes; and Salish-Kootenai Tribes of the Flathead Indian Reservation. "Bob" is located in Spokane and can be reached at 509-358-7357.

Valerie Shelton - Administrative support for Tribal Relations staff. Val can be reached in Spokane at 509-358-7361.

John Smith - Tribal Relations Manager, Policy level consultation with all thirteen tribes, 509-358-7446.

List of Possible Internal Services

- Help identify potentially interested/affected Tribes and assist in making appropriate contacts within the Tribes

- Provide assistance in establishing mutually-acceptable expectations for consultation with each Tribe
- Make initial contacts for project staff and set up opportunities for long term relationships
- Provide guidance on Tribal protocol
- Help develop Tribal communications strategies
- Help BPA include Tribes early in decisions
- Provide a central location for information on Tribal contracts, MOAs, etc.

The 13 federally recognized tribes in the Columbia River Basin

Burns - Paiute	Nez Perce	Umatilla
Coeur D'Alene	Salish and Kootenai	Yakama
Colville	Shoshone - Bannock	Warm Springs
Kalispell	Shoshone - Paiute	
Kootenai	Spokane	

Updated June 25, 2001 by BPA Communications, 503-230-5131.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
P. O. Box 848
Ephrata, Washington 98823
Phone: 509-754-8580 Fax: 509-754-8575

May 7, 2001

Jamie Gray
Jones and Stokes
2820 Northrup Way, Suite 100
Bellvue, Washington 98004-1419

RECEIVED
MAY 10 2001
BY:

RE: Species List Request
FWS Reference: 01-SP-E0308

Dear Ms. Gray:

We have received your March 16, 2001, request for a list of endangered and threatened species and their habitats that may be present near the proposed 500-kilovolt transmission line between McNary Dam and John Day Dam along the Columbia River in Klickitat and Benton Counties, Washington. The following threatened and endangered species, and candidate species may be present within the project area: **Threatened;** Bald eagle *(Haliaeetus leucocephalus)*, Bull trout *(Salvelinus confluentus)*, Ute ladies'-tresses *(Spiranthes diluvialis)* **Proposed;** Coastal Cutthroat Trout *(Oncorhynchus clarki clarki)* **Candidate;** Mardon Skipper (butterfly) (*Polites mardon*) Oregon spotted frog (Rana pretiosa), Northern wormwood *(Artemisia campestris* var. wormskioldii).

Should the Biological Assessments (BA) for the proposed projects indicate that a listed species is likely to be affected (adversely or beneficially) by the project, the federal agency or its designated representative should request section 7 consultation through this office. If the BA indicates that the proposed action is "not likely to adversely affect" a listed species, the federal agency or its designated representative should request Service concurrence with that determination through the informal consultation process. If the BA indicates the project to have "no effect," we would appreciate receiving a copy for our information.

There are other species, including anadromous fishes that have been federally listed by the National Marine Fisheries Service (NMFS). Some of these species may occur in the vicinity of your project. Please contact NMFS in Lacey, WA at (360) 481-5742 to request a species list.

Thank you for your efforts to protect our nation's species and their habitats. If you have additional questions regarding responsibilities under the Act, please contact Gregg Kurz of this office at (509) 754-8580.

Sincerely,

Kate Terrell
Acting
Supervisor

From: "Dennis J Carlson" <Dennis.J.Carlson@noaa.gov>
To: "Chris Soncarty" <ChrisSo@jsanet.com>
Date: 12/12/01 11:16PM
Subject: Re: Species List Concurrence.

Chris,

Sorry for the delay in responding, our computer system server has been down and I'm just getting around to E-mails. Your list of threatened and endangered anadromous fish is current and appears correct. thanks for the inquiry. Dennis.

----- Original Message -----
From: "Chris Soncarty" <ChrisSo@jsanet.com>
Date: Tuesday, December 4, 2001 3:07 pm
Subject: Species List Concurrence.

> Dennis,
>
> Just spoke with you on the phone. But my name is Chris Soncarty and
> I'm with Jones and Stokes Associates in Bellevue, WA. I'm working
> on a
> BA for a BPA project that involves the construction of a new
> electricaltransmission line corridor between the McNary Dam and
> the John Dam Dam.
> The project begins on the Oregon side, at the McNary Substation,
> crossesthe Columbia River to Washington and runs down through
> Benton and
> Klickitat Counties on the Washington side, paralleling the Columbia
> River and SR 14, before crossing the Columbia River back to
> Oregeon and
> ending at the John Day substation near the town of Rufus.
>
> I'm anticipating that I will need to address the following species in
> the BA. Could you please confirm or deny this, and indicate
> whether any
> other threatened or endangered species may be affected by the proposed
> action.
>
> -Chinook salmon
>   -Upper Columbia River spring (E)
>   -Snake River spring/summer (T)
>   -Snake River fall (T)
>
> -Sockey salmon
>   -Snake River (E)
>
> -Steelhead trout
>   -Middle Columbia River (T)
>   -Snake River Basin (T)
>   -Upper Columbia River (E)
>
> Thank You,
> Chris Soncarty

>
>
>
> Chris Soncarty
> Fisheries Biologist
> Jones and Stokes Associates
> 11820 Northup Way, Suite E300
> Bellevue, WA 98005-1946
>
> Phone 425-893-6407
>
>
>

Appendix B
Public Involvement

Appendix B
Public Involvement

- Letter to public announcing project and public meetings, dated May 1, 2001
- Letter to public summarizing scoping comments, dated August 14, 2001
- Scoping comments received

Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

TRANSMISSION BUSINESS LINE

August 14, 2001

In reply refer to: KEC-4

To: People Interested in the McNary-John Day Transmission Line Project

In May, Bonneville Power Administration (Bonneville) wrote to tell you about a proposed new 75-mile-long transmission line that could affect you. We asked for your comments on the project and had two public meetings. Response was great; we received over 300 comments on the proposal. Thank you for taking the time to tell us your ideas.

This letter briefly summarizes those comments, outlines our next steps, and tells where to call if you have questions.

The proposal is the same - BPA is proposing to construct a transmission line from the McNary Substation to the John Day Substation, a distance of about 75 miles (see enclosed map). The new 500-kilovolt (kV) line would begin at the existing McNary Substation in Umatilla County, Oregon, cross the Columbia River into Washington, and generally follow the River west through Benton and Klickitat counties. At the John Day Dam, the proposed line would cross back into Oregon and connect into the John Day Substation in Sherman County.

The proposed line would, for its entire distance, parallel existing transmission lines that run between McNary and John Day Substations. BPA has existing right-of-way available next to those lines for most of the distance. The new line would be in this available right-of-way wherever possible. The proposed line would use lattice steel structures that are about 145 feet tall.

The existing lines in this area are operating at capacity. With the power shortage that the Northwest is experiencing, many new generation facilities are being considered. The McNary-John Day line would help ensure that the newly generated power could move through the system.

Public Comments – In May and June Bonneville received 350 comments on this proposed new transmission line. Most of the comments (78%) were given at the public meetings held in late May. One meeting was in Paterson and one in Roosevelt. We also received comments by mail, e-mail, and with permission-to-enter forms.

Most of the comments (45%) focused on potential impacts of the new line. The three topics that drew the most comments about impacts were:

- landuse (going through orchards and vineyards, cattle grazing, etc.),
- vegetation (mostly noxious weed concerns, some clearing concerns), and
- fire (concerns about workers starting brush fires).

Other impact comments were on cultural resources, social impacts, economic, noise, public health and safety, soils, visual, water and wildlife.

We also received many comments or questions on why we need to build the line, alternatives to building the line, where the line would go and what would it look like.

If you would like to see all the comments we received, you can visit our website at www.efw.bpa.gov under *environmental planning/analysis*. If you would like us to send you a copy of the comments, please call our toll-free document request line at 1-800-622-4520, and leave a message (please include the name of this project and your complete mailing address).

Next Steps – We are analyzing the possible environmental impacts of the project. Your comments are helping us know where to focus our efforts. The information that we gather will be published in a Draft Environmental Impact Statement that will be available for review and comment early next year.

You will continue to see crews working along the line through the following months. To address some of the noxious weed concerns, we will be conducting a weed survey along the right-of-way. This will help us know if follow-up with treatments will be necessary after there are no more activities in the field. We have also asked all of our crews to take strict fire prevention measures and to carry fire suppression equipment in their vehicles.

Once we have completed the environmental review, Bonneville will decide whether and how to proceed with the project. If Bonneville decides to proceed, construction would likely begin in 2003**.**

For More Information - If you have any questions about this proposal, please call me toll-free at 1-800-282-3713, at my direct number, (503) 230-5525; or send an e-mail to lcdriessen@bpa.gov.

Thank you for your interest in our work.

Sincerely,

Lou Driessen *08-10-2001*

Lou Driessen
Project Manager

1 Enclosure:
Map

Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

ENVIRONMENT, FISH & WILDLIFE

May 1, 2001

In reply refer to: KEC-4

To: People Interested in the McNary-John Day Transmission Line Project

Bonneville Power Administration (BPA) is proposing to build a new transmission line that could affect you. This letter briefly explains what is being proposed, outlines our process and schedule, and invites you to meetings where you can learn more.

Proposal - BPA is proposing to construct a transmission line from the McNary Substation to the John Day Substation, a distance of about 75 miles (see enclosed map). The new 500-kilovolt (kV) line would begin at the existing McNary Substation in Umatilla County, Oregon, cross the Columbia River into Washington, and generally follow the River west through Benton and Klickitat counties. At the John Day Dam, the proposed line would cross back into Oregon and connect into the John Day Substation in Sherman County.

The proposed line would, for its entire distance, parallel existing transmission lines that run between McNary and John Day Substations. BPA has existing right-of-way available next to those lines for most of the distance. The new line would be in this available right-of-way wherever possible. The proposed line would use lattice steel structures that are about 145 feet tall.

The existing lines in this area are operating at capacity. With the power shortage that the Northwest is experiencing, many new generation facilities are being considered. The McNary-John Day line would help ensure that the newly generated power could move through the system.

Alternatives - At this point the alternatives we are considering for this project include alternative tower locations near the existing lines, and the alternative of not building the line (an alternative we always consider).

Public Meetings - We will soon start to assess the environmental impacts of the alternatives, but before we do, we would like to hear from you. What questions do you have? Are there other routes we should consider? What resources should we analyze? We have scheduled open house public meetings to hear your ideas.

Wednesday, May 23, 2001
4 to 8 p.m.
Paterson School
51409 West Prior Road
Paterson, Washington

Thursday, May 24, 2001
4 to 8 p.m.
Roosevelt School
615 Chinook Avenue
Roosevelt, Washington

We do not plan to give a formal presentation at the meetings, so come anytime between 4 and 8 p.m. Members of the project team will be available to answer your questions and listen to your ideas.

Other Ways to Comment - If you cannot come to one of the meetings, you can still comment. If you comment by June 7, 2001, we'll be able to incorporate your ideas into our environmental studies. Call BPA's toll-free comment line at 1-800-622-4519, and leave a message (please include the name of this project); send an e-mail to: comment@bpa.gov; or mail comments to Bonneville Power Administration, Public Affairs Officer - KC-7, P.O. Box 12999, Portland, Oregon 97212. You can use the enclosed form to submit comments if you like.

Process/Schedule - You may see a survey crew in the area as they begin preliminary mapping and design work to refine possible routes. We will also conduct on-the-ground environmental surveys. If we need to access property along the proposed route for this work, we will contact property owners for permission.

The information we gather in our environmental analysis will be published in a Draft Environmental Impact Statement that will be available for review and comment next year. If you would like to receive a copy, please return the enclosed postcard and check whether you would like to receive it by regular or electronic mail. If you do not return the postcard, you will still receive notice when the study is available.

Once we have completed the environmental review, BPA will decide whether and how to proceed with the project. If BPA decides to proceed, construction would likely begin in 2003.

For More Information - If you have any questions about this proposal, please call me toll-free at 1-800-282-3713, at my direct number, (503) 230-5525; or send an e-mail to lcdriessen@bpa.gov.

Thank you for your interest in our work.

Sincerely,

/s/ Lou Driessen 5-1-01
Lou Driessen
Project Manager

3 Enclosures:
Map
Post Card
Comment Form

MCNARY-JOHN DAY TRANSMISSION LINE PROJECT - SCOPING COMMENTS

Notes:
Mtg1 = comments made at 5/23/01 public meeting at Paterson School, Paterson, WA
Mtg2 = comments made at 5/24/01 public meeting at Roosevelt School, Roosevelt, WA
E-M = commenter sent e-mail
Phone = commenter phoned
Letter = comments made through letter to BPA
Form = commenter used BPA form
PEP = comments written on *Permission to Enter Property* form

How	Chap	Topic	Comments
Comment Topics that fall into Chapter 1 of EIS (Purpose of and Need for Action)			
Mtg2	1	Background	Power producers don't want to connect to the 500 line. It is too expensive.
Letter	1	Background	I need more information about why you oversold our power, made commitments that you could not keep.
Mtg1	1	Background	How will this affect rates?
Mtg1	1	Background	Where is funding coming from?
Mtg2	1	Background	The existing line is at capacity; does that include Calpine-Goldendale?
	1	Decision	Has a decision been made?
Mtg1	1	Need	What is the need for the third line?
Mtg1	1	Need	Is the power going to California?
Mtg1	1	Need	How will the grid system work? Who is it serving?
Mtg1	1	Need	Is the Cogentrix Plant/Mercer Ranch impacting the need for this project?
Mtg1	1	Need	How about the gas-fired plants in Hermiston? How do they affect this project?

Mtg1	1	Need	What is driving the need for this project?
Mtg1	1	Need	How does the Port of Umatilla and the Umatilla Tribes proposed generation plant near McNary impact this project?
Mtg1	1	Need	What is driving the need for this project? Generation facilities? Where?
Mtg1	1	Need	We have to put up with this for California not taking care of their problems.
Mtg1	1	Need	Where is electricity going to go?
Mtg2	1	Need	With the wind and other energy plants going in, there is a need for transmission.
Mtg2	1	Need	How long will the new lines be good for until their capacity is maxed out?
Mtg2	1	Need	What about the lines beyond John Day? Will they also need new lines for extra capacity, or is it just the John Day-McNary section?
Mtg2	1	Need	If 2000 MW come on line in the next three years, will you need to build another line then?
Mtg2	1	Need	What about all the proposed wind power? How will that affect this project?
Mtg2	1	Need	Is the new proposed line already going to be maxed out for capacity?
Mtg2	1	Need	With all the interest in wind power generation, at what point would they tie into a line like what you have proposed?
Mtg2	1	Need	Are they studying the Mercer Ranch project, integrating it into this project?
Mtg2	1	Need	What additional generation will be carried on the new line?
Mtg2	1	Need	What about all the proposed wind power? Will it get funneled into these new lines?
Mtg2	1	Need	Are the existing lines operating at capacity right now, around 230-kV and 345-kV?
	1	Need	What about the (*megawatt capacity of the*) existing lines?

Mtg2	1	Need	Would other projects such as wind projects tie into this line?
Mtg2	1	Need	Is this put in for existing power or potential new power?
Mtg2	1	Need	We all need power.
Mtg2	1	Need	How will new line affect Cogentrix proposal to connect into 500 line?
Mtg2	1	Need	Will building the 500 line lessen flow on the 230-kV and 345-kV lines, making it available for new generation?
Mtg2	1	Need	We have gas and wind project in this area, so we support this line.
Mtg2	1	Need	Is this area a serious bottleneck?
Letter	1	Need	The Tribes understand that the currently proposed scope of the McNary-John Day Project EIS is limited to a transmission line that will be capable of transmitting only 1400-2300 MW of new generation. Given the existing generation shortfall in the Region, and the likelihood that a substantial amount of new generation will be located near the McNary Substation, the Tribes urge BPA to expand the scope of the McNary-John Day Project EIS to ensure that the proposed new transmission line is capable of transmitting an amount of power for which it is reasonably foreseeable that the McNary-John Day Project will serve.
Letter	1	Need	Specifically, the Tribes urge BPA to scope the McNary-John Day Project EIS in a manner sufficient to transmit 5000 or more megawatts (MW) of new power generation from the area. This is the amount of new generation currently under development near McNary Substation for which a substantial likelihood exists that the McNary-John Day projects will need to transmit in the near future.
Letter	1	Need	The Tribes understand that BPA is currently undertaking an analysis of upgrades to the entire BPA transmission system that will be required to meet the long term needs of the Region.
Letter	1	Need	In addition, the BPA is conducting a cumulative quality impact assessment under NEPA for all new generation projects in the area. The Tribes believe BPA should adopt a similar cumulative approach to scoping the size of the new McNary-John Day Project, rather than simply sizing the line to meet only the proposed generation projects which have completed full scale system impact and interconnection studies. Given the costs and time associated with conducting an EIS, it is inefficient to study only limited and immediate needs rather than immediately foreseeable future needs.

Letter	1	Need	The Pacific Northwest currently needs 3000 MW of new generation to be on-line by 2003 just to come into load/resource balance. This situation will exist whether or not the current drought conditions repeat themselves. Additional generation will continue to be added to the region's supply in order to meet increasing demand. The new generation that will meet this deficit and anticipated increases in demand requires adequate transmission interconnection and transfer capability.
Letter	1	Need	Because of siting and gas supply constraints, a large amount of this new generation is being developed near the McNary Substation. The McNary-John Day transmission path is critical to moving that generation to load centers west of the Cascades. BPA should plan its transmission system improvements in order to transmit this new generation as it comes on line.
Letter	1	Need	If BPA scopes the McNary-John Day Project EIS to include all reasonably foreseeable new generation that will likely utilize this transmission path upgrade, i.e., 500 MW, BPA will be able to install upgrades as needed to the extent allowed by the EIS process and as funding becomes available. If a narrower EIS is performed, i.e., one only anticipating up to 2500 MW of new generation, BPA will have to repeat the EIS process as new generation exceeds that limit. Additional studies entail additional costs and delay the ability of the region to reach and maintain a load/resource balance.
Letter	1	Need	If the McNary-John Day Project is restricted to the extent currently proposed in the EIS, BPA will be limited to constructing a new transmission line that can only transmit up to 2500 MW. In that instance, the Wanapa Project and others proposed for construction in the Area may become impractical due to lingering transmission constraints. Such an outcome may in fact be more harmful to the environment than a larger transmission upgrade given that the Wanapa Project and similar new generation projects are using more efficient (and thus environmentally friendly) technology than many existing generation projects.
Letter	1	Need	In sum, the Tribes request that the scope of the McNary-John Day Project EIS address the need for improvements to the BPA transmission system on a long-term rather than immediate basis. The EIS should address the need for the McNary-John Day Project to transmit 5000 MW of new generation.

Letter	1	Need	In determining the scope of an EIS for a new transmission line, NEPA requires BPA to account for all alternatives likely needed to accommodate new generation projects to be constructed in the foreseeable future. *See* Columbia Basin Land Protection Assoc. v. Kleppe, 417 F Supp. 46, 51 O.D. Wash. 1976). As the court in *Greene County Planning Bd. v. Federal Power Commission, 559 F.2d 1227, 1232 (2nd Cir. 1944),* stated: "The purposes of NEPA are frustrated when consideration of alternatives and collateral effects is unreasonably restricted. This can result if proposed agency actions are evaluated in artificial isolation from one another. Accordingly, an agency is required to consider the full implications of each decision in light of other developments in the area, and to prepare a comprehensive impact statement if several projects are significantly interdependent." Thus, in scoping the EIS for the McNary-John Day project, BPA should consider the need to transmit all generation under development in the Northeast
Letter	1	Need	Williams understands that the currently proposed scope of the McNary-John Day Project EIS is limited to a transmission line that will be capable of transmitting only 1400-2300 MW of new generation. Given the currently existing generation shortfall in the Region, and the likelihood that a substantial amount of new generation will be located in the Area and need to be transmitted to load centers west of the Cascades, Williams urges Bonneville to expand the scope of the McNary-John Day Project EIS to ensure that the proposed new transmission line is capable of transmitting an amount of power for which it is reasonably foreseeable that the McNary-John Day Project will serve. Specifically, Williams urges Bonneville to scope the McNary-John Day Project EIS in a manner sufficient to transmit 5000 MW of new power generation. This is the amount of new generation currently under development in the Area and for which there is a substantial likelihood the McNary-John Day Project will need to transmit in the foreseeable f
Letter	1	Need	Current projections of load growth versus generation capacity in the Pacific Northwest indicates that 3000 MW of new generation will be required by 2003 to ensure adequate load/resource balance. This situation will exist whether or not the current drought conditions repeat themselves. Additional generation will continue to be added to the Region's supply in order to meet increasing demand. The new generation that will meet this deficit and anticipated increases in demand requires adequate transmission interconnection and transfer capability. Because of siting and gas supply constraints, a large amount of this new generation is being developed in the Area and the McNary-John Day transmission path is critical to moving that generation to load centers west of the Cascades. Bonneville should plan its transmission system improvements so as to be able to transmit this new generation as it comes on line.
Letter	1	Need	In sum, Williams requests that the scope of the McNary-John Day Project EIS address the need for improvements to the BPA transmission system on a long-term rather than immediate basis. The EIS should address the need for the McNary-John Day Project to transmit 5000 MW of new generation.
Mtg1	1	Need	What power is being added with some of these gas-fired generators?
Mtg1	1	Need	I guess they should have finished the nuclear power plants.

Mtg1	1	Need	Nuclear is safe.
Mtg1	1	Need	Should have been building the last eight years (power and lines).
Mtg2	1	Need	I feel this is a worthwhile project.
Mtg2	1	Need	Glad you're considering building the line.
Form	1	Need	I think it's a great idea and only wish the former administration would've had an actual energy policy in place instead of waiting until critical meltdown!
Letter	1	Need	........The other hat is their interest in successfully building a natural-gas-fired power plant on Tribal land that would use the proposed transmission line and insuring that the line will be built large enough to support all of the reasonably foreseeable power plants that might be built in this region, including theirs.
PEP	1	Need	Wish this was for windmills!
Mtg2	1	other projects	Are you doing a separate line to McNary?
Mtg2	1	other projects	Where are the other lines/projects?
Mtg2	1	other projects	How does Mercer Ranch project fit into this line?
Letter	1	other projects	Improvements to the overall McNary-John Day transmission path is of a particular concern to Tribes because the Tribes are undertaking the development of the Wanapa Power Project (Wanapa Project). The Wanapa Project will be a highly efficient gas turbine generation facility located on trust land owned by the Tribes adjacent to the McNary substation. The Tribes are developing the Wanapa Project in partnership with the City of Hermiston, the Port of Umatilla, the Eugene Water and Electric Board, and the Williams Energy and Marketing Trading Company, the developer. The developer believes that this facility can be placed in operation on an extremely timely and efficient basis given this partnership.
Letter	1	other projects	Improvements to the overall McNary-John Day transmission path is of a particular concern to Williams because Williams is presently undertaking the development of the Wanapa Energy Center (Wanapa Project). The Wanapa Project will be a highly efficient gas turbine generation facility located on land owned by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) adjacent to the McNary substation. Williams is developing the Wanapa Project in conjunction with the CTUIR, the City of Hermiston, the Port of Umatilla and the Eugene Water & Electric Board. As the developer for the Wanapa Energy Center, Williams believes that this facility can be placed in operation on an extremely timely and efficient basis given this partnership between Williams and these public entities. The Wanapa Project, under the Confederated Tribes of the Umatilla Indians and Williams, has submitted an interconnection and transmission request to BPA and has fulfilled all requirements to have BPA initiate a system impact study relate

Mtg2	1	other projects	Will wind generation be an alternative to other types of generation?
Mtg1	1	other projects	A concern is the 250-acre pond the Mercer Ranch is proposing in association with Cogentrix's generation plant.
Mtg1	1	PI	Why didn't you include all the community names, such as Plymouth, on the map that accompanied the letter?
Mtg2	1	PI	By the aluminum plant, it doesn't appear that there's much choice but to build on the south side.
Mtg2	1	PI	Do you notify all landowners?
Mtg2	1	PI	Is this the last meeting?
Mtg2	1	PI	Where will comments be compiled, written?
Mtg2	1	PI	Be nice, stop by and tell us they (survey crew) will be there.
Mtg2	1	PI	Are all these posters and information on a website?
Letter	1	PI	Since the meeting will occur on the same day as the deadline for comments, we will be going forward in submitting written comments before that deadline. I will try to make our comments get to you prior to the meeting, so that you have some idea of our concerns. Please let me know if you can make it out to meet us on our proposed date and who might be coming with you. I greatly appreciate BPA's willingness to meet with us and look forward to meeting you in person.
Letter	1	PI	Thank you for your consideration of these comments. The Tribes will submit their comments regarding environmental and cultural resource impacts in response to the draft EIS when it comes out. Please address any formal written response to me and copy to J.D. Williams, Managing Attorney, at the same address.
Mtg2	1	PI	How does the information on the project get out to the public?
Mtg1	1	PI	We will have a landowner meeting.
Mtg1	1	PI	Most people won't come to meeting.

Mtg1	1	Process	What happens if I don't give you permission to enter property?
Mtg1	1	Process	Suggestions for PEP: It sounds like you could do anything - like putting the line right through town. Could have made PEP so that it just said "this is to lay control panel." It would have caused less alarm. Say "big plastic X so the planes could see." It would have caused less alarm.
Mtg1	1	Process	Remove photo panels after flight is flown - because they stay forever.
Mtg1	1	Process	Don't think we'll sign PEP.
Mtg1	1	Process	Don't want Environmental Review with PEP. Survey, appraisal, and testing is O.K.
Mtg2	1	Process	Will photo panels be removed? When they built John Day Dam they left them on the ground.
Mtg2	1	Process	BPA should have one contact person and have knowledgeable staff assigned.
Mtg2	1	Process	Will you get together with the landowners to decide where the towers will be placed?
Mtg2	1	Process	They are out on the property before getting permission.
Mtg2	1	Process	When the lines were built in the '50's, the contractors were really good about closing gates; it was the government inspectors that caused the problems leaving gates open. If you eliminate 80 percent of the inspectors, you'd have fewer problems!
Mtg2	1	Process	Our title report did not say there was easement for access (59/1, 58/4).
Letter	1	Process	It is very important to have **one** contact person in **one** office to which we, as landowners, can refer our questions and concerns. You will note that this letter is being sent to Portland, and our contact people are in Walla Walla!
Mtg1	1	Process	Wants notification before entry to avoid pesticide danger to survey crew.
Mtg1	1	Process	Why did I receive a PEP if my property is not on the right-of-way?
Mtg1	1	Schedule	What is time frame for construction?

Mtg1	1	Schedule	Time frame.
Mtg1	1	Schedule	When is construction?
Mtg2	1	Schedule	What's the schedule?
Mtg2	1	Schedule	When will the line be flown and photo panels removed?
Mtg2	1	Schedule	When will construction start and end?
Mtg2	1	Schedule	When will you get out bids to construct this project - and how long will it take to build?
Mtg2	1	Schedule	What's the time frame for construction and completion if everything goes according to plan?
Mtg2	1	Schedule	When will be construction if it goes through?
Mtg2	1	Schedule	How long is construction?
Mtg2	1	Schedule	What is time line?
Comment Topics that fall into Chapter 2 of EIS (Proposed Action and Alternatives)			
Mtg2	2	Alternatives	Staying within the existing right-of-way is the best thing for environment.
Mtg1	2	Alternatives	Static vars, can that help?
Mtg1	2	Alternatives	You should eliminate existing two lines and make just one transmission line corridor.
Mtg1	2	Alternatives	Do you have any alternate routes to the proposed route where proposed is within existing right-of-way?
Mtg1	2	Alternatives	Underground would be terrific.
	2	Alternatives	What are the options if it is decided that the transmission line is determined not to be feasible?
Mtg2	2	Alternatives	Are there other ways to transmit power?

Mtg2	2	Alternatives	What about going underground?
Mtg2	2	Alternatives	You can't amortize the costs of going underground to compare costs above ground?
Mtg2	2	Alternatives	It is common sense that if more power is needed, building new lines next to existing lines will have the least impact on the environment.
Mtg2	2	Alternatives	Why can't you take out one of the existing lines and double circuit to accommodate the new line?
Mtg2	2	Alternatives	Can you come back and double circuit this line later?
Mtg2	2	Alternatives	Maybe put a second line in now, since we'll need it in future.
Letter	2	Alternatives	Please be sure your environmental studies look at alternative methods of producing electricity.
Letter	2	Alternatives	Williams also understands that Bonneville is currently undertaking an analysis of upgrades to the entire Bonneville transmission system that will be required to meet the long-term needs of the Region. In addition, BPA is conducting a cumulative air quality impact assessment under NEPA to assess the impacts of all new generation projects proposed for the Area. Williams believes that Bonneville should adopt a similar cumulative approach to scoping the size of the new McNary-John Day Project, rather than simply sizing the line to meet anticipated new generation for which there are completed full scale system impact and interconnection studies. Given the cost associated with conducting an EIS assessment as well as the time required to complete one, it is inefficient to study only limited and immediate needs rather long-term needs.
Letter	2	Alternatives	If Bonneville scopes the McNary-John Day Project EIS to include all reasonably foreseeable new generation that will likely utilize this transmission path upgrade, i.e., 5000 MW, Bonneville will be able to install upgrades as needed to the extent allowed by the EIS process and as funding becomes available. If a narrower EIS is performed, i.e., one only anticipating up to 2500 MW of new generation, Bonneville will need to repeat the EIS process as new generation exceeds that limit. Additional studies not only entail additional costs, but they can delay the ability of the Region to reach and maintain a load/resource balance.

Letter	2	Alternatives	If the McNary-John Day Project is restricted to the extent currently proposed in the EIS, BPA will be limited to constructing a new transmission line that can only transmit up to 2500 MW. In that instance, the Wanapa Project and others proposed for construction in the Area may become impractical due to lingering transmission constraints. Such an outcome may in fact be more harmful to the environment than a larger transmission upgrade given that the Wanapa Project and similar new generation projects are using more efficient (and thus environmentally friendly) technology than many existing generation projects.
Mtg1	2	Alternatives	I'm tickled pink!
Mtg1	2	Alternatives	At least no new roads.
Mtg1	2	Alternatives	California lines are all underground?
Mtg2	2	Alternatives	The line doesn't bother me; I understand need for the project, and there are already plenty of towers in this area anyway!
Mtg2	2	Alternatives	I don't have a problem with line; you already have the right-of-way; the impact is already there.
PEP	2	Alternatives	my suggestion to place the lines above the existing lines must have been unworkable
Mtg1	2	Alternatives/ No action	Ah *(obscenity)*!
Mtg1	2	Construction	How do I let you know when you can and can't enter? Six months out of year are okay, six months are not. We spray March through August.
Mtg1	2	Construction	Will you be doing any blasting? Should be concerned about gas lines in area, McNary-Ross structure, 16/3.
Mtg1	###	Construction	Gas line parallels transmission line right-of-way from 16/3 to Sandpiper Farms. Williams Corporation owns the gas line - Pasco, WA - local contract. Contact David Fife, Engineering Dept., Salt Lake. Should look at their blasting policy. North side in Paterson area, but crosses at 13/5.
Mtg1	2	Construction	Concern about taking bulldozer through orchard.
Mtg2	2	Construction	How long will it take to build the towers; how are they constructed?
Mtg2	2	Construction	Can BPA schedule construction so we can harvest our fruit?

Mtg1	2	Construction	We have telephone underground; it's not well marked. (30/1)
Mtg1	2	Construction	Willing to give short-term easement for construction.
Mtg1	2	Construction	Buried fiber, south of BPA's right-of-way, parallels all the way to freeway from around Paterson.
Mtg1	2	Construction	Note: Gas pipeline easement shown on photo map at 47/2.
	2	Construction	BPA should require contractor to grade and gravel the pasture roads.
Mtg2	2	Construction	Access roads in area of 55/5 and east and pasture roads to north will be used, and should be upgraded.
Mtg1	2	Construction	Plymouth has a water line, with parallel sensing lines to water line for their water tank along Plymouth Road. City water.
Mtg2	2	Description	Just one set of towers.
Mtg2	2	Description	Gas line is on maps.
Mtg1	2	Description	Benton County PUD needs 115-kV source on north side of river - either a new substation or part of the double-circuit 500-kV crossing.
Mtg2	2	Description	Map 57067 shows right-of-way angling off main right-of-way on north side of Highway 14. Does BPA have an easement?
Mtg1	2	Description	Will you place structures adjacent to existing structures?
Mtg1	2	Description	Will you be on the north or south side of the existing lines?
Mtg1	2	Description	Will the new towers be taller than the existing structure?
Mtg1	2	Description	Will the line be larger?
Mtg1	2	Description	If lightning strikes, will it hit the taller towers, and is that why you're adding grounding wire?
Mtg1	2	Description	How wide is the wire grid under the towers, and how deep is it?

Mtg1	2	Description	How large of an area will the towers occupy? Footing size?
Mtg1	2	Description	Do you have more room in the right-of-way to put in a fourth line?
Mtg1	2	Description	Will the new towers be taller? If so, by how much?
Mtg1	2	Description	Are you planning any additional substations and additional capacity on your grid?
Mtg1	2	Description	Near the Ashe-Slatt line, do you need to buy more right-of-way? We're growing Boise Cascade trees here. Boise Cascade leases from Sandpiper Farms.
Mtg1	2	Description	How many megawatts?
Mtg2	2	Description	What is the life of these lines?
Mtg2	2	Description	Will towers be similar to existing towers?
Mtg2	2	Description	How will you be crossing the lines around 51/4?
Mtg2	2	Description	What's your estimated cost for this project?
Mtg2	2	Description	How much clearance is needed around towers for construction? How about afterwards?
Mtg2	2	Description	Does BPA add or bury fiber when the new line is put in?
Mtg2	2	Description	Will these towers be shorter than the existing 500-kV lines in the Mercer Ranch area?
	2	Description	Will the new line just be one circuit?
Mtg2	2	Description	Can you add another circuit at a later date?
Mtg2	2	Description	What is the megawatt capacity of the new line?
Mtg2	2	Description	How many megawatts can go on a 500-kV line?

Mtg2	2	Description	Will this line be at capacity?
Mtg2	2	Description	Tower heights aren't they the same now?
Mtg2	2	Description	This new line will be a lot bigger - more kilowatts.
Mtg2	2	Description	Why are the towers bigger?
Mtg2	2	Description	Where does the Ashe line go?
Mtg1	2	Location	Have you found any structures (buildings) in the way of the new line that need to be moved?
Mtg1	2	Location	Will you need to have the new line outside the existing right-of-way in any locations? If so, where?
Mtg1	2	Location	Will the new line be north or south of the existing lines?
Mtg1	2	Location	Which side will the new line be built?
Mtg1	2	Location	Will line go north of existing?
Mtg2	2	Location	Do you have any discretion on where the towers go?
Mtg2	2	Location	It's easier to build in this location than say the I-5 corridor!
Mtg2	2	Location	What are you going to do at the place where Hanford-John Day comes into the right-of-way?
Form	2	Location	I need more information about the exact location of this line. According to the map you sent, it appears to run south of SR-14 in the area where SR-14 and Plymouth Road intersect, but it is hard to tell because of the size of the map and the fact that Plymouth Road is not marked. My property is the NE corner of the land at the intersection of SR-14 and Plymouth Road.
Mtg1	2	Location	This is going to run all the way to John Day.
Mtg2	2	Maintenance	They left trees cut on right-of-way.
Form	2	Maintenance	I have encountered your maintenance crew members carrying GUNS. Why? They should not be hunting. All my land is posted "No Hunting."

Comment Topics that fall into Chapter 3 of EIS (Affected Environment, Environmental Consequences)			
Mtg1	3	Cultural Resources	Concern about 100-year-old school house in Plymouth, the only original structure in town.
Mtg1	3	Cultural Resources	How does this project impact the fishing platforms near the John Day crossing primarily on the west side of Hanford-John Day line?
Mtg1	3	Cultural Resources	All ridge tops along project route have cultural significance to the tribe.
Mtg1	3	Cultural Resources	High potential for tribal cultural sites along all the creeks.
Mtg1	3	Cultural Resources	There are pictographs along river, south of railroad tracks.
Mtg1	3	Cultural Resources	If you locate the new line on the south side near John Day, you will need to mitigate for cultural resources.
Mtg1	3	Cultural Resources	BPA must adhere to executive order 13007 - Native American Religious Freedom, freedom of access and prevention of degradation, and Traditional Cultural Property.
Mtg1	3	Cultural Resources	To the best of my knowledge, there are no cultural issues within the existing BPA transmission line right-of-way.
Mtg1	3	Cultural Resources	Canoe Ridge TCP.
Mtg2	3	Cultural Resources	On your map at 70/1, indicate "Indian Burial." We've fenced it off. It's not only Indians buried there, pioneers, at least four adults (1870's) babies (1896). Maybe more!
Mtg2	3	Cultural Resources	55/5 and 56/1, a burial site: 1910 A. J. Worrell, in right-of-way. Klickitat County records and a book by Historical Society, "Three-County Historical Update," a red book, '70's.
Letter	3	Cultural Resources	The Yakama Nation's Cultural Resources Program is concerned about the effects this transmission line project will have on its sacred and sensitive sites and sincerely hopes BPA will work cooperatively with the Yakama Nation in addressing these concerns. It is the sincere wish of the Yakama Nation that Bonneville will abide by the provisions of the American Indian Religious Freedom Act, 42 U.S.C. 1996, 1973 and Executive Order 13007 of May 24, 1996 (61 FR 26771). Under Section 1 of Executive Order 13007, any executive branch agency with statutory or administrative authority shall (1) accommodate access to the ceremonial use of Indian sacred sites by Indian religious practitioners and (2) avoid adversely affecting the physical integrity of such sacred sites.

Letter	3	Cultural Resources	Because a majority of the project area lies within the Ceded Lands of the Confederated Tribes and Bands of the Yakama Nation under the Treaty of 1855, we must insist that the Yakama Nation be designated the lead tribe for coordination purposes. Should archaeological or cultural resources be inadvertently discovered during this project, the Yakama Nation reserves its sovereign treaty rights under the Treaty of 1855 and will exercise its subsequent legal rights under the National Historic Preservation Act's Section 106 process to participate as a consulting party and provide direction and comment on this undertaking.
Mtg1	3	Cultural Resources	Tribal culturally sensitive plants (roots) are a concern along with T&E species.
Mtg1	3	E – Social*	We have lived with the lines 22 years.
Mtg2	3	E - Social	Construction people would be located where?
Mtg2	3	E - Social	Concern about school and kid impacts.
Mtg2	3	E - Social	Where will people stay?
Mtg2	3	E - Social	We are suddenly strategically located - no longer middle of nowhere.
Mtg1	3	E - Social	A lot of people don't like to have EPA find an extinct bug on their property.
Mtg1	3	E - Social	BPA comes off Highway 14 - easy access through our property; no access rights, don't ask permission. Would like help maintaining road (ask Heredia for plans). Benton/Klickitat 30/1. Steep driveway. Driving on airstrip - drive around lost. Drive too fast.
Mtg1	3	E - Social	Would "access" give Joe-Blow public access?
Mtg1	3	E - Social	If we give permission to enter property and we're spraying chemicals, what's the liability to us?
Mtg1	3	E - Social	Do BPA's easement rights give rights to the public?
Mtg1	3	E - Social	Does BPA have an access road easement to around 30/1 from Highway 14? BPA crews currently use it.
Mtg2	3	E - Social	Increased traffic along right-of-way and going off-right-of-way.

* E-social topics are social issues to be addressed under socioeconomic

Mtg2	3	E - Social	If your backhoes and towers on line, crews are home on weekend.
Mtg1	3	E - Social	Giving up ground, *(still)* we pay property taxes.
Mtg1	3	Economic	Is there any plan of reimbursing for trees?
Mtg1	3	Economic	What type of compensation for loss of production due to placement of towers and reduced irrigation capabilities?
Mtg1	3	Economic	Trees on right-of-way in way (*of*) tower. How do we compensate for removal?
Mtg2	3	Economic	I'm glad you're considering this project because then Klickitat County will be strategically located to retain our existing businesses and accommodate new businesses.
Mtg2	3	Economic	Will property be appraised fairly?
Mtg2	3	Economic	Klickitat County encourages power plant, wind farm construction, as it supports economic development.
Mtg2	3	Economic	Both wind farms and power plants offer huge benefits to the property tax base with few infrastructure demands.
Mtg2	3	Economic	The Roosevelt Community Action Plan endorses economic growth.
Mtg2	3	Economic	From Klickitat County: This is a plus for County.
E-mail	3	Economic	This project is a good economic development opportunity for Klickitat County, and the County Commissioners are very supportive of development that ties into the gas pipeline. Plan to attend the meeting in Roosevelt.
Letter	3	Economic	The Arlington City Council is actively pursuing industrial development for our area of Eastern Oregon. The City of Arlington owns industrial property adjacent to a BPA substation on Rhea Creek Road and would like to be considered as a site for alternate energy projects. The proximity to a major power grid makes our property a prime location for wind turbines, cogeneration, nuclear power, and other alternate energy sources. The Council is very pro-active in promoting industry in the area. Whatever part you can play in promoting the City of Arlington would be greatly appreciated.

Mtg1	3	E-social	Feel sorry for folks along line.
Mtg2	3	Fire	Fire danger - if fire is caused by your crews, is BPA responsible?
Mtg1	3	Fire	Extremely opposed to the line!
Mtg2	3	Fire	We found a cigarette on one of the photo panels. We are very concerned about fire danger!
Mtg2	3	Fire	All the landowners in this area are extremely fire conscious!
Mtg2	3	Fire	Problem with fires that could be started by surveyors, others working along the route and during construction; just the catalytic converter (hot) on the rig may be enough.
Mtg2	3	Fire	The best time to construct the project is in the winter when the fire danger is lower.
	3	Fire	We can lose crops and equipment *(to fire)* during the summer.
Mtg2	3	Fire	Build in winter so no fire issue.
Mtg2	3	Fire	Cigarettes butts thrown (59/4) on ground by surveyor.
Mtg2	3	Fire	On access road under right-of-way, we disk with tractor for a fire guard.
Mtg2	3	Fire	Survey crews are not staying on the right path. They will start fire on dry grass if they aren't on a path.
Mtg2	3	Fire	Use 4-wheelers without catalytic converters, or walk-in.
Mtg2	3	Fire	Call us ahead. Let us know when they'll be there. We can know whether we should stay home and look for smoke. (59/1, 58/4)
Mtg2	3	Fire	Cigarette butt on the survey marker.
Mtg2	3	Fire	We've mowed grass on access roads so exhaust pipes won't start fire.
Mtg2	3	Fire	Will BPA pay for the hay if a fire is started?

PEP	3	Fire	Appropriate measures for fire prevention will be followed when working off-road and workers will not smoke outside vehicles.
Mrg1	3	Landuse	Wind breaks, would take out four wind breaks.
Mtg2	3	Landuse	The less space you take up with towers, the better for orchards.
Mtg1	3	Landuse	Irrigation circles.
Mtg1	3	Landuse	Can you increase spans so that towers can avoid circle irrigation systems?
Mtg1	3	Landuse	Can I continue to grow crops underneath lines?
Mtg1	3	Landuse	Vineyards, which side of existing towers? North side better because of wind machines.
Mtg1	3	Landuse	Line will cross a corner of our property.
Mtg1	3	Landuse	Want to grow grapes - want to stay flexible.
Mtg1	3	Landuse	Will you require that an entire strip of crops be removed, or just the area around the towers?
Mtg1	3	Landuse	Would prefer that the minimal number of trees be removed across Sandpiper Farms (21/4 - 24/4). Alan Cleaver, CBS, Boise Cascade all lease Sandpiper. One hundred percent irrigated. Grass seed, potatoes, onions, organic onions, sweet corn, peas, trees, carrots, rape seed (canola). Trees have drip-line irrigation.
Mtg1	3	Landuse	Drip-line irrigation can be moved, but buried risers are fixed. Would probably impact trees in entire blocks.
Mtg1	3	Landuse	The trees (Boise Cascade) are for pulpwood and are grown 50-60 feet in height.
Mtg1	3	Landuse	Are orchards allowed within the right-of-way?
Mtg1	3	Landuse	Giving up five tower spots.
Mtg1	3	Landuse	Asparagus, want to put in grapes.
Mtg1	3	Landuse	Red Chief and Rome apples impacted.

Mtg2	3	Landuse	I'll need to remove orchards when this line is built!
Mtg2	3	Landuse	Can I plant an orchard under your line?
Mtg2	3	Landuse	How about filters (6-7') that are currently not under power lines? Will they have to be moved?
Mtg2	3	Landuse	I'm concerned about gates! Stock can get mixed up; stock intrudes on properties where they're not wanted!!
Mtg2	3	Landuse	Concern about open gates and cut fences in livestock area, resulting in having livestock in sensitive environmental areas.
Mtg2	3	Landuse	Impacts to pasture.
Mtg2	3	Landuse	Don't want lines to affect well or corral.
Mtg2	3	Landuse	Brahma bulls mean give notice before entering (48/2, 48/3). Bulls on right-of-way.
Mtg2	3	Landuse	Allied Waste owns property. They lease land for cattle grazing at 48/3 - 49.
Mtg2	3	Landuse	Concern about cattle during construction: Keep gates closed; calving in winter months, calve around towers.
Mtg2	3	Landuse	Better if no towers in the vineyards.
Letter	3	Landuse	Survey and construction activities also result in open gates and cut fences. This not only results in lost time for ranch operators but can place livestock in environmentally sensitive areas, into neighbors' range or onto overgrazed areas. As for the cost and effort of returning livestock to their proper pasture, we will address that matter when appropriate.
Form	3	Landuse	This area is designated as residential and interchange commercial on the comprehensive plan.
Mtg1	3	Landuse	Right next to us.
Mtg1	3	Landuse	Worried if tower right near house - location. *(It isn't.)*

Mtg1	3	Landuse	The line goes through back of our property.
Mtg1	3	Landuse	Not sure *(where)* our property line is - no house yet.
Mtg1	3	Landuse	Through our orchards, homes near Paterson.
Mtg1	3	Landuse	One tower in bin pile not a problem.
Mtg1	3	Landuse	We have to spray the trees all season so we will let you know for access.
Mtg1	3	Landuse	Major frost protection.
Mtg1	3	Landuse	If you break a water main line, it could ruin all crops.
Mtg1	3	Landuse	We water all through frost season; wet, muddy, night watering; March, April, May.
Mtg1	3	Landuse	Harvest is September, October.
Mtg2	3	Landuse	Need several months notice so we know whether to spray, prune, etc.
Mtg2	3	Landuse	Aluminum company owns house where Hanford-John Day line comes into right-of-way.
	3	Landuse	Cattle on right-of-way and land from October through May.
PEP	3	Landuse	I think you have a large enough footage next to the existing transmission line without taking any other property form people in the Paterson area.
PEP	3	Landuse	Range fences that must be kept tight and gates closed to keep livestock where they belong.
PEP	3	Landuse	one more line over my small 3 1/2 acres would render it useless.
Mtg1	3	Noise	Worried about the TV reception.
Mtg1	3	Noise	How do you mitigate for TV interference?
Mtg2	3	Noise	The lines snap, crackle and pop when they're wet, but they don't bother anything.
Mtg1	3	Public Health	Health reason, EMF concerns.

Mtg1	3	Public Health	We get shocked when under the lines, touching metal.
Mtg1	3	Public Health	We have no problem, as long as not electrocuted.
Mtg2	3	Public Health	What is the chance of shock if I park my vehicle under your lines?
Mtg2	3	Public Health	Fencing for faults, 50' out from the towers. Any closer and it's a serious safety hazard.
Mtg2	3	Public Health	Will cattle burn under this new line because it is higher voltage?
Form	3	Public Health	What impact, if any, would this line have on this particular area with regard to health hazards, interference with electrical reception, etc?
Mtg2	3	Public Health	How about the need to ground fences?
PEP	3	Public Health	with all the talk about powerline radiation….
PEP	3	Public Health	I have worked at reinforcing radio towers to place heavier T.V. antennas
Mtg1	3	Soils	Entire basin is fractured basalt/sand - probably 24" - 36" sand on top of bedrock.
Mtg2	3	Soils	Have natural cave and want it preserved (51/3).
Mtg1	3	Soils	Gas line can erode - exposed along lines.
Letter	3	Tribal	As we discussed, the Tribes wear two hats when it comes to the proposed transmission line. One hat involves their interest in protecting their treaty-reserved fishing and hunting resources located off-reservation from such large scale projects.
Mtg1	3	Vegetation	Will any trees need to be cut for the new right-of-way?
Mtg1	3	Vegetation	What about the windbreak located in the right-of-way - does it need to be cut?
Mtg1	3	Vegetation	We will lose trees at tower sites.

Mtg2	3	Vegetation	I'm concerned about noxious weeds. Equipment is a definite carrier for spreading noxious weeds, Canadian thistle - which is difficult to control, knapweed.
Mtg2	3	Vegetation	Introducing weed species, known and unknown.
Mtg2	3	Vegetation	Annual spray program in right-of-way for two years after construction.
Mtg2	3	Vegetation	Clean vehicles *(of)* noxious weeds while driving across multiple properties.
Mtg2	3	Vegetation	Survey crews are driving across land dragging yellow star thistle.
Mtg2	3	Vegetation	2000 acres - $27,000 in spray only. Star thistle.
Mtg2	3	Vegetation	Take out all Russian olives.
Mtg2	3	Vegetation	Our pasture is taken over with Russian olives.
E-mail	3	Vegetation	When you develop alternative routes, please consider re-seeding all areas that are disturbed during construction with a desirable grass species so noxious weeds won't invade those areas. Also, there needs to be follow-up to ensure new weed infestations are detected and controlled, preventing establishment and further spread.
E-mail	3	Vegetation	Please be sure your environmental studies look at managing noxious weeds and include measures that can be used to limit invasion and establishment.
E-mail	3	Vegetation	BPA needs to make sure that landowners understand that noxious weeds are managed along right-of-way with an integrated approach. The methods include biological, mechanical, herbicide, competitive planting and prevention. The comments submitted above are intended to ensure preventive measures are taken.
Letter	3	Vegetation	Project activities, we are informed, would be confined mostly to the existing right-of-way; but 1951 and 1953 line construction experiences taught us that is not always convenient or practical, and consequently our ranch roadways become dust-holes and boulders, seeded with undesirable weed species harmful to our range lands. We would recommend that BPA require contractors to prepare such accesses to receive a graded gravel surface to reduce roadway damage and aid in dust abatement concerns of Sundale Fruit, Inc., and other new neighbors. We also recommend that BPA consider expanding its weed control budget with Klickitat County Noxious Weed Control Board to include these off-right-of-way accesses with a road-width annual broadleaf control program during any construction phase followed by two years of semi-sterilization to catch late germinating undesirable species.

Form	3	Vegetation	I am distressed that you are considering MORE towers because your record for WEED CONTROL is very poor. The noxious weed yellow star thistle is out of control on your rights-of-way, and your vehicles spread the seeds.
	3	Vegetation	Using pasture roads: spread weeds and get torn up.
Mtg1	3	Vegetation	Tribal culturally sensitive plants (roots) are a concern along with T&E species.
PEP	3	Vegetation	Contractors and workers will inspect vehicles or noxious weeds in the undercarriage before driving onto the property and leaving the work site. Upon discovery, weeds are to be removed, placed in a sealed container, taken to a licensed landfill or transfer station for disposal.
Mtg1	3	Visual	Look at ugly tower.
Mtg1	3	Visual	Will obstruct our view a little.
Mtg1	3	Visual	Block our view of the river.
Mtg2	3	Visual	Hoping for cement pole towers - look nicer.
Mtg1	3	Visual/socioe conomic	Impact to the houses near Plymouth, near McNary Substation.
Mtg1	3	Water	Studies need to be done on the water wells along the right-of-way.
Mtg1	3	Water	A City water well, maybe two, are located in Paterson. There are two water wells in Plymouth where blasting may be a concern.
Mtg2	3	Water	At 57/1, nearby is a 6 gpm spring on north side of right-of-way.
Mtg2	3	Water	There is a drilled well in the area of Chapman Creek.
Mtg2	3	Water	Has spring on right-of-way, wants caution (51/2).

Form	3	Water	If your project needs water for construction purposes, you may need a limited license. For information, please contact Vern Church 541-384-4207.
Mtg2	3	Water	McNary-Ross, 69/4 to aluminum plant is leased for pasture; there are a lot of springs in this area. Not used for pasture January through March, generally.
Mtg1	3	Wildlife	Wildlife mitigation is needed along route.
Mtg1	3	Wildlife	Deer migration needs to be considered, drainages.
Mtg1	3	Wildlife	The north-south migration corridor for water fowl runs entire length of project route.
Mtg1	3	Wildlife	Mitigation needed for mortality of raptors, for entire 75 miles.

Mtg1	3	Wildlife	Needs mitigation for waterfowl and raptors.
Form	3	Wildlife	Please be sure your environmental studies look at mule deer (lots), elk (transient, a few), bald eagles.
Letter	3	Wildlife	In response to your May 16, 2001, Notice, the U.S. Fish and Wildlife Service offers no comment on the subject document.
Mtg2		other	No complaints.
Letter		other	As we discussed a couple of days ago, we are inviting you and other BPA representatives to meet with the Umatilla Tribes to discuss the McNary and John Day substations transmission line EIS process. We have reserved a time to meet with you in our Board of Trustees room on June 7 from 1:30 to 3:00 p.m. If this will work, please let me know and I will send you a map on how to get to our office and suggestions on where to stay if there is any interest in staying overnight.
Letter		other	The Chair of our Cultural Resource Commission, Armand Minthorn, and a leader in the traditional religion, has offered to be a tour guide for any of your group that would like to also take a tour of the Tamastslikt Cultural Institute, our Tribal museum, either before or after the meeting. Since the museum takes an hour or two hours to go through, please indicate whether you and others in the group would like to do this before our meeting at 1:30 p.m. or at the end of our meeting.
Letter		other	The Confederated Tribes of the Umatilla Indian Reservation (Tribes) submit these comments to address the scope of the Environmental Impact Statement (EIS) being prepared by the BPA for the proposed McNary-John Day Transmission Line Project (McNary-John Day Project). These comments are submitted in response to the Department of Energy, BPA, McNary-John Day Transmission Line Project, Notice of Intent to Prepare An Environmental Impact Statement (EIS) and Notice of Floodplain and Wetlands Involvement, 66 Fed. Reg. 27038, published on May 16, 2001.
Mtg2		other	It must be a ball designing a 500-kV line. It's been a while since BPA has built these lines!

Appendix C
Common and Scientific Names of Plants in the Project Corridor

Appendix C
Common and Scientific Names of Plants in Study Corridor

alkali saltgrass	*Distichlis stricta*
Baltic rush	*Juncus balticus*
big sagebrush	*Artemisia tridentata* ssp. *tridentata*
black cottonwood	*Populus balsamifera* ssp. *trichocarpa*
black locust	*Robinia pseudoacacia*
bluebunch wheatgrass	*Agropyron spicatum*
bitterbrush	*Purshia tridentata*
bottlebrush squirreltail	*Sitanion hystrix*
buckwheat	*Eriogonum* sp.
bulbous bluegrass	*Poa bulbosa*
bulrush	*Scirpus* sp.
Canada thistle	*Cirsium arvense*
Carey's balsamroot	*Balsamorhiza carreyana*
cheatgrass	*Bromus tectorum*
common cattail	*Typha latifolia*
creeping spike-rush	*Eleocharis palustris*
Douglas's sedge	*Carex douglasii*
fiddle-neck	*Amsinckia* sp.
fleabane	*Erigeron* sp.
foxtail barley	*Hordeum jubatum*
gray rabbitbrush	*Chrysothamnus nauseosus*
greasewood	*Sarcobatus vermiculatus*
green rabbit-brush	*Chrysothamnus viscidiflorus*
hairy milkvetch	*Astragalus inflexus*
Idaho fescue	*Festuca idahoensis*
indigo bush	*Amorpha fruticosa*
knapweed	*Centaurea diffusa*
kochia	*Kochia scoparia*
medusa-head wild rye	*Elymus caput-medusae*
mountain alder	*Alnus incana* var. *occidentalis*
needle and thread grass	*Stipa comata*
nootka rose	*Rosa nutkana*
northern wormwood	*Artemisia campestris* ssp. *borealis* var. *wormskioldii*

Pacific willow	*Salix lasiandra*, *S. sitchensis*
pauper's milvetch	*Astragalus misellus* var. *pauperi*
pearhip rose	*Rosa woodsii*
perennial pepperweed	*Lepidium latifolium*
piper's daisy	*Erigeron piperianus*
prickly-pear cactus	*Opuntia polycantha*
puncture vine	*Tribulus terrestris*
quaking aspen	*Populus tremuloides*
red alder	*Alnus rubra*
red elder	*Sambucus racemosa*
red fescue	*Festuca rubra*
reed canarygrass	*Phalaris arundinacea*
rosy pussytoes	*Antennaria rosea*
rush skeletonweed	*Chondrilla juncea*
Russian knapweed	*Centaurea repens*
Russian olive	*Elaeagnus angustifolia*
Sandberg's bluegrass	*Poa sandbergii*
sedge	*Carex* sp.
silky lupine	*Lupinus sericeus*
Sitka willow	*Salix sitchensis*
small-fruited bulrush	*Scirpus microcarpus*
smooth sumac	*Rhus glabra*
Snake River cryptantha	*Cryptantha spiculifera*
soft rush	*Juncus effusus*
spotted knapweed	*Centaurea maculosa*
tall sagebrush	*Artemisia tridentata*
tall wheatgrass	*Elytrigia elongata*
tree-of heaven	*Ailanthus*
Utes ladies' tresses	*Spiranthes diluvialis*
western yarrow	*Achillea millifolium*
white top	*Cardaria draba*
willow	*Salix* sp.
yellow starthistle	*Centaurea solstitialis*

Appendix D
Common and Scientific Names of Animals in the Project Corridor

Appendix D
Common and Scientific Names of Animals in Study Corridor

American white pelican	*Pelecanus erythrorhynchos*
American wigeon	*Anas americana*
badger	*Taxidea taxus*
bald eagle	*Haliaeetus leucocephalus*
black-tailed jackrabbit	*Lepus californicus*
Brewer's blackbirds	*Euphagus cyanocephalus*
brown-headed cowbirds	*Molothrus ater*
bufflehead	*Bucephala albeola*
Canada geese	*Branta canadensis*
cinnamon teal	*Anas cyanoptera*
common goldeneye	*Bucephala clangula*
cottontail	*Sylvilagus spp*.
cougar	*Felis concolor*
coyote	*Canis latrans*
deer	*Odocoileus hemionus columbianus*
Ferruginous hawk	*Buteo regalis*
fox	*Vulpes fulva*
gadwall	*Anas strepera*
golden eagle	*Aquila chrysaetos*
great basin spadefoot	S*caphiopus intermontanus*
great blue heron	*Ardea herodias*
green-winged teal	*Anas crecca*
harlequin duck	*Histrionicus histrionicus*
killdeer	*Charadrius vociferus*
leopard frog	R*ana pipiens*
Loggerhead shrike	*Lanius ludovicianus*
long-billed curlew	*Numenius americanus*
mallard	*Anas platyrhynchos*
Mardon skipper	*Polites mardon*
Merlin	*Falco columbarius*
mice	*Microtus spp.*
mule deer	*Odocoileus hemionus*
northern goshawk	*Accipiter gentiles*

northern harriers	*Circus cyaneus*
northern pintail	*Anas acuta*
northern shoveler	*Anas clypeata*
Oregon vesper sparrow	*Pooecetes gramineus* ssp. *affinis*
osprey	*Pandion haliaetus*
painted turtle	*Chrysemys picta*
peregrine falcon	*Falco peregrinus*
prairie falcon	*Falco mexicanus*
pygmy rabbit	*Sylvilagus idahoensis*
red-tailed hawk	*Buteo jamaicensis*
sage sparrow	*Amphispiza belli*
sage thrasher	*Oreoscoptes montanus*
sagebrush lizard	*Sceloporus graciosus*
sagebrush vole	*Lagurus curtatus*
sandhill crane	*Grus Canadensis*
skunk	*Mephitis mephitis*
song sparrows	*Melospiza melodia*
spotted frog	R*ana pretiosa*
streaked horned lark	*Eremophila alpestris* ssp. *strigata*
striped whipsnake	*Masticophis taeniatus*
voles	*Lagurus spp.*
Washington ground squirrel	*Citellus spermophilus washingtoni*
western burrowing owl	*Athene cunicularia*
western meadowlark	*Sturnella neglecta*
western pocket gopher	*Thomomys mazama*
western rattlesnake	*Crotalus viridis*
white-crowned sparrows	*Zonotrichia leucophyrys*
white-tailed jackrabbits	*Lepus townsendii*

Dear Neighbor,

BPA, along with your local electric utility, is continually looking for ways to improve safety awareness and practices around electrical lines and equipment. We feel our efforts are best spent in reaching people like yourself — those most likely to be living and working around high-voltage power lines.

This booklet presents safe practices for work and recreation activities near high-voltage transmission lines. It documents and expands on information that has generally been available to the public.

Please take this opportunity to reacquaint yourself, members of your family, and others that use or have access to your property, with these safety precautions. If you have other questions, please feel free to contact your nearest BPA office (listed on page 1), or your local utility.

Thank you for taking the time to let us share how "working smarter" near power lines can save lives — even your own.

Sincerely,

Fred M. Johnson

FRED JOHNSON, CHAIRPERSON
Central Safety and Health Committee
Bonneville Power Administration

Table of Contents

Preface

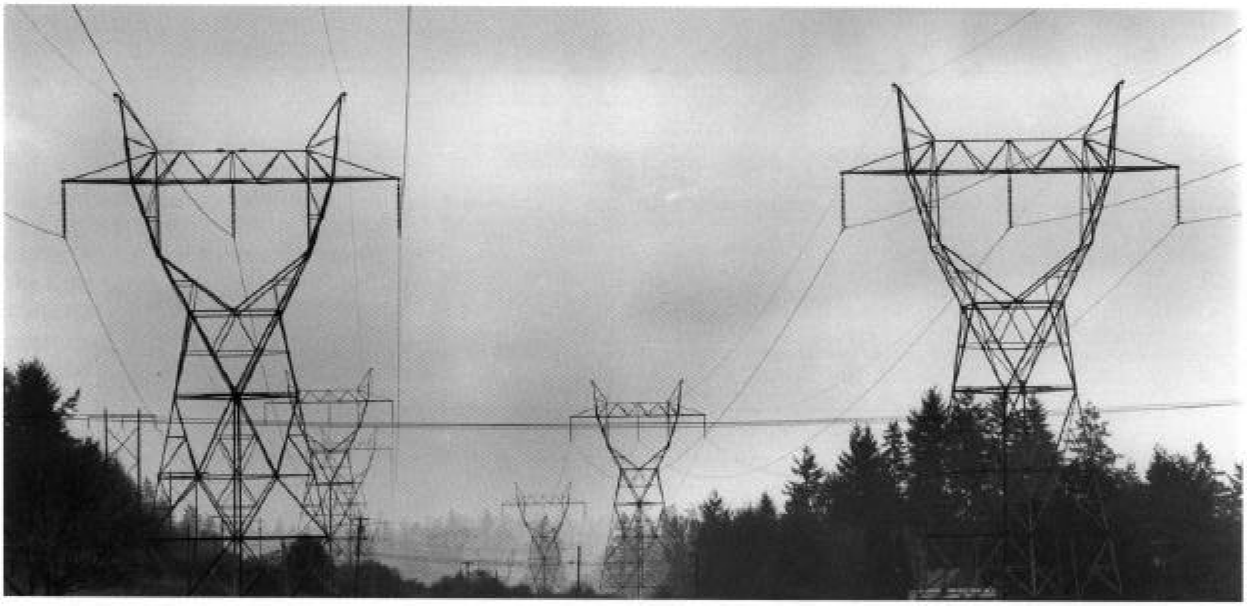
High-voltage transmission lines can be just as safe as the electrical wiring in our homes — or just as dangerous. The crucial factor is ourselves: we must learn to behave safely around them.

This booklet is a basic safety guide for those who live and work around power lines. It deals primarily with nuisance shocks due to induced voltages, and with potential electric shock hazards from contact with high-voltage lines. See last page for references on possible long-term biological effects of transmission lines.

In preparing this booklet, the Bonneville Power Administration has drawn on more than 50 years of experience with high-voltage transmission. BPA operates one of the world's largest networks of long-distance, high-voltage lines. This system has more than 400 substations and about 15,000 miles of transmission lines, almost 4,400 miles of which are operated at 500,000 volts.

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. They traverse hundreds of miles of irrigated and non-irrigated farmlands.



If you have questions about safe practices near transmission lines, call the nearest BPA regional office listed below.

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. Oftentimes, the restrictions can be tempered. To determine what practices are applicable to your case, contact BPA.

SNOHOMISH REGION
914 Avenue D
Snohomish, WA 98290
(360) 568-4962

OLYMPIA REGION
5240 Trosper Rd. S.W.
Olympia, WA 98512-5623
(360) 704-1601

EUGENE REGION
8600 Franklin
Eugene, OR 97405
(541) 465-6991

REDMOND REGION
3655 W. Highway 126
Redmond, OR 97756
(541) 548-4015

WALLA WALLA REGION
1520 Kelly Place
Walla Walla, WA 99362
(509) 527-6241

SPOKANE REGION
707 W. Main, Suite 500
Spokane, WA 99201-0608
(509) 358-7376

MONTANA REGION
2520 US Highway 2 East
Kalispell, MT 59901
(406) 755-6202

IDAHO FALLS REGION
1350 Lindsay Blvd.
Idaho Falls, ID 83402
(208) 524-8770

Using the Easement

Before a transmission 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 easement rights to construct, operate and maintain a transmission line and the right to keep the easement clear of all structures, trees, brush, fire hazards and any other vegetation that may interfere with the operation or maintenance of the line. Almost all farm crops can be grown safely under transmission lines. Crops grown on trellises require special consideration. Call BPA before installing trellises.

Call the nearest BPA regional office if you plan to use the right-of-way for any use other than growing crops.

Ask for the *"Landowner's Guide to Use of BPA Rights-of-Way,"* which explains how to apply for permission to use a portion of a BPA right-of-way and easements for approved purposes.

Construction and maintenance of homes, sheds, machinery buildings or any other structures, are specifically prohibited within a right-of-way.

These arrangements also serve to eliminate possible hazards.

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 transmission 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 transmission line — must be treated with respect.

The most significant risk of injury from a transmission line is the danger of electrical contact. Electrical contact between an object on the ground and an energized conductor can occur even though the two do not

Farm equipment or open large machinery 14 feet or less in height may be operated safely under all BPA lines in cultivated fields.

actually touch. In the case of high-voltage lines, electricity will arc across an air gap. The distance varies with the voltage at which the line is operated. Unlike the wiring at home, the conductors of overhead transmission lines are not enclosed by an electrical insulating material.

Injuries are more likely to result with lower voltage power lines (12,500 to 115,000 volts) than with higher voltage lines because contact is more likely. The electrical conductors of lower voltage lines are closer to the ground, smaller, and less noticeable. an injury from contact with a 12,500-volt line can be just as serious as that from a 500,000-volt line.

The most important safe practice is this:

Avoid bringing yourself, or any object you are holding, too close to an overhead line.

In other words, do not lift, elevate, build or pass under a transmission line any object, implement, facility or vehicle that could become near the energized conductors.

BPA does not recommend that anyone attempt to calculate how close they can come to a transmission 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 that the clearance between the conductors of a line and the ground meets or exceeds the minimum set forth in the code.

The minimum clearance to ground usually occurs midway between towers because the conductors sag. The clearance is usually greatest near the towers or poles.

Vehicles and large equipment up to 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. The operators of equipment that can be extended, such as bale wagons, stack movers or cranes, should exercise extreme care when near a power line.

The 14 feet limitation is a general standard applicable in the worst possible situations. In some instances, it can be exceeded without any problems. However, care must be taken since transmission lines sag, or droop, when they become heated. Having passed safely beneath a line in December with a piece of equipment higher than 14 feet does not automatically mean you can do so in July.

Instead of enumerating every situation or exception, we suggest, again, that you contact the nearest BPA regional office or your local utility, if you have need to exceed the 4-meter 14-feet limitation.

Induced Voltages

Under certain conditions, a perceptible electrostatic voltage can be induced on such objects as a large vehicle, a fence, metal building or irrigation system. This can happen when the object is near a high-voltage transmission line and is insulate from the ground.

When an induced voltage is present, touching a vehicle, wire fence, metal building or irrigation system can result in a sensation similar to the shock you may receive when you cross a carpet and then touch a door-knob. The static discharge from the rug is momentary. The sensation from a voltage induced by an alternating-current power line is similar, but may continue to be felt as long as contact with the object is maintained.

The magnitude of an induced voltage depends on the voltage of the transmission line, distance from the conductor, size or length of the object, and its orientation to the line. Shocks caused by an induced voltage do not usually present a hazard; for this reason we refer to them as nuisance shocks. However, mitigation methods to remove the possibility of hazards are identified in sections of the booklet that follow.

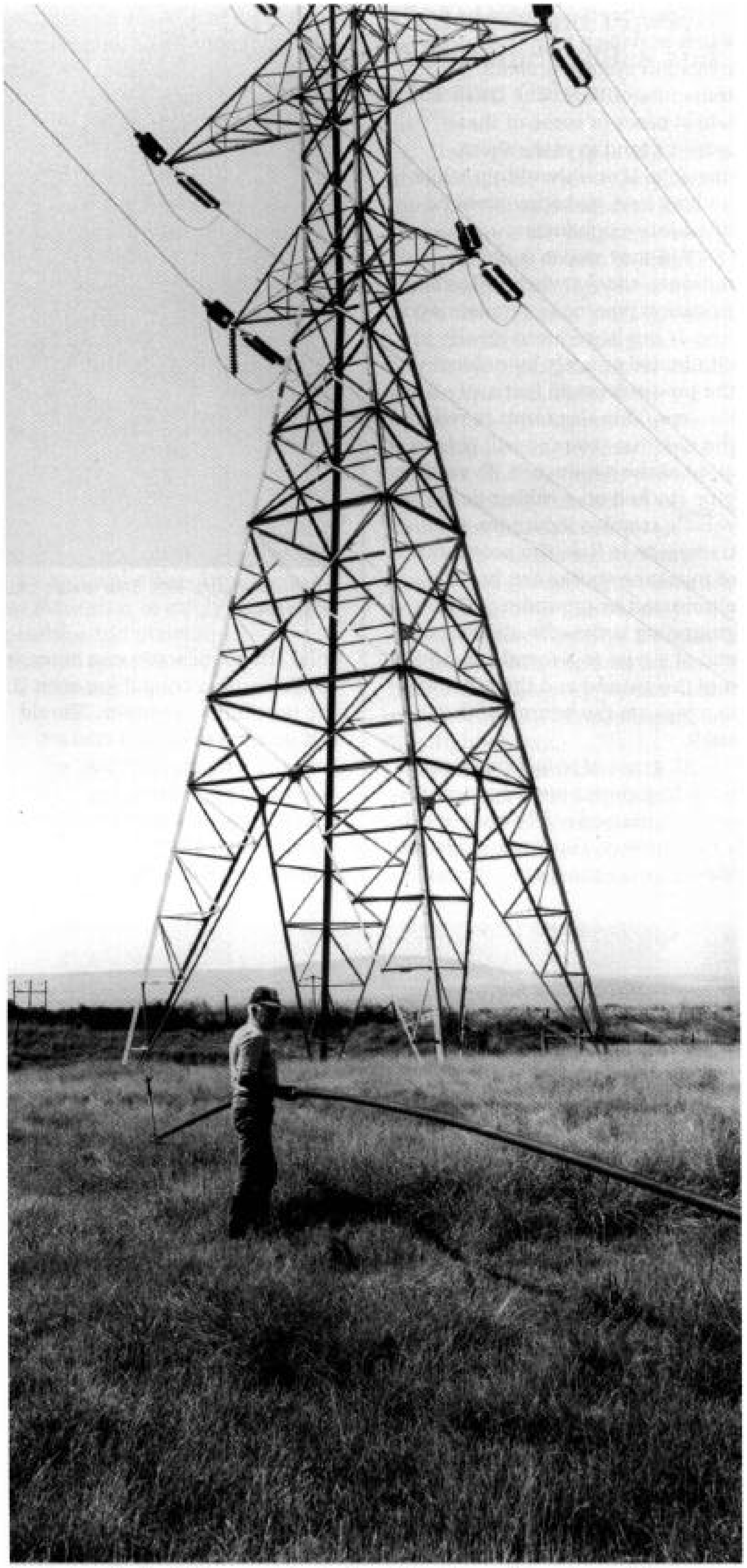
Irrigation Systems

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.

Irrigation pipe should be moved in a horizontal position under and near all power lines to keep it away from conductors overhead.

Again, we stress that the one critical hazard from overhead lines is the danger of bringing an object — in this case, a length of irrigation pipe — into close proximity to a conductor. One purpose of this booklet is to repeatedly make this warning.

As a precautionary measure, equipment used to install irrigation systems should be kept away from transmission lines. If you wish to, contact one of BPA's regional offices about your particular situation. If you are working near a line, it is wise to supplement normal precautions by assigning one person to act as a "safety watcher." This person simply stands by, watches, and warns the other workers against unsafe moves.



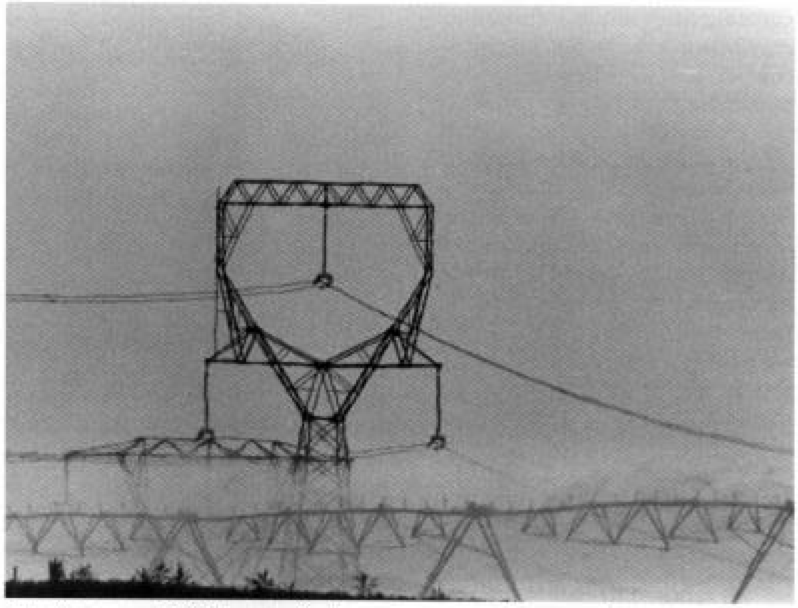
Irrigation pipe should be moved in a horizontal position under and near all power lines to keep it away from the conductors overhead.

Great caution should be used when moving a high-pressure irrigation system under a transmission line. The small wheel bases of some of these systems tend to make them unstable. If one should tip while under a line, its boom could be lifted into a conductor.

You may notice some nuisance shocks when unloading irrigation pipe near a transmission line. It can be reduced greatly or eliminated entirely by unloading the pipe at least 50 feet away from the line. This also tends to reduce the risk that the pipe will get too close to the conductors. Even if pipe stacked on a rubber-tired vehicle is unloaded under a transmission line, the possibility of nuisance shocks can be eliminated by grounding. The grounding is done by clipping one end of a wire to a metal rod driven into the ground and the other end to a pipe on the bottom of the stack.

All types of irrigation systems, including center pivot systems, can be operated safely near or on a right-of-way. However, irrigators should avoid situations where a solid stream of water can come in contact with a conductor, even if the possibility is remote. Should this occur, a person in contact with the irrigation system, or standing very near it, say 5 feet or so, may receive a severe shock. When asked, BPA will provide assistance as to the proper installation or operation of an irrigation system to avoid hazardous situations.

If a sprinkler malfunctions and a solid stream of water reaches a conductor, turn off the water at its source — by switching off the pump — before attempting to correct the problem.



Irrigation around BPA lines is safe when proper precautions are taken on the rights-of-way.

The possiblity of nuisance shocks can be eliminated by grounding metal pipe when unloading near BPA lines.

All nozzle risers in the vicinity of a transmission line should be equipped with spoilers or automatic shutoffs. This will prevent a solid stream from striking a conductor if a nozzle breaks or falls off.

Equipment with smaller diameter or fine mist spray nozzles do not usually present a problem. Ordinarily, a broken spray will not conduct a significant amount of current. However, spray containing fertilizer is much more conductive. Therefore, additional precautions should be taken to avoid spraying water with fertilizer into contact with transmission line conductors.

High-volume irrigation systems which use large nozzles and high pressure to sprinkle big areas are of special concern. Nozzle diameters vary from 3/4 inch to 1-15/16 inches and water pressures range from 80 to 100 psi. Thus, a solid stream discharged from one of these nozzles may reach heights of 30 to 35 feet and go as far as 200 feet. When such a system is in operation, a safe distance must be kept between it and a transmission line. If requested, BPA will gladly help you determine what a safe distance is for your equipment. Contact the nearest BPA regional office, listed on page 1, if you want help.

Nuisance shocks may be experienced when touching mobile pipe-type and wheel-type irrigation systems located near transmission lines. These shocks can occur when soil conditions are dry and there is a long section of irrigation pipe parallel to and within 15 meters (50 feet) of the transmission line centerline. Simple grounding procedures can prevent nuisance shocks on these types of systems. Contact BPA for assistance or information about your particular situation.

Central pivot circular irrigation systems installed near or udner transmission lines can develop hazardous shock potentials during operation and maintenance. To eliminate these hazards:

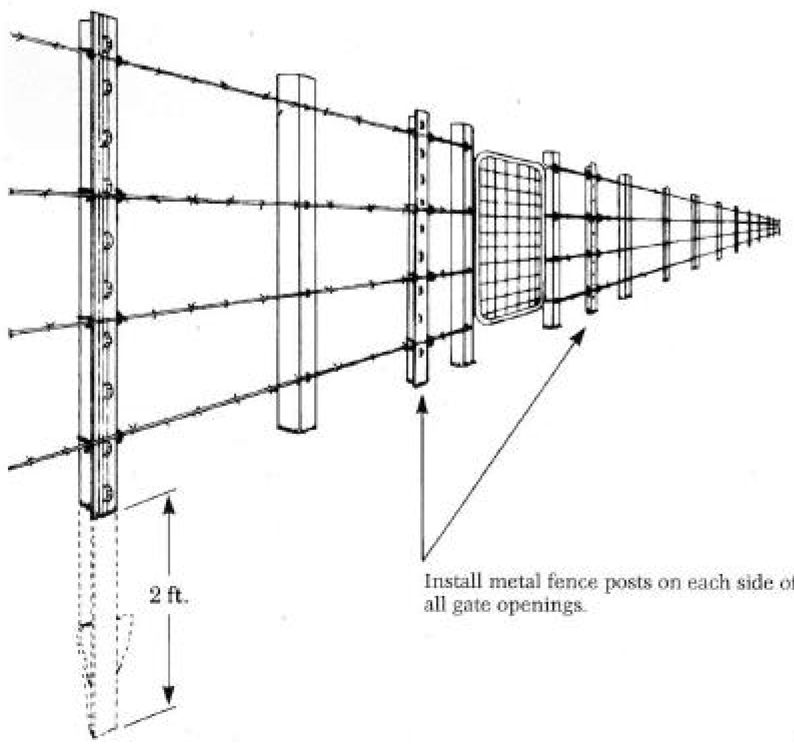
- Provide a good electrical ground for the pivot point.
- Do not touch the sprinkler pipe or its supporting structures when the system is operating under or parallel to and near a transmission line.
- Maintain the system with the sprinkler pipe perpendicular to the transmission line.

BPA has prepared a guideline for the installation and operation of irrigation systems near high-voltage transmission lines. A copy will be provided when you contact BPA's regional office for approval and assistance in safely locating, operating and maintaining irrigation systems near transmission lines.

Underground Pipes, Telephone Cables and Electric Cables

Underground pipes and cables are compatible with transmission lines providing installation and maintenance are properly done. However, they should be installed at an angle of 60 degrees or more to the transmission line centerline (a perpendicular crossing is best). Normally, pipes and cables should not be installed closer than 50 feet to a BPA structure or the buried grounding system. These systems are long buried wires that are sometimes attached to the structures and can run up to 300 feet along the right-of-way. Since these grounding systems are not visible above ground they must be located by BPA. Contact the nearest BPA regional office before installing any pipe or cable which crosses a BPA transmission line right-of-way.

Proper orientation of the line with respect to underground pipes, telephone cables and electric cables is required to prevent an accident in an extreme



Install metal fence posts on each side of all gate openings.

case when a fault on the transmission line might cause electricity to arc from the conductor to the tower and go to ground. This could produce a dangerous voltage on an underground piping or cable system.

Wire Fences

Barbed wire and woven wire fences insulated from ground on wood posts can assume an electrostatic voltage when located near transmission lines. Normally, the voltage will not be noticeable. If you are having a problem, call BPA for an investigation. The fence may need to be grounded if it:

- crosses the right-of-way;
- parallels the line within 125 feet of the outside conductor and is longer than 150 feet; or
- parallels the line 125 to 250 feet from the conductor and is longer than 6,000 feet.

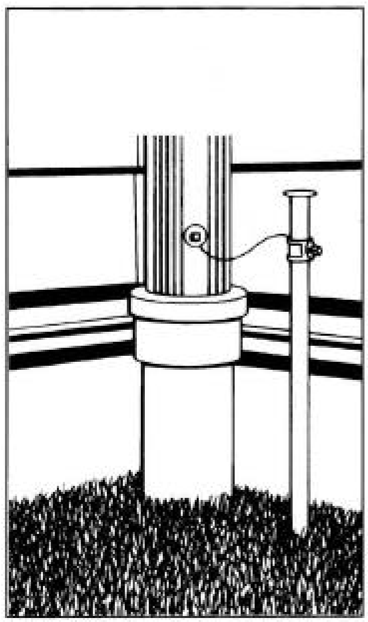
These fences should be grounded at each end and every 200 feet with a metal post driven at least 2 feet into the ground. Attach all wire strands of the fence to the metal post. Install the grounding posts at least 50 feet from the nearest transmission tower. If nuisance shocks are experienced when contacting a fence or gate, or if you have any questions about the need for grounding, call the nearest BPA regional office.

Electric Fences

In certain situations, BPA provides electric filters to ground 60-Hz voltages induced by a power line. These filters will allow the charging voltage on the fence to be effective. BPA provides these filters if the electric fence:

- crosses the right-of-way;
- parallels the line within 60 feet of the outside conductor and is longer than 1,000 feet; or
- parallels the line within 125 feet of the outside conductor and is longer than 2,500 feet.

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 transmission lines are not present. For more information about fences, fence chargers or filters, call the nearest BPA regional office.



Buildings

This section applies to buildings outside BPA's rights-of-way, since BPA prohibits buildings within a right-of-way.

Metal buildings are buildings whose frame, roof or walls consist of substantial amounts of metal. A voltage induced on a metal building is usually drained away through the building's plumbing, electrical service, metal sheeting or metal frame. Nonetheless, BPA's present practice is to ground any metal building near a 500,000-volt line when:

- it is within 100 feet of the outside conductor;
- it has more than 2,000 square feet of metal surface and is within 100 to 150 square feet of the outside conductor; or
- it is used to store flammable materials and is within 250 feet of the outside conductor.

One grounding rod is adequate for a building with less than 2,000 square feet of metal surface. Two grounding rods are used if a building's metal surface exceeds 2,000 square feet of metal surface. Two grounding rods are used if a building's metal surface exceeds 2,000 square feet. Even if the metal surface is less than 2,000 square feet, an extra grounding rod is useful in case one is damaged or develops a high-resistance contact.

Aluminum windows, downspouts, gutters or other metal parts on buildings constructed of wood or other insulating materials may also require gounding as shown above.

Again, call BPA if you have any questions about grounding a building.

Vehicles

Under some high-voltage lines, vehicles can carry a nuisance shock. This is particularly true if the vehicle is parked on a nonconductive surface such as dry rock. You can drain the shock from your vehicle to the ground by attaching a chain that reaches the ground to the vehicle 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 power line.

Theorectically, it is possible that an electric spark from an induced voltage could ignite a gasoline vapor that is created during refueling of a vehicle. BPA has never had a report of a refueling accident near our lines. Such an accident could occur, but the vehicle would have to be insulated from ground and the fuel and air would have to mix together in proportions that would have to be almost exactly right for an explosion. The chance that all these conditions would occur simultaneously is remote.

However, because such an accident is theorectically possible, BPA recommends that you not refuel your vehicle in close proximity to a transmission line.

Lightning

Lightning will usually strike the highest nearby object. In rural areas, this may be a power line tower or conductor. Transmission facilities are designed to withstand lightning strikes by channeling them to ground at the tower. When lightning strikes a tower, the damage is usually much less than if a barn or tree had been hit.

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 transmission line, electricity could arc from the conductor to the ground, endangering people and objects near the arc.

Field burning and other large fires in and around transmission lines can damage transmission lines and cause power outages. Water and other chemicals used to extinguish those fires should never be directed toward a transmisison line.

Kite Flying and Model Airplanes

BPA discourages anyone from flying a kite or model airplane anywhere near a power line. However, if your kite or model airplane is about to touch a power line, drop the string or handline 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 and Shooting

When hunting in remote areas, do not shoot at transmission lines.

Insulators are, for the most part, made of porcelain or glass and are easily broken. Not only can broken insulators cause flashovers, an insulator string hit by gunfire could pull apart and let the conductor fall to the ground. This could be a serious hazard to anyone close to the line. It could also cause a power outage and possible a fire in dry areas.

Unfortunately, most insulator damage from gunfire is the result of simple vandalism.

Hunters sometimes assume that the land under a transmission line belongs to the federal government and is therefore public property. This is rarely the case. Most land beneath power lines — except in national forests or on Bureau of Land Management lands — is privately owned.

Those who cause willful damage to BPA transmission facilities or property along easements can be prosecuted by the federal government, the property owner, or both.

Remember, insulators and conductors are not fair game. Do not use them for target practice. To do so is illegal and can be extremely hazardous.

Please report broken insulators and conductors, or any other damage you see, to BPA's Crime Witness program by calling **1-800-437-2744**. Crime Witness allows you to report, confidentially, 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 of any waste or material on BPA property.
- Vandalism to BPA property, buildings and vehicles.
- Theft of BPA equipment, supplies, tools or materials.

The program offers rewards of up to $1,000 for information leading to the arrest and conviction of the persons causing the damage.

Metal Objects

As a precautionary practice, do not raise nay metal object more than 14 feet in the air underneath a transmission line.

When you mount an antenna on a large vehicle that you plan to operate on a BPA easement, 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 transmission 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.

Swimming pool skimmers should not be raised vertically under any power line. BPA strongly discourages the building of swimming pools within BPA easements because of the possiblity of an accident.

Climbing

Climbing on power line poles, towers or guy wires can be extremely hazardous. Don't do it under any circumstances.

Pacemakers

Under some circumstances, voltages and currents from power lines, and household and other electrical devices may 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, persons 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 60-Hz interference.

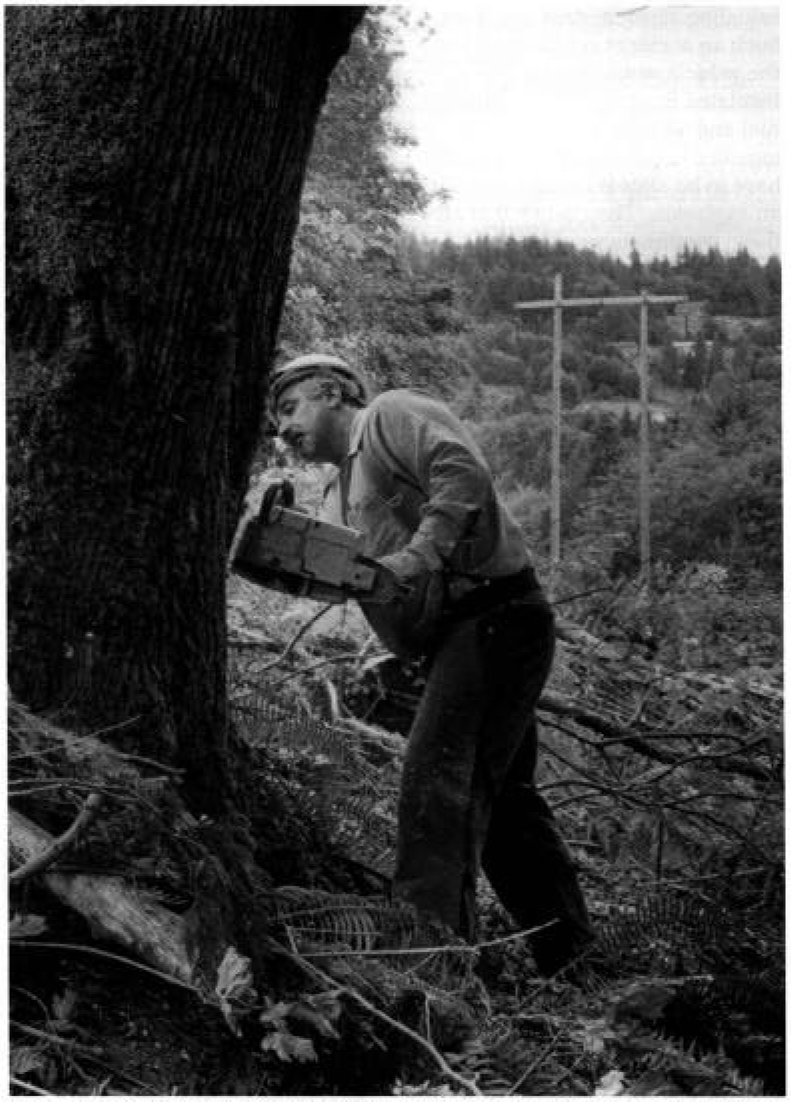
If a person with a pacemaker is in an electrical environment and the pacemaker begins to produce a regularly spaced pulse that is not related to a normal heartbeat, the person should leave the environment and consult a physician.

Trees and Logging

No logging or tree cutting should be done within BPA's easement without first contacting the nearest BPA regional office. In many cases BPA owns the timber within its easements. Additionally, logging near transmission lines can be very hazardous and and requires special caution. Since trees conduct electricity, if one should fall into or close to a line, the current could follow the tree trunk to the ground and endanger anyone standing near its base. Here are two simple rules: If you should come upon a tree which has fallen into a power line, stay away from it. If you should accidentally cause a tree to fall into a line, run for your life! Do not go back to retrieve your saw or equipment. Call BPA or your local utility immediately.

We suggest if you have trees either on or close to the easement which need to be cut and could fall on or close to a transmission line, that you contact BPA. It may be safer to have BPA remove the trees than to do it yourself.

Since transmission line rights-of-way are usually not owned by BPA, but are acquired through easements from the landowner,



Cutting trees within power line rights-of-way can be dangerous. It may be safer to have BPA do it for you.

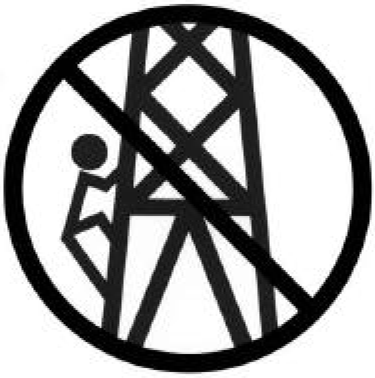
trees or logs stacked within or alongside them are not public property. People removing trees and logs without permission are stealing and can be prosecuted.

In addition, there are special considerations for growing Christmas trees, orchards and other tall-growing vegetation. Ask for the *"Landowner's Guide to Trees and Transmission Lines"* and the *"Landowners Guide to Use of BPA Rights-of-Way."*

Explosives

If you plan to detonate explosives near a BPA transmission line, notify BPA well in advance. See the list at the front of this booklet for the address and telephone number of the BPA office nearest you. BPA will tell you if any special precautionary measures must be taken at a particular blasting site.

As a general rule, do not use electric detonating devices when blasting within 1,000 feet of a power line. Nonelectric methods of detonation will avoid the



NEVER
climb towers or poles.

danger of accidentally discharging an electric blasting cap.

If you are blasting within 1,000 feet of a power line and there is no reasonable alternative to the use of an electronic detonating device, you must clear the layout of the electric detonation circuit with BPA.

Concerning Towers and Conductors

- Do not climb towers.
- Do not shoot or otherwise damage insulators.
- Never touch a fallen line.
- Do not attempt to dismantal tower steel members.
- Do not apply additional loads to tower members for temporary support of a structure or vehicle.
- Stay away from towers and lines during extreme wind storms, thunder storms, ice storms or under other extreme conditions.

Preventive measures include:

- Stay away from and report broken or damaged insulators to BPA or your nearest electrical utility.
- Stay away from and report broken, damaged or abnormally low-hanging lines to BPA 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 — and just as safe. Nevertheless, every year people are killed or seriously injured by power lines and 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 upon 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. So, 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

Call BPA's document request line at **1-800-622-4520** and ask for the following publications:

1) For information on possible long-term biological effects of transmission lines: *"What We Know (and don't know) About EMF"* (DOE/BP-2059)

2) For information on using the land under a BPA right-of-way: *"Landowner's Guide to Use of BPA Rights-of-Way"* (DOE/BP-1678)

3) For information on growing trees on a BPA right-of-way: *"Landowner's Guide to Trees and Transmission Lines"* (DOE/BP-2868)

Bonneville Power Administration
PO Box 3621 Portland, Oregon 97208-3621
DOE/BP-1821 APRIL 1998 3M

Appendix G
Electric and Magnetic Fields

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Electric and Magnetic Fields

- Assessment of Research Regarding EMF and Health and Environmental Effects
- Electrical Effects

McNARY – JOHN DAY TRANSMISSION-LINE PROJECT

ASSESSMENT OF RESEARCH REGARDING EMF AND HEALTH AND ENVIRONMENTAL EFFECTS

January, 2002

Prepared by

Exponent™

and

T. Dan Bracken, Inc.

for

Bonneville Power Administration

Table of Contents

ASSESSMENT OF RESEARCH REGARDING EMF AND HEALTH AND ENVIRONMENTAL EFFECTS

1.0 Introduction

Over the last 20 years, research has been conducted in the United States and around the world to examine whether exposures to electric and magnetic fields (EMF) at 50/60 Hertz (Hz) from electric power lines are a cause of cancer or adversely affect human health. The research included epidemiology studies that suggested a link with childhood leukemia for some types of exposures, as well as other epidemiology studies that did not; it also included lifetime animal studies, which showed no evidence of adverse health effects. Comprehensive reviews of the research conducted by governmental and scientific agencies in the U.S. and in the United Kingdom (UK) had examined the research, and did not find a basis for imposing additional restrictions (NIEHS, 1999; IEE, 2000).

The Bonneville Power Administration (BPA) requested that Exponent update the BPA on research on EMF and health in relation to exposures that might occur near the McNary – John Day Transmission Line Project. This update concentrates on recent major research studies to explain how they contribute to the assessment of effects of EMF on health (Section 2). The focus is on both epidemiologic and laboratory research, because these research approaches provide different and complementary information for determining whether an environmental exposure can affect human health. Section 3, Ecological Research, reviews studies of potential effects of EMF on plants and animals in the natural environment. This update includes studies of residential or environmental exposures to EMF and health effects that became available in 2001 (through November).

2.0 Health

2.1 The NIEHS Report and Research Program

In 1998, the NIEHS completed a comprehensive review of the scientific research on health effects of EMF. The NIEHS had been managing a research program that Congress funded in 1992 in response to questions regarding exposure to EMF from power sources. The program was known as the RAPID Program (Research and Public Information Dissemination Program). The NIEHS convened a panel of scientists (the "Working Group") to review and evaluate the RAPID Program research and other research. Their report, *Assessment of Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields,* was completed in July 1998 (NIEHS, 1998).

The director of the NIEHS prepared a health risk assessment of EMF and submitted his report to Congress in June 1999 (NIEHS, 1999). Experts at NIEHS, who had considered the previous Working Group report, reports from four technical workshops, and research that became available after June 1998, concluded as follows:

> The scientific evidence suggesting that ELF-EMF [extremely low frequency-electric and magnetic field] exposures pose any health risk is weak. The strongest evidence for health effects comes from associations observed in human populations with two forms of cancer: childhood leukemia and chronic lymphocytic leukemia in occupationally exposed

> adults. . . . In contrast, the mechanistic studies and animal toxicology literature fail to demonstrate any consistent pattern. . . . No indication of increased leukemias in experimental animals has been observed. . . . The lack of consistent, positive findings in animal or mechanistic studies weakens the belief that this association is actually due to ELF-EMF, but it cannot completely discount the epidemiology findings. . . . The NIEHS does not believe that other cancers or other non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern (NIEHS, 1999: 9-10).

Although the results of the RAPID research are described in some detail in the 1998 report, many of the studies had not been published in the peer-reviewed literature. Recognizing the need to have these results reviewed and considered for publication, the NIEHS arranged for a special edition of the journal *Radiation Research* (Radiation Research, 153[5], 2000) to be devoted to this topic.[1]

2.2 Update of Research Related to Cancer

This update includes studies of residential or occupational exposures to EMF and leukemia that became available through November 2001, including several epidemiology studies of childhood cancer and meta-analyses. The California Department of Health Services (CDHS) conducted a workshop in 1999 to discuss epidemiologic research on EMF and health. The reports presented at this workshop were published in January 2001 as a supplement to the journal, *Bioelectromagnetics*. Many of the papers were technical discussions of methodology issues in epidemiologic studies of EMF, including discussions of how to better understand the conflicting results reported in previous studies (Neutra and Del Pizzo, 2001). For example, one study evaluates the extent to which systematic errors (known in epidemiology as selection bias or information bias) occurred in EMF studies, and if those errors occurred, whether the effect on results could be evaluated (Wartenberg, 2001a). Other researchers discuss epidemiologic approaches to study how possible confounding factors, such as the age and type of home and traffic density, might affect the interpretation of studies of EMF and childhood cancer (Langholz, 2001; Reynolds et al., 2001).

For this update, we reviewed epidemiology and laboratory studies of cancer and reproduction. Several of the studies are "meta-analyses," an approach that incorporates statistical methods to analyze differences among studies and aggregate the results of smaller studies. The sections below include a review of meta-analyses of the studies of childhood leukemia, and a meta-analysis of studies of breast cancer in adults (Erren, 2001).

2.2.1 Epidemiology Studies of Children

The question of power lines and childhood cancer has been based on the assumption that the relevant exposure associated with power lines is the magnetic field, rather than the electric field. This assumption rests on the fact that electric fields are shielded from the interior of homes (where people spend the vast majority of their time) by walls and vegetation, while magnetic fields are not. The magnetic field in the vicinity of a power line results from the flow of current; higher currents result in higher levels of magnetic fields.

Epidemiologic studies report results in the form of statistical associations. The term "statistical association" is used to describe the tendency of two things to be linked or to vary in the same way, such

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[1] See, for instance, the articles cited in the **List of References** under Balcer-Kubiczek, Boorman, Loberg, and Ryan.

as level of exposure and occurrence of disease. However, statistical associations are not automatically an indication of cause and effect, because the interpretation of numerical information depends on the context, including (for example) the nature of what is being studied, the source of the data, how the data were collected, and the size of the study. The larger studies and more powerful studies of EMF have not reported convincing statistical associations between power lines and childhood leukemia (e.g., Linet et al., 1997; McBride et al., 1999; UKCCS, 1999). Despite the larger sample size, these studies usually had a limited number of cases exposed over 2 or 3 milligauss (mG).

Epidemiology Studies

The following discussion briefly describes major studies.

- A study from Germany included 514 children with leukemia and 1,301 control children (Schuz et al., 2001). Measurements of magnetic-field intensity (50 Hz) were taken for 24 hours in each child's bedroom. The results were calculated separately for daytime or nighttime levels in the bedroom, rather than for a child's overall 24-hour exposure. The authors report an association with leukemia for mean daytime magnetic-field exposures that might have been due to chance. They reported an association between mean nighttime magnetic-field levels and leukemia for the highest exposed group (4 mG or higher; 9 cases). The assessment of exposure by mean field levels in the bedroom did not link magnetic-field levels to any specific source. The authors note in their conclusions that " . . . fewer than one-third of all stronger magnetic fields were caused by high-voltage powerlines . . . . " (Schuz et al., 2001:734).

  Several aspects of the study detract from the validity of the results: the estimate included a broad margin of error because only a small number of cases was exposed at the higher levels, and many eligible cases and controls did not participate, which means that the responders may not represent the population and results could be biased. Another concern is that these magnetic-field measurements were taken in 1997, long after the relevant exposure period for cases diagnosed in 1990-1994. Magnetic-field levels may have changed over time, as electricity usage changed.

- A study from British Columbia, Canada, included 462 children who had been diagnosed with leukemia and an equal number of children without leukemia for comparison (McBride et al., 1999). Magnetic-field exposure was assessed for each of the children in several ways: personal monitors were worn in a backpack for 48 hours, a monitor took measurements in the bedroom for 24 hours, the wiring outside the house was rated by potential exposure level (wire codes), and measurements were taken around the outside perimeter of the homes. (Wire codes are a method of estimating relative exposure intensity based on the configuration of the power lines.) Regardless of the method used to estimate magnetic-field exposure, the magnetic-field exposure of children who had leukemia was not greater than that of the children in the comparison group.

- A study conducted in Ontario, Canada reported on the magnetic-field exposure of a smaller group of children than in other recent studies (Green et al., 1999a). No increased risk estimates were found with the average magnetic fields in the bedroom or the interior, or with any of the three methods of estimating exposure from wire-configuration codes. A still smaller group of 88 children with leukemia and their controls wore personal monitors to measure magnetic fields (Green et al., 1999b). Associations with magnetic fields were reported in some of the analyses, but most of the risk estimates had a broad margin of error, and major methodological problems in the study preclude any clear interpretation of the findings.

- The United Kingdom Childhood Cancer Study, the largest study to date, included a total of 1073 childhood leukemia cases (UKCCS, 1999). Exposure was assessed by spot measurements in the home (bedroom and family room) and school, and summarized by averaging these over time. No evidence was found to support the idea of an increased risk of leukemia from exposures to magnetic fields inside or outside of the home.

- The UKCCS investigators had obtained magnetic-field measurements on only a portion of the childhood cancer cases in their study (UKCCS, 1999). To obtain additional information, they used a method to assess exposure to magnetic fields without entering homes; they were thus able to analyze 1331 child leukemia cases (UKCCS, 2000). For these children, they measured distances to power lines and substations. This information was used to calculate the magnetic field from these external field sources, based on power-line characteristics related to production of magnetic fields. The results of the second UKCCS study showed no evidence for an association with leukemia for magnetic fields calculated to be between 1 mG and 2 mG, 2 mG and 4 mG, or 4 mG or greater at the residence, in contrast to the weak association reported for measured fields of 4 mG or greater in the first report (UKCCS, 1999).

Researchers have proposed that the associations that are sometimes reported between childhood leukemia and power lines might be due to other factors that can confound (other risk factors for disease that may distort the analysis) the analysis. One example is heavy traffic, which may occur near power lines and which can increase the levels of potentially carcinogenic chemicals in the area. Earlier studies had reported associations between traffic density and childhood cancer (Savitz et al., 1988). If power lines were more common in areas that had higher traffic density, then the increased air pollution might explain an association between power lines and childhood cancer. However, more recent studies seem to eliminate this possibility. In a study of 90 cases of childhood leukemia, Reynolds et al. (2001) found no evidence of an association with traffic density. In a larger study that included 986 cases of childhood leukemia, no association was found with high traffic-density exposure during pregnancy or childhood (Raaschou-Nielsen et al., 2001).

Meta-analyses of Studies of Leukemia

Recently, researchers re-analyzed the data from previous epidemiology studies of magnetic fields and childhood leukemia (Ahlbom et al., 2000; Greenland et al., 2000). The researchers pooled the data on individuals from each of the studies, creating a study with a larger number of subjects and therefore greater statistical power than any single study. A pooled analysis is preferable to other types of meta-analyses in which the results from several studies are combined from grouped data obtained from the published studies. These analyses focused on studies that assessed exposure to magnetic fields using 24-hour measurements or calculations based on the characteristics of the power lines and current load. Both Ahlbom et al. and Greenland et al. used exposure categories of <1 mG (<0.1 microtesla [μT]) as a reference category. The statistical results of these analyses can be summarized as follows:

- The pooled analyses provided no indication that wire codes are more strongly associated with leukemia than measured fields.

- Pooling these data corroborates an absence of an association between childhood leukemia and magnetic fields for exposures below 3 mG (0.3 μT).

- Pooling these data results in a statistical association with leukemia for exposures greater than 3-4 mG (0.3 or 0.4 μT).

The authors are appropriately cautious in the interpretation of their analyses, and they clearly identify the limitations in their evaluation of the original studies. Magnetic fields above 3 mG (0.3 μT) in residences are estimated to be rather rare, about 3% in the U.S. (Zaffanella, 1993). Limitations include sparse data (few cases) to adequately characterize a relationship between magnetic fields and leukemia, uncertainties related to pooling different magnetic-field measures without evidence that all of the measures are comparable, and the incomplete and limited data on important confounders such as housing type and traffic density.

A meta-analysis of the data from epidemiologic studies of childhood leukemia studies was presented at the California Workshop and recently published (Wartenberg, 2001b). This meta-analysis did not have the advantage of obtaining and pooling the data on all of the individuals in the studies, unlike those published before it (Ahlbom et al., 2000; Greenland et al., 2000). Instead of using individual data, Wartenberg (2001b) used an approach that extracted the published results, reported as grouped data from several published studies. He used 19 studies overall, after excluding 7 studies that had insufficient data on individuals or deficiencies in the exposure assessment data. He reported a weak association for a) "proximity to electrical facilities" based on wire codes or distance, and b) magnetic-field level over 2 mG, based on either calculations from wiring and loading characteristics (if available) or on spot magnetic-field measurements. The results show more cases than controls exposed to measured or calculated fields above 2 mG. The author concludes that the analysis supports an association, although the size of the effect is small to moderate, but also notes "limitations due to design, confounding, and other biases may suggest alternative interpretations" (Wartenberg, 2001b:S-100).

The results of this meta-analysis are not directly comparable to previous ones regarding fields of 3 or 4 mG because the analysis was not based on individual data. The comparison of grouped data used different exposure cut points for the analysis and different criteria for the comparison group. None of these three analyses (Ahlbom et al., 2000; Greenland et al., 2000; Wartenberg, 2001b) included the results of the latest UK analysis of 1331 child leukemia cases based on calculated fields, which found no association between EMF and childhood leukemia or other cancers, regardless of the exposure level.

2.2.2 Epidemiology Studies of Adults

Studies of adults with certain types of cancer, such as brain cancer, breast cancer, or leukemia, have reported associations with exposure to magnetic fields at residences, but results have not been consistent across studies. Contradictory results among studies argue against a conclusion that the association reflects a cause-and-effect relationship. In their assessments of risk, scientists give most weight to studies that include more people, obtain more detailed and individual exposure assessments, and/or include people who have higher exposures.

A study of 492 adult cases of brain cancer in California included measurements of magnetic fields taken in the home and at the front door, and considered the types of power-line wiring (Wrensch et al., 1999). The authors report no evidence of increased risk with higher exposures, no association with type of power line, and no link with levels measured at the front door.

A number of recent studies of breast cancer focused on electric blankets as a source of high exposure. Electric blankets are assumed to be one of the strongest sources of EMF exposure in the home. Three studies of electric-blanket use found no evidence that long-term use increased the risk of breast cancer. Women who developed breast cancer reported no difference in total use of electric blankets, use in recent years, or use many years in the past:

- Gammon et al. (1998) reported that, even for those who kept the blanket on most of the time, no increase in risk was found for those who had longer duration of use (measured in months).

- A study of 608 breast cancer cases found no evidence of increased use of electric blankets or other home appliances in cases compared to controls, and no indication of increasing risk with a longer time of use (Zheng et al., 2000).

- In a cohort of over 120,000 female nurses, data were obtained on known risk factors for breast cancer as well as electric-blanket use (Laden et al., 2000). For a large subset of this group, the questions about exposure were asked before the disease occurred, a step taken to eliminate bias in recalling exposure. No associations with electric blanket use were found.

Erren (2001) reported the results of a meta-analysis of the studies of breast cancer, in which the results of 24 different studies in women were statistically aggregated. When the results of all 24 studies, including studies of workplace exposures, were pooled, the estimate indicated an association between EMF and a small excess breast cancer risk. The pooled results for exposure to EMF in the vicinity of electrical facilities did not show an association with breast cancer, nor did the results for exposure to EMF from appliance use. However, the meta-analysis also showed a lack of consistency among the results of the individual studies, a broad variation in the designs, and a wide range of methods used to assess exposure. No adjustments were made to the data to give increased weight to studies based on more comprehensive exposure assessments. The author also noted that the weak statistical association might be an artifact (a result of chance or unforeseen error) rather than an indication of a cause-and-effect relationship (Erren, 2001).

2.2.3 Laboratory Studies of EMF

Laboratory studies complement epidemiologic studies of people because the effects of heredity, diet, and other health-related exposures of animals can be better controlled or eliminated. The assessment of EMF and health, as for any other exposure, includes chronic, long-term studies in animals (*in vivo* studies) and studies of changes in genes or other cellular processes observed in isolated cells and tissues in the laboratory (*in vitro*).

Although the results of the RAPID Program were described in some detail in the NIEHS reports (NIEHS, 1998), many of the studies had not been published in the peer-reviewed literature. The RAPID research program included studies of four biological effects, each of which had previously been observed in only one laboratory. These effects are as follows: effects on gene expression, increased intracellular calcium in a human cell line, proliferation of cell colonies on agar, and increased activity of the enzyme ornithine decarboylase (ODC). Some scientists have suggested that these biological responses are signs of possible adverse health effects of EMF. It is standard scientific procedure to attempt to replicate results in other laboratories, because artifacts and investigator error can occur in scientific investigations. Replications, often using more experiments or more rigorous protocols, help to ensure objectivity and validity. Attempts at replication can substantiate and strengthen an observation, or they may discover the underlying reason for the observed response.

Studies in the RAPID program reported no consistent biological effects of EMF exposure on gene expression, intracellular calcium concentration, growth of cell colonies on agar, or ODC activity (Boorman et al., 2000b). For example, Balcer-Kubiczek et al. (2000) and Loberg et al. (2000) studied the expression of hundreds of cancer-related genes in human mammary or leukemia cell lines. They found no increase in gene expression with increased intensity of magnetic fields. To test the experimental procedure, they used X-rays and treatments known to affect the genes. These are known as positive controls and, as expected, caused gene expression in exposed cells.

Scientists have concluded that the combined animal bioassay results provide no evidence that magnetic fields cause, enhance, or promote the development of leukemia and lymphoma, or mammary cancer (e.g., Boorman et al., 1999; McCormick et al., 1999; Boorman et al., 2000 a, b; Anderson et al., 2001).

2.2.4 Summary Regarding Cancer

Epidemiology studies do not support the idea that EMF from power lines increase the risk of cancers in adults. The latest epidemiologic studies of childhood cancer, considered in the context of the other data, provide no persuasive evidence that leukemia in children is causally associated with magnetic fields measured at the home, calculated magnetic fields based on distance and current loading, or wire codes. Recent meta-analyses reported no association between childhood cancer and magnetic fields below 2 or 3 mG. Although some association was reported for fields above this level, fields at most residences are likely to be below 3 or 4 mG. The authors of each of these analyses list several biases and problems that render the data inconclusive and prevent resolution of the inconsistencies in the epidemiologic data. For this reason, laboratory studies can provide important complementary information. Large, well-conducted animal studies and studies of initiation and promotion, provide no basis to conclude that EMF increases leukemia, lymphoma, breast, brain, or any other type of cancer.

2.3 Research Related to Reproduction

Previous epidemiologic studies reported no association with birth weight or fetal growth retardation after exposure to sources of relatively strong magnetic fields, such as electric blankets, or sources of typically weaker magnetic fields such as power lines (Bracken et al., 1995; Belanger et al., 1998).

A recent epidemiology study examined miscarriages[2] in relation to exposures to magnetic fields from electric bed-heating (electric blankets, heated waterbeds and mattress pads), which result in higher exposures than residential fields in general (Lee et al., 2000). The researchers assessed exposure prior to the birth (a prospective study) and included information to control for potential confounding factors (other exposures and conditions that affect the risk of miscarriage). This study had a large number of cases and high participation rates. Miscarriage rates were lower among users of electric bed-heating.

Studies of laboratory animals exposed to pure 60-Hz fields have shown no increase in birth defects, no multigenerational effects, and no changes that would indicate an increase in miscarriage or loss of fertility (e.g., Ryan et al., 1999; Ryan et al., 2000). Exposed and unexposed litters were no different in the amount of fetal loss and the number and type of birth defects, indicating no reproductive effect of EMF.

In summary, the recent evidence from epidemiology and laboratory studies provides no indication that exposure to power-frequency EMF has an adverse effect on reproduction, pregnancy, or growth and development of the embryo. The results of these recent studies are consistent with the conclusions of the NIEHS.

2.4 Power-line Electric Fields and Airborne Particles and Ions

Researchers from a university in England have suggested that the alternating-current (ac) electric fields from power lines might affect health indirectly, by interacting with the electrical charges on certain airborne particles in the air. They hypothesize that more particles would be deposited on the skin by a strong electric field, or in the lung by charges on particles (Henshaw et al., 1996; Fews et al., 1999a, b).

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[2] The medical term for miscarriage is spontaneous abortion.

If this hypothesis were correct, and interaction did occur (i.e., the airborne particles were charged to increase deposition on skin and in lungs to a sufficient degree), then the researchers further hypothesize that human exposure to various airborne particles and disease might increase. These hypotheses remain highly speculative; scientists have found their assumptions unconvincing, and recognize data gaps in the steps of the hypotheses. Nevertheless, questions about effects of these charged particles have been raised in the media.

In their laboratory, Henshaw and colleagues have developed models to test the physical assumptions that are the first step of their hypotheses: that electric fields can change the behavior of particulates in the air. For example, they measured the deposition of radon daughter[3] particles on metal plates, in the presence of electric fields at intensities found under or near power lines. They also reported increased deposition at similar electric field strengths outdoors near high voltage transmission lines. Under these conditions, deposition of products on surfaces was slightly increased, an occurrence that implies that the deposition might also occur on other surfaces, such as the skin. However, Henshaw and colleagues have not tested the most speculative parts of their hypothesis: that such changes in the deposition rate of particles would lead to an important increase in human exposure, and also that the increased skin exposure would be sufficient to affect human health, in this case to cause an increase in skin cancer. Given (a) the small change anticipated, (b) the ability of wind to disperse particles, and (c) the limited amount of time that people spend outdoors directly under high-voltage power lines, the assumption of health effects is unsupported (Swanson and Jeffers, 2000).

Henshaw et al. also hypothesize that ac electric fields at the surface of power line conductors lead to increased charges on particles, and thereby increase the likelihood that inhaled particles, including radon daughters, would be deposited on surfaces inside the lung or airways, even at considerable distances from the line. Air contains particles of various sizes, including aerosols[4] from emissions from cars and trucks and manufacturing, as well as natural sources such as radon from soil, rock, and building materials. If, as hypothesized, charges on the aerosol particles were increased, and if this change were to increase deposition in the lungs when inhaled over long periods of time, in theory these events could lead to increases in respiratory disease, and possibly other diseases.

The physical basis for aspects of these hypotheses is reasonable. However, the other steps of the hypothesis are highly speculative, and the idea that power lines could substantially affect human exposure to airborne particles or lead to adverse health effects is unwarranted (Swanson and Jeffers, 2000).

The National Radiological Protection Board (NRPB) of Great Britain considered the hypotheses and data published by Fews et al. regarding aerosol deposition increased by electric fields (1999a) and exposure to corona ions from power lines (1999b). The NRPB report (2001) concluded:

> The physical principles for enhanced aerosol deposition in large electric fields are well understood. However, it has not been demonstrated that any such enhanced deposition will increase human exposure in a way that will result in adverse health effects to the general public (NRPB, 2001: 23).

2.5 Recent Reviews by Scientific Advisory Groups

Reviews of the scientific research regarding EMF and health by the Health Council of the Netherlands (HCN) were published in 2000 and updated in May 2001. The Institute of Electrical Engineers of Great

[3] Radon daughters refers to the radioactive decay products of radon (^{222}Rn).
[4] An aerosol is a relatively stable suspension of solid particles or liquid droplets in a gaseous medium.

Britain (IEE) published a review in 2000. The NRPB Advisory Group on Non-Ionising Radiation (AGNIR) published the most recent review in 2001. That review includes research published in 2000, and includes the most comprehensive discussion of the individual research studies. The International Agency for Research on Cancer (IARC) evaluated health effects of EMF and released a statement regarding their findings in June 2001.

2.5.1 National Radiological Protection Board of Great Britain (NRPB) Advisory Group on Non-Ionising Radiation

The conclusions from the report prepared by the NRPB's Advisory Group on Non-Ionising Radiation (AGNIR) on ELF-EMF and the risk of cancer are consistent with previous reviews. Members from universities, medical schools, and cancer research institutes reviewed the reports of experimental and epidemiological studies, including reports in the literature in 2000. Their general conclusions are as follows:

> Laboratory experiments have provided no good evidence that extremely low frequency electromagnetic fields are capable of producing cancer, nor do human epidemiological studies suggest that they cause cancer in general. There is, however, some epidemiological evidence that prolonged exposure to higher levels of power frequency magnetic fields is associated with a small risk of leukaemia in children. In practice, such levels of exposure are seldom encountered by the general public in the UK [or in the U.S.] (NRPB, 2001: 164).

The group further recognizes that the scientific evidence suggesting that exposure to power-frequency electromagnetic fields poses an increased risk of cancer is very weak. Virtually all of the cellular, animal and human laboratory evidence provides no support for an increased risk of cancer incidence following such exposure to power frequencies, although sporadic positive findings have been reported. In addition, the epidemiological evidence is, at best, weak.

These conclusions of the Advisory Group are consistent with previous reviews by the NIEHS (1999) and the Health Council of the Netherlands (HCN, 2000). The NRPB response to the Advisory Group report states that "the review of experimental studies by [the Advisory Group] AGNIR gives no clear support for a causal relationship between exposure to ELF-EMFs and cancer" (NRPB, 2001: 1).

2.5.2 Health Council of the Netherlands (HCN)

The Health Council of the Netherlands has prepared updates of its 1992 Advisory Report on exposure to electromagnetic fields (0 Hz to 10 MHz) (HCN, 2000; 2001). Members of the Expert Committee who prepared the report include specialists in physics, biology, and epidemiology. The Expert Committee based its analysis on the review and summaries of the studies provided in the NIEHS (1998) and concurred with the views of the director of the NIEHS (1999). For the update, the Committee evaluated a number of publications that appeared after these reports, e.g., McBride et al., (1999) and Green et al. (1999a), and wrote:

> The committee thinks that the quality of the relevant epidemiological research has improved considerably since the publication of the advisory report in 1992. Even so, this research has not resulted in unequivocal, scientifically reliable conclusions (HCN, 2000: 15).

The Council emphasizes that the associations with EMF reported in epidemiologic studies are strictly statistical and do not demonstrate a cause-and-effect relationship. In their view, experimental research does not demonstrate a causal link or a mechanism to explain EMF as a cause of disease in humans. They concluded that there is no reason to recommend measures to limit residence near overhead power lines (HCN, 2000).

The 2001 update (HCN, 2001) includes three major studies (described above) published in 2000 and 2001 (Ahlbom et al., 2000; Greenland et al., 2000; Wartenberg 2001b). The Council concludes:

> Because the association is only weak and without a reasonable biological explanation, it is not unlikely that [an association between ELF exposure and childhood leukemia] could also be explained by chance . . . . The committee therefore sees no reason to modify its earlier conclusion that the association is not likely to be indicative of a causal relationship (HCN, 2001: 40).

2.5.3 Institution of Electrical Engineers (IEE) of Great Britain

One of the recent reviews was that of the Institution of Electrical Engineers (IEE) of Great Britain (IEE, 2000). In 1992, the IEE set up a Working Party whose eight members, with broad expertise in the health sciences, review the relevant scientific literature and prepare reports of their views. Their conclusion is based on recent major epidemiologic studies and the scientific literature built up over the past 20 years. In May 2000, the Working Party concluded " . . . that there is still not convincing scientific evidence showing harmful effects of low level electromagnetic fields on humans" (IEE, 2000:1).

2.5.4 International Agency for Research on Cancer (IARC)

The International Agency for Research on Cancer sponsored a review of EMF research by a Working Group of scientific experts from 10 countries. This multidisciplinary group reviewed health effects of ELF-EMF. Although their monograph is still in preparation, IARC has released a summary of the Group's conclusions. The Working Group concluded that the epidemiologic studies do not provide support for an association between childhood leukemia and residential magnetic fields at intensities less than 4 mG. IARC reviewers also evaluated the animal data and concluded that it was "inadequate" to support a risk for cancer. Their summary states that the EMF data does not merit the category "carcinogenic to humans" or the category "probably carcinogenic to humans," nor did they find that "the agent is probably not carcinogenic to humans" (IARC, 2001).

2.6 Summary

The results of the latest epidemiologic studies of childhood cancer do not provide convincing evidence to support the hypothesis that exposure to magnetic fields or power lines near the home are a cause of leukemia in children. The larger, more reliable, residential studies do not support the idea that fields in the residence contribute to the risk of cancer in adults. Although epidemiology studies provide evidence most relevant to humans, the results may include uncertainties because they are observational rather than experimental. For this reason, laboratory studies can provide important complementary information. The larger and more thorough animal studies that exposed animals for EMF for their entire lifespan show no increases in cancer or other adverse health effects, including reproduction outcomes, in exposed animals.

3.0 Ecological Research

Scientists have studied the effects of high-voltage transmission lines on many plant and animal species in the natural environment. In this section, the research on the effects of EMF on ecological systems to assess the likelihood of adverse impacts was briefly reviewed. In addition to the comprehensive review of research on this topic by wildlife biologists at BPA (Lee et al., 1996), a search of the published scientific literature for more recent studies published between 1995 and June 2001 was conducted.

3.1 Fauna

The habitat on the transmission-line right-of-way and surrounding area shields most wildlife from electric fields. Vegetation in the form of grasses, shrubs, and small trees largely shields small ground-dwelling species such as mice, rabbits, foxes, and snakes from electric fields. Species that live underground, such as moles, woodchucks, and worms, are further shielded from electric fields by the soil. Hence, large species such as deer and domestic livestock (e.g., sheep and cattle) have greater potential exposures to electric fields since they can stand taller than surrounding vegetation. However, the duration of exposure for deer and other large animals is likely to be limited to foraging bouts or the time it takes them to cross under the line. Furthermore, all species would be exposed to higher magnetic fields under a transmission line than elsewhere, as the vegetation and soil do not provide shielding from this aspect of the transmission-line electrical environment.

Field studies have been performed in which the behavior of large mammals in the vicinity of high-voltage transmission lines was monitored. No effects of electric or magnetic fields were evident in two studies from the northern United States on big game species, such as deer and elk, exposed to a 500-kilovolt (kV) transmission line (Goodwin 1975; Picton et al., 1985). In such studies, a possible confounding factor is audible noise. Audible noise associated with high-voltage power transmission lines (with voltages greater than 110-kV) is due to corona. Audible noise generated by transmission lines reaches its highest levels in inclement weather (rain or snow).

Much larger populations of animals that might spend time near a transmission line are livestock that graze under or near transmission lines. To provide a more sensitive and reliable test for adverse effects than informal observation, scientists have studied animals continuously exposed to fields from the lines in relatively controlled conditions. For example, grazing animals such as cows and sheep have been exposed to high-voltage transmission lines and their reproductive performance examined (Lee et al., 1996). No adverse effects were found among cattle exposed over one or more successive breedings to a 500-kV direct-current overhead transmission line (Angell et al., 1990). Compared to unexposed animals in a similar environment, the exposure to 50-Hz fields did not affect reproductive functions or pregnancy of cows (Algers and Hennichs, 1985; Algers and Hultgren, 1987).

A group of investigators from Oregon State University, Portland State University, and other academic centers evaluated the effects of long-term exposure to EMF from a 500-kV transmission line operated by BPA on various cellular aspects of immune response, including the production of proteins by leukocytes (IL-1 and IL-2) of sheep. In previous unpublished reports, the researchers found differences in IL-1 activity between exposed and control groups. However, in their most recent replication, the authors found no evidence of differences in these measures of immune function. The sheep were exposed to 27 months of continuous exposure to EMF, a period of exposure much greater than the short, intermittent exposures that sheep would incur grazing under transmission lines. Mean exposures of EMF were 3.5-3.8 µT (35-38 mG) and 5.2-5.8 kV/m, respectively (Hefeneider et al., 2001).

Scientists from the Illinois Institute of Technology (IIT) monitored the possible effects of electric and magnetic fields on fauna and flora in Michigan and Wisconsin from 1969 – 1997 to evaluate the effects of an above-ground, military-communications antenna operating at 76 Hz. The antenna produces EMF similar in physical characteristics to those produced by high-voltage transmission lines, but of much lower intensity. This study, which included embryonic development, fertility, postnatal growth, maturation, aerobic metabolism, and homing behavior, showed no adverse impacts of ELF electric and magnetic fields on the animals (NRC, 1997).

The hormone melatonin, secreted at night by the pineal gland, plays a role in animals that are seasonal breeders. Studies in laboratory mice and rats have suggested that exposure to electric and/or magnetic fields might affect levels of the hormone melatonin, but results have not been consistent (Wilson et al., 1981; Holmberg, 1995; Kroeker et al., 1996; Vollrath et al., 1997; Huuskonen et al., 2001). However, when researchers examined sheep and cattle exposed to EMF from transmission lines exceeding 500-kV, they found no effect on the levels of the hormone melatonin in blood, weight gain, onset of puberty, or behavior in sheep and cattle (Stormshak et al., 1992; Lee et al., 1993; Lee et al., 1995; Thompson et al., 1995; Burchard et al., 1998).

Another part of the IIT study examined the effect of the antenna system fields on the growth, development, and homing behavior of birds. Studies of embryonic development (Beaver et al., 1993), fertility, postnatal growth, maturation, aerobic metabolism, and homing behavior showed no adverse impacts of ELF electric and magnetic fields on the animals (NRC, 1997). Fernie and colleagues studied the effects of continuous EMF exposure of raptors to an electric field of 10 kV/m in a controlled, laboratory setting. The exposure was designed to mimic exposure to a 765-kV transmission line. Continuous EMF exposure was found to reduce hatching success and increase egg size, fledging success, and embryonic development (Fernie et al., 2000). In a study of the effects on body mass and food intake of reproducing falcons, the authors found that EMF lengthened the photoperiod as a result of altered melatonin levels in the male species, yet concluded that "EMF effects on adult birds may only occur after continuous, extended exposure," which is not likely to occur from resting on power lines (Fernie and Bird, 1999:620).

Several avian species are reported to use the earth's magnetic field as one of the cues for navigation. It has been proposed that deposits of magnetite in specialized cells in the head are the mechanism by which the birds can detect variations in the inclination and intensity of a direct-current (dc) magnetic field (Kirschvink and Gould, 1981; Walcott et al., 1988). In early studies of transmission lines, it was reported that the migratory patterns of birds appeared to be altered near transmission lines (Southern, 1975; Larkin and Sutherland, 1977). However, these studies were of crude design, and Lee et al. (1996) concluded that, "During migration, birds must routinely fly over probably hundreds (or thousands) of electrical transmission and distribution lines. We are not aware of any evidence to suggest that such lines are disrupting migratory flights" (Lee et al., 1996:4-59). No further studies on this topic were identified in the literature.

Bees, like birds, are able to detect the earth's dc magnetic fields. They are known to use magnetite particles, which are contained in an abdominal organ, as a compass (Kirschvink and Gould, 1981). In the laboratory, they are able to discriminate between a localized magnetic anomaly and a uniform background dc magnetic field (Walker et al., 1982; Kirschvink et al., 1992).

Greenberg et al. (1981) studied honeybee colonies placed near 765-kV transmission lines. They found that hives exposed to electric fields of 7 kV/m had decreased hive weight, abnormal amounts of propolis (a resinous material) at hive entrances, increased mortality and irritability, loss of the queen in some hives, and a decrease in the hive's overall survival compared to hives that were not exposed. Exposure to electric fields of 7-12 kV/m may induce a current or heat the interior of the hive; however, placing the hive farther from the line, shielding the hive, or using hives without metallic parts eliminates this problem. ITT studied the effects of EMF on bees exposed to the 76-Hz antenna system at lower intensities and concluded that these behavioral effects of "ELF-EMF impacts are absent or at most minimal" (NRC, 1997:102).

Reptiles and amphibians contribute to the overall functioning of the forest ecosystems. However, little research has been performed on the effects of EMF on reptiles and amphibians in their natural habitat.

3.2 Flora

Numerous studies have been carried out to assess the effect of exposure of plants to transmission-line electric and magnetic fields. These studies have involved both forest species and agriculture crops. Researchers have found no adverse effects on plant responses, including seed germination, seedling emergence, seedling growth, leaf area per plant, flowering, seed production, germination of the seeds, longevity, and biomass production (Lee et al., 1996).

The only confirmed adverse effect of transmission lines on plants was reported for transmission lines with voltages above 1200 kV. For example, Douglas Fir trees planted within 15 m of the conductors were shorter than trees planted away from the line. Shorter trees are believed to result from corona-induced damage to the branch tips. Trees between 15 and 30 m away from the line suffered needle burns, but those 30 m and beyond were not affected (Rogers et al., 1984). These effects would not occur at the lower field intensities expected beyond the right-of-way of the proposed 500-kV transmission line.

3.3 Summary

The habitat on the transmission-line rights-of-way and surrounding areas shields smaller animals from electric fields produced by high-voltage transmission lines; thus, vegetation easily shields small animals from electric fields. The greatest potential for larger animals to be exposed to EMF occurs when they are passing beneath the lines. Studies of animal reproductive performance, behavior, melatonin production, immune function, and navigation have found minimal or no effects of EMF. Past studies have found little effect of EMF on plants; no recent studies of plants growing near transmission lines have been performed. In summary, the literature published to date has shown little evidence of adverse effects of EMF from high-voltage transmission lines on wildlife and plants. At the field intensities associated with the proposed 500-kV transmission line, no adverse effects on wildlife or plants are expected.

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MCNARY – JOHN DAY 500-kV TRANSMISSION-LINE PROJECT

ELECTRICAL EFFECTS

January 2002

Prepared by

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for

Bonneville Power Administration

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ELECTRICAL EFFECTS FROM THE PROPOSED MCNARY — JOHN DAY TRANSMISSION-LINE PROJECT

1.0 Introduction

The Bonneville Power Administration (BPA) is proposing to build a 87-mile (mi.) (140- kilometer [km]) 500-kilovolt (kV) transmission line from the existing BPA McNary Substation near the McNary Dam on the Columbia River, to the existing BPA John Day Substation near the John Day Dam on the Columbia River. The proposed line is designated the McNary – John Day 500-kV line. The proposed line would be built on new and existing right-of-way. Although both substations are located on the south (Oregon) side of the river, most of the proposed line route is on the north (Washington) side of the river. For most of its length the proposed line would parallel existing 230- and 345-kV lines. For some portions of the route, the proposed line would also parallel existing 500-kV lines and in one section there would be no parallel lines within about 600 feet of the line. The parallel line configurations and their lengths are given in Table 1. The purpose of this report is to describe and quantify the electrical effects of the proposed McNary – John Day 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 McNary – John Day line. Therefore, the levels of these quantities for the proposed line are computed and compared with those from the existing lines in Oregon, Washington, and elsewhere.

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 ft. (1 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 also usually measured or calculated at a height of 3.28 ft. (1 m) above the ground. The electric field at the surface of the conductors causes the phenomenon of *corona*. Corona is the electrical breakdown or ionization of air in very strong electric fields, and is the source of audible noise, electromagnetic radiation, and visible light.

To quantify EMF levels along the route, the electric and magnetic fields from the proposed and existing lines were calculated using the BPA Corona and Field Effects Program (USDOE, undated). In this program, the calculation of 60-Hz fields uses standard superposition techniques for vector fields from several line sources: in this case, the line sources are transmission-line conductors. (Vector fields have both magnitude and direction: these must be taken into account when combining fields from different sources.) Important input parameters to the computer program are voltage, current, and geometric configuration of the line. The transmission-line conductors are assumed to be straight, parallel to each other, and located above and parallel to an infinite flat ground plane. Although such conditions do not occur under real lines because of conductor sag and variable terrain, the validity and limitations of calculations using these assumptions have been well verified by comparisons with measurements. This approach was used to estimate fields for the proposed McNary – John Day 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; the contribution of induced image currents in the conductive earth is not included.

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 (98 percent of maximum voltage) and with the average line height over a span: 540 kV and about 45 ft. (13.7 m) clearance for the proposed 500-kV line. 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 route of the proposed McNary – John Day transmission line, such conditions are expected to occur about 1% of the time during a year, based on hourly precipitation records recorded at Arlington, Oregon during 1997 – 2000. Corona activity also increases with altitude. For purposes of evaluating corona effects from the proposed line, an altitude of 600 ft. (183 m) was assumed.

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. The maximum phase-to-phase voltage would be 550 kV; the average voltage would be 540 kV. The maximum electrical current on the line would be 1758 A per phase, based on the BPA projected normal system annual peak load with 2004 as the base year. The load factor for this load would be about 0.50 (average load = peak load x load factor). 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 1, and summarized in Table 2. Each phase of the proposed 500-kV line would have three 1.3-inch (in.) (3.30-centimeter [cm]) diameter conductors (ACSR: steel-reinforced aluminum conductor) arranged in an inverted triangle bundle configuration, with 17-in. (43.3-cm) spacing between conductors. Voltage and current waves are displaced by 120° in time (one-third of a cycle) on each electrical phase. The horizontal phase spacing between the lower conductor positions would be 48 ft. (14.6 m). The vertical spacing between the conductor positions would be 34.5 ft. (10.5 m). (The spacing between conductor locations would vary slightly where special towers are used, such as at angle points along the line.)

Minimum conductor-to-ground clearance would be 35 ft. (10.7 m) at a conductor temperature of 122°F (50°C), which represents maximum operating conditions and high ambient air temperatures; clearances above ground would be greater under normal operating temperatures. The average clearance above ground along a span would be approximately 45 ft. (13.7 m); this value was used for corona calculations. At road crossings, the ground clearance would be at least 54 ft. (16.5 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 Electrical 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 would vary depending on location and the presence of parallel lines. The distance from the centerline of the proposed line to the edge of the right-way would vary from 72.5 ft. (22 m) to 187.5 ft. (57 m).

2.2 Existing Lines

Six possible corridor configurations were identified for analyzing electrical effects along the route from McNary Substation to John Day Substation (Table 1). These configurations are:

1) the proposed line parallel to and north of the existing McNary – Horse Heaven – Harvalum 230-kV and McNary – Ross No. 1 345-kV lines;

2) the proposed line parallel to and north of the existing 230-kV and 345-kV lines and the existing Ashe – Marion No. 1/Ashe – Slatt No. 1 double circuit 500-kV line;

3) the proposed line with no parallel lines within 600 feet;

4) the proposed line parallel to and 125 feet south of the existing 230-kV and 345-kV lines and the existing Hanford – John Day 500-kV line;

4A) the proposed line located on the existing Hanford – John Day 500-kV towers and parallel to and north of the existing McNary – Horse Heaven – Harvalum 230-kV and McNary – Ross No. 1 345-kV lines (The existing Hanford – John Day 500-kV line would be relocated on new towers north of the proposed line.); and

4B) the proposed line parallel to and 275 feet south of the existing 230-kV and 345-kV lines and the existing Hanford – John Day 500-kV line.

Configurations 4, 4A, and 4B are possible alternatives in the short section of the route where the proposed line parallels the existing Hanford – John Day 500-kV line; their presence and respective lengths would depend on the final engineering design for the line.

The physical and electrical characteristics of the corridor configurations that were analyzed are given in Table 2; cross-sections of the corridors are shown in Figure 1. Short sections of the proposed line entering the substations were not analyzed.

Changes in the electrical phasing of the existing lines in Configuration 1 occur and would affect field levels slightly. The four phasing schemes produce similar electric and magnetic fields and only the maximum results for field calculations are included here. In portions of Configuration 1, it may be necessary to increase the ground clearance to 37 feet (11.3 m) to ensure that the BPA criterion of 9 kV/m for peak electric field is met. BPA would select the means of achieving the 9-kV/m field criterion during the engineering design of the line. Corona effects from all phasing schemes of Configuration 1 were essentially the same. The maximum levels for fields and corona effects computed for the different phasing schemes are reported here.

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 both 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 2004, and the minimum conductor clearances.

There are standard techniques for measuring transmission-line electric fields (IEEE, 1987). Provided that the conditions at a measurement site closely approximate those of the ideal situation assumed for calculations, measurements of electric fields agree well with the calculated values. If the ideal conditions are not approximated, the measured field can differ substantially from calculated values. Usually the actual electric field at ground level is reduced from the calculated values by various common objects that act as shields.

Maximum or peak field values occur over a small area at midspan, where conductors are closest to the ground. As the location of an electric-field profile approaches a tower, the conductor clearance increases, and the peak field decreases. A grounded tower will reduce the electric field considerably by shielding. For the parallel-line configurations considered here, minimum conductor clearances were assumed to occur along the same lateral profile for both lines. This condition will not necessarily occur in practice, because the towers for the parallel lines may be offset or located at different elevations. **The assumption of simultaneous minimum clearance results in peak (worst-case) fields that may be larger than what occurs in practice.**

For traditional transmission lines, such as the proposed line, where the right-of-way extends laterally well beyond the conductors, electric fields at the edge of the right-of-way are not as sensitive as the peak field to conductor height. Computed values at the edge of the right-of-way for any line height are fairly representative of what can be expected all along the transmission-line corridor. However, the presence of vegetation on and at the edge of the right-of-way will reduce actual electric-field levels below calculated values. The triangular arrangement of the conductor bundles for the proposed line reduces the electric and magnetic field levels below what they would be for a flat conductor arrangement.

3.3 Calculated Values of Electric Fields

Table 3 shows the calculated values of electric field at 3.28 ft. (1 m) above ground for the proposed McNary – John Day 500-kV transmission-line configurations. The peak value on the right-of-way and the value at the edge of the right-of-way are given for the six proposed configurations at minimum conductor clearances and at the estimated average clearance over a span. Figure 2 shows lateral profiles for the electric field for both existing and proposed configurations. Electric fields for the minimum and average line heights for the proposed line with no immediately adjacent parallel lines are shown in Figure 2c.

The calculated peak electric field expected on the right-of-way of the proposed line is 8.97 kV/m or less, depending on the configuration. For average clearance, the peak field would be 6.0 kV/m or less. As shown in Figure 2, 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 right-of-way of the proposed line would be 2.8 kV/m. Maximum electric fields under the existing parallel 500-kV, 345-kV, and 230-kV lines are 8.9, 4.7 and 4.5 kV/m, respectively.

3.4 Environmental Electric Fields

The electric fields associated with the McNary – John Day 500-kV 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 naturally occurring 60-Hz fields of about 0.0001 V/m, which stem from atmospheric and extraterrestrial sources.

Electric fields in outdoor, publicly accessible places range from less than 1 V/m to 12 kV/m; the large fields exist close to high-voltage transmission lines of 500 kV or higher. In remote areas without electrical service, 60-Hz field levels can be much lower than 1 V/m. Electric fields in home and work environments generally are not spatially uniform like those of transmission lines; therefore, care must be taken when making comparisons between fields from different sources such as appliances and electric lines. In addition, fields from all sources can be strongly modified by the presence of conducting objects. However, it is helpful to know the levels of electric fields generated in domestic and office environments in order to compare commonly experienced field levels with those near transmission lines.

Numerous measurements of residential electric fields have been reported for various parts of the United States, Canada, and Europe. Although there have been no large studies of residential electric fields, sufficient data are available to indicate field levels and characteristics. Measurements of domestic 60-Hz electric fields indicate that levels are highly variable and source-dependent. Electric-field levels are not easily predicted because walls and other objects act as shields, because conducting objects perturb the field, and because homes contain numerous localized sources. Internal sources (wiring, fixtures, and appliances) seem to predominate in producing electric fields inside houses. Average measured electric fields in residences are generally in the range of 5 to 20 V/m. In a large occupational exposure monitoring project that included electric-field measurements at homes, average exposures for all groups away from work were generally less than 10 V/m (Bracken, 1990).

Electric fields from household appliances are localized and decrease rapidly with distance from the source. Local electric fields measured at 1 ft. (0.3 m) from small household appliances are typically in the range of 30 to 60 V/m. Stopps and Janischewskyj (1979) reported electric-field measurements near 20 different appliances; at a 1-ft. (0.3-m) distance, fields ranged from 1 to 150 V/m, with a mean of 33 V/m. In another survey, reported by Deno and Zaffanella (1982), field measurements at a 1-ft. (0.3-m) distance from common domestic and workshop sources were found to range from 3 to 70 V/m. The localized fields from appliances are not uniform, and care should be taken in comparing them with transmission-line fields.

Electric blankets can generate higher localized electric fields. Sheppard and Eisenbud (1977) reported fields of 250 V/m at a distance of approximately 1 ft. (0.3 m). Florig et al. (1987) carried out extensive empirical and theoretical analysis of electric-field exposure from electric blankets and presented results in terms of uniform equivalent fields such as those near transmission lines. Depending on what parameter was chosen to represent intensity of exposure and the grounding status of the subject, the equivalent vertical 60-Hz electric-field exposure ranged from 20 to over 3500 V/m. The largest equivalent field corresponds to the measured field on the chest with the blanket-user grounded. The average field on the chest of an ungrounded blanket-user yields an equivalent vertical field of 960 V/m. As manufacturers have become aware of the controversy surrounding EMF exposures, electric blankets have been redesigned to reduce *magnetic* fields. However, electric fields from these “low field” blankets are still comparable with those from older designs (Bassen et al., 1991).

Generally, people in occupations not directly related to high-voltage equipment are exposed to electric fields comparable with those of residential exposures. For example, the average electric field measured in 14 commercial and retail locations in rural Wisconsin and Michigan was 4.8 V/m (ITT Research Institute, 1984). Median electric field was about 3.4 V/m. These values are about one-third the values in residences reported in the same study. Power-frequency electric fields near video display terminals

(VTDs) are about 10 V/m, similar to those of other appliances (Harvey, 1983). Electric-field levels in public buildings such as shops, offices, and malls appear to be comparable with levels in residences.

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 the proposed McNary – John Day 500-kV transmission line are consistent with the levels reported for other 500-kV transmission lines in Oregon, 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 (IEEE, 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 4 gives the calculated values of the magnetic field at 3.28 ft. (1 m) height for the proposed 500-kV transmission line configurations. Field values on the right-of-way and at the edge of the right-of-way are given for projected maximum currents during system annual peak load in 2004, for minimum and average conductor clearances. The maximum currents are 1758 A on each of the three phases of the proposed 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 50% of the maximum values. The levels shown in the figures represent the highest magnetic fields expected for the proposed McNary – John Day 500-kV line. Average fields over a year would be considerably reduced from the peak values, as a result of increased clearances above the minimum value and reduced currents from the maximum value.

Figure 3 shows lateral profiles of the magnetic field under maximum current and minimum clearance conditions for configurations of the proposed 500-kV transmission line. A field profile for average height under Configuration 3 is also included in Figure 3c. Maximum field levels for the existing configurations are also shown in Figure 3.

For the proposed 500-kV line, the maximum calculated 60-Hz magnetic field expected at 3.28 ft. (1 m) above ground is 311 mG. This field is calculated for the maximum current of 1758 A, with the conductors at a height of 35 ft. (10.7 m). The maximum field would decrease for increased conductor clearance. For an average conductor height over a span of 45 ft. (13.7 m), the maximum field would be 216 mG. Maximum fields under the proposed line in the configuration with no immediately adjacent parallel lines would be slightly less than these values.

The magnetic field at the edge of the right-of-way depends on the width of the right-of-way which varies considerably for the proposed line. For maximum current conditions the calculated magnetic field at the edge of the right-of-way varies from 89 mG to 16 mG as the center line to edge of right-of-way distance varies from 72.5 ft. to 175 ft. The field at the edge of the right-of-way adjacent to a parallel line would depend on that line.

The magnetic field falls off rapidly as distance from the line increases. At a distance of 225 ft. (69 m) from the centerline of the proposed line with no parallel lines, the field would be less than 10 mG for maximum current conditions.

For the existing lines, the peak magnetic fields on the rights-of-way are 327 mG and 298 mG, for the 500-kV and 230-kV lines, respectively. The peak value of 327 mG occurs under the existing Hanford – John Day 500-kV line. Fields at the edges of the existing rights-of-way range from 84 mG for the McNary – Horse Heaven 230-kV line to 9 mG for the Hanford – John Day 500-kV line which is 220 ft. from the edge of the right-of-way.

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 McNary – John Day 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% of the houses and 2.9 mG in 5% 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% 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 an electric 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.

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 3.28 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 video display terminals (VDTs). In publicly accessible indoor areas, such as offices and stores, field levels are generally comparable with residential levels, unless a high-current source is nearby.

Because high-current sources of magnetic field are more prevalent than high-voltage sources, occupational environments with relatively high magnetic fields encompass a more diverse set of occupations than do those with high electric fields. For example, in occupational magnetic-field measurements reported by Bowman et al. (1988), the geometric mean field from 105 measurements of magnetic field in "electrical worker" job locations was 5.0 mG. "Electrical worker" environments showed the following elevated magnetic-field levels (geometric mean greater than 20 mG): industrial power supplies, alternating current (ac) welding machines, and sputtering systems for electronic assembly. For secretaries in the same study, the geometric mean field was 3.1 mG for those using VDTs (n = 6) and 1.1 mG for those not using VDTs (n = 3).

Measurements of personal exposure to magnetic fields were made for 1,882 volunteer utility workers for a total of 4,411 workdays (Bracken, 1990). Median workday mean exposures ranged from 0.5 mG for clerical workers without computers to 7.2 mG for substation operators. Occupations not specifically associated with transmission and distribution facilities had median workday exposures less than 1.5 mG, while those associated with such facilities had median exposures above 2.3 mG. Magnetic-field exposures measured in homes during this study were comparable with those recorded in offices.

Magnetic fields in publicly accessible outdoor areas seem to be, as expected, directly related to proximity to electric-power transmission and distribution facilities. Near such facilities, magnetic fields are generally higher than indoors (residential). Higher-voltage facilities tend to have higher fields. Typical maximum magnetic fields in publicly accessible areas near transmission facilities can range from less than a few milligauss up to 300 mG or more, near heavily loaded lines operated at 230 to 765 kV. The levels depend on the line load, conductor height, and location on the right-of-way. Because magnetic fields near high-voltage transmission lines depend on the current in the line, they can vary daily and seasonally. To characterize fields from the distribution system, Heroux (1987) measured 60-Hz magnetic fields with a mobile platform along 140 mi. (223 km) of roads in Montreal. The median field level averaged over nine different routes was 1.6 mG, with 90% of the measurements less than about 5.1 mG. Spot measurements indicated that typical fields directly above underground distribution systems were 5 to 19 mG. Beneath overhead distribution lines, typical fields were 1.5 to 5 mG on the primary side of the transformer, and 4 to 10 mG on the secondary side. 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 Oregon, 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 for the proposed McNary – John Day 500-kV transmission line.

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 McNary – John Day 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 (IEEE, 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 54 ft. (16.5 m) over major road crossings along the route, resulting in a maximum field of 4.4 kV/m or less at the 3.28 ft. (1 m) height. The largest truck allowed on roads in Oregon and Washington without a special permit is 14 ft. high by 8.5 ft. wide by 75 ft. 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 4.2 kV/m (at 3.28-ft. height) would be less than 4.0 mA (Reilly, 1979). For smaller trucks, the maximum induced currents for perpendicular orientation to the proposed line would be less than this value. (Larger special-permitted trucks, such as triple trailers, can be up to 105 feet in length. However, because they average the field over such a long distance, the maximum induced current to a 105-ft. vehicle oriented perpendicular to the 500-kV line at a road crossing would be less than 3.8 mA.) Thus, the NESC 5-mA criterion would be met for perpendicular road crossings of the proposed line. These large vehicles are not anticipated to be off highways or oriented parallel to the proposed line. As discussed below, these are worst-case estimates of induced currents at road crossings; conditions for their occurrence are rare. The conductor clearance at each road crossing would be checked during the design stage of the line to ensure that the NESC 5-mA criterion is met. Furthermore, it is BPA policy to limit the maximum induced current from vehicles to 2 mA in commercial parking lots. Line clearances would also be increased in accordance with the NESC, such as over railroads and water areas suitable for sailboating.

Several factors tend to reduce the levels of induced current shocks from vehicles:

(1) Activities are distributed over the whole right-of-way, and only a small percentage of time is spent in areas where the field is at or close to the maximum value.

(2) At road crossings, vehicles are aligned perpendicular to the conductors, resulting in a substantial reduction in induced current.

(3) The conductor clearance at road crossings may not be at minimum values because of lower conductor temperatures and/or location of the road crossing away from midspan.

(4) The largest vehicles are permitted only on certain highways.

(5) Off-road vehicles are in contact with soil or vegetation, which reduces shock currents substantially.

Induced voltages occur on objects, such as vehicles, in an electric field where there is an inadequate electrical ground. If the voltage is sufficiently high, then a spark discharge shock can occur as contact is made with the object. Such shocks are similar to "carpet" shocks that occur, for example, when a person touches a doorknob after walking across a carpet on a dry day. The number and severity of spark discharge shocks depend on electric-field strength. Based on the low frequency of complaints reported by Glasgow and Carstensen (1981) for 500-kV alternating current 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 for ignition to occur 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, 1995).

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% 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. In addition, the proposed line would be located in an existing corridor where mitigation measures will have already been implemented for the existing lines.

Magnetic fields from transmission and distribution facilities can interfere with certain electronic equipment. Magnetic fields can cause distortion of the image on VDTs and computer monitors. The threshold field for interference depends on the type and size of monitor and the frequency of the field. Interference has been observed for certain monitors at fields at or below 10 mG (Baishiki et al., 1990; Banfai et al., 2000). Generally, the problem arises when computer monitors are in use near electrical distribution facilities in large office buildings. Fields from the proposed line would fall below this level at approximately 225 ft. (69 m) from the centerline.

Interference from magnetic fields can be eliminated by shielding the affected monitor or moving it to an area with lower fields. Similar mitigation methods could be applied to other sensitive electronics, if necessary. Interference from 60-Hz fields with computers and control circuits in vehicles and other equipment is not anticipated at the field levels found under and near the proposed 500-kV transmission line.

The magnetic fields from the proposed line would 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 <u>might</u> 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 or direct the water stream from an irrigation system into or near the conductors. In addition, as a matter of safety, the NESC specifies that electric-field-induced currents from transmission lines must be below the 5 mA ("let go") threshold deemed a lower limit for primary shock. BPA publishes and distributes a brochure that describes safe practices to protect against shock hazards around power lines (USDOE, 1995).

Field limits or guidelines have been adopted in several states and countries and by national and international organizations. Electric-field limits have generally been based on minimizing nuisance shocks or field perception. The intent of magnetic-field limits has been to limit exposures to existing levels, given the uncertainty of their potential for health effects.

There are currently no national standards in the United States for 60-Hz electric and magnetic fields. Oregon's formal rule in its transmission-line-siting procedures specifically addresses field limits. The Oregon limit of 9 kV/m for electric fields is applied to areas accessible to the public (Oregon, State of, 1980). The Oregon rule also addresses grounding practices, audible noise, and radio interference. Oregon does not have a limit for magnetic fields from transmission lines. The state of Washington does not have guidelines for electric or magnetic fields from transmission lines.

Besides Oregon, several states have been active in establishing mandatory or suggested limits on 60-Hz electric and (in two cases) magnetic fields. Five other states have specific electric-field limits that apply to transmission lines: Florida, Minnesota, Montana, New Jersey, and New York. Florida and New York have established regulations for magnetic fields. These regulations are summarized in Table 5, adapted from TDHS Report (1989).

Government agencies and utilities operating transmission systems have established design criteria that include EMF levels. BPA has maximum allowable electric fields of 9 and 5 kV/m on and at the edge of the right-of-way, respectively (USDOE, 1996). BPA also has maximum-allowable electric field strengths of 5 kV/m, 3.5 kV/m, and 2.5 kV/m for road crossings, shopping center parking lots, and commercial/ industrial parking lots, respectively. These levels are based on limiting the maximum short-circuit currents from anticipated vehicles to less than 1 mA in shopping center lots and to less than 2 mA in commercial parking lots.

Electric-field limits for overhead power lines have also been established in other countries (Maddock, 1992). Limits for magnetic fields from overhead power lines have not been explicitly established anywhere except in Florida and New York (see Table 5). However, general guidelines and limits on EMF have been established for occupational and public exposure in several countries and by national and international organizations.

The American Conference of Governmental Industrial Hygienists (ACGIH) sets guidelines (Threshold Limit Values or TLV) for occupational exposures to environmental agents (ACGIH, 2000). In general, a TLV represents the level below which it is believed that nearly all workers may be exposed repeatedly without adverse health effects. For EMF, the TLVs represent ceiling levels. For 60-Hz electric fields, occupational exposures should not exceed the TLV of 25 kV/m. However, the ACGIH also recognizes the potential for startle reactions from spark discharges and short-circuit currents in fields greater than 5-7 kV/m, and recommends implementing grounding practices. They recommend the use of conductive clothing for work in fields exceeding 15 kV/m. The TLV for occupational exposure to 60-Hz magnetic fields is a ceiling level of 10 G (10,000 mG) (ACGIH, 2000).

Electric and magnetic fields from various sources (including automobile ignitions, appliances and, possibly, transmission lines) can interfere with implanted cardiac pacemakers. In light of this potential problem, manufacturers design devices to be immune from such interference. However, research has shown that these efforts have not been completely successful and that a few models of pacemakers could be affected by 60-Hz fields from transmission lines. There were also numerous models of pacemakers that were not affected by fields even larger than those found under transmission lines. Because of the known potential for interference with pacemakers by 60-Hz fields, field limits for pacemaker wearers have been established by the ACGIH. They recommend that wearers of pacemakers and similar medical-assist devices limit their exposure to electric fields of 1 kV/m or less and to magnetic fields to 1 G (1,000 mG) or less (ACGIH, 2000).

The International Committee on Non-ionizing Radiation Protection (ICNIRP), working in cooperation with the World Health Organization (WHO), has developed guidelines for occupational and public exposures to EMF (ICNIRP, 1998). For occupational exposures at 60 Hz, the recommended limits to exposure are 8.3 kV/m for electric fields and 4.2 G (4,200 mG) for magnetic fields. The electric-field level can be exceeded, provided precautions are taken to prevent spark discharge and induced current shocks. For the general public, the ICNIRP guidelines recommend exposure limits of 4.2 kV/m for electric fields and 0.83 G (830 mG) for magnetic fields (ICNIRP, 1998).

ICNIRP has also established guidelines for contact currents, which could occur when a grounded person contacts an ungrounded object in an electric field. The guideline levels are 1.0 mA for occupational exposure and 0.5 mA for public exposure.

The electric fields from the proposed 500-kV line would meet the ACGIH standards, provided wearers of pacemakers and similar medical-assist devices are discouraged from unshielded right-of-way use. (A passenger in an automobile under the line would be shielded from the electric field.) The electric fields in limited areas on the right-of-way would exceed the ICNIRP guideline for public exposure. The magnetic fields from the proposed line would be below the ACGIH limits, as well as below those of ICNIRP. The electric fields present on the right-of-way could induce currents in ungrounded vehicles that exceeded the ICNIRP level of 0.5 mA.

The estimated peak electric fields on the right-of-way of the proposed transmission line would meet the Oregon limit as well as those set in Florida and New York, but not those of Minnesota and Montana (see Table 5). The BPA maximum allowable electric field-limit would be met for all configurations of the proposed line. The edge-of-right-of-way electric fields from the proposed line would be below limits set in New Jersey, but above those in Florida, Montana, and New York.

The magnetic field at the edge of the right-of-way from the proposed line would be below the regulatory levels of states where such regulations exist.

7.0 Audible Noise

7.1 Basic Concepts

Audible noise (AN), as defined here, represents an unwanted sound, as from a transmission line, transformer, airport, or vehicle traffic. Sound is a pressure wave caused by a sound source vibrating or displacing air. The ear converts the pressure fluctuations into auditory sensations. AN from a source is superimposed on the background or ambient noise that is present before the source is introduced.

The amplitude of a sound wave is the incremental pressure resulting from sound above atmospheric pressure. The sound-pressure level is the fundamental measure of AN; it is generally measured on a logarithmic scale with respect to a reference pressure. The sound-pressure level (SPL) in decibels (dB) is given by:

$$SPL = 20 \log (P/P_o) dB$$

where P is the effective rms (root-mean-square) sound pressure, P_O is the reference pressure, and the logarithm (log) is to the base 10. The reference pressure for measurements concerned with hearing is usually taken as 20 micropascals (Pa), which is the approximate threshold of hearing for the human ear. A logarithmic scale is used to encompass the wide range of sound levels present in the environment. The range of human hearing is from 0 dB up to about 140 dB, a ratio of 10 million in pressure (EPA, 1978).

Logarithmic scales, such as the decibel scale, are not directly additive: to combine decibel levels, the dB values must be converted back to their respective equivalent pressure values, the total rms pressure level found, and the dB value of the total recalculated. For example, adding two sounds of equal level on the dB scale results in a 3 dB increase in sound level. Such an increase in sound pressure level of 3 dB, which corresponds to a doubling of the energy in the sound wave, is barely discernible by the human ear. It requires an increase of about 10 dB in SPL to produce a subjective doubling of sound level for humans. The upper range of hearing for humans (140 dB) corresponds to a sharply painful response (EPA, 1978).

Humans respond to sounds in the frequency range of 16 to 20,000 Hz. The human response depends on frequency, with the most sensitive range roughly between 2000 and 4000 Hz. The frequency-dependent sensitivity is reflected in various weighting scales for measuring audible noise. The A-weighted scale weights the various frequency components of a noise in approximately the same way that the human ear responds. This scale is generally used to measure and describe levels of environmental sounds such as those from vehicles or occupational sources. The A-weighted scale is also used to characterize transmission-line noise. Sound levels measured on the A-scale are expressed in units of dB(A) or dBA.

AN levels and, in particular, corona-generated audible noise (see below) vary in time. In order to account for fluctuating sound levels, statistical descriptors have been developed for environmental noise. Exceedence levels (L levels) refer to the A-weighted sound level that is exceeded for a specified percentage of the time. Thus, the L_5 level refers to the noise level that is exceeded only 5% of the time. L_{50} refers to the sound level exceeded 50% of the time. Sound-level measurements and predictions for transmission lines are often expressed in terms of exceedence levels, with the L_5 level representing the maximum level and the L_{50} level representing a median level.

Table 6 shows AN levels from various common sources. Clearly, there is wide variation. Noise exposure depends on how much time an individual spends in different locations. Outdoor noise generally does not contribute to indoor levels (EPA, 1974). Activities in a building or residence generally dominate interior AN levels. The amount of sound attenuation (reduction) provided by buildings is given in Table 7. Assuming that residences along the line route fall in the "warm climate, windows open" category, the typical sound attenuation provided by a house is about 12 dBA.

The BPA design criterion for corona-generated audible noise (L_{50}, foul weather) is 50 ±2 dBA at the edge of the ROW (Perry, 1982). This criterion has been interpreted by the state and BPA to meet Oregon Noise Control Regulations (Perry, 1982). The Washington Administrative Code provides noise limitations by class of property, residential, commercial or industrial (Washington, State of, 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 p.m. to 7:00 a.m.), 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 only about 1% of the time during the year.

For a few months after line construction, residual grease or oil on the conductors can cause water to bead up on the surface. This results in more corona sources and slightly higher levels of audible noise and electromagnetic interference if the line is energized. However, the new conductors "age" in a few months, and the level of corona activity decreases to the predicted equilibrium value. During fair weather, insects and dust on the conductor can also serve as sources of corona. The proposed line has been designed with three 1.3-inch (3.30-cm) 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 the proposed line operated at a voltage of 540 kV are given in Table 8 and plotted in Figure 4 for the proposed configurations. For comparison, Table 8 also gives the calculated levels for the existing parallel lines.

The calculated median level (L_{50}) during foul weather 75 feet from the centerline of the proposed McNary – John Day right-of-way with no parallel lines is 47 dBA; the calculated maximum level (L_5) during foul weather at this location is 51 dBA. These levels are comparable with levels at the edges of some existing 500-kV lines in Oregon and Washington and lower than the levels from the existing Hanford – John Day 500-kV line in the corridor. However, for all the proposed configurations the resulting AN levels are higher than these because of contributions from existing lines.

For the configurations with immediately adjacent parallel lines (Configurations 1, 2 and 4), the foul weather L_{50} AN level at the edge of the right-of-way adjacent to the proposed line would be 49 to 54 dBA. In these cases, AN from the existing parallel 345-kV and/or 500-kV lines is comparable to or greater than that from the proposed line; and the proposed line would add 4 dBA or less to existing noise levels at the proposed edge of the right-of-way. Such an increase would be barely discernible. Even for Configuration 3 where the proposed line would be more than 600 feet from the existing 345-kV line, the proposed line would add only about 6 dBA to existing levels. At the edge of the right-of-way adjacent to the existing lines in the corridor, the foul weather L_{50} AN level would change 1 dBA or less with the addition of the proposed line.

During fair-weather conditions, which occur about 99% of the time, audible noise levels at the edge of the right-of-way would be about 20 dBA lower than the foul weather levels (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 with no parallel lines would be comparable to, or less, than those from existing 500-kV lines in Oregon and Washington. During fair weather, noise from the conductors might be perceivable on the right-of-way, but beyond the right-of-way it would likely be masked or so low as not to be perceived, even during foul weather when ambient noise is higher.

Where the proposed line parallels the existing lines, the increase of less than 4 dBA due to the addition of the proposed line would barely be discernible at the edge of the right of-way and beyond. The level at the edge of the right-of-way of the existing lines would be the same, whether the proposed line were present or not.

No transformers are being added to the existing McNary and John Day Substations. Noise from the existing substation equipment and transmission lines would remain the primary source of environmental noise at these locations. 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.

Off the right-of-way, the levels of audible noise from the proposed line during foul weather would be 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 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 47-dBA level for the proposed line would meet the BPA design criterion and, hence, the Oregon regulations and the Washington Administrative Code limits for transmission lines. Noise levels at the edges of the rights-of-way of the existing McNary – Ross 345-kV and Hanford – John Day 500-kV lines (not shown in Table 8) exceed the limits of both Oregon and Washington and presumably are allowed because of the ages of the lines.

The computed annual L_{dn} level for transmission lines operating in areas with about 1% foul weather is about $L_{dn} = L_{50}$ - 6 dB (Bracken, 1987). Therefore, assuming such conditions in the area of the proposed McNary – John Day 500-kV line, the estimated L_{dn} at the edge of the right-of-way would be approximately 48 dBA or less, which is well below the EPA L_{dn} guideline of 55 dBA.

7.5 Conclusion

Along the proposed line route where no parallel lines are within 600 feet, there would be increases in the perceived noise above ambient levels during foul weather at the edges of the right-of-way. Where the proposed line parallels the existing 345-kV or 500-kV lines, the incremental noise contributed by the proposed line would be less than 4 dBA at the edge of the proposed new right-of-way and beyond, and would probably not be discernible from existing noise levels.

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 transmission line would be below EPA guideline levels and would meet the BPA design criterion that complies with the Oregon and 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-in. diameter conductors used in the design of the proposed 500-kV line would mitigate corona generation and thus keep radio and television interference levels at acceptable levels.

Spark gaps on distribution lines and on low-voltage wood-pole transmission lines are a more common source of RI/TVI than is corona from high-voltage electrical systems. This gap-type interference is primarily a fair-weather phenomenon caused by loose hardware and wires. The proposed transmission line would be constructed with modern hardware that eliminates such problems and therefore minimizes gap noise. Consequently, this source of EMI is not anticipated for the proposed line.

No state has limits for either RI or TVI. In the United States, electromagnetic interference from power transmission systems is governed by the Federal Communications Commission (FCC) Rules and Regulations presently in existence (FCC, 1988). A power transmission system falls into the FCC category of "incidental radiation device," which is defined as "a device that radiates radio frequency energy during the course of its operation although the device is not intentionally designed to generate radio frequency energy." Such a device "shall be operated so that the radio frequency energy that is emitted does not cause harmful interference. In the event that harmful interference is caused, the operator of the device shall promptly take steps to eliminate the harmful interference." For purposes of these regulations, harmful interference is defined as: "any emission, radiation or induction which endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radio communication service operating in accordance with this chapter" (FCC, 1988: Vol II, part 15. 47CFR, Ch. 1).

Electric power companies have been able to work quite well under the present FCC rule because harmful interference can generally be eliminated. It has been estimated that more than 95% of power-line sources that cause interference are due to gap-type discharges. These can be found and completely eliminated, when required to prevent interference (USDOE, 1980). Complaints related to corona-generated interference occur infrequently. This is especially true with the advent of cable television and satellite television, which are not subject to corona-generated interference. Mitigation of corona-generated interference with conventional radio and television receivers can be accomplished in several ways, such as use of a directional antenna or relocation of an existing antenna (USDOE, 1977; USDOE, 1980; Loftness et al., 1981).

8.2 Radio Interference (RI)

Radio reception in the AM broadcast band (535 to 1605 kilohertz (kHz)) is most often affected by corona-generated EMI. FM radio reception is rarely affected. Generally, only residences very near to transmission lines can be affected by RI. The IEEE Radio Noise Design Guide identifies an acceptable limit of fair-weather RI as expressed in decibels above 1 microvolt per meter (dBμV/m) of about 40 dBμV/m at 100 ft. (30 m) from the outside conductor (IEEE Committee Report, 1971). As a general rule, average levels during foul weather (when the conductors are wet) are 16 to 22 dBμV/m higher than average fair-weather levels.

8.3 Predicted RI Levels

Table 9 gives the predicted fair- and foul-weather RI levels (1000 kHz) at 100 ft. (30 m) from the outside conductor for the proposed 500-kV line in the four configurations. Median foul-weather levels would be about 17 dB higher than the fair-weather levels. The predicted L_{50} fair-weather level at the edge of the proposed right-of-way with no parallel lines is 45 dBμV/m for 540-kV line operation; at 100 ft. (30 m) from the outside conductor, the level is 36 dBμV/m. Predictions indicate that fair-weather RI will meet the IEEE 40 dBμV/m criterion at distances greater than about 100 ft. (30 m) from the outside conductor of the proposed line in all configurations. Predicted fair-weather L_{50} levels are comparable with those for the existing 345-kV line and lower than that from the existing 500-kV Hanford – John Day 500-kV line (45 dBμV/m at 100 ft. [30 m]).

8.4 Television Interference (TVI)

Corona-caused TVI occurs during foul weather and is generally of concern for transmission lines with voltages of 345 kV or above, and only for conventional receivers within about 600 ft. (183 m) of a line. As is the case for RI, gap sources on distribution and low-voltage transmission lines are the principal observed sources of TVI. The use of modern hardware and construction practices for the proposed line would minimize such sources.

8.5 Predicted TVI Levels

Table 10 shows TVI levels predicted at 100 ft. (30 m) from the outside conductor of the proposed line operating at 540 kV and from existing lines. At this distance, the foul-weather TVI level (75 megahertz (MHz)) predicted for the proposed line is 23 to 24 dBμV/m for all configurations. This is comparable with TVI levels from the existing 345-kV line and some other existing BPA 500-kV lines, and lower than that from the existing Hanford – John Day 500-kV line (33 dBμV/m at 100 ft. [30 m] from the outside conductor).

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 would 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. Where the proposed line parallels the existing 500-kV line with higher TVI levels, interference issues may have already been addressed and the potential for impacts would be less than where a new line with no parallel lines is built.

Other forms of TVI from transmission lines are signal reflection (ghosting) and signal blocking caused by the relative locations of the transmission structure and the receiving antenna with respect to the incoming television signal. Television systems that operate at higher frequencies, such as satellite receivers, are not affected by corona-generated TVI. Cable television systems are similarly unaffected.

Interference with television reception can be corrected by any of several approaches: improving the receiving antenna system; installing a remote antenna; installing an antenna for TV stations less vulnerable to interference; connecting to an existing cable system; or installing a translator (cf. USDOE, 1977). BPA has an active program to identify, investigate, and mitigate legitimate RI and TVI complaints. It is anticipated that any instances of TVI caused by the proposed line could be effectively mitigated.

8.6 Interference with Other Devices

Corona-generated interference can conceivably cause disruption on other communications bands such as the citizen's (CB) and mobile bands. However, mobile-radio communications are not susceptible to transmission-line interference because they are generally frequency modulated (FM). Similarly, cellular telephones operate at a frequency of about 900 MHz, which is above the frequency where corona-generated interference is prevalent. In the unlikely event that interference occurs with these or other communications, mitigation can be achieved with the same techniques used for television and AM radio interference.

8.7 Conclusion

Predicted EMI levels for the proposed 500-kV transmission line are comparable to, or lower, than those that already exist near 500-kV lines; 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% of the oxidants, while the remaining 10% is composed principally of nitrogen oxides. The national primary ambient air quality standard for photochemical oxidants, of which ozone is the principal component, is a one-hour average not to exceed 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 Oregon, 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 Oregon, Washington, and elsewhere.

The peak electric field expected under the proposed line would be less than 9.0 kV/m; the maximum value at the edge of the right-of-way would be about 2.8 kV/m. Clearances at road crossings would be increased to reduce the peak electric-field value to 4.4 kV/m.

Under maximum current conditions, the maximum magnetic fields under the proposed line would be 311 mG; at the edge of the right-of-way of the proposed line the maximum magnetic field would be 89 mG.

The electric fields from the proposed line would meet regulatory limits for public exposure in Oregon, but could exceed the regulatory limits or guidelines for peak fields established in some other states and by ICNIRP. Washington does not have a limit for electric fields from transmission lines. The magnetic fields from the proposed line would be within the regulatory limits of the two states that have established them and within guidelines for public exposure established by ICNIRP. Oregon and Washington do not have any 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 in areas where there are no immediately adjacent parallel lines. In sections with parallel lines the increase in audible noise during foul weather caused by the proposed line would be barely perceptible. The levels would be comparable to those near existing 500-kV transmission lines in Oregon and Washington, would be in compliance with noise regulations in Oregon and 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 and Oregon. 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 Oregon and Washington; if legitimate complaints arise, BPA has a mitigation program.

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Table 1: Possible configurations for McNary – John Day 500-kV corridor.

Configuration	Description of other lines in corridor with McNary – John Day 500-kV line	Miles
1	McNary – Horse Heaven – Harvalum 230-kV and McNary – Ross 345-kV lines[1]	73.0
2	Horse Heaven – Harvalum 230-kV, McNary – Ross 345-kV, and Ashe – Marion No. 1/ Ashe – Slat No. 1 double-circuit 500-kV	4.1
3	Proposed McNary – John Day 500-kV line only	3.0
4	Horse Heaven – Harvalum 230-kV, McNary – Ross 345-kV, and Hanford – John Day 500-kV lines (125-ft. spacing)	—[2]
4A	Horse Heaven – Harvalum 230-kV, McNary – Ross 345-kV, and re-located Hanford – John Day 500-kV lines (proposed line located on existing Hanford – John Day towers)	—[2]
4B	Horse Heaven – Harvalum 230-kV, McNary – Ross 345-kV, and Hanford – John Day 500-kV lines (275-ft. spacing)	—[2]

1 Four different electrical phasing options are present. Only maximum field results are presented.
2 Length of individual configurations depends on engineering design. Total length of section parallel to Hanford –John Day 500-kV line is 6.7 miles.

Table 2: Physical and electrical characteristics of configurations in the McNary – John Day 500-kV transmission-line corridor. (4 pages)

	Proposed	Existing Lines in Corridor	
Configuration	**3**	**1**	
Line Description	**McNary – John Day 500-kV Only**	**McNary – Horse Heaven – Harvalum 230-kV**	**McNary – Ross 345-kV**
Voltage, kV Maximum/Average[1]	550/540	242/237	362/355
Peak current, A Existing/Proposed	1758	1107/985	516/604
Electric phasing (south-north)	CBA	CBA[2]	ACB[2]
Clearance, ft. Minimum/Average[1]	35/45	26.5/36.5	34/44
Centerline distance-direction from McNary – John Day 500-kV Line, ft.	—[3]	250 South	125 South
Centerline distance to edge of ROW, ft.	72.5 – 187.5	62.5	62.5
Tower configuration	Delta	Flat	Flat
Phase spacing, ft.	48H, 34.5V	26.3H	32H
Conductor: #/diameter, in.; spacing, in.	3/1.300; 17.04	1/1.382	1/1.602

1 Average voltage and average clearance used for corona calculations.
2 Most prevalent phasing scheme; three other phasing schemes also present in corridor.
3 Existing lines are 625 feet south of proposed line and affect audible noise but not electric or magnetic fields near proposed line.

Table 2, continued

	Existing Lines in Corridor			
Configuration	**2**			
Line Description	**Horse Heaven – Harvalum 230-kV**	**McNary – Ross 345-kV**	**Ashe – Marion No. 1/ Ashe – Slatt No. 1 500-kV Double Circuit**	
Voltage, kV Maximum/Average[1]	242/237	362/355	550/540	
Peak current, A Existing/Proposed	817/805	516/604	1239/1332	1760/1802
Electric phasing (south-north)	CBA	ACB	A A B C C B	
Clearance, ft. Minimum/Average[1]	26.5/36.5	34/44	35/45	
Centerline distance-direction from McNary – John Day 500-kV Line, ft.	435 South	310 South	200 South	
Centerline distance to edge of ROW, ft.	62.5	—	100	
Tower configuration	Flat	Flat	Vertical, Double-circuit	
Phase spacing, ft.	26.3H	32H	30H, 50H, 30H, 31V	
Conductor: #/diameter, in.; spacing, in.	1/1.382	1/1.602	3/1.602; 17.04	

1 Average voltage and average clearance used for corona calculations.

Table 2, continued

Configuration	Existing Lines in Corridor 4, 4B		
Line Description	**Horse Heaven – Harvalum 230-kV**	**McNary – Ross 345-kV**	**Hanford – John Day 500-kV**
Voltage, kV Maximum/Average[1]	242/237	362/355	550/540
Peak current, A Existing/Proposed	817/805	516/604	1797/1842
Electric phasing (south-north)	BAC	BAC	CBA
Clearance, ft. Minimum/Average[1]	26.5/36.5	34/44	33/43
Centerline distance-direction from McNary – John Day 500-kV Line, ft.	125 North (4) 275 North (4B)	250 North (4) 400 North (4B)	375 North (4) 525 North (4B)
Centerline distance to edge of ROW, ft.	62.5	—	220
Tower configuration	Flat	Flat	Delta
Phase spacing, ft.	26.3H	32H	40H, 27.5V
Conductor: #/diameter, in.; spacing, in.	1/1.382	1/1.602	2/1.602; 18.0

[1] Average voltage and average clearance used for corona calculations.

Table 2, continued

	Existing Lines in Corridor		
Configuration	**4A**		
Line Description	**Horse Heaven – Harvalum 230-kV**	**McNary – Ross 345-kV**	**Hanford – John Day 500-kV[4]**
Voltage, kV Maximum/Average[1]	242/237	362/355	550/540
Peak current, A Existing/Proposed	817/805	516/604	1797/1842
Electric phasing (south-north)	BAC	BAC	CBA
Clearance, ft. Minimum/Average[1]	26.5/36.5	34/44	33/43
Centerline distance-direction from McNary – John Day 500-kV Line, ft.	250 South	125 South	0 North[4]
Centerline distance to edge of ROW, ft.	62.5	—	220 (existing) 75 (proposed)
Tower configuration	Flat	Flat	Delta
Phase spacing, ft.	26.3H	32H	40H, 27.5V
Conductor: #/diameter, in.; spacing, in.	1/1.382	1/1.602	2/1.602; 18.0

1 Average voltage and average clearance used for corona calculations.

4 Data is for existing configuration. Proposed line would be located on the existing towers and the Hanford – John Day 500-kV line would be re-located 200 feet north of its existing location on new towers with 3/1.300-in. conductors (Figure 1e).

Table 3: Calculated peak and edge-of-right-of-way electric fields for the proposed McNary – John Day 500-kV line operated at maximum voltage by configuration. Configurations are described in Tables 1 and 2 and shown in Figure 1.

a) Peak electric field on right-of-way, kV/m

Location	Under Proposed Line		In Remainder of Proposed Corridor		In Existing Corridor	
Line Clearance	Minimum	Average	Minimum	Average	Minimum	Average
Configuration 1	8.9	6.0	4.8	3.4	4.7	3.3
Configuration 2	8.9	6.0	8.8	6.4	8.8	6.3
Configuration 3	9.0	6.0	—	—	—	—
Configuration 4	8.8	5.9	8.9	6.0	8.9	6.0
Configuration 4A	8.9	6.0	8.8	5.9	8.9	6.0
Configuration 4B	8.8	5.9	8.9	6.0	8.9	6.0

b) Electric field at edge of proposed right-of-way, kV/m

Location	Adjacent to Proposed Line[1]		Adjacent to Existing Line in Proposed Corridor		In Existing Corridor[1]	
Line Clearance	Minimum	Average	Minimum	Average	Minimum	Average
Configuration 1	0.3	0.3	1.4	1.3	0.03, 1.4	0.04, 1.3
Configuration 2	2.8	2.8	1.2	1.1	0.3, 1.2	0.3, 1.1
Configuration 3	2.5, 0.4	2.4, 0.4	—	—	—	—
Configuration 4	2.5	2.5	0.2	0.2	0.1, 0.2	0.1, 0.2
Configuration 4A	2.5	2.5	1.5	1.4	0.1, 1.5	0.1,1.4
Configuration 4B	2.5	2.5	0.2	0.2	0.1, 0.2	0.1, 0.2

[1] Electric field at edge of right-of-way adjacent to proposed line is given first, except for Configuration 3, where levels at 75 and 175 ft. from centerline are given.

Table 4: Calculated peak and edge-of-right-of-way magnetic fields for the proposed McNary – John Day 500-kV line operated at maximum current by configuration. Configurations are described in Tables 1 and 2 and shown in Figure 1.

a) Peak magnetic field on right-of-way, mG

Location	Under Proposed Line		In Remainder of Proposed Corridor		In Existing Corridor	
Line Clearance	Minimum	Average	Minimum	Average	Minimum	Average
Configuration 1	296	203	261	166	298	192
Configuration 2	309	216	241	178	225	162
Configuration 3	303	207	—	—	—	—
Configuration 4	301	207	333	218	327	215
Configuration 4A	311	202	302	205	327	215
Configuration 4B	296	203	335	219	327	215

b) Magnetic field at edge of proposed right-of-way, mG

Location	Adjacent to Proposed Line[1]		Adjacent to Existing Line in Proposed Corridor		In Existing Corridor[1]	
Line Clearance	Minimum	Average	Minimum	Average	Minimum	Average
Configuration 1	17	17	78	65	3, 84	3, 71
Configuration 2	89	79	58	47	12, 58	12, 48
Configuration 3	82, 16	71, 16	—	—	—	—
Configuration 4	77	67	10	10	8, 9	7, 9
Configuration 4A	89	77	69	60	69, 6	59, 6
Configuration 4B	80	70	10	10	3, 9	3, 9

[1] Magnetic field at edge of right-of-way adjacent to proposed line is given first, except for Configuration 3,where levels at 75 and 175 ft. from centerline are given.

Table 5: States with transmission-line field limits.

STATE AGENCY	WITHIN RIGHT-OF-WAY	AT EDGE OF RIGHT-OF-WAY	COMMENTS
a. 60-Hz ELECTRIC-FIELD LIMIT, kV/m			
Florida Department of Environmental Regulation	8 (230 kV) 10 (500 kV)	2	Codified regulation, adopted after a public rulemaking hearing in 1989.
Minnesota Environmental Quality Board	8	—	12-kV/m limit on the 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)[1]	1.6	Explicitly implemented in terms of a specified right-of-way width.
Oregon Facility Siting Council	9	—	Codified regulation, adopted after a public rulemaking hearing in 1980.
b. 60-Hz MAGNETIC-FIELD LIMIT, mG			
Florida Department of Environmental Regulation	—	150 (230 kV) 200 (500 kV)	Codified regulations, adopted after a public rulemaking hearing in 1989.
New York State Public Service Commission	—	200	Adopted August 29, 1990.

[1] At road crossings
[2] Landowner may waive limit

Sources: TDHS Report, 1989; TDHS Report, 1990

Table 6: Common noise levels.

Sound Level, dBA	Noise Source or Effect
128	Threshold of pain
108	Rock-and-roll band
80	Truck at 50 ft.
70	Gas lawnmower at 100 ft.
60	Normal conversation indoors
50	Moderate rainfall on foliage
47	Edge of proposed 500-kV right-of-way during rain
40	Refrigerator
25	Bedroom at night
0	Hearing threshold

Adapted from: USDOE, 1996.

Table 7: Typical sound attenuation (in decibels) provided by buildings.

	Windows opened	Windows closed
Warm climate	12	24
Cold climate	17	24

Source: EPA, 1978.

Table 8: Predicted foul-weather audible noise (AN) levels at edge of proposed right-of-way (ROW) for the McNary – John Day 500-kV line by configuration. AN levels expressed in decibels on the A-weighted scale (dBA). L_{50} and L_5 denote the levels exceeded 50 and 5 percent of the time, respectively. Configurations are described in Tables 1 and 2 and shown in Figure 1.

	Foul-weather AN			
	Proposed Corridor[1]		Existing Corridor[1]	
Configuration[1]	L_{50}, dBA	L_5, dBA	L_{50}, dBA	L_5, dBA
1	49, 50	52, 54	46, 49	50, 53
2	51, 50	54, 54	47, 50	51, 53
3	49, 46	52, 49	43, 41	46, 45
4	53, 54	56, 57	51, 54	55, 57
4A	54, 53	57, 57	53,53	56, 57
4B	52, 54	55, 57	50, 54	53, 57

[1] AN level at edge of right-of-way adjacent to proposed line is given first, except for Configuration 3, where levels at 75 and 175 ft. from centerline are given.

Table 9: Predicted fair-weather radio interference (RI) levels at 100 feet (30.5 m) from the outside conductor of the proposed McNary – John Day 500-kV line by configuration. RI levels given in decibels above 1 microvolt/meter (dBµV/m) at 1.0 MHz. L_{50} denotes level exceeded 50 percent of the time. Configurations are described in Tables 1 and 2 and shown in Figure 1.

Configuration	Fair-weather RI	
	Proposed Corridor [1]	Existing Corridor[1]
	L_{50}, dBµV/m	L_{50}, dBµV/m
1	38, 31	39, 30
2	38, 31	38, 31
3	37	—
4	37, 45	33, 45
4A	37, 33	45, 33
4B	37, 45	33, 45

[1] RI level at 100 ft. from outside conductor of proposed line given first.

Table 10: Predicted maximum foul-weather television interference (TVI) levels at 100 feet (30.5 m) from the outside conductor of the proposed McNary – John Day 500-kV line by configuration. TVI levels given in decibels above 1 microvolt/meter (dBμV/m) at 75 MHz. Configurations are described in detail in Tables 1 and 2 and shown in Figure 1.

	Foul-weather TVI	
	Proposed Corridor[1]	Existing Corridor[1]
Configuration	Maximum (foul), dBμV/m	Maximum (foul), dBμV/m
1	23, 14	26, 14
2	23, 14	21, 14
3	23	—
4	23, 33	14, 33
4A	23, 14	33, 14
4B	23, 33	14, 33

[1] TVI level at 100 ft. from outside conductor of proposed line is given first.

Figure 1: Configurations for the proposed McNary – John Day 500-kV line: a) Proposed line with parallel 230-kV and 345-kV lines (Configuration 1); b) Proposed line with parallel 230-kV, 345-kV, and double-circuit 500-kV lines (Configuration 2); c) Proposed line with no parallel lines (Configuration 3); d) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configurations 4 and 4B); and e) Proposed line on existing Hanford – John Day 500-kV line towers with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4A). (5 pages)

a) Proposed line with parallel 230-kV and 345-kV lines (Configuration 1) (not to scale)

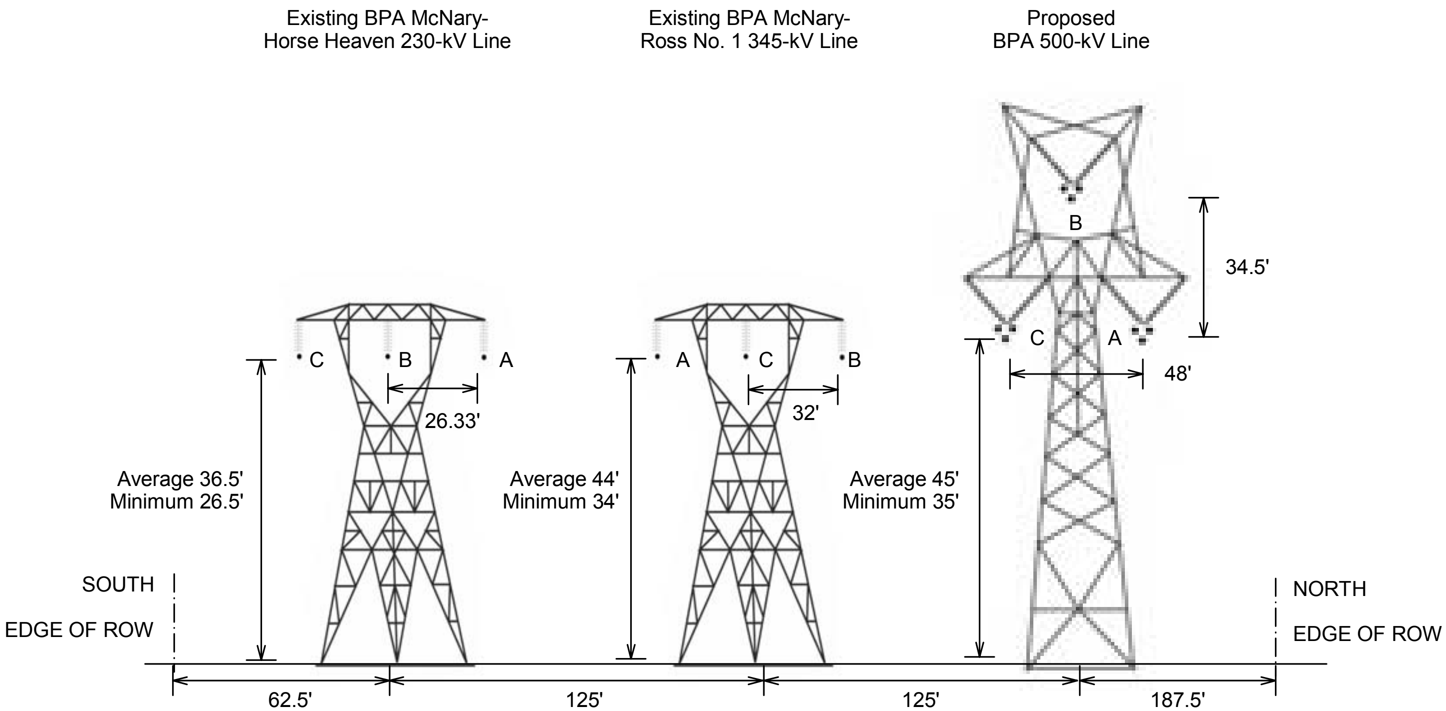


Figure 1, continued

b) Proposed line with parallel 230-kV, 345-kV, and double-circuit 500-kV lines (Configuration 2) (not to scale)

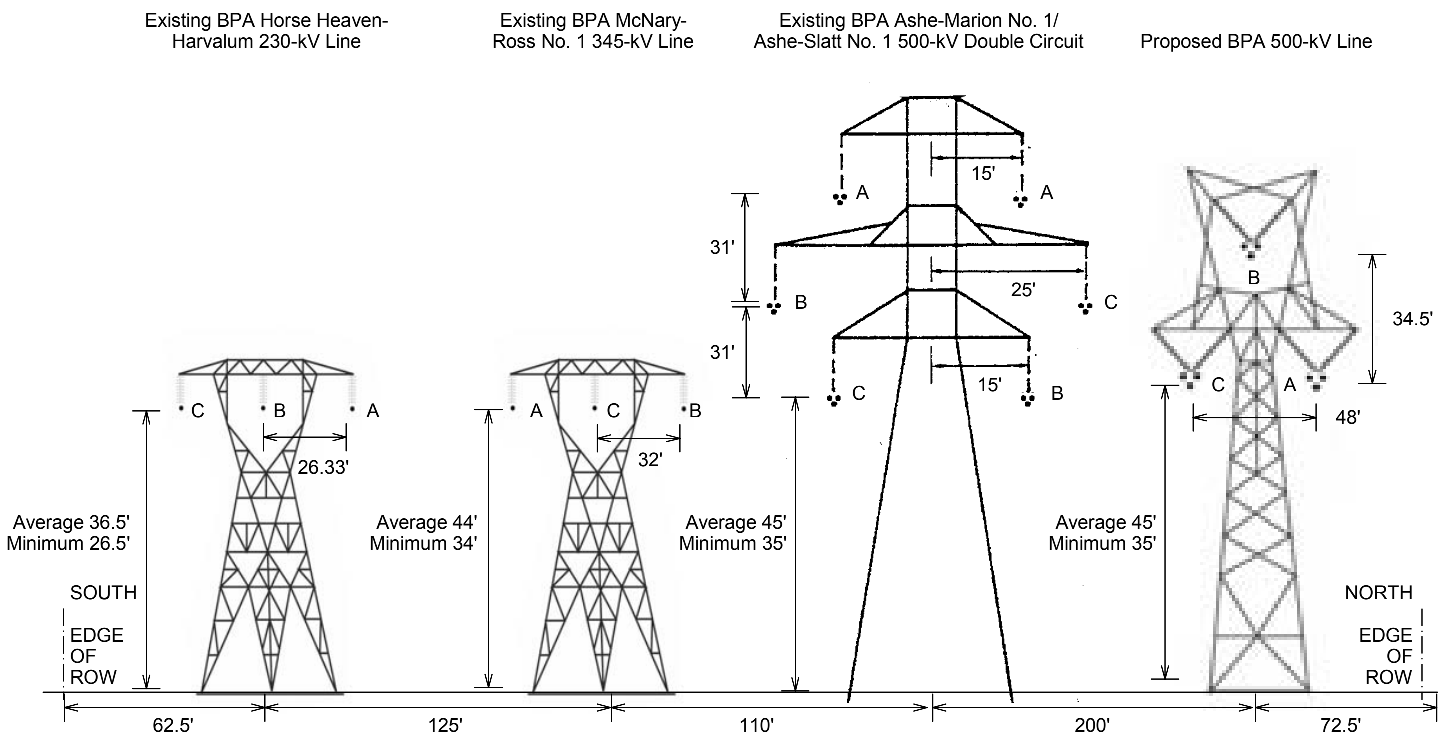


Figure 1, continued

c) Proposed line with no parallel lines within 600 feet (Configuration 3) (not to scale)

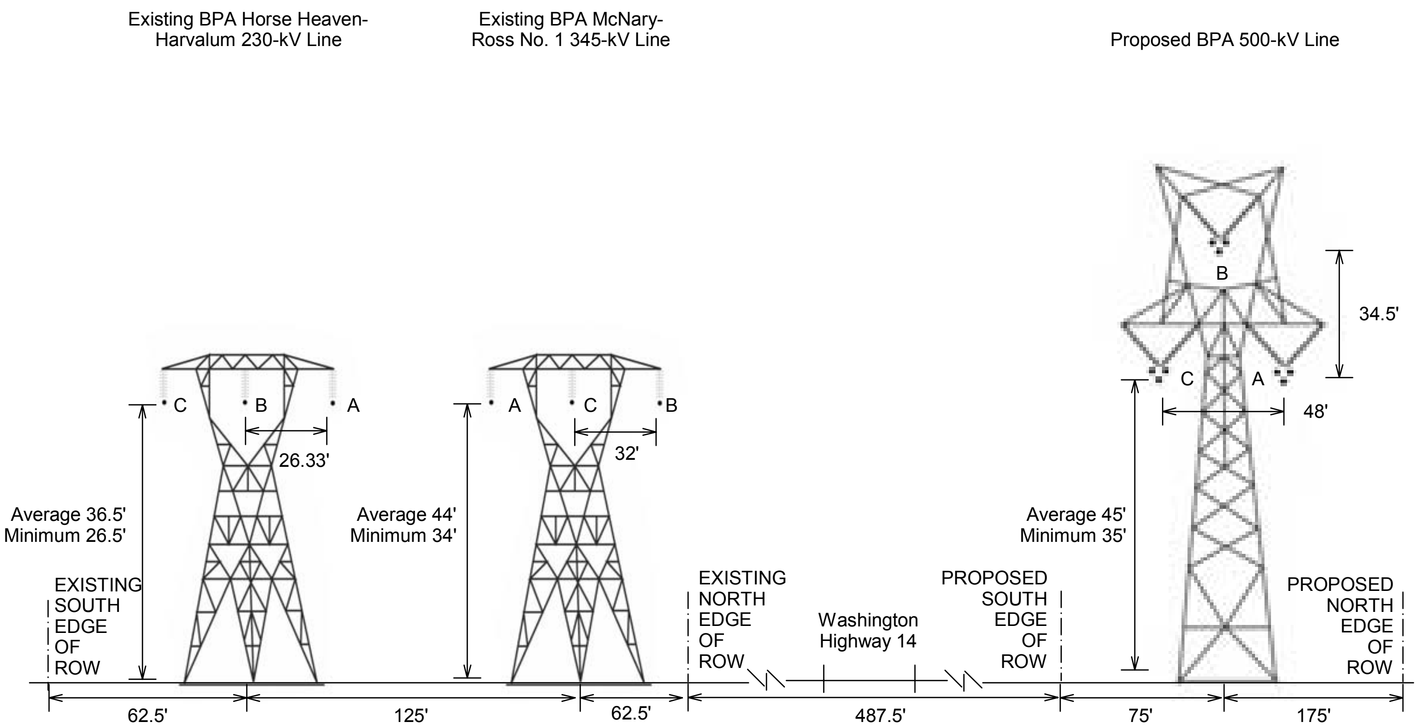


Figure 1, continued

d) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configurations 4 and 4B) (not to scale)

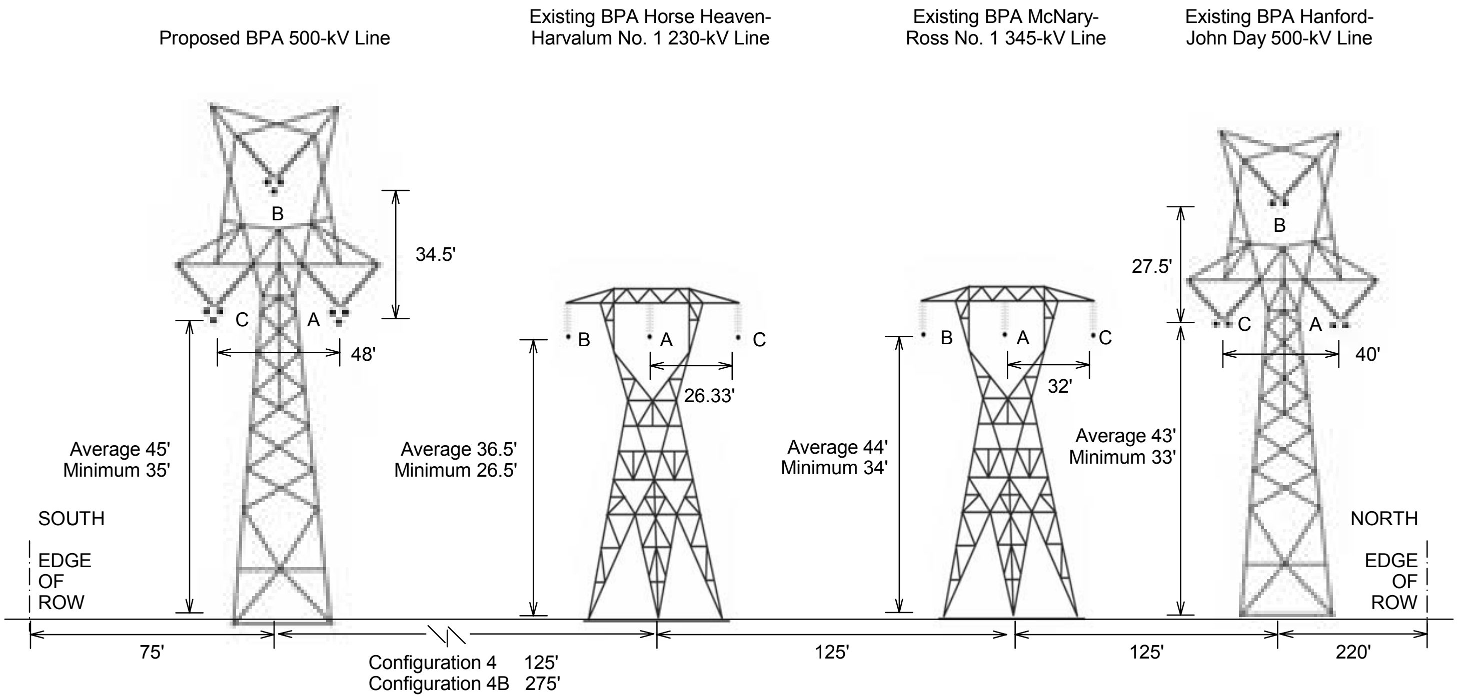


Figure 1, continued

e) Proposed line on existing Hanford – John Day 500-kV towers with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4A) (not to scale)

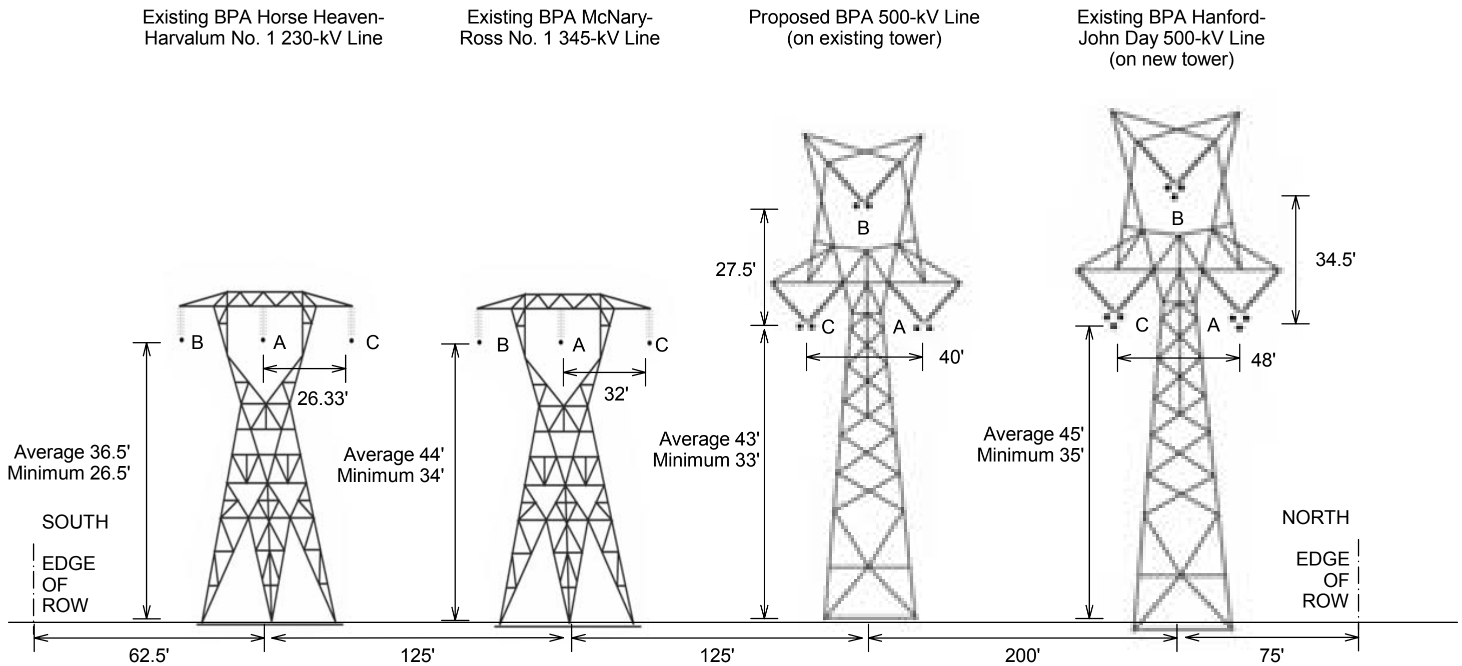


Figure 2: **Electric-field profiles for configurations of the proposed McNary – John Day 500-kV line under maximum voltage conditions: a) Proposed line with parallel 230-kV and 345-kV lines (Configuration 1); b) Proposed line with parallel 230-kV, 345-kV, and double-circuit 500-kV lines (Configuration 2); c) Proposed line with no parallel lines within 600 feet (Configuration 3); d) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configurations 4); e) Proposed line on existing towers with parallel 230-kV, 345-kV, and 500-kV lines (Configurations 4A); and f) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4B).** (4 pages) Configurations are described in Tables 1 and 2 and shown in Figure 1.

a) Proposed line with parallel 230-kV and 345-kV lines (Configuration 1)

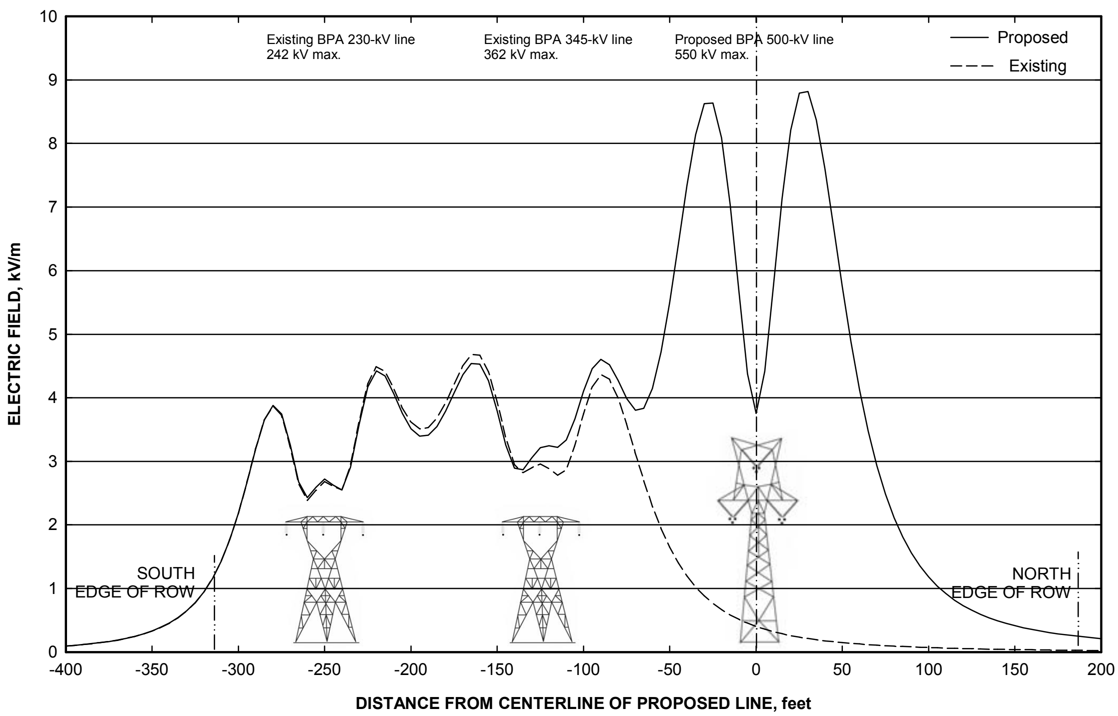
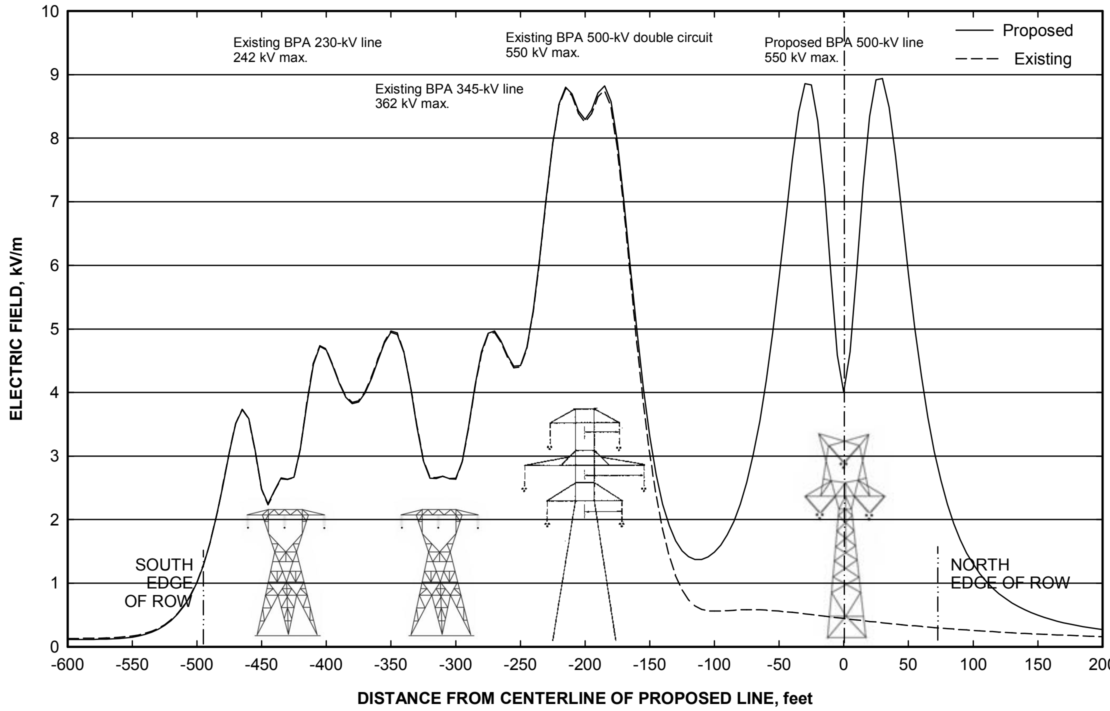


Figure 2, continued

b) Proposed line with parallel 230-kV, 345-kV, and double-circuit 500-kV lines (Configuration 2)



c) Proposed line with no parallel lines within 600 feet (Configuration 3)

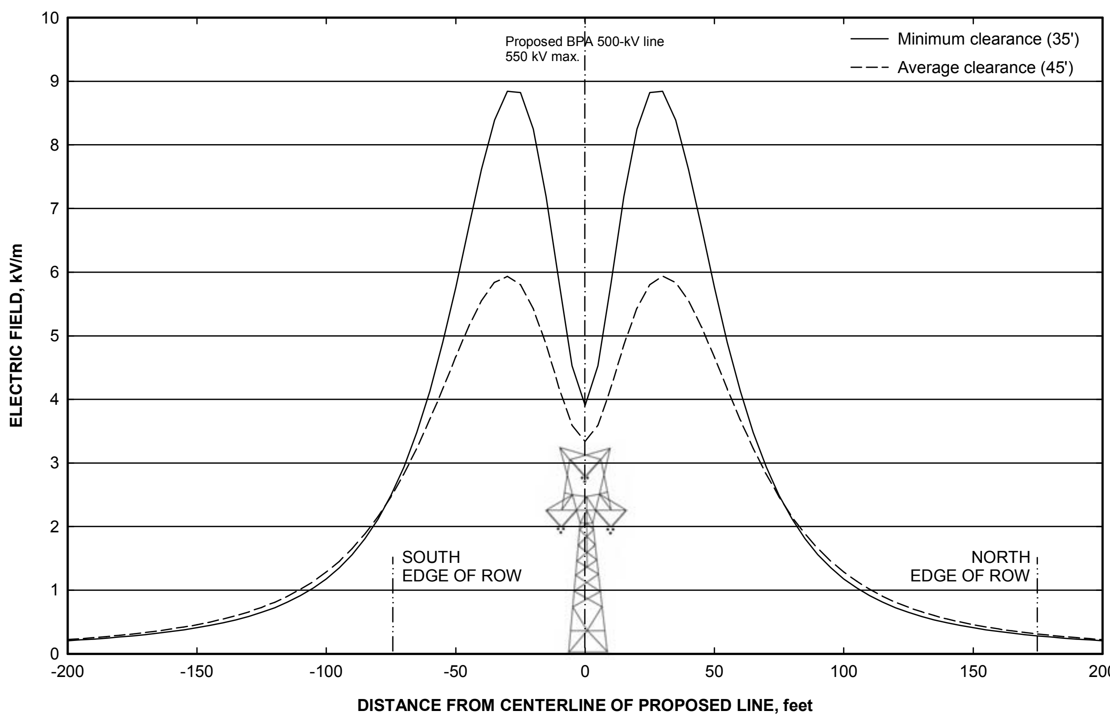
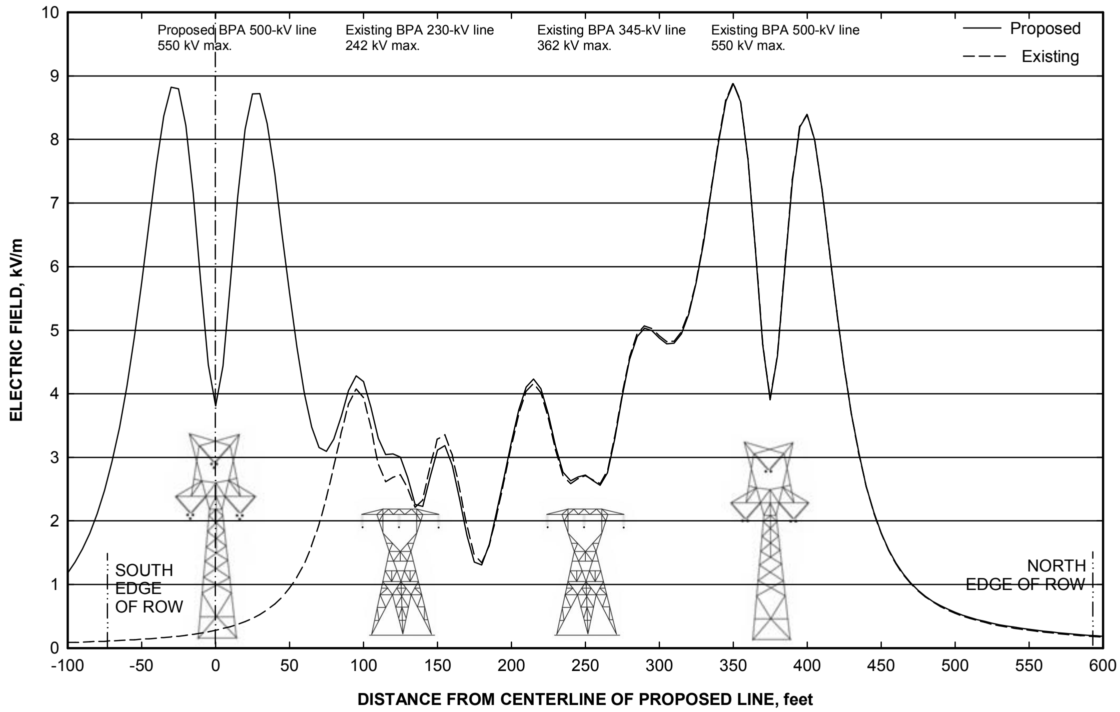


Figure 2, continued

d) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4, 125-ft. spacing)



e) Proposed line on existing towers with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4A)

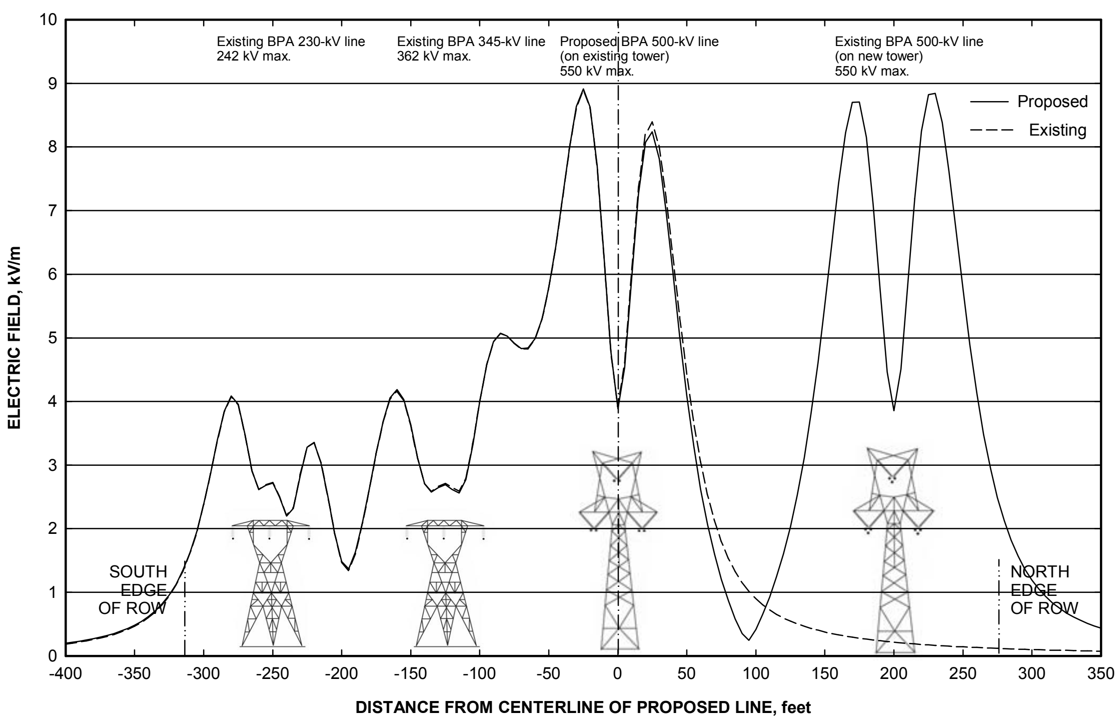


Figure 2, continued

f) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4B, 275-ft. spacing)

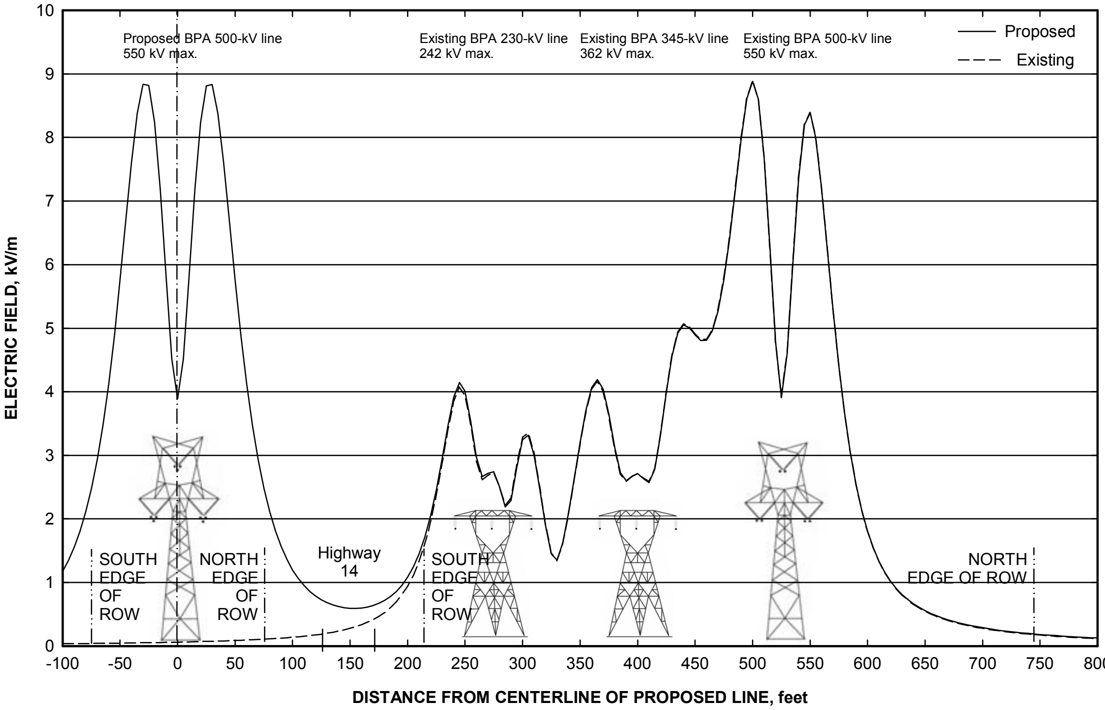


Figure 3: Magnetic-field profiles for configurations of the proposed McNary – John Day 500-kV line under maximum current conditions: a) Proposed line with parallel 230-kV and 345-kV lines (Configuration 1); b) Proposed line with parallel 230-kV, 345-kV, and double-circuit 500-kV lines (Configuration 2); c) Proposed line with no parallel lines (Configuration 3); and d) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4); e) Proposed line on existing towers with parallel 230-kV, 345-kV, and 500-kV lines (Configurations 4A); and f) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4B). (4 pages) Configurations are described in Tables 1 and 2 and shown in Figure 1.

a) Proposed line with parallel 230-kV and 345-kV lines (Configuration 1)

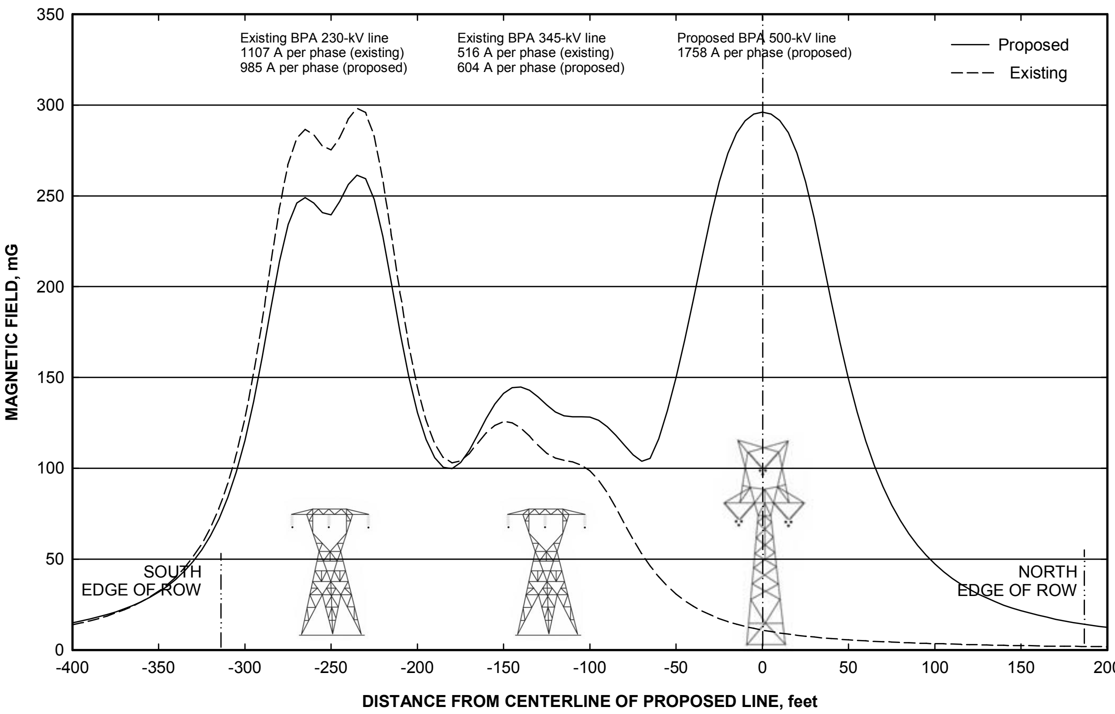
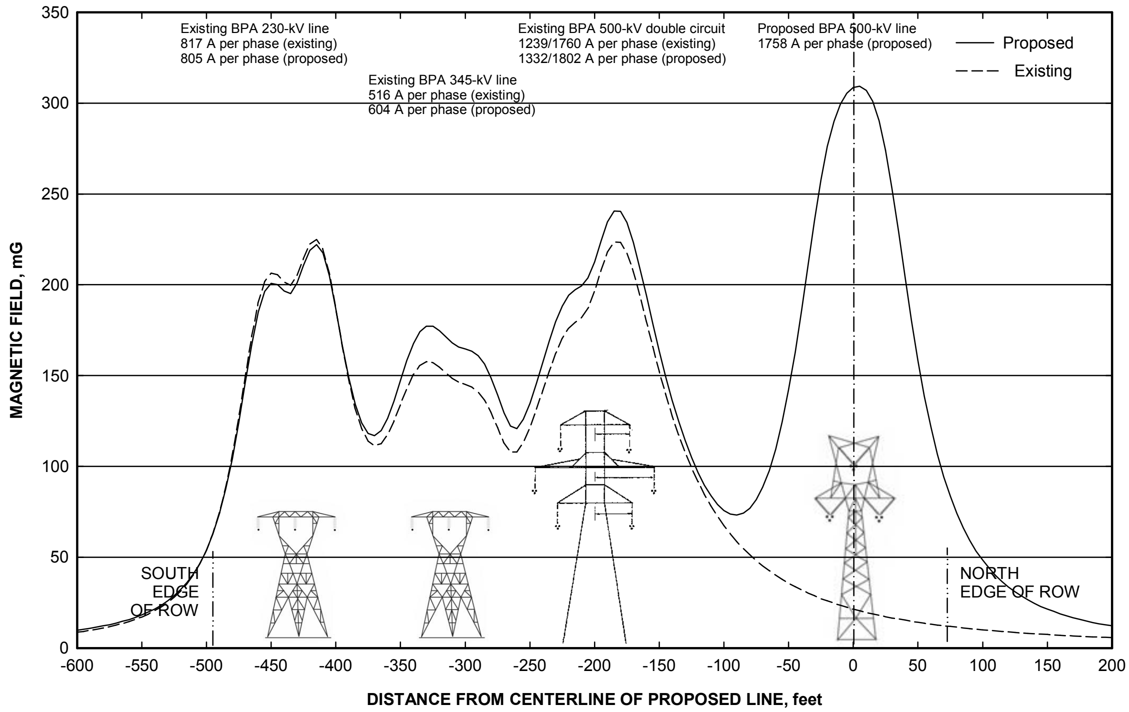


Figure 3, continued

b) Proposed line with parallel 230-kV, 345-kV, and double-circuit 500-kV lines (Configuration 2)



c) Proposed line with no parallel lines within 600 feet (Configuration 3)

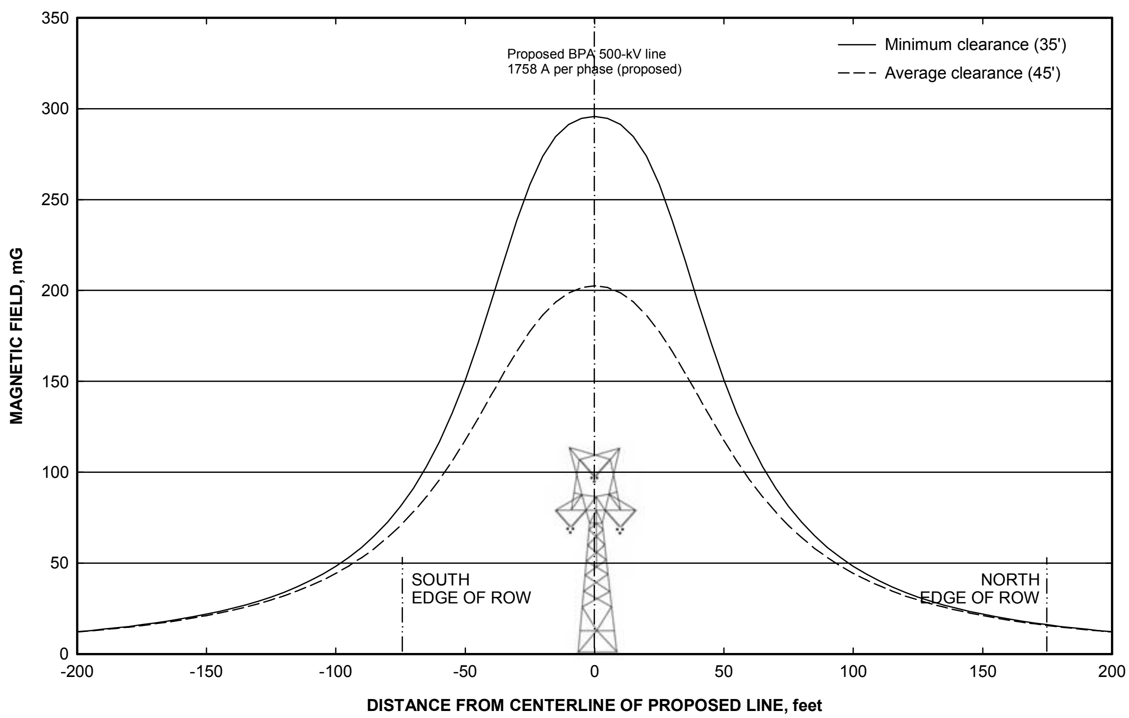
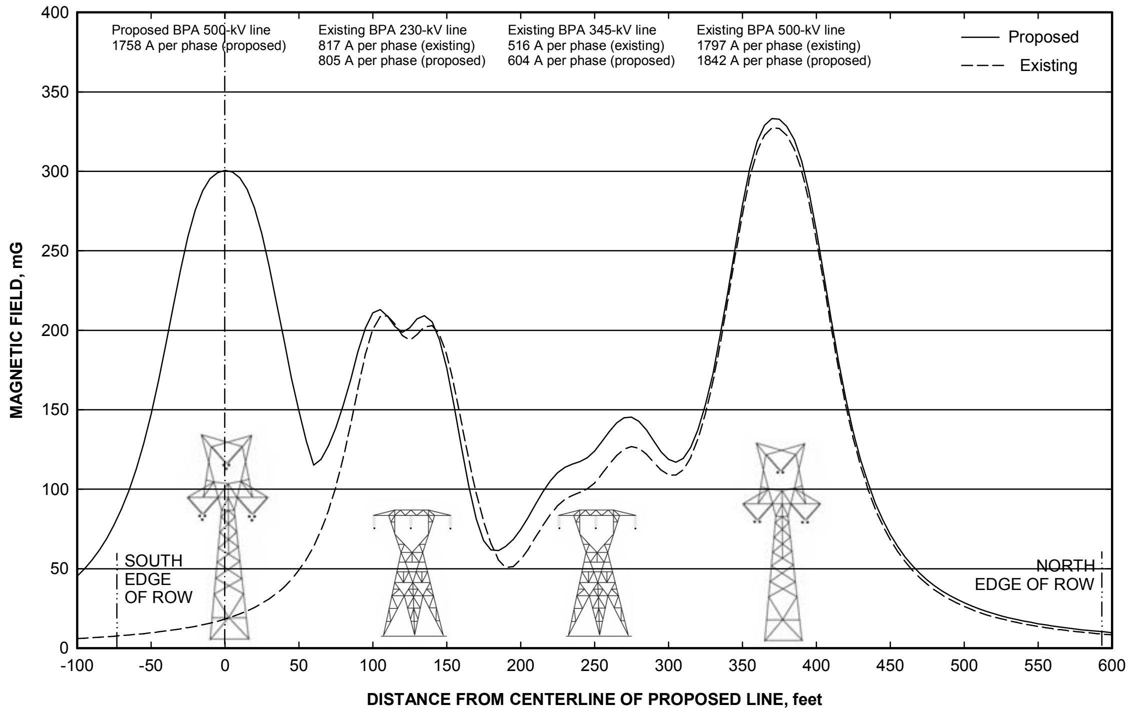


Figure 3, continued

d) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4, 125-ft. spacing)



e) Proposed line on existing towers with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4A)

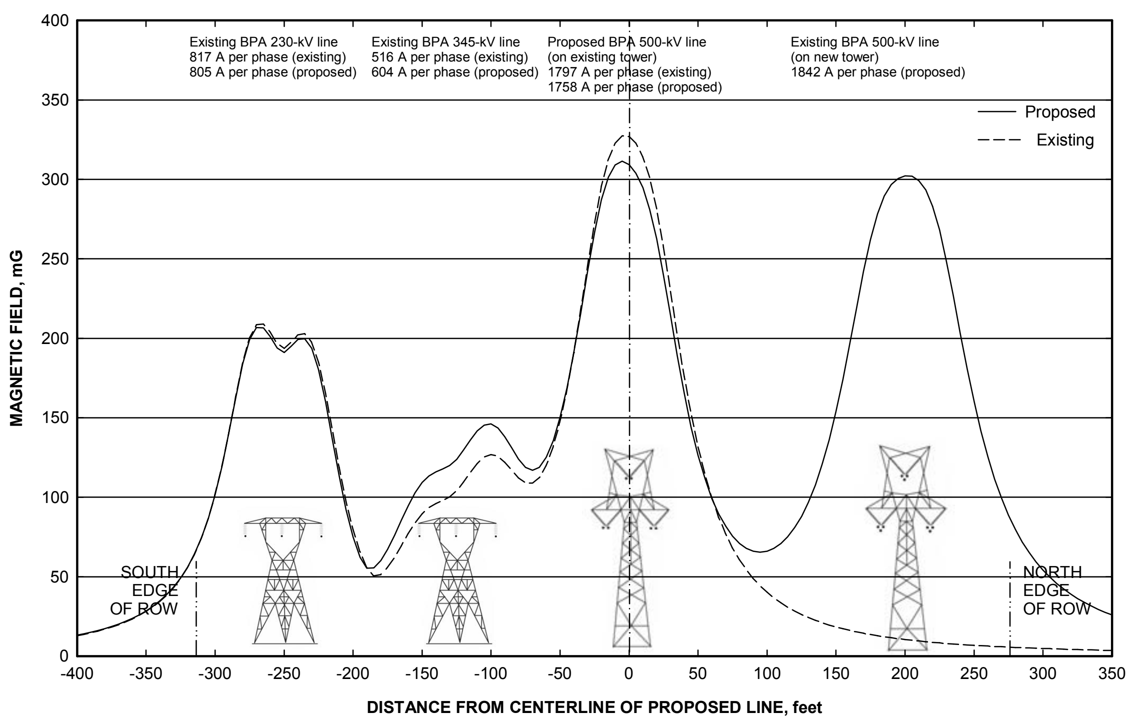


Figure 3, continued

f) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4B, 275-ft. spacing)

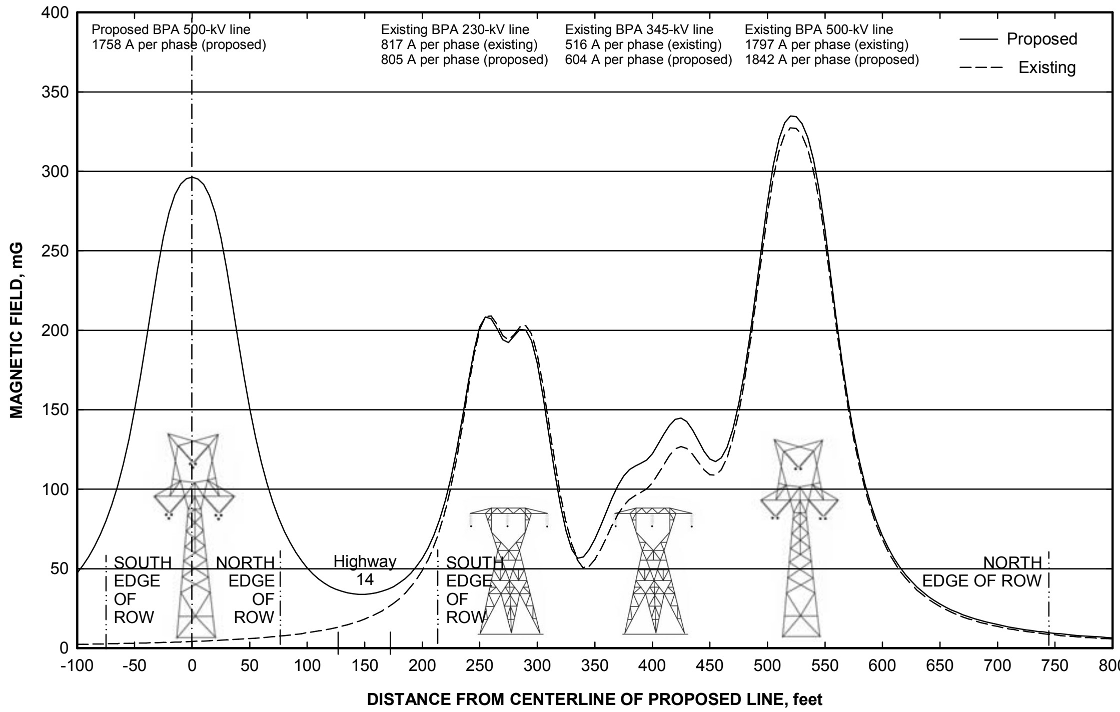


Figure 4: Predicted foul-weather L_{50} audible noise levels from configurations of proposed McNary – John Day 500-kV line: a) Proposed line with parallel 230-kV and 345-kV lines (Configuration 1); b) Proposed line with parallel 230-kV, 345-kV, and double-circuit 500-kV lines (Configuration 2); c) Proposed line with no parallel lines (Configuration 3); and d) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4); e) Proposed line on existing towers with parallel 230-kV, 345-kV, and 500-kV lines (Configurations 4A); and f) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4B). (4 pages) Configurations are described in Tables 1 and 2 and shown in Figure 1.

a) Proposed line with parallel 230-kV and 345-kV lines (Configuration 1)

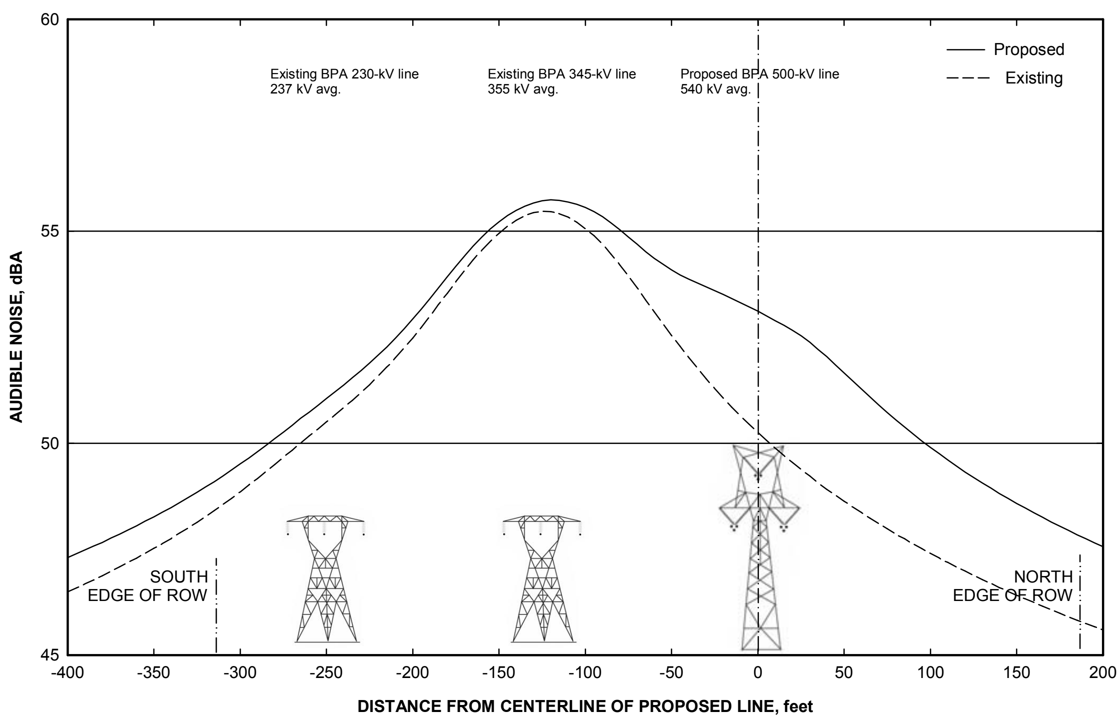
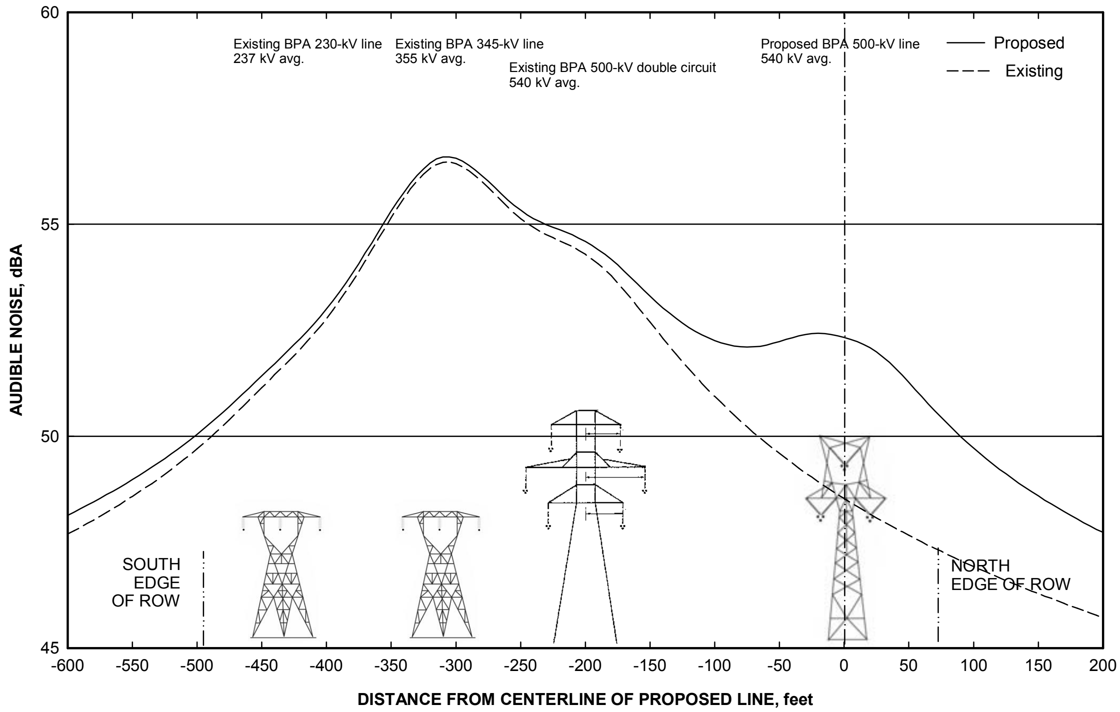


Figure 4, continued

b) Proposed line with parallel 230-kV, 345-kV, and double-circuit 500-kV lines (Configuration 2)



c) Proposed line with no parallel lines within 600 feet (Configuration 3)

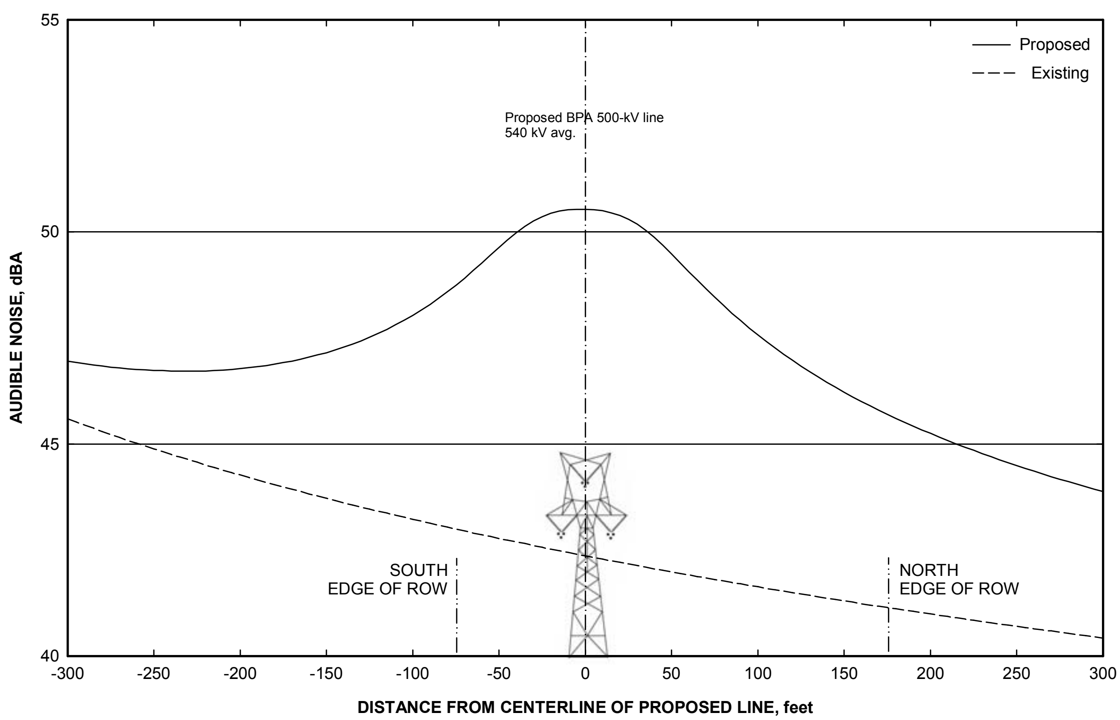
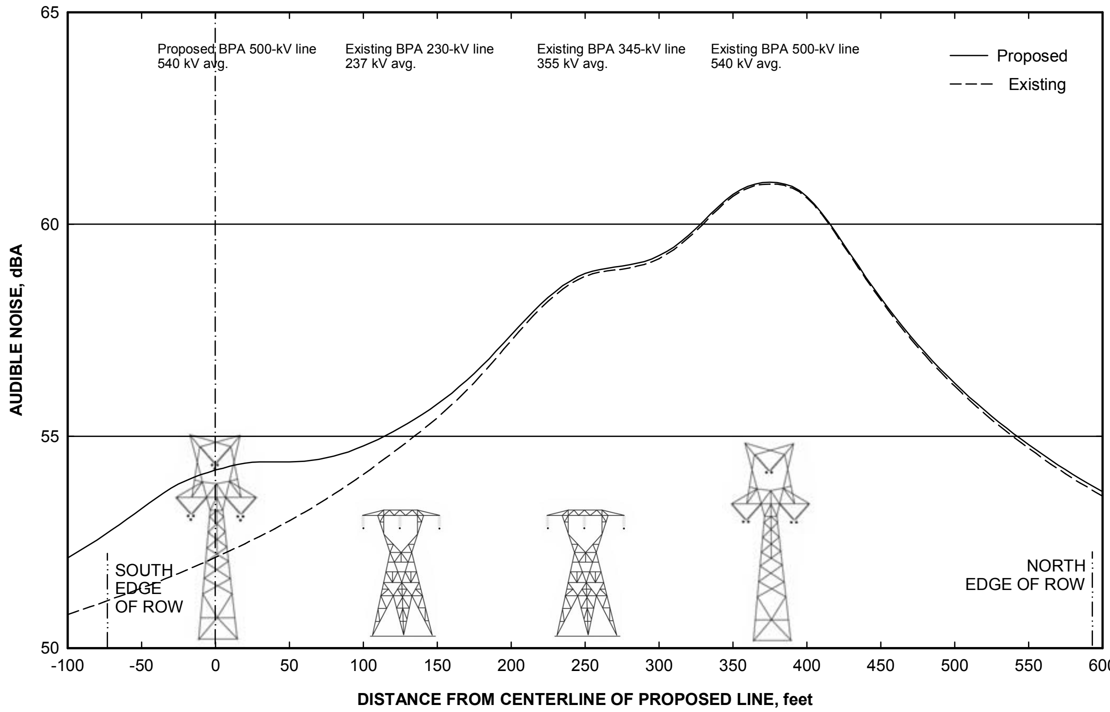


Figure 4, continued

d) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4, 125-ft. spacing)



e) Proposed line on existing towers with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4A)

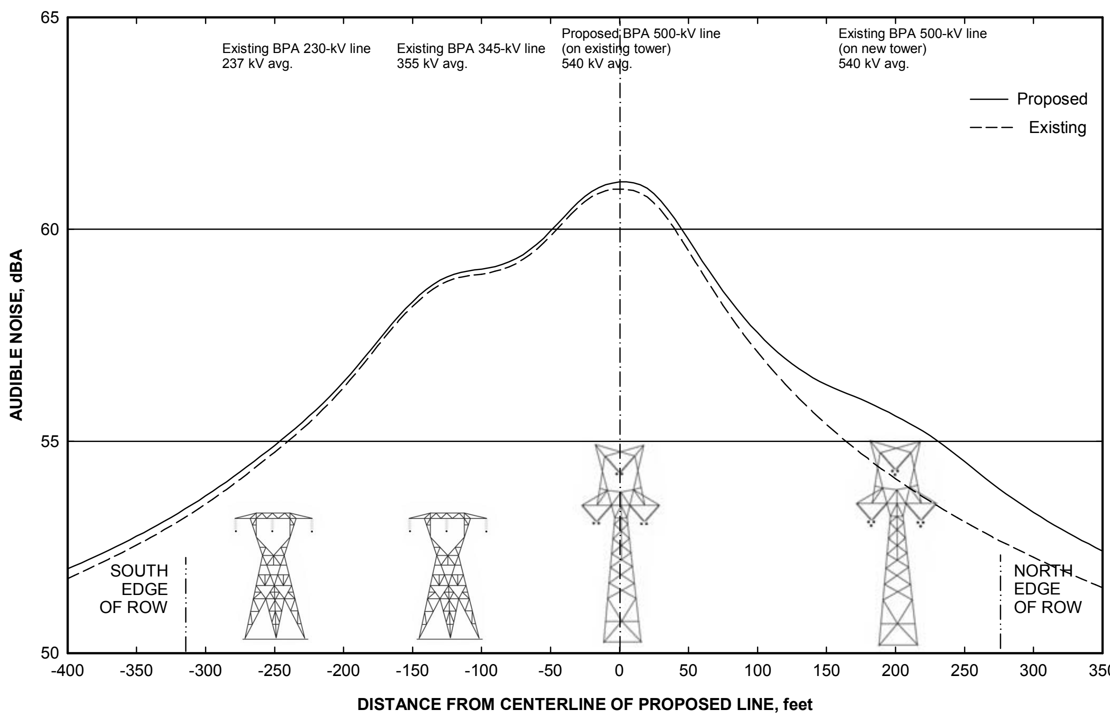
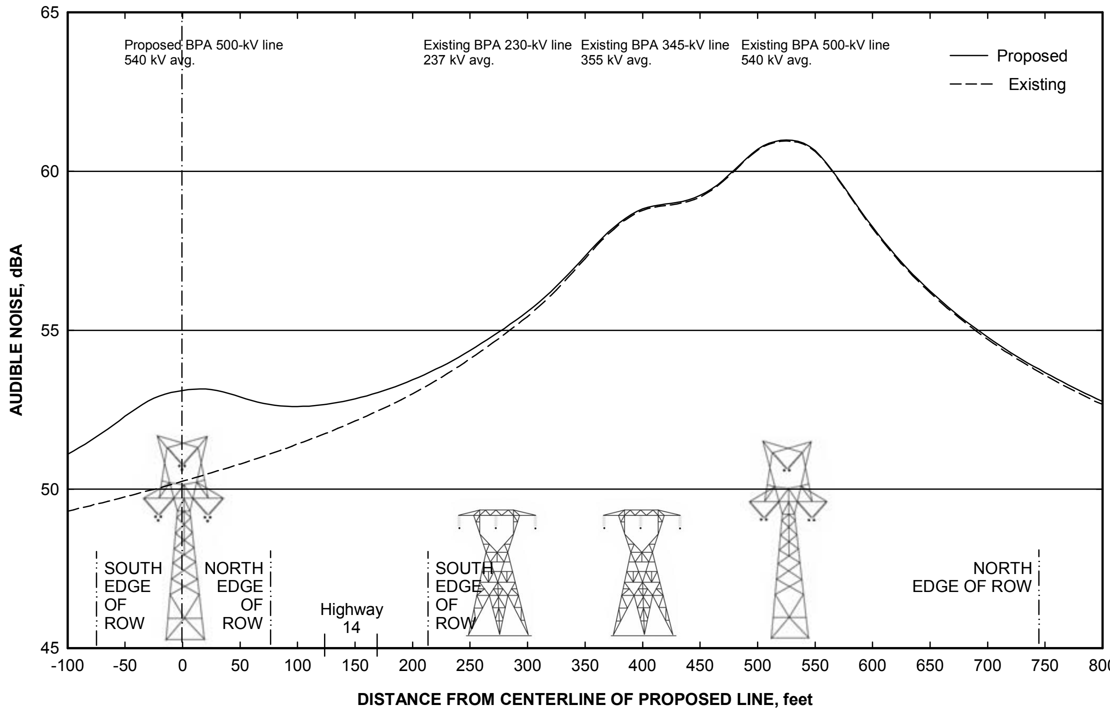


Figure 4, continued

f) Proposed line with parallel 230-kV, 345-kV, and 500-kV lines (Configuration 4B, 275-ft. spacing)



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