Kangley-Echo Lake Transmission Line Project

Supplemental Draft

Environmental Impact Statement

Bonneville Power Administration

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

Cooperating Agency: U.S. Department of Agriculture, Forest Service (USFS)

Title of Proposed Project: Kangley-Echo Lake Transmission Line Project

State Involved: Washington

Abstract: BPA is proposing to build a new transmission line to accommodate increasing demand for electricity and address reliability concerns in the Puget Sound area. The Proposed Action would construct a new line that would connect to an existing transmission line near the community of Kangley, and then connect with BPA's existing Echo Lake Substation. The major purpose of this proposal is to improve system reliability in the King County area. An outage on an existing line during times of heavy use, such as during a winter cold snap, could cause voltage instability and a loss of power in the King County area. System planners have projected total system load using normal growth in demand and determined that system instability could develop as early as the winter of 2002-03.

Besides meeting this need for system reliability, this project would enhance the United States' delivery of power to Canada as required under the Columbia River Treaty of 1961.

BPA described and analyzed transmission route alternatives in a draft environmental impact statement (DEIS) released in June 2001. The DEIS identified a preferred alternative that would parallel an existing BPA transmission line through the Cedar River Municipal Watershed. BPA received over 700 comments from landowners, agencies, tribes and special interest groups on the DEIS. Many of the comments suggested BPA re-evaluate the range of alternatives considered and prepare a supplemental draft environmental impact statement (SDEIS).

After reviewing the comments and refining the cost estimates associated with BPA's preferred alternative, BPA decided to prepare this SDEIS to re-evaluate alternatives not analyzed in detail in the DEIS. The added transmission alternatives, all located outside of the Cedar River Watershed, were initially considered but dropped from detailed analysis. They are identified as Alternatives A, B, C, and D. Alternatives A and C are located to the west of the Cedar River Watershed boundary. Alternatives B and D cross the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. Under all transmission alternatives, Echo Lake Substation would be expanded about three acres to the east and new equipment to accommodate the new line would be installed.

BPA is also considering a Non-Transmission Alternative and the No Action Alternative.

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For more copies of this document, please call 1-800-622-4520 and ask for the document by name. The SDEIS Summary is also available on the Internet at: www.efw.bpa.gov.

For additional information on DOE National Environmental Policy Act activities, please contact Carol Borgstrom, Director, Office of NEPA Policy and Compliance, EH-42, U. S. Department of Energy, 1000 Independence Avenue S.W., Washington D.C. 20585, phone: 1-800-472-2756.

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Summary

In this Summary:

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

This summary covers the major points of the supplemental draft environmental impact statement (**SDEIS**) prepared for the Kangley-Echo Lake Transmission Project proposed by the Bonneville Power Administration (**BPA**). The Proposed Action involves constructing a new 500-***kilovolt*** (***kV***) line in central King County, Washington. The new line would connect an existing line near the community of Kangley to BPA's existing Echo Lake Substation nine miles to the north. The project would also involve expansion of that substation to accommodate the new transmission line. BPA is also considering other transmission and non-transmission alternatives. As a federal agency, BPA is required by the National Environmental Policy Act (**NEPA**) to take into account potential environmental consequences of its proposal and take action to protect, restore, and enhance the environment during and after construction. Preparation of this environmental impact statement (**EIS**) assists in meeting those requirements.

➲ For Your Information

Words in bold are defined in sidebars or in the glossary.

*A **kilovolt** is one thousand volts.*

***Load** - The amount of electric power or energy delivered or required at any specified point or points on a system. Load originates primarily at the energy-consuming equipment of customers.*

*A **megawatt** is one million watts, or one thousand kilowatts. A megawatt is enough power to light 10,000 100-watt lightbulbs.*

***Voltage** is the driving force that causes a current to flow in an electrical circuit.*

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

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

S.1 Purposes and Need for Action

S.1.1 Background summary

BPA's existing transmission system in the Puget Sound area provides reliable power to customers throughout the Northwest, and to other regions and Canada. As population grows, however, the need for electrical energy increases. Winter ***loads*** in the Puget Sound area alone are forecasted to increase 150-200 ***megawatts (MW)*** per year over the next decade, an average annual growth rate of 1.6 percent.

BPA is required to ensure its transmission system can reliably serve customer power needs under all operating conditions, including times of peak use (maximum demand). BPA system planners now anticipate peak use could exceed existing system capacity as soon as winter 2002-03. When system capacity is exceeded, the ***voltage*** on transmission lines can drop below acceptable levels, causing ***brownouts***, or can cause automatic devices to disconnect lines and cut off power entirely, causing a ***blackout***. To avoid these unplanned outages, system

operators may try selectively ***dropping*** or ***shedding loads***, purposefully disconnecting some customers to prevent equipment damage or widespread loss of load. Whether planned or unplanned, electrical outages can be inconvenient, costly and even dangerous to customers, especially in winter during a cold snap.

Consequently, BPA needs to improve its transmission system to ensure continued reliable electrical power for Puget Sound area customers and other regions.

S.1.2 BPA's Purposes

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

- Facilitate the orderly planning of the region's power system [Northwest Power Act (16 USC section 839(3)(B)];
- Increase BPA system capacity to meet growing customer demand for electricity (Northwest Power Act 16 USC section 839(4) and 16 USC 839a(4)(A)(i);
- Maintain BPA transmission system reliability [Federal Columbia River Transmission Act (16 USC 838b(d); Northwest Power Act 16 USC section 839(2) and 16 USC 839a(4)(A)(i)];
- Maintain environmental quality [Northwest Power Act 16 USC 839(3)(C)];
- Minimize impacts to the human environment through site selection and transmission line design (National Environmental Policy Act 42 USC 4321 et seq., and Endangered Species Act 16 USC 1531 et seq.)
- Minimize costs to BPA's ratepayers [Northwest Power Act 16 USC 839(2) and 16 USC 839a(4)(A)(ii)] while meeting BPA's long-term transmission system objectives for the area.

S.2 Alternatives

BPA conducts region-wide transmission planning studies annually. Looking several years into the future to ensure reliable electric service, the studies use a computer model called a "power flow" to represent the system as it is expected to operate. The studies indicate a new transmission line is needed by winter 2002-03 to reliably serve potential peak load in the Puget Sound area during an "extreme" cold weather event and by winter 2005-06 to serve even "normal" peak winter load.

Based on this information, an energization date of fall 2002 for a new line was proposed.

BPA described and analyzed transmission route alternatives in a draft environmental impact statement (DEIS) released in June 2001. The DEIS identified a preferred alternative that would parallel an existing BPA transmission line through the Cedar River Municipal Watershed (CRW). BPA received over 700 comments from landowners, agencies, tribes and special interest groups on the DEIS. Many of the comments suggested BPA re-evaluate the range of alternatives considered and prepare a supplemental draft environmental impact statement.

After reviewing the comments and refining the cost estimates associated with BPA's preferred alternative, BPA decided to prepare this SDEIS to re-evaluate alternatives not analyzed in detail in the DEIS. The added transmission alternatives, all located outside of the CRW, were initially considered but dropped from detailed analysis. They are identified as Alternatives A, B, C, and D (see Map 1). Alternatives A and C are located to the south and west of the Cedar River Watershed. Alternatives B and D cross the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. Under all transmission alternatives, Echo Lake Substation would be expanded about three acres to the east and new equipment to accommodate the new line would be installed.

BPA is also considering a Non-Transmission Alternative and the No Action Alternative.

➲ For Your Information

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

***Tap** - Point at which a transmission line is connected to a substation or other electrical device to provide service to a local load.*

S.2.1 Proposed Action

BPA proposes to build a ***single-circuit*** 500-kV transmission line from a ***tap*** point on an existing 500-kV line near Kangley, Washington, to its Echo Lake Substation near North Bend, Washington. The proposed route for this line, also called Alternative 1, is nine miles long (see Map 2). Five miles of the proposed route would go through the Cedar River Municipal Watershed. In addition, Echo Lake Substation would be expanded about three acres to the east and new equipment would be installed there to accommodate the new line.

This alternative was proposed because it would be located immediately parallel to an existing 500-kV transmission line. Locating a new line next to an existing one minimizes right-of-way (**ROW**) clearing needed for the new line and reduces construction of additional access roads (only 2.9 miles of new access roads needed). About 0.6 miles of access road would be removed from service. However, the Proposed Action would displace two residences and a barn near Kangley, and impact a proposed subdivision.

The estimated construction cost for the transmission line is $23.5 million, plus the estimated $6.5 million for expanding the

➲ For Your Information

Mitigation *— Steps taken to lessen the effects predicted for a resource. They may include reducing the impact, avoiding it completely, or compensating for the impact. Some mitigation, such as adjusting the location of a tower to avoid a special resource, is taken during the design and location process. Other mitigation, such as reseeding access roads to desirable grasses and avoiding weed proliferation, is taken after construction.*

substation. The additional cost of ***mitigation*** measures would increase the Proposed Action's overall cost by about $5 million, for a total project cost of $35 million. The following mitigation measures are proposed:

- use of special design elements such as micropile footings;
- erection of towers in the Cedar River Municipal Watershed using a helicopter;
- use of vegetable oil in place of hydraulic fluids within the CRW;
- use of temporary mats to cross wetlands instead of permanent fill;
- use of special surveying techniques to minimize vegetation cutting;
- use of special clearing criteria to minimize clearing;
- use of helicopter within the CRW to remove cut trees to designated central areas, then removal by log trucks;
- restricting ground-disturbing activities to the dry season (May through September);
- use of erosion specialists and monitors for erosion control;
- purchasing land as replacement habitat for habitat affected by the proposed project;
- purchasing insurance for the unlikely event that drinking water quality is degraded;
- wetland mitigation including careful cutting and removal of only vegetation that are tall-growing species, reseeding where vegetation has been removed, and purchase of lands that contain wetlands and creeks and have other environmental/social benefits;
- special mitigation (best management practices) within the CRW concerning noxious weed removal/control and general vegetation management for wildlife habitat;
- special care along creeks important to fish habitat and water quality by removing only tall-growing vegetation within and immediately next to the ROW and replanting/seeding low growing vegetation;
- no vehicular crossing of the Cedar River within the CRW including no vehicular use of the current bridge within the CRW and no crossing of the Cedar River by a helicopter with a load of logs;

- use of two double-circuit towers to cross the Cedar River within the CRW and no clearing of vegetation near the Cedar River. Remove two existing towers and put the new line and the existing 500-kV line onto the new double-circuit towers.

The following equipment and activities would be part of the Proposed Action (most are shared in common with the other transmission alternatives):

S.2.1.1 Transmission Structures

About 47 lattice steel transmission towers would support the 500-kV transmission line. These structures average 135 feet high, with the average span between towers about 1,150 feet.

➲ For Your Information

Micropiles *— A type of footing that involves augering holes about 6 inches in diameter to a depth of approximately 30 feet, inserting 1 steel bar into the holes, then grouting the bar in place using a cement grout. Using micropiles reduces the amount of ground disturbance required.*

For the Proposed Action, BPA is proposing a new type of footing that requires less ground disturbance. The new footing design would use what are known as ***micropiles*** instead of the standard footing designs. Site grading would not be required. Brush clearing would only be necessary for the tracked equipment to operate. Most vegetation would not need to be uprooted. Tree stumps at footing sites may need to be ground down to ground level or removed, but could be crushed, bent over, broken or trimmed to the ground. The tower leg normally embedded in the ground would be above ground, so limited excavation would be required other than drilling. This method of securing the footing to the tower leg would typically disturb an area of about 10 square feet per tower leg for a total of 40 square feet at each tower site. BPA estimates that this new design would reduce the area of site disturbance within the CRW by about 16 acres, and about 16 acres on land outside the CRW.

Towers would be lifted into place in the CRW by sky-crane helicopters to reduce disturbance.

S.2.1.2 Conductors and Insulators

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 the towers to the ground. Conductors are installed on the insulators, often by helicopter, after the towers have been built. Then two overhead ***ground wires*** are attached to the top of the towers for lightning protection. There is also a series of wires (called counterpoise) buried in the ground and a grounding well at each structure to establish a low resistance path to earth, usually for lightning protection. Finally, one fiber optic cable needed for communications would be strung on the new line.

➲ For Your Information

Ground wire *is wire that is strung from the top of one structure to the next; it shields the line against lightning strikes.*

S.2.1.3 Right-of-Way Clearing

BPA would acquire easements to build, operate and maintain the new transmission line across public and private properties. The Proposed Action would require 150-feet of new right-of-way over nine miles.

➲ For Your Information

Danger trees *— Trees (or high growing brush) in or alongside the right-of-way, which are hazardous to the transmission line.*

If tall trees outside the 150-foot easement could fall and damage the line, BPA would acquire rights that allow BPA to remove these "***danger trees***." BPA would also acquire rights to use private roads to access the transmission line ROW. When no existing roads are near the ROW, BPA would acquire an access road easement that allows BPA to construct a new road.

For safe and uninterrupted operation of the transmission line, vegetation within the ROW would then need to be cleared. BPA would develop a clearing plan to guide the construction contractor hired to clear off and on the ROW. The plan would specify the allowable vegetation heights along and at varying distances from the line. Generally, all tall-growing vegetation (trees and woody brush) would be removed from the 150-foot right-of-way, as well as identified danger trees outside the ROW.

Where the Proposed Action crosses the CRW, BPA would use different clearing criteria that would take fewer trees. This "stable tree" criteria would leave trees considered stable in place, even though they may be tall enough to fall into the transmission line.

S.2.1.4 Access Roads

Easements — BPA normally acquires access road easements and develops and maintains permanent road access to each of its transmission line structures. Surfaced with crushed gravel, access roads are designed for trucks and equipment used during construction and maintenance of the line and may include short spur roads (roads that go to a structure if the structure is not located on a trunk road).

Easements for new roads outside the proposed transmission line ROW would be 50 feet wide. Typically, new or existing access roads would be graded to provide a 16-foot travel surface, with an additional 4-6 feet to accommodate curves. However, due to the use of the new tower footing design (micropiles) and use of helicopter tower erection, there would be no need for heavy equipment (track hoe and crane) for all but one of the transmission towers. Ground crews would require only smaller vehicles, including track-mounted or multi-tire vehicles, such as log trucks, to complete clearing and installation. As a result, access road requirements can be reduced in the Cedar River Watershed, in particular the width of the roads (from 16 feet to 10-14 feet). This means most existing roads do not need to be widened and

BPA can reduce road requirements by 10-15 acres. (In those areas where access is or would be inadequate for a logging truck, trees would either be left on the ground or taken out by helicopter.) Precise access road locations would be coordinated with landowners to minimize impacts on property.

Stream Crossings — New and existing access roads may cross rivers and both perennial and intermittent streams. No new bridges or stream crossings would be constructed and no new culvert locations across streams are needed for this project.

Gates — Access roads that cross private timberlands and lands managed by the CRW would be gated and locked in accordance with the wishes of landowners and land managers. BPA would install nine gates.

S.2.1.5 Staging Areas

During transmission line construction, tower steel, electrical conductors, insulators and hardware are often stockpiled at sites called staging areas. The contractor(s) hired to construct the line could secure temporary rights to establish staging areas somewhere near the center and at both ends of the proposed line. To facilitate construction efficiency, staging areas tend to be located next to major highways and often are former industrial storage yards. When helicopters are used to build the transmission line structures, staging areas are typically used to pre-assemble the towers for helicopter delivery to tower sites and are used as fueling sites for those helicopters. Staging areas are only used during construction. Although the staging area locations have not yet been determined, none would be located within the CRW.

S.2.1.6 Substation Facilities

➲ For Your Information

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

Expansion of Echo Lake Substation would include construction of a new 500-kV ***bay*** (terminal) on BPA property immediately east of the substation. The size of the expansion would be 150 feet by 750 feet. The site would be cleared, fenced and graded. A short section of the existing road around the substation would be realigned to the east.

S.2.1.7 Maintenance

Once the new line is built, BPA would manage vegetation on the new rights-of-way as it does on existing ROWs and substation sites. This includes manual, mechanical, biological and chemical (herbicide) maintenance activities. BPA uses an integrated vegetation management (IVM) approach, which looks at existing environmental conditions and selects a vegetation management strategy best suited to these conditions. If threatened or endangered fish, animal, or plant species listed under the Endangered Species Act (**ESA**) are found along a

transmission line route, buffer zones are defined around these areas and no herbicides are used. This practice also applies to riparian areas. The IVM plan would insure that the mitigation measures identified in the EIS and implemented during construction would be carried forward and maintained throughout the life of the line.

At the landowner's request, no herbicides would be used in the Cedar River Watershed. BPA has not used herbicides in the Watershed for the past 16 years.

S.2.2 Alternative 2

Alternative 2 would originate from a tap point about 1.5 miles east of the tap point for the Proposed Action and traverse northwest about three miles before continuing north paralleling the existing Raver-Echo Lake Transmission Line into Echo Lake Substation. This alternative would be approximately nine miles long.

Alternative 2 has all the components of the Proposed Action, but would require 2.7 miles of new access roads. About 0.6 miles of existing access roads would be removed from service. It would require additional clearing because part of the route would be on new ROW, not next to the existing line. Alternative 2 was explored because it would avoid impacting two residences and a small subdivision affected by the Proposed Action.

The estimated cost for Alternative 2 is $22.5 million, plus the estimated $6.5 million for the substation expansion. The cost of mitigation measures would increase the overall cost for Alternative 2 by $4 million, for a total project cost of $34 million. Mitigation measures would largely be the same as those proposed for the Proposed Action.

S.2.3 Alternative 3

Alternative 3 would begin at the same tap point as Alternative 2. From this point, it would traverse northeasterly then turn north-northwesterly to Echo Lake Substation. This alternative would be about 10.2 miles long, or about 1 1/4 miles longer than the Proposed Action. It would also require additional clearing because none of the route is next to the existing line. Alternative 3 was considered to better meet Western Electricity Coordinating Council reliability criteria, which requires its members to study all outages of two parallel lines on the same ROW if the outage has a statistical frequency of more than one occurrence in 300 years. The benefit of this routing alternative is that it provides enough separation from the existing line to provide increased reliability. Alternative 3 has the same components as the Proposed Action, but requires about 6.4 miles of new access roads; no roads would be abandoned.

The estimated cost for the transmission line is $25.5 million, plus the estimated $6.5 million for the substation expansion. Mitigation measures similar to those proposed for the Proposed Action could increase costs by an additional $5 million, for a total project cost of around $37 million.

S.2.4 Alternative 4A

Alternative 4A would begin at the same tap point as Alternative 2 (see Map 2). About one-third of the way along Alternative 2, this alternative turns northwest to connect with the Proposed Action. Alternative 4A has the same components as the Proposed Action, with about the same transmission line length (9.5 miles), and similar new access road requirements (2.7 miles). About 0.6 miles of existing access roads would be removed from service. It would require additional clearing because part of the route would be on new ROW, not next to the existing line. It was considered to avoid the two residences and the small subdivision adjacent to the Proposed Action, while avoiding a second separate crossing of the Cedar River further upstream from the existing crossing.

The estimated cost for Alternative 4A is the same as the Proposed Action, $23.5 million plus the estimated $6.5 million for expanding the substation. Mitigation measures could add $5 million more in costs to bring the overall project cost for Alternative 4A to $35 million. Proposed mitigation measures for this alternative are largely the same as those for the Proposed Action.

S.2.5 Alternative 4B

Alternative 4B would begin at the same tap point as Alternative 2. About half way along Alternative 2, this alternative would traverse southwest to connect with the Proposed Action. Alternative 4B has the same components as the Proposed Action, with an equivalent transmission line length (9.2 miles). It would require about 2.2 miles of new access roads. About 0.6 miles of existing access roads would be removed from service. It would require additional clearing because part of the route would be on new ROW, not next to the existing line. Alternative 4B was considered for the same reasons identified in Alternative 4A, plus the added benefit of taking advantage of established clearing in the CRW for the existing 115-kV transmission line parallel to Pole Line Road, and using this county road for access to the proposed power line.

The estimated cost for Alternative 4B is the same as the Proposed Action, $23.5 million plus the estimated $6.5 million for expanding the substation. The cost of mitigation measures could increase Alternative 4B's costs by $5 million, for a total project cost of $35 million. The

mitigation measures proposed for Alternative 4B are largely the same as those for the Proposed Action.

S.2.6 Alternative A

Alternative A would require construction of about 20 miles of new 500-kV transmission line on mostly rural residential land, on mostly existing ROW. The alternative would use a vacant ROW between the tap point along the existing transmission line near Kangley, to a point near Covington Substation, immediately north of a portion of an existing 230-kV transmission line (see Map 1). Some new ROW would need to be acquired around the northeast side of Covington Substation to connect two transmission line ROWs, which is adjacent to Covington Substation. Connecting these two existing transmission line ROWs may require removing/relocating approximately 25 homes and displacing two undeveloped tax lots. In all, Alternative A impacts 401 tax lots along its route, 242 of which are developed.

BPA is considering an option for this alternative (Option A1) that would impact fewer homes. This option would run through Covington Substation (see Map 3) on mostly BPA-owned land.

The existing single-circuit 230-kV line from Covington Substation to the north to a tap point on an existing double-circuit 500-kV transmission line would need to be torn down and replaced with a new double-circuit transmission line. This new transmission line would have a 230-kV line on one side and a 500-kV line on the other. The 500-kV circuit would tap one of the vacant 500-kV circuits, on an existing double-circuit 500-kV line coming from the west to take the power into Echo Lake Substation (see Map 1).

The estimated construction cost for Alternative A is $44.5 million, plus the estimated $6.5 million to expand the substation. General mitigation measures (described below) could boost this cost by $2.5 million, for a total project cost of $53.5 million. In addition, the use of tubular poles to mitigate views from homes very near the new line would add $3.5 million in costs, bringing the total to $57 million for this alternative.

If Option A1 (crossing mainly BPA land near Covington Substation) were pursued, the estimated construction cost is $37 million. This is less than the original Alternative A because of reduced property acquisition costs. The substation expansion and general mitigation measures would boost this total by about $8.5 million and tubular poles would cost an additional $3.5 million, for a potential total project cost of $49 million.

The following mitigation measures are proposed for Alternative A:

- minimizing wetland impacts and mitigate for any fill and tree removal in wetlands;

- use of special clearing criteria;
- restricting the construction period to the dry season;
- use of erosion specialists and monitors for erosion control;
- use of special care and design for crossing fish-bearing streams;
- use of special care and mitigation for crossing the City of Kent's watershed;
- measures needed for the approximately 401 landowners potentially affected;
- special care for construction near residences, particularly when removing small existing buildings and disrupting areas currently used as extensions of residents' properties (such as extending backyards into the vacant ROW).

As previously noted, Alternative A uses a vacant circuit on the Maple Valley-Echo Lake line. As loads grow, BPA would normally use this circuit. If Alternative A were selected, a new 500-kV single-circuit line may need to be built in the future at an estimated cost of $19 million. This cost also needs to be considered when evaluating this alternative.

S.2.6.1 Transmission Structures

The single-circuit 500-kV line between the tap point near Kangley would be supported by single-circuit towers approximately 135 feet high, and the double-circuit line between Covington and the vacant circuit of the Maple Valley-Echo Lake line would be supported by towers approximately 180 feet high. Tangent structures and several dead-end structures would be used. For most of this alternative, BPA would use plate, grillage, and rock anchor footings. BPA would use micropile footings in the city of Kent's watershed.

S.2.6.2 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action.

S.2.6.3 Right-of-Way Clearing

Alternative A would require 150 feet of new ROW width over about one mile. For Option A1, about one-quarter mile of new ROW would be needed.

Clearing would be required within the existing ROW where trees have been allowed to grow. Some trees outside the ROW, if

determined to be unhealthy or danger trees, would need to be removed. A total of 397 acres of vegetation would be impacted by clearing (118 acres, or 30 percent of this total, would be forested stands permanently converted to non-forest use).

S.2.6.4 Access Roads

About 6.6 miles of new access road would need to be acquired to build and maintain the new transmission line.

S.2.6.5 Staging Areas

Staging areas for this alternative have not been determined.

S.2.6.6 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line. Components would be the same as the Proposed Action.

S.2.6.7 Communication and Maintenance

See the Proposed Action.

S.2.7 Alternative B

For this alternative, 35.6 miles of the existing 345-kV single-circuit transmission line and towers between Stampede Pass and Echo Lake Substation would be torn down and new double-circuit towers erected to accommodate two new 500-kV lines. Alternative B would tap an existing 500-kV line just east of Stampede Pass and divert power to Echo Lake Substation (see Map 1). The new double-circuit line would operate on one side at 345-kV (like the existing line) and the other at 500-kV. The new double-circuit line would be built mostly on existing ROW, but would impact 110 tax lots, of which 20 are developed. No homes would be displaced. This alternative crosses the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests.

The estimated construction cost for Alternative B is $77 million, plus the estimated $6.5 million to expand the substation. Mitigation measures (described below) could boost this cost by $4 million, for a total project cost of $87.5 million. The following mitigation measures would likely be required for this alternative:

- compensatory mitigation for wetland impacts and timber removed in sensitive/critical areas;
- seasonal restrictions on construction operations for wildlife protection;

- special design elements;
- special construction techniques;
- improvement of existing BPA roads to meet standards of operation and maintenance on USFS-managed lands;
- special environmental considerations associated with the line's location near I-90;
- measures needed for the approximately 110 landowners potentially affected; and
- surveys required for Survey and Manage and Threatened and Endangered species.

S.2.7.1 Transmission Structures

Alternative B would replace the existing 150-foot double-circuit towers that are over 50 years old with 180-foot double-circuit towers. Tangent structures and several dead-end structures would be used. BPA would use plate, grillage, and rock anchor footings for this alternative.

S.2.7.2 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action.

S.2.7.3 Right-of-Way Clearing

The new transmission line would be built mostly on existing ROW with the exception of a short segment within the Wenatchee National Forest, where the line would tap the Schultz-Raver No. 2 500-kV Transmission Line. BPA would acquire special use permits from the Forest Service and easements from other property owners where BPA does not already have a permit or easement.

About 250 acres of vegetation would need to be cleared within and adjacent to the existing Rocky Reach-Maple Valley line ROW to accommodate the double-circuit line. Of that total, 210 acres, or 84 percent, would be forested stands permanently converted to non-forest use.

S.2.7.4 Access Roads

Alternative B would follow an existing transmission line ROW; therefore, new access road construction would be limited to improving the existing trunk access and spur roads, reconstructing some spur roads to improve drainage, and constructing some new, short spur roads to any new tower locations. About two miles of new access road would need to be acquired to build and maintain the new transmission line. BPA would acquire access road easements on existing roads to access

the transmission line ROW or road use permits from the Forest Service. When no existing roads are near the ROW, BPA would acquire special use permits allowing construction of new roads.

Many of the existing roads would need upgrading. It is likely several culverts would need to be replaced.

S.2.7.5 Staging Areas

Staging areas for this alternative have not been determined.

S.2.7.6 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line. Components would be the same as the Proposed Action.

S.2.7.7 Communication and Maintenance

See the Proposed Action.

S.2.8 Alternative C

Alternative C has two options, Option 1 and Option 2. Option C1 is approximately 10.1 miles long and Option C2 is approximately 10.6 miles long (see Map 1). Both would require new ROW away from existing transmission lines. Option C1 would begin at Raver Substation and proceed 2.5 miles west immediately north of and parallel to an existing double-circuit 500-kV transmission line on new 150-foot-wide ROW, before turning north and traveling about 7.6 miles on new 150-foot ROW through the rural residential areas of Ravensdale and Hobart. The proposed line would then tap the vacant circuit on an existing double-circuit 500-kV transmission line, west of Echo Lake Substation, just north of State Route 18 (**SR** 18). Power would be carried by this existing transmission line into Echo Lake Substation, following the completion of a short segment at Echo Lake Substation similar to that described at the north end of Alternative A.

Option C2 would begin at a tap point on an existing 500-kV double-circuit transmission line near Kangley, about 2.8 miles northeast of Raver Substation, and traverse about 4.5 miles west within a vacant transmission line ROW immediately north of a 230-kV transmission line, before turning north and continuing on the same alignment as Option C1 into Echo Lake Substation.

Both options would cross primarily private land. Option C1 would cross 128 tax lots, of which at least 54 are developed; 30-35 homes could be displaced. Option C2 would cross 134 tax lots, of which 56 are developed; 23-28 homes could be displaced.

The estimated construction cost for Option C1 is $46.5 million, which includes the estimated $6.5 million to add new equipment to Raver Substation. Adding the estimated $6.5 million to expand Echo Lake Substation and $5.5 million in estimated general mitigation costs would boost the total project cost to $58.5 million. In addition, the use of tubular poles to mitigate views from homes near the new line would add $1.2 million in costs, bringing the total to $59.7 million for this alternative.

If Option C2 were pursued, the estimated construction cost is $32.5 million, plus the estimated $6.5 million cost of expanding Echo Lake Substation. General mitigation measures could boost this total by $4 million and tubular poles would cost an additional $1.2 million, for a potential total project cost of $44.2 million.

The following mitigation measures are proposed for both Alternative C options:

- minimizing wetland impacts;
- use of special clearing criteria;
- restricting the construction period to the dry season;
- use of erosion specialists and monitors for erosion control;
- use of special care and design for crossing fish-bearing streams;
- use of special care and mitigation for crossing the city of Kent's watershed;
- measures needed for the landowners potentially affected (128 under Option C1; 134 under Option C2); and
- special care for construction near residences, particularly when removing trees adjacent to the ROW.

As previously noted, Alternative C uses a portion of the vacant circuit on the Maple Valley-Echo Lake line. As loads grow, BPA would normally use this circuit. If Alternative C were selected, a new 500-kV single-circuit line may need to be built in the future at an estimated cost of $9 million. This cost also needs to be considered when evaluating this alternative.

S.2.8.1 Transmission Structures

Both options would use single-circuit 500-kV towers approximately 135 feet high. Tangent structures and several dead-end structures would be used. BPA would use plate, grillage, and rock anchor footings for both options.

S.2.8.2 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action.

S.2.8.3 Right-of-Way Clearing

Option C1 would require 150 feet of new ROW width over about 10.1 miles. Option C2 would require 150 feet of new ROW over about 6.1 miles.

For Option C1, about 195 acres of vegetation would need to be cleared, of which about two-thirds (130 acres) would be forested stands permanently converted to non-forest use. For Option C2, about 206 acres of vegetation would need to be cleared, of which 56 percent would be permanently converted forested stands.

S.2.8.4 Access Roads

Option C1 would require approximately 8.7 miles of new access roads, while Option C2 would require about 8 miles of new access roads.

S.2.8.5 Staging Areas

Staging areas for this alternative have not been determined.

S.2.8.6 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line. Components would be the same as the Proposed Action.

Option C1 would start at Raver Substation and similar equipment as is proposed at Echo Lake Substation would be installed at Raver Substation.

S.2.8.7 Communication and Maintenance

See the Proposed Action.

S.2.9 Alternative D

Alternative D would tap an existing 500-kV line just east of Stampede Pass and divert power to Echo Lake Substation over 35.6 miles of new single-circuit 500-kV transmission line.

Alternative D has two options, Option D1 and Option D2. Option D1 is located immediately adjacent to and south of the existing 345-kV line; Option D2 is located immediately adjacent to and north of this line. Either option would entail acquiring and clearing a new

150-foot wide ROW and building a new 500-kV single-circuit transmission line. Option D1 crosses 134 tax lots, of which 32 are developed; 11-14 homes would be displaced. Option D2 crosses 121 tax lots, of which 22 are developed; eight homes would be displaced. Both options cross the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests.

The estimated construction cost for Option D1 is $55.5 million, plus the estimated $6.5 million to expand Echo Lake Substation. Mitigation measures could increase costs by $10.5 million, for a total project cost of $72.5 million.

The estimated construction cost for Option D2 is $53 million, plus the estimated $6.5 million to expand Echo Lake Substation. Mitigation measures could increase costs by $11 million, for a total project cost of $70.5 million.

The following mitigation measures would likely be required for this alternative:

- compensatory mitigation for wetland impacts and timber removed in sensitive/critical areas;
- seasonal restrictions on construction operations for wildlife protection;
- special design elements;
- special construction techniques;
- improvement of existing BPA roads to meet standards of operation and maintenance on Forest Service managed lands;
- potential relocation of roads;
- special environmental considerations associated with the line's location near I-90;
- measures needed for the approximately 134 landowners potentially affected by Option D1 and 121 landowners potentially affected by Option D2.
- surveys required for survey and manage and threatened and endangered species; and
- requirements to mitigate for potential impacts to threatened and endangered species and survey and manage species that are discovered.

S.2.9.1 Transmission Structures

Alternative D (either option) would be supported by steel towers approximately 150 feet tall, about the same height as most of the

existing towers supporting the Rocky Reach–Maple Valley line that would be next to this new line. BPA would use tangent structures, several dead-end structures, and plate, grillage, and rock anchor footings for this alternative.

S.2.9.2 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action.

S.2.9.3 Right-of-Way Clearing

The new transmission line would be built on new ROW. BPA would acquire a special use permit on National Forest land and easements on private land where BPA does not already own these rights. Options D1 and D2 would require 150 feet of new ROW width over about 35.6 miles.

In general, where new ROW is obtained, a strip of land about 150 feet wide would be cleared to allow for tower construction and conductor clearance. About 769 acres of vegetation would need to be cleared within the new ROW for Option D1. Of that amount, 82 percent (632 acres) would be forestland permanently converted to non-forest use. For Option D2, 776 acres of vegetation would be cleared, of which 89 percent (694 acres) would be permanently converted forestland.

S.2.9.4 Access Roads

About 13.6 miles of new access road would need to be acquired to build and maintain the new transmission line for Option D1 and 13.2 miles for Option D2. This would result in the clearing of 33 acres for Option D1 and 32 acres for Option D2. BPA would acquire access road easements on existing roads to access the transmission line ROW. When no existing roads are near the ROW, BPA would acquire easements that allow BPA to construct new roads.

Many of the existing roads would need upgrading. It is likely several culverts would need to be replaced.

S.2.9.5 Staging Areas

Staging areas for this alternative have not been determined.

S.2.9.6 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line. Components would be the same as the Proposed Action.

S.2.9.7 Communication and Maintenance

See the Proposed Action.

S.2.10 Non-Transmission Alternative

Some commentors suggested that a variety of non-transmission alternatives such as Demand-Side Management (**DSM**), Distributed Generation (**DG**), large-scale generation (**G**) and Demand Response (**DR**), could defer or eliminate the need for a new transmission line. BPA examined the following:

Demand Response (DR) Programs — DR programs are a potential source of load reduction that could be exercised during a cold snap to prevent overloads on the Covington transformers. These options include Direct Load Control (**DLC**), interruptible/curtailable (non-firm) rates, and demand bidding (i.e., the Demand Exchange) to reduce loads when needed during system peaks. These types of solutions can be an effective approach to achieve load reductions because they directly address the capacity nature of the problem.

DR programs can be categorized into two major types: 1) price-based dispatch programs that offer customers incentives to voluntarily curtail load during the peak; and 2) pre-arranged contracts with customers (such as interruptible/curtailable rates or direct load control) that would require a customer to reduce loads during the system peak for a fixed price at BPA's request. These programs differ in their implementation and potential for providing load relief as discussed below. In this analysis we evaluate both price-based dispatch and interruptible/curtailable for their capability to provide the needed capacity to BPA.

Price-based dispatch programs are voluntary programs in which the price for curtailment or interruption is determined through a price convergence mechanism (i.e., auction, bidding system, etc.) between load serving entities and customers. Customers can choose the point at which the price available to them is high enough to offset their productivity losses from reducing or shutting-off their load. If the price offered by the load serving entity is high enough, then sufficient load reduction can, in all probability, be purchased at that price. While price-based dispatch programs result in a particularly efficient process of load reduction, they do not provide firm or guaranteed reductions in system load when needed.

Interruptible/curtailable contracts differ from the price-based dispatch programs because the terms (i.e., number of times/year the customer can be curtailed, maximum hours per interruption, and notification period for interruption) and the price (fixed component) are pre-determined and bound with an enforceable contract. By securing a contract for the load reduction, the available peak load relief is more

certain for planning purposes. This type of program is better suited for the type of system conditions driving the need for the transmission line, where extreme but infrequent weather conditions result in high levels of load relief required over relatively few hours of the year.

Demand-Side Management Measures — DSM measures are typically considered energy efficiency measures rather than peak shaving programs. However, certain measures such as heating efficiency and weatherization will reduce heating loads and have an impact on peak demand reduction so they were included in the economic screen.

Generation and Distributed Generation — There are a variety of generation options that could help to defer the transmission line, including both existing and new generation. In the course of this study we identified 277 MW of additional capacity that could potentially be available from existing generators in the Puget Sound area. An additional 270 MW of capacity is currently under construction. Together, these plants could provide up to 170 MW of relief at Covington Substation. Another 2,700 MW of capacity are either permitted or planned, although it is uncertain how much, if any, of this capacity will eventually be constructed.

BPA makes assumptions about the disposition of existing generators when it conducts its studies of the power flows across critical transmission system elements. BPA generally assumes that all generators in the Puget Sound area would be running to meet the extremely heavy loads during a cold snap. However, this analysis uncovered approximately 390 MW of capacity at several generating stations in the area that is not running for BPA's load flow studies. This capacity could potentially be called upon by BPA during the target hours.

In addition to the existing facilities, a number of new, large power plants have been proposed for the Puget Sound area since the late 1990s. Nearly all of these plants would be large natural gas-fired, combined-cycle combustion turbine plants. Together, these plants would add approximately 3,000 MW of generating capacity. Of course, many if not most of these projects will never be built. Still, even one of the larger projects could reduce the need for the transmission project.

Regional Availability of Natural Gas — One issue is the availability of natural gas, and the ability of the region's natural gas system to deliver the gas to all of the existing and new natural gas-fired generators in the Puget Sound area. As generating capacity would be needed by BPA during the highest loads of a cold snap, this time period would almost certainly experience extremely high coincident demand for natural gas. Like electricity transmission, the natural gas delivery system has a fixed peak delivery capacity; once the limits of the system are reached, there is very little that can be done on short notice to

increase deliveries. BPA relies on gas-fired generators to operate to avoid a Puget Sound-area blackout during a cold snap. Whether generators would be able to obtain firm gas supplies with the incentive level BPA can offer might not be known until the implementation phase.

Existing Distributed Generation — In addition to the existing large generation discussed above, there are also small-scale distributed generators in the Puget Sound region. According to estimates, existing idle DG at local industrial sites, banks, hospitals etc., amounts to approximately 60 MW in the region. This translates to less than 20 MW available at Covington Substation after applying the appropriate load flow factors. This idle capacity could potentially be called upon by BPA during the target hours.

New Distributed Generation — Small-scale, distributed generation can often serve as a substitute for investment in transmission or distribution circuits. However, in this case, the potential overload is sufficiently large and the load area sufficiently diverse such that distributed generation does not appear to be an economically viable alternative.

Renewable Generation and Emerging Technologies — Renewable generation such as wind and solar were not considered for this study, because their resource characteristics are a poor match for BPA's needs to defer the project. Wind energy was excluded because the Puget Sound Area is not home to a commercial-grade wind resource. Solar was excluded because the critical hours occur during the winter months when solar radiation is scarce, and many of the target hours occur during the evening. Fuel cells do not suffer from these disadvantages, and were considered for the high-level screen. However, their extremely high cost makes them unattractive as a substitute for the project.

S.2.11 No Action Alternative

The No Action Alternative is often called the no-build alternative. The environmental impacts described for each of the alternatives described above would not occur. The No Action Alternative does not mean there would never be a need for future transmission projects, only that no line would be considered for construction in this general area in the near future.

S.2.12 Alternatives Considered but Eliminated from Detailed Study

A wide variety of alternatives was considered. The following were eliminated when they were judged to not meet the purpose and need:

- **Building an underground transmission line —** Excessively high costs (as much as 10 times more) of this option prevented its further consideration. BPA considers undergrounding a tool for limited, special situations.
- **Energy conservation —** While BPA- and utility-sponsored conservation programs in the region have helped to reduce power demand, the magnitude of savings that can be accomplished is too small to defer the need for the new transmission line.
- **Load curtailment plan —** BPA has a curtailment plan in place that calls for cuts to firm transmission customers in the Puget Sound area when system conditions (such as a potential overload) require. While this plan can reduce load temporarily to protect the system, it is not a reasonable long-term solution to the region's additional transmission needs.
- **Transmission line route variations —** Other transmission line routes, some proposed by the public during the environmental scoping process, were considered.
- **Flexible AC Transmission Systems (FACTS) —** BPA invests in technological improvements that boost transmission capacity whenever it is cost efficient. Known as Flexible AC Transmission Systems, these advances in power electronics enhance the controllability and usable capacity of alternating current (**AC**) transmission systems. The current problem in the Puget Sound area, however, is lack of surplus transmission capacity. If the existing line goes out of service during a cold weather event, existing transformers and the underlying low voltage (230-kV) system will be overloaded. While it is theoretically possible to reroute power flow through other transformers and lines in the area with one or more FACTS devices, this would be a temporary solution at best. There is little margin left in the system. Remaining capacity, if any, will run out shortly. At that point a new line would be needed.
- **Revise the Columbia River Treaty —** BPA does not have authority to unilaterally change the terms of the treaty.

S.3 Affected Environment

S.3.1 Land Use

Most of the project area lies within unincorporated King County. The easternmost one-third of Alternatives B and D runs through Kittitas County from the King County border near Snoqualmie Pass to Stampede Pass. A small portion of Alternatives A and C are in the vicinity of two small incorporated cities, Maple Valley and Covington. With the exception of land within those municipalities, local land use planning is under each county's jurisdiction.

Alternatives 1 through 4, B, and D primarily cross forested land that is managed for natural resource conservation (National Forests), watershed protection and/or timber production. For example, two-thirds of Alternatives B and D is located within the boundaries of the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. Alternatives 1 through 4 cross the Cedar River Municipal Watershed.

Other uses in the vicinity of some alternatives are rural residential development, urban areas, and mineral extraction (aggregate).

Only Alternative A crosses any incorporated land: 3.6 miles within the cities of Covington and Maple Valley.

S.3.2 Recreation

Many recreational resources are located in and around Alternatives A through D. By comparison, there are no recognized recreation sites within the project areas for Alternatives 1 through 4. Even informal, dispersed recreation is minimal around Alternatives 1 through 4 because public access is restricted in the CRW and on private timberlands traversed by these alternatives.

Alternative A crosses Elk Run Golf Course, a public course located on private land and land leased from King County. On land immediately under the ROW and existing line, Maple Valley plans an active recreation area, including ball fields, and bus barn development. Design has been completed and construction will begin soon. Plans include a perimeter trail that would connect to the Cedar River and planned Cedar to Green River Trails (Starbord, 2002).

As Alternative A turns north at Covington Substation, it passes through the city of Covington between Gas Line Right-of-Way Park, which is currently being developed, and the Soos Creek Park and Trail, which is planned to extend into Covington. North of Covington, Alternative A passes between Lake Youngs Watershed and Shadow Lake, then crosses through the Peterson Lake Natural Area and the Cedar River Trail, which connects Maple Valley and Renton along Highway 169 and the Cedar River.

Approximately 22 miles of Alternatives B and D (both Options D1 and D2) cross through National Forest land from the Yakima River east of Keechelus Lake to about midway between exits 38 and 42 on the I-90 corridor. The land allocations assigned to public land in this area show maintenance of recreational opportunities is a primary objective. Acquisition and exchange of land have occurred recently, but there are no plans to add to existing recreational facilities (Rogalski, 2002). Federal recreational resources of note in the vicinity include:

- Alpine Lakes Wilderness Area, located north of I-90 near Snoqualmie Pass, which is currently being analyzed for expansion.
- Pacific Crest Trail, which crosses the existing BPA ROW west of Surveyors Lake and east of the Iron Horse State Park Gate.
- Tinkham Campground, located between existing BPA ROW and I-90, east of exit 42.
- McClellen Butte Trail, with its trailhead at exit 42.
- The ski area at Snoqualmie Pass has ski trails and mountain bike trails that run underneath or adjacent to Alternatives B and D.

The remainder of the length of Alternatives B and D (approximately 14 miles) crosses a mix of public and private land. Though outside the National Forest, this length is located within the Mountains-to-Sound Greenway Trust and a mix of state, federal, and privately funded recreational resources has been established.

Recreational resources outside the National Forest boundary include the following:

- Iron Horse State Park and John Wayne Pioneer Trail, which parallel the I-90 corridor from Rattlesnake Lake through private lands to National Forest lands near Lake Keechelus and the Yakima River. Parts of this converted railroad line trail parallel the BPA ROW and the proposed alternatives cross the trail in four locations. It is managed cooperatively by the Forest Service and State.
- Ollalie State Park, located east of the Upper Twin Falls Trailhead.
- Upper and Lower Twin Falls Trailhead, Twin Falls Natural Area, and Twin Falls Trail, located east of exit 34 along the south side of I-90.
- Camp Waskowitz, with about 40 acres north of the South Fork along I-90 accessed off of 150th and approximately 330 acres south of the South Fork Snoqualmie River. A

portion of the 330 acres extends up to the existing line. Most of the property is used for hiking and outdoor educational sites. Outhouses and "infrequently used shelter houses" are located up along the existing line and some Christmas trees have been planted under the existing line.

- Snoqualmie Valley Trail, which extends from the John Wayne Pioneer Trail and Rattlesnake Lake recreation area down the Snoqualmie River Valley.
- Rattlesnake Mountain Scenic Area, Rattlesnake Mountain Trail, and Rattlesnake Lake Recreation Area. Rattlesnake Lake Recreation Area is more than 1.5 miles south of the existing BPA ROW on Cedar Falls Road off Exit 32. The existing BPA ROW runs along the east side, then passes through the northern end of the Rattlesnake Mountain Scenic Area approximately 0.75 mile south of Snoqualmie Point Trailhead where it crosses the Rattlesnake Mountain Trail.

West of the Rattlesnake Mountain Scenic Area, the existing BPA ROW turns southwest toward Echo Lake Substation after crossing the Rattlesnake Mountain Trail. Here it crosses Weyerhaeuser Real Estate Company land that has been identified for a planned trail connection between the Tiger Mountain State Forest and Rattlesnake Mountain Scenic Area (Konigsmark, 2002).

Alternative C passes just west of Ravensdale Park and along the east side of Big Bend along the Cedar River just north of Kent-Kangley Road. At its north end, this segment crosses Tiger Mountain State Forest.

S.3.3 Geology and Soils

The topography, geology, and soils of the project area are key factors affecting the susceptibility of different areas to erosion and sedimentation. Erosion and sedimentation can cause degradation of water quality and affect fisheries and other habitat.

Topography — The project areas can be subdivided into three ***physiographic*** provinces: a southern lowland area (Puget Lowlands) in Green Valley and a northern mountainous area, which includes Taylor Mountain, Brew Hill, Rattlesnake Mountain, and the intervening Raging River Valley (Rosengreen, 1965), and the foothills and peaks of the Cascade Mountains. Proportionally, Alternatives A and C encounter more lowland than the other alternatives. The project area for Alternatives B and D, by comparison, is predominantly mountainous.

➲ For Your Information

Glacial drift *— Sand, gravel, boulders, etc., moved and deposited by a glacier or by water arising from its melting ice.*

Lowland areas are underlain by ***glacial drift***; Alternatives B and D are dominated by volcanic rock.

Geology and Soils — The project area is along the western margin of the South Cascade Range, which are composed primarily of volcanic, volcaniclastic and associated sedimentary rocks that have folded and faulted over the years. Continental glaciers have contributed to the resulting surface deposits and landforms. Soils are typical of those found in the western Cascades of Washington, including soil deposited directly by streams and rivers, glaciers and glacial outwash streams; residual soils (an accumulation of rock debris and soil formed by weathering); colluvial soil transported downslope; and volcanic ash from nearby Cascade volcanoes that mixed with the other soil types.

Seismology — The project area is in a moderately active earthquake region that has been subjected to many quakes of low to moderate strength, and occasional strong shocks, during the Pacific Northwest's 170-year historical record. Recently, the area experienced a 6.8 earthquake centered near Olympia. The seismicity of the region results from the ongoing subduction of the Juan de Fuca Plate beneath the North American Plate along the Cascadia Subduction Zone.

S.3.4 Water Resources

Precipitation — Precipitation patterns in the project area are under the prevailing marine influence of the Pacific Ocean, which produces mild, wet falls and winters, relatively dry summers, and mild temperatures year round. Most of the precipitation falls as rain in the southern lowlands of the project area, while a mixture of rain and snow falls on the upper portions of the northern mountainous area. Annual precipitation in the project area averages between 40 and 60 inches in the Kent area along the western extension of Alternative A, to more than 180 inches at Stampede Pass at the east end of Alternatives B and D. In general, the annual precipitation amounts increase from west to east as elevation increases. There is a distinct wet season; over 75 percent of the total annual precipitation falls between October and April.

Floodplains — The **Federal Emergency Management Administration** (**FEMA**) has not mapped floodplains for the entire project area, usually doing so only in populated areas. However, FEMA has mapped the 100-year floodplain along the Cedar River a short distance downstream from the project area. Based on this mapping, it appears that the 100-year floodplain just west of the watershed is initially limited to a narrow area along the active Cedar River channel. Farther downstream, however, in the vicinity of Alternative A's northern route, the Cedar River flows into a broad valley where the floodplain averages 1,000 to 1,500 feet in width.

FEMA has also mapped the floodplain of the South Fork Snoqualmie River in the vicinity of North Bend. Here the floodplain is also generally confined to a narrow area along the active channel and appears to have the same geomorphic conditions upstream where Alternatives B and D cross the river twice. FEMA has not mapped the reach of the Yakima River Valley where Alternatives B and D cross the Yakima River. However, the valley is generally broad and flat in this area and several bog areas occur, tending to indicate periodic flooding. Flooding in the Yakima River is controlled to a certain degree by operation of the Keechelus Lake Reservoir, which is about four miles upstream of the proposed river crossing.

Remaining waterways in the project area, including the Raging River and its tributaries, and tributaries to the Cedar and South Fork Snoqualmie rivers, are in moderately incised channels. As such, these streams do not have significant floodplains and flooding generally would not rise above the incised channels.

➲ For Your Information

Sole source aquifer *- An aquifer designated by the Environmental Protection Agency which provides at least half of an area's drinking water.*

Groundwater — There are no ***sole-source aquifers*** designated or proposed by the Environmental Protection Agency (***EPA***) in the project area. However, there are numerous domestic and public supply wells and wellhead protection programs (City of Kent, City of Covington) located within the project area. The principal groundwater aquifers are in glacial outwash deposits in the southern lowland area. These aquifers are locally developed for domestic and some farm consumption in the communities of Selleck and Kangley. In the northern mountainous area, the community of Halmar Gates, near the end of Kerriston Road, likely uses groundwater for domestic consumption. Wells in this area would produce groundwater from the underlying bedrock. Potential aquifers in alluvium, outwash and ice contact drift deposits also exist between North Bend and Twin Falls Sate Park along the Snoqualmie River Valley.

Water in the Cedar River, which provides unfiltered drinking water to 1.3 million people, is also partially derived from groundwater sources. As such, contamination of the groundwater could impact the drinking water supplies. Activities in the Watershed that could affect the groundwater supply are strictly controlled.

Water Quality — The project area includes portions of the Cedar River Municipal Watershed, where water quality is very high. Both water quality and quantity are important components of the CRW's ability to provide a clean and reliable drinking water supply. The Cedar River is listed for fecal coliform at points two miles and 10 miles downstream (west) of the Alternatives A and C crossings, respectively. The upper Yakima River is listed as temperature-impaired at a point seven miles downstream from where Alternatives B and D cross it. Two segments of the South Fork Snoqualmie River are listed as pH-impaired at points 1,000 feet upstream from the Alternatives B and D western

crossing and 2,000 feet downstream from the Alternatives B and D eastern crossing.

S.3.5 Fisheries

Each of the transmission alternatives would cross some fish-bearing streams and an unknown number of non-fish-bearing streams.

The fish resources in the study area include resident and anadromous species. Resident species live their life cycles within the watershed. Anadromous species are hatched in freshwater, then spend part of their life at sea before returning to their home waters to spawn.

➲ For Your Information

Anadromous fish *— Chinook, coho and sockeye salmon and steelhead trout, which hatch in fresh water, spend part of their life at sea, and then migrate up rivers to their home waters to spawn.*

Along the route of some alternatives, surrounding trees and vegetation produce conditions well suited as ***anadromous*** fish-rearing habitat. Other streams support only resident fish. Shade produced by forest stands adjoining these fish-bearing streams are often a primary control on water temperature and fish habitat health.

S.3.5.1 Special-Status Fish Species

Special-status fish species include those that are listed, proposed, or candidates for listing as threatened or endangered under the federal ESA, or that are regarded as species of concern by the U. S. Fish and Wildlife Service (**USFWS**), or that are listed as species of concern (including endangered, threatened, sensitive and candidate categories) according to the Washington Department of Fish and Wildlife (**WDFW*).***

Federally Listed Species — All transmission alternatives could affect two species of fish listed as either threatened or endangered under the ESA: Puget Sound chinook salmon and Puget Sound bull trout. Alternatives B and D (Options D1 and D2) could affect two additional species of fish, Middle Columbia steelhead and Columbia River bull trout, listed as threatened under the ESA.

Federal Candidate Species — All transmission alternatives could affect one species of fish that is a candidate for listing under the ESA: the Puget Sound/Strait of Georgia ***ESU*** coho salmon. Although the National Marine Fisheries Service (**NMFS**), in its proposal, found listing to be "not warranted," the species has not been withdrawn from candidate status and may be listed in the future. Coho salmon are potentially present in streams crossed by each of the transmission alternatives.

➲ For Your Information

Evolutionarily Significant Unit (ESU) *— A salmon population or group of populations that are substantially reproductively isolated from other conspecific population units, and contributes substantially to ecological/genetic diversity of the biological species as a whole.*

Federal Species of Concern — The USFWS has identified the Pacific lamprey and river lamprey as species of concern potentially occurring in the project area. Both Pacific and river lamprey are potentially present in streams crossed by each of the transmission alternatives.

Essential Fish Habitat — All transmission alternatives could affect two fisheries protected by federal Essential Fish Habitat (**EFH**) provisions: the chinook salmon and coho salmon fisheries. All streams in the project area are included in designated EFH for these two fisheries. Some streams are included because they may support spawning, rearing and migratory use by chinook and coho salmon. Others are included because they are situated upstream of areas used by salmon, and the salmon are sensitive to water quality in these streams.

Washington State Special-Status Species — Chinook salmon, bull trout, and river lamprey are state candidates for listing by the WDFW.

National Forest Plan Fish Protection Strategies — The U.S. Forest Service (**USFS)** manages two National Forests in the project area, the Mt. Baker-Snoqualmie National Forest and the Okanogan-Wenatchee National Forest. USFS also manages lands on the fringes of these two national forests within the project area. In 1993, USFS and the Bureau of Land Management (**BLM**) developed the Northwest Forest Plan to set guidelines for the management of the natural environment in Pacific Region National Forests. The goals of the Northwest Forest Plan are designed to protect forest ecosystems and allow renewable use of forest material, but they also include protection for riparian areas and waters. As part of the plan, the Aquatic Conservation Strategy (**ACS**) was developed. This strategy protects salmon and steelhead habitat on federal lands managed by USFS and BLM. The Northwest Forest Plan Standards and Guidelines define the process by which proposed projects are determined to be in compliance with the ACS objectives (**ACSO**s). If either Alternative B or D (Options D1 or D2) is chosen as the preferred alternative, USFS-managed lands would be involved, and the appropriate level of analysis for ascertaining impacts to ACSOs would need to be completed.

S.3.6 Wildlife

Analysis of wildlife focused on species that are: species federally-listed as threatened or endangered; federal species of concern; USFS "***Survey and Manage" species***, sensitive and proposed sensitive species, ***Management Indicator Species (*MIS*)***, and species of interest; and Washington State-listed threatened, endangered, sensitive or ***monitor species.*** Species found in the project area include:

Forest Community Dependent Species — A number of forest community species, including invertebrates, were identified as potentially occurring within (*e.g.,* nesting in, foraging in, or traveling through) the project area. These include northern spotted owls, great gray owls, marbled murrelet, black-backed woodpecker, northern

goshawks, merlins, pileated woodpeckers, Vaux's swifts, band-tailed pigeons, blue grouse, fisher, six species of bats, and seven species of terrestrial mollusks.

Riparian Community Dependent Species — Seven riparian community species were identified as potentially occurring within the project vicinity. They include: bald eagle, great blue herons, osprey, willow flycatchers, harlequin ducks, Aleutian Canada goose, mink and Van Dyke's salamanders.

Aquatic Community Dependent Species — Seven aquatic community species were identified as potentially occurring within the project vicinity. These include: the Cascades frog, northern red-legged frog, Cascade torrent salamander, Oregon spotted frog, tailed frog, western toad and Fender's soliperlan stonefly.

Species Dependent on Unique Habitats — Two wildlife species, the Larch Mountain salamander, and the peregrine falcon were identified as potentially occurring within the project vicinity and having a primary association with unique habitat types.

Early Regeneration Community Dependent Species — Three wildlife species preferring young forest surroundings were identified as potentially occurring within the project vicinity: elk, black-tailed deer, western bluebirds, and four species of butterfly.

S.3.7 Vegetation

Vegetation communities found in the vicinity of the transmission line alternatives vary considerably in their general characteristics and species composition. The project area for Alternatives 1 through 4 is almost entirely within forests that have been maintained in timber production for most of the last 150 years. Located further west, Alternative A is generally characterized by highly disturbed, intensely managed vegetation communities typically found in cleared and maintained transmission line corridors and surrounding residential and commercial development. Alternative B is also a highly disturbed, intensely managed transmission line corridor; however, the area immediately adjacent to the corridor is relatively undisturbed and infrequently managed. Alternative C (Options C1 and C2) is typified by moderately disturbed managed vegetation communities typical of rural and suburban development. Alternative D (Options D1 and D2) generally contains vegetation communities with low-to-moderate disturbance and low management intensity.

Vegetation cover types were determined by the type of dominant plants (*e.g.*, tree, grass, shrub), the species of dominant plants (e.g., Douglas fir, alder, and maple), and the regeneration stage of a given forested stand. For Alternatives 1 through 4, vegetation cover types in the CRW HCP database were reviewed and consolidated into 12

categories. The vegetation along Alternative A is dominated by rural-residential and suburban development cover types, and by the managed shrubland communities typical of existing transmission line corridors. For Alternatives B and D (Options D1 and D2), analyses of existing vegetation communities were based on USFS stand data, resulting in six additional categories for mature forests and managed rural-residential areas. The vegetation for Alternative C, particularly Option C1, presents an intermediate condition between development-dominated Alternative A and the forest dominated Alternatives 1 and D (Options D1 and D2). The rural residential managed cover type is most prevalent of any cover type along Option C2.

The **Proposed Action** (Alternative 1) **—** is dominated by coniferous forest stands in the mature coniferous regeneration cover type. The north leg of the Proposed Action tends to be mixed coniferous-deciduous forest. The south leg of the Proposed Action has more conifer-dominated stands. A thin riparian strip along the Raging River contains several large old conifers, including Douglas fir and western red cedar trees over 35 inches diameter breast height (dbh).

Alternative 2 — is dominated by coniferous forest stands in the mature coniferous regeneration cover type. The extreme southern end of Alternative 2 passes through a young Douglas fir plantation. Alternative 2 also passes through young Douglas fir plantations just southeast of the point where it joins Segment D along the existing transmission line ROW (see Map 8 for segments on Alternatives 1-4).

As with the Proposed Action, the portion of Alternative 2 that follows Segment D tends to have more mixed forest to the west and more conifers to the east. This alternative crosses a thin stand of older Douglas fir and western red cedar at the Raging River.

Alternative 3 — generally passes through older, more mature coniferous regeneration and mid-regeneration coniferous stands, and less non-forested area. There are no mature deciduous stands. The project area of Alternative 3 includes approximately six acres of wetlands and numerous cover types in the lakes/rivers/streams category.

At least two older, mature Douglas fir stands were found during field studies for Alternative 3. These were off Pole Line Road near Taylor Creek and along Binus Creek Road. Trees in these stands were over 32 inches dbh and averaged 160 feet in height. Increment cores from these trees showed these stands to be over 70 years old.

Alternative 4A — is dominated by mature coniferous regeneration cover type. This alternative also crosses the same young Douglas fir plantation that is crossed at the south end of Alternative 2. Most of the younger stands within the project area were found along Segment D,

toward the north end of the alternative. The areas north of Selleck and Pole Line Road, where Alternative 4A crosses from Segment E to Segment C, are dominated by mature coniferous regeneration stands.

Alternative 4B — is dominated by mature coniferous regeneration forest cover type. It is similar to Alternative 4A in that it begins in a young, Douglas fir plantation, then passes through older coniferous areas before joining Segment D. From there, stand age tends to drop and cover type becomes more mixed forest.

Alternative A — is dominated by rural-residential and suburban development cover types, and by the managed shrubland communities typical of existing transmission line corridors. Over 40 percent of Alternative A's study area is in developed or rural-residential cover types. Less than a quarter of the area is in conifer-dominated forest. Of the coniferous forest present, most is less than 35 years old, and conifers up to 75 years old dominate only 4 percent of the total study area. While remnant older trees are likely present in the Alternative A area, no stands were identified that are dominated by trees older than 75 years.

Alternative B — lies within the existing transmission line corridor that extends westward from Stampede Pass to Echo Lake Substation. In the eastern two-thirds of Alternative B, vegetation communities adjacent to the existing corridor are dominated by coniferous forest stands. Most of these are mature stands, especially near the eastern end of Alternative B.

Within the portion of Alternative B cleared for operation and maintenance of the transmission line, vegetative cover types are dominated by managed shrublands and patches of managed early regeneration coniferous stands. Most of the young regenerating conifers are Douglas fir. In higher elevations (generally above 3,500 feet), Pacific silver fir seedlings that have volunteered from adjacent mature stands are also present. Since no transmission line is currently hung from the south side of the tower arms, the need to keep that side of the corridor cleared has not been as great as on the north side of the ROW. As a result, most of the young coniferous regeneration stands in the ROW are found along the southern edge of the transmission line corridor.

Alternative C (Option C1) **—** presents an intermediate condition between the development-dominated Alternative A and the other forest-dominated alternatives. Total developed and rural residential area is under 25 percent, and forested communities of any kind account for approximately two-thirds of the project area. However, as with Alternative A, conifer-dominated communities within the

Option C1 area are primarily young stands under 35 years old. Mid-regeneration coniferous stands (20 to 35 years old), mid-regeneration mixed stands (10 to 30 years old), and early regeneration coniferous stands (less than 20 years old) account for 31 percent of the study area. Rural residential managed landscape has the highest percentage cover of any type.

Alternative C (Option C2) **—** shares the northern portion of the Option C1 alignment and so has similar percentages of cover types: total developed and rural-residential areas account for 25 percent; forested communities of any kind cover about two-thirds of the project area; and rural residential managed landscape has the highest percent cover of any type. Conifer-dominated communities are primarily young stands under 35 years old. Mid-regeneration coniferous and mixed stands, and early regeneration coniferous stands account for 34 percent of the study area.

Alternative D (both Options D1 and D2) **—** passes through National Forest land managed by the Okanogan-Wenatchee and Mt. Baker-Snoqualmie National Forests from Stampede Pass heading west toward North Bend. Vegetation within the area of this alternative is 86 percent forested, with 61 percent of the area in coniferous forest. Options D1 and D2 contain the oldest and largest conifer stands of all the alternatives. Almost 18 percent of the conifer stands are in the range of 75 to 250 years in age, and another 18 percent are approaching 75 years old. Development and rural residential areas account for less than 6 percent of the study area.

The area around Echo Lake Substation is grass/forb/shrub, with small mixed coniferous-deciduous stands. The perimeter area to about 100 feet around the substation is surrounded by gravel and non-native grasses.

The area around Echo Lake Substation is grass/forb/shrub, with small mixed coniferous-deciduous stands. The perimeter area to about 100 feet around the substation is surrounded by gravel and non-native grasses.

S.3.8 Wetlands

Wetlands perform many important functions, including flood storage and flood flow moderation, filtering pollutants and sediments before they enter streams, and providing foraging, breeding, cover, and rearing habitat for many wildlife species.

A total of 90 wetlands were identified within the ROWs of the transmission alternatives. Wetland vegetation classes include palustrine emergent, scrub-shrub, open water, riverine, unconsolidated bottom and forested wetlands as defined by Cowardin et al. (1979).

➲ For Your Information

Depressional areas *— Wetland areas that receive water from overland runoff and precipitation.*

Commonly these wetlands are associated with ***depressional areas*** that receive water from overland runoff and precipitation. They are generally greater than 1 acre and include a mosaic of wetland and upland areas following small variations in topography. Several wetlands were also found to be associated with the riparian area of ***low-gradient*** streams. Wetlands east of Snoqualmie Pass are generally associated with riparian fringes and floodplains of streams. Hydrology of these wetlands depends on stream flows and flooding. Just west of Snoqualmie Pass, wetlands are predominantly located on sloped areas and were fed by groundwater discharge seeps.

Wetland buffers inside the Cedar River Watershed, private timberlands and National Forests are generally intact and dominated by a mix of shrubs and young forest. Wetland buffers within existing power line ROWS have been cut to allow conductor span, and generally have low shrub and herbaceous cover. Wetland buffers in the more urban areas (Alternatives A and C [Options C1 and C2]) typically consist of grasses, shrubs, or trees.

Common dominant wetland plant species include red alder, western hemlock, willow, salmonberry, Douglas' spiraea, soft rush, creeping buttercup, skunk cabbage, piggy-back plant, and slough sedge.

S.3.9 Visual Resources

The visual project area includes numerous landscape types, including the Cedar River Municipal Watershed, private timberlands, National Forest land, rural residential uses and pastureland in unincorporated communities, and some limited higher density uses in incorporated areas.

S.3.10 Socioeconomics

The project area is located within rural areas of King and Kittitas counties and the incorporated cities of Covington and Maple Valley. Other cities near the project area are North Bend, Snoqualmie and Black Diamond. The routes of most alternatives pass predominantly through forested areas with little population, although there are varying degrees of rural residential and/or denser residential use along each route.

King County is the most populated county in Washington. King County and the state have both experienced substantial increases in their populations since 1960, with growth rates exceeding the national average. Although population growth experienced by King County has been rapid, the state as a whole has been growing at an even faster rate. The average annual covered wage in King County of $47,000 was above the state average annual covered wage of $37,000 in 1999, the

latest information available. Average annual covered wage in Kittitas County was $22,400, significantly lower than the state annual coverage wage. Household income in the incorporated communities near the project alternatives had fewer households below the poverty level than did King and Kittitas counties as a whole. Eight percent of King County residents and almost 20 percent if Kittitas County residents fell below the poverty level in 1999, the latest information available. This compares to 6.5 percent in North Bend, 4 percent in Covington, and 1.7 percent in Maple Valley.

The ethnicity of the project vicinity is predominantly Caucasian and the remainder primarily African-American, American Indian, Pacific Islander, and Asian. King County as a whole has a higher minority population (greater than 20 percent) than does Kittitas County (11 percent). The project vicinities all have lower percentages of minorities than their respective counties.

The main economic activities in King County are manufacturing, shipping and trade, agriculture, business services, shipbuilding, fishing, wood products, and tourism. Total employment in King County has grown gradually over the past six years. King County has consistently had lower rates of unemployment than the statewide average during the last decade. Employment in King County is nearly one-third in services, slightly higher than the distribution of employment for the state of Washington as a whole, with nearly 28 percent of all jobs in the state attributable to the services sector. This sector is dominated by the business services industry, which accounts for nearly one-third of King County's services sector jobs. Government employment is the dominant sector in Kittitas County.

S.3.11 Cultural Resources

The project area is rich in cultural history. Portions of the project area have been and continue to be used traditionally by members of many Indian tribes. Members have used the area for camping, fishing, hunting, gathering berries, trading with other tribes and as a traveling route. BPA has asked potentially affected tribes to identify tribal concerns about potential ***traditional cultural properties*** (**TCP**s) (locations that may not contain physical remains, but hold heritage importance for their association with cultural traditions) within the project area. The corridors for Alternatives B and D, for example, contain previously identified TCPs near Rattlesnake Mountain and in the Snoqualmie River drainage. Another traditional cultural use site, Lookout Mountain, occurs within the Cedar River Watershed, but is more than one mile from any of the alternatives (SPU 1999:3.6-4).

Other existing cultural resource sites, prehistoric and historic, described in various records and literature were researched. No

➲ For Your Information

Traditional Cultural Properties
A traditional cultural property is defined generally as one that is eligible for inclusion in the National Register of Historic Places because of its association with cultural practices or beliefs (e.g., traditions, beliefs, practices, lifeways, arts, crafts, and social institutions) of a living community that are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community.

registered historic sites – structures or districts – are located within a quarter mile of the proposed ROW for each alternative, although three are located within one mile of one or more of the alternatives. The Selleck National Historic District, for example, is the closest cultural resource site and is separated from Alternative 2 by a road and more than 700 feet.

Of the cultural resources identified through archival and map research, only the former Barneston townsite (including Hemlock and the related Japanese settlement) and the Pedro Felise cabin (no longer standing) occur on or within the 150-foot right-of-way of BPA's proposed alternative routes. The probability for encountering prehistoric cultural resources along any of the four action alternatives varies by landform and increases along the Cedar River.

There is a high probability of encountering historic-period cultural resources in the project area, such as remnants of historic-period logging activities. Many historic-period cultural resources have been identified in archival sources and maps, although few have been formally inventoried or even verified on the ground by cultural resource professionals.

S.3.12 Noise, Public Health and Safety

S.3.12.1 Transmission-line Noise

Audible noise — usually characterized as a hissing, crackling sound sometimes accompanied by a hum — can be produced by transmission lines. Usually this happens during foul weather which, based on meteorologic records near the route of the proposed transmission line, is expected to occur less than 9 percent of the time.

Along the alternative routes of the proposed 500-kV transmission line, existing noise levels depend on land use and on whether there is an existing transmission line. Background noise levels in remote areas depend on ambient conditions: wind, rain, traffic or other human activity nearby. For example, levels associated with rain on foliage will be up to 50 dBA. During foul weather, median levels of audible noise from an existing 500-kV line at the ROW edge would be about the same (50 dBA).

BPA design criterion for median levels of audible noise during foul weather is 50 $\pm$2 dBA at the edge of the right-of-way. 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 p.m. to 7 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 has encouraged BPA to design lines with lower audible noise levels (WDOE, 1981).

King County additionally defines a rural area where the maximum sound arising from an industrial area (say, a transmission line) is limited to 57 dBA, with a reduction to 47 dBA during nighttime hours and on weekends and holidays.

S.3.12.2 Electric and Magnetic Fields (EMF)

Transmission lines, like all electrical devices and equipment, produce EMF. While electric-field strength tends to be constant, magnetic-field strength can vary depending on the design of and distance from the line, the amount of electrical load on the line, and even meteorological factors. In all cases, field strength decreases rapidly with distance.

There are no national standards for EMF from power facilities such as transmission lines. Washington does not have a standard. BPA has an electric field standard of 9kV/m maximum on the ROW and 5kV/m at the edge of the ROW, which it applies to all transmission lines, including those already existing in the study area.

S.3.12.3 Toxic and Hazardous Substances

Because a transmission line and substations already exist in the project area, routine maintenance procedures for such facilities are already occurring. These generate minimal amounts of hazardous waste. BPA uses herbicides sparingly when managing vegetation in rights-of-way. All herbicides used by BPA must be approved by the EPA and must also go through a BPA environmental review process. Only trained crew members are allowed to apply herbicides, and they are required by law to follow label directions. BPA does not use herbicides in the Cedar River Watershed.

S.3.12.4 Fire

The City of Seattle permits fire suppression activities in the Cedar River Watershed and requires that activities in the Watershed follow strict fire control regulations. This policy is consistent with safe and reliable operation of the existing transmission lines.

The USFS and Weyerhaeuser require that vehicles traveling and working on their land carry fire suppression tools during the fire season. All BPA vehicles used for maintenance of transmission lines are equipped with such tools.

Fires on or near the ROW can jeopardize safe and reliable operation of transmission lines. Besides physical damage from heat and flames, smoke and hot gases from a fire can cause arcing between lines,

between lines and a tower, or between lines and the ground. Such occurrences can pose a threat to the safety of personnel in the vicinity, such as firefighters, and can result in line outages.

To prevent fires and other hazards, safe clearances are maintained between the tops of trees and the existing lines in the corridors. Electricity can arc from the conductor to a tree top. Generally, trees are not allowed to grow over 20 feet high on the ROW. Trees that need to be cleared from the ROW or that could cause such an arc are removed. BPA also prohibits storage of flammable materials on its ROWs.

➲ For Your Information

Corona *— Corona occurs in regions of high electric field strength on conductors, insulators, and hardware when sufficient energy is imparted to charged particles to cause ionization (molecular breakdown) of the air.*

S.3.12.5 Radio/TV Interference

Corona on transmission-line conductors can generate electromagnetic noise in the frequency bands used for radio and television signals. The noise can cause radio and television interference (***RI*** and ***TVI***). However, correct design of a line can mitigate corona generation and keep radio and television interference at acceptable levels.

S.3.13 Air Quality

King County, inclusive of the project area, is designated as a marginal ozone maintenance area, a moderate carbon monoxide maintenance area, and a moderate particulate matter maintenance area. A maintenance area designation means that King County is not currently but was previously listed as a non-attainment area for these three pollutants but had not exceeded the National Ambient Air Quality Standard (**NAAQS**) for the three years prior to its designation as a maintenance area. Alternatives B and D cross over the Cascade Mountains and would be located in Kittitas County as well as King County. Kittitas County is an attainment area; the NAAQS are met for all criteria pollutants in Kittitas County.

S.4 Impacts

To analyze potential impacts from construction, operation and maintenance of the alternatives, resource specialists analyzed actions using a scale with four impact levels: **high, moderate, low** and **no** impact. The impact discussion also lists ***mitigation*** that could reduce impacts and cumulative impacts of the alternatives.

S.4.1 Land Use Impacts

The **Proposed Action —** would cross each of the main land uses in the area: forest production, watershed protection, and rural residential. The majority of land crossed would be forestland, where

impacts would be low. It would parallel the ROW of the existing transmission line, converting only negligible amounts of forestland to utility use. It would require 2.9 miles. However, where it would traverse the communities of Kangley and Selleck, it would displace two residences and a small barn and prevent the development of one lot of a proposed four-lot subdivision. Land-use impact: **moderate**.

Alternative 2 — would cross forestland and, because it shares most of its route with the Proposed Action (paralleling an existing line), would convert only negligible amounts of forestland to utility use. It would require 2.7 miles of new access roads. Land-use impact: **low**.

Alternative 3 — would require clearing a separate new ROW, but would cross only forestland, converting negligible amounts to utility use. It would come within 650 feet of two residences on its north end, but placement of the line in the eastern portion of the corridor could minimize this impact. It would require 6.4 miles of new access roads. Land-use impact: **low**.

Alternative 4A — would cross only forestland and, because it shares most of its route with the Proposed Action (paralleling an existing line), would convert only negligible amounts of forestland to utility use. It would require 2.7 miles of new access roads. Land-use impact: **low**.

Alternative 4B — would cross only forestland and, because it shares most of its route with the Proposed Action (paralleling an existing line), would convert only negligible amounts of forestland to utility use. It would require 2.2 miles of new access roads. Land-use impact: **low**.

Alternative A — Location of the transmission line outside existing BPA-owned land around Covington Substation would affect as many as 25 homes and two tax lots in the subdivision located at the corner of SE Wax Road and Covington Way. Alternative A would require 6.6 miles of new access roads. Alternative A would be considered to have a **high** land use impact.

By comparison, Option A1 would displace up to three homes located on private property just east of the substation. It may also occupy an area where BPA was planning to construct a new large maintenance headquarters building. Land-use impact: **moderate**.

Alternative B — would require rebuilding the existing transmission facility within existing ROW, allowing less ground disturbance and vegetation clearing than construction in new ROW. This alternative crosses predominantly land zoned for forest use and some limited rural residential land and would not displace any dwellings. Alternative B requires 2 miles of new access roads. Alternative B would be considered to have **low** land use impact.

Alternative C, Option C1 — the north-south segment of Alternative C, which is common to both Options C1 and C2, would

require clearing of new ROW. It runs almost entirely through rural residential land and would displace between 23 and 28 dwellings. The rest of Option C1, also requiring newly-cleared ROW, runs across more rural residential and some forestland. This option could displace an additional seven dwellings (total of 30 to 35 homes for this option). Option C1 would require 8.7 miles of new access roads. Overall, Option C1 would have a **high** land use impact. In all, the 10.1-mile length of Option C1 could cross 128 tax lots, at least 54 of which are developed.

Alternative C, Option C2 — Option C2 does not displace any additional homes beyond the 23-28 displaced along the north-south portion. Along its 10.6-mile length, it would cross mainly rural residential land (including 134 tax lots, of which 56 are developed), but also some forestland zoned for mineral extraction. It would require 8 miles of new access roads. Option C2 would have a **high** land use impact.

Alternative D, Option D1 — Option D1 would require acquisition of additional ROW across land predominantly zoned forest, but also some rural residential areas. Clearing of these new ROWS would conflict with National Forest land management goals outlined for the area by the Northwest Forest Plan and Snoqualmie Pass Adaptive Management Area Plan. Specifically, clearing of vegetation would not meet the intent of managing for late-successional habitat and maintenance of connectivity emphasis areas on National Forest lands. Aquatic conservation strategy objectives are also not likely to be met. In addition, Option D1 would displace between 11 and 14 homes and possibly prevent development on up to five additional unused tax lots as a result of easement expansion south of the existing line. Along its 35.6-mile length, this alternative would cross more than 134 tax lots, at least 32 of which are developed. Clearing of danger trees would impact tax lots adjacent to the new ROW. Additional land use concerns along this option include potential impacts to existing cabins and lots at Roaring Creek, a development west of Lake Keechelus. The new line would also directly conflict with the new North Bend Gravel Mine that is proposed by Cadman on Weyerhaeuser land east of North Bend. Option D1 would require 13.6 miles of new access roads. This option would likely have a **high** land use impact.

Option D2 — land use impacts related to Option D2 would be similar to Option D1, although less new ROW would be required since a portion of the ROW already has sufficient width to accommodate an additional transmission line near the ski areas at Snoqualmie Pass. It would cross a minimum of 121 tax lots, at least 22 of which are developed. Clearing of danger trees would impact tax lots adjacent to the new ROW. Option D2 would displace about eight homes. It requires 13.2 miles of new access roads. It would have a **high** land use impact.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on land use.

S.4.2 Transportation Impacts

Most alternatives: **No** impact. Because of tower locations and height clearances for lines spanning roadways, none of the alternatives would restrict future expansion or acquisition of public road or railway ROW. Alternative A, however, would have a **low** impact on the urbanized area of Covington as a result of converting a portion of easement (now covered by paved ingress and egress routes in the Covington Square Shopping Center area) to transmission line use.

S.4.3 Recreation Impacts

The **Proposed Action** and **Alternatives 2, 4B, A, B, C and D2 —** would have **no** to low impact on recreation. Option D1 would have a moderate experiential impact because it crosses several recreation areas.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on recreation.

S.4.4 Geology and Soils

The **Proposed Action, Alternatives 2, 4A, 4B, B, and C —** would have a **low** impact. Alternatives 3, A and D would have moderate to high impacts because they cross soils with more potential for erosion.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would

be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on soils.

S.4.5 Floodplains

All alternatives — **No** to **low** impact. No towers or roads would be built in designated floodplains. Construction activities above stream channels could cause more peak runoff, but only in the short term.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on floodplains.

S.4.6 Water Quality — Streams

Most **transmission alternatives,** except Alternatives 3, B and D would have **low** impacts to streams.

Alternative 3, B and D — would have **low** to **moderate** impacts because of the erosion potential of soil crossed and vegetation removal.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on stream water quality.

S.4.7 Water Quality — Groundwater

Most **transmission alternatives,** except Alternatives 3, B and D would have **low** impacts to water quality.

Alternative 3, B and D — would have **low** to **high** impacts because of the erosion potential of soil crossed and vegetation removal, and presence of well-head protection programs.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on groundwater quality.

S.4.8 Fisheries

All **transmission alternatives,** except Alternatives B and D**: low** to **moderate** impact with extensive mitigation. Construction of any line would necessitate careful steps to lessen potential impacts on fish. BPA would ensure that all actions potentially affecting fish habitat — riparian vegetation removal, road construction, culvert installation, bedrock blasting and other soil disturbances — would meet or exceed applicable regulations.

Alternatives B and D — would have **low** to **high** impacts. Impacts would be created by more clearing of riparian vegetation and erosion potential on upland areas.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on fisheries.

S.4.9 Wildlife

All **transmission alternatives,** except Alternatives B and D: **low** to **moderate** impacts from vegetation and tree clearing in ROWs, with extensive mitigation to preclude greater impacts. Impacts on specific species are:

- threatened/endangered/sensitive species — **moderate**. Any reduction in habitat for these species, however small, is considered to have relatively greater impact than reduction in habitat for non-threatened species.
- forest species — **low**. The relative amount of forest habitat that would be cleared is small and this habitat type is common in the project area.

- riparian species — **low** to **moderate**. As above, the relative amount of riparian habitat impacted would be small, but vegetation removal could result in a loss of productivity in adjacent aquatic habitat as well.
- aquatic species — **moderate**. Line construction could reduce the quantity and quality of both wetland and stream habitat.
- unique habitat species — **low**. Few if any of these species are likely present in the project area.
- early regeneration species — **no** to **low**. Construction would actually increase habitat for these species, particularly elk and deer, although the increase in foraging habitat would not appreciably benefit western bluebirds.

Alternatives B and D — would have **low** to **high** impacts. Clearing on National Forest lands would have a high impact on several sensitive Survey and Manage species.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on wildlife.

S.4.10 Vegetation

The **Proposed Action** would disturb 152 acres of vegetation. ROW clearing and soil compaction and movement in forested areas would create most impacts, which vary depending on vegetation type. The impact on individual vegetation communities would be **low**. The impact on coniferous forested communities would be **moderate**. A potentially high impact from noxious weed colonization in disturbed areas could be mitigated to have a **low** impact. Overall vegetation impact: **low** to **high**.

Alternative 2 would disturb 155 acres. Impact is the same as the Proposed Action.

Alternative 3 would disturb 187 acres. Impact is the same as the Proposed Action.

Alternatives 4A would disturb 164 acres. Impact is the same as the Proposed Action.

Alternative 4B would disturb 175 acres. Impact is the same as the Proposed Action.

Alternative A would disturb 397 acres. Impact is the same as the Proposed Action, except low impact on coniferous forest.

Alternative B would disturb 250 acres. Impact is the same as the Proposed Action.

Alternative C (Option C1) would disturb 195 acres. Impact is the same as the Proposed Action.

Alternative C (Option C2) would disturb 206 acres. Impact is the same as the Proposed Action, except low impact on coniferous forest.

Alternative D (Option D1**)** would disturb 769 acres. Impact is the highest of the alternatives.

Alternative D (Option D2**)** would disturb 776 acres. Impact is the highest of the alternatives.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on vegetation.

S.4.11 Wetlands

The **Proposed Action** would affect 14 acres of wetlands. Impacts vary depending on wetland type. The impact on forested wetlands due to ROW clearing would be **high**. The impact on scrub-shrub and open water wetlands would be **none** to **moderate**. Impacts on wetland water quality and wildlife would be **low**. Overall wetlands impact: **low** to **high**.

Alternative 2 would also affect 14 acres of wetlands. Impact is the same as the Proposed Action.

Alternative 3 would affect 6 acres of wetlands. Impact is the same as the Proposed Action.

Alternatives 4A would affect 14 acres of wetlands. Impact is the same as the Proposed Action.

Alternative 4B would affect 15 acres of wetlands. Impact is the same as the Proposed Action.

Alternative A would affect 17 acres. **No** impact on forested wetlands; **moderate** impact on scrub-shrub and open water wetlands, although mitigation could offset this.

Alternative B would affect 27 acres. **No** impact on forested wetlands; **moderate** impact on scrub-shrub and emergent wetlands, which could be offset with mitigation.

Alternative C (Option C1) would affect 10 acres. Impact is the same as Alternative B.

Alternative C (Option C2) would affect 8 acres. Impact is the same as Alternative B.

Alternative D (Option D1) would affect 18 acres. **High** impact on forested wetlands; **no** impact on scrub-shrub and emergent wetlands.

Alternative D (Option D2) would affect 16.5 acres. **No** to **high** impact. Same as Option D1.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on wetlands.

S.4.12 Visual Resources

The **Proposed Action** — **Moderate** to **high** impact on some Kangley area residents for whom the transmission lines would be dominant visual features. **Low** impact on occasional recreationalist, visitors, or employees in CRW. **Low** to **moderate** impacts on views from cars or aircraft in near vicinity.

Alternative 2 — **Moderate** impact on some Selleck residents. **Low** impact on occasional recreationalist visitors, or employees in CRW. **Low** impacts on local motorists' or aircraft views.

Alternative 3 — **Low** to **moderate impact** on some Kerriston Road residents. **No** to **low** impact on occasional recreationalist visitors, or employees in CRW. **No** to **low** impacts on local motorists' or aircraft views.

Alternatives 4A and **4B** — would have the same impact as Alternative 2. Overall visual resources, **low** to **moderate** impact.

Alternative A — **Moderate** to **high** impact on residents in and around Maple Valley and Covington, for whom taller towers would be dominant visual features. **Moderate** impacts on local recreationalists and motorists; **low** impact on aircraft views.

Alternative B — **Moderate** impact on limited number of residents along route due to slightly taller towers. **Moderate** impact on recreationalists at nearby ski/ wilderness areas and motorists on I-90. **Low** impact on aircraft views.

Alternative C (Option C1) — **Moderate** to **high** impact on some Ravensdale, Hobart and Landsburg/South Hobart residents, for whom new towers would be dominant visual features. **High** impacts on recreationalists along Cedar River and Tiger Mountain trails and on local motorists. **Low** impact on aircraft views.

Alternative C (Option C2) — **Moderate** to **high** impact on Hobart area (including Landsburg/South Hobart) residents, for whom new towers would be dominant visual features. **High** impact on recreationalists along Cedar River and Tiger Mountain trails. **Moderate** to **high** impact on local motorists. **Low** impact on aircraft views.

Alternative D (Option D1) — **Moderate** to **high** impact on residents near Twin Falls State Park, in the Edgewick area, and along Upper Yakima River, due to second set of towers. **Moderate** to **high** impacts on recreationalists at nearby ski/wilderness areas and on motorists on I-90 and local roads near North Bend and Twins Falls State Park. **Low** impact on aircraft views.

Alternative D (Option D2) — **Low** to **high impacts.** Same as Option D2.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on visual resources.

S.4.13 Socioeconomics

All construction alternatives would have **no** to **low** impacts on the project area's socioeconomic features. There would be no impact on local lodging, employment, population or business access. Impacts would be low from minor increases in local spending by project workers and removal of a small amount of timberland from production. The

project is expected to have marginal impact on overall community values.

Alternatives A and C — **No** to **moderate** impact. Same as Proposed Action except for **low** to **moderate** impact on community values due to number of displaced homes and **no** impact on timber resources.

Non-Transmission Alternative — **Low** to **high** impact to area employment. If increased capacity were needed, it is unlikely the line could be built in time to avoid outages.

No Action Alternative — **High** impact due to the potential for transmission system collapse, brownouts and blackouts affecting not only the immediate Northwest, but regions to the south and north. Commerce and industry would be adversely affected as the quality and reliability of power decreased. Some businesses and their employees could decide to relocate to an area where the power supply is more reliable. Loss of businesses and an unstable power supply could influence whether some people move to the area.

S.4.14 Cultural Resources

The **Proposed Action** would not cross any inventoried or identified cultural resource sites. The potential for unknown sites is minimal due to steep terrain along the route. Cultural resources impact: **low**.

Alternative 2 would cross the western proposed site boundary of the Japanese Camp at Barneston townsite. It would also pass within one-half mile of the Selleck National Historic District. Cultural resources impact: **moderate**.

Alternative 3 would pass near flat land on which historic-period cultural resources are identified on archival maps. Cultural resources impact: **moderate**.

Alternatives 4A and **4B** would have low impacts along most of their routes (the portion shared with the Proposed Action). However, they would have moderate impacts where they would cross a highly sensitive landform north of the Selleck National Historic District. Overall cultural resources impact: **low** to **moderate**.

Alternative A has an estimated **moderate** to **high** impact. Two-thirds of route crosses relatively flat ground with high potential for culturally sensitive areas, both historic and prehistoric, particularly in Cedar River Valley.

Alternative B has an estimated **low** to **moderate** impact. Nearly half of route crosses steep terrain with little potential for culturally sensitive sites or resources. Further surveys would be necessary to confirm.

Alternative C (Option C1) has an estimated **moderate** to **high** impact. Has highest potential among alternatives for encountering cultural sites. Crosses flat land through Cedar River valley with potential prehistoric resources and crosses developed areas with potential historic-period resources.

Alternative C (Option C2) has an estimated **moderate** to **high** impact. Same as Alternative C1.

Alternative D (Option D1**)** has an estimated **moderate** impact. Substantially higher level of ground disturbance and vegetation clearing increase the risk of impacting cultural resources. Further surveys would be necessary to confirm.

Alternative D (Option D2**)** has an estimated **low** impact. Same as Alternative B.

The **Non-Transmission Alternative** and the **No Action Alternative** would have **no** impact on cultural resources.

S.4.15 Noise

All construction alternatives would have **no** to **low** impact. Incremental noise from the new line would not be discernible in most cases. Alternative 3, which does not parallel an existing line, may produce new, low-level audible noise, but in a largely unpopulated area.

The **Non-Transmission Alternative** and the **No Action Alternative** would have **no** impact on noise.

S.4.16 Public Health and Safety

All construction alternatives would have **no** to **low** impact. Incremental EMF generated by a new line would be minor because most of the land passed through is unpopulated. There would be no impact from toxic or hazardous substances, and only low impacts related to fire danger and radio/TV interference, both of which can be mitigated.

Non-Transmission Alternative —This alternative could create similar impacts as the No Action Alternative.

No Action Alternative — **High** impact due to the potential for transmission system collapse, brownouts and blackouts, which could affect public health and safety services, security devices, and other vital functions throughout the Northwest.

S.4.17 Air Quality

All construction alternatives would have **no** long-term impact. Minimal, short-term construction impacts would be limited to dust and engine exhaust. No burning of cleared vegetation would be allowed in most of the alternatives; some burning may be allowed along Alternative 3, if approved by the landowners.

Non-Transmission Alternative — This alternative could create more emissions due to greater use of wood stoves by residents or operation of new gas-fueled power plants in region.

No Action Alternative — **no** impact on air quality.

Chapter 1 — Purpose and Need

In this Chapter:

- The Purpose and Need for Action
- Major Issues
- Decisions to be Made

➲ For Your Information

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

*A **kilovolt** is one thousand volts.*

Bonneville Power Administration (***BPA***)*, a federal agency, owns and operates more than 15,000 circuit miles of electric ***transmission lines***. The lines carry most of the Northwest's ***high-voltage*** (230-***kilovolt*** [***kV***] and above) ***capacity*** from the resources of the Federal Columbia River Power System and other interconnected private and federal projects. Besides moving power throughout the Northwest, this transmission system provides power as needed to nearby regions (*e.g.,* south to California and Arizona and north to Canada). BPA's customers include publicly-owned power marketers (public utility districts), municipalities, investor-owned utilities, and large, direct service industries (***DSI****s*). The utility customers, in turn, provide electricity to homes, businesses, and farms.

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

Chapter 1 of this ***supplemental draft environmental impact statement (SDEIS)*** details a problem that exists on BPA's transmission system in the Puget Sound area of Washington. This chapter describes what created the problem, why BPA needs to correct it, and how BPA is working with others to develop alternatives and decide how to proceed.

1.1 BPA's Need for Action

The existing BPA transmission system in the Puget Sound area provides reliable power to BPA's customers. However, as the area population grows, the need for electrical energy increases and more ***load*** is put on the system. BPA is required to ensure that the transmission system can reliably serve customer power needs under all operating conditions, including times of ***peak use*** (maximum demand). Anticipated peak use could now exceed existing system capacity as soon as the winter of 2002-03.

*Lightning, trees falling into the line and other unusual events can cause **outages** on transmission lines.*

During 1989, a cold front called the Arctic Express brought extreme cold weather to the Northwest (average daily temperature was 14 degrees F). The entire region struggled to meet the power demand for heating and lighting homes and businesses. (See box.) If another Arctic Express hits the region and a major 500-kV transmission line experienced an ***outage*** for any reason, large power ***transformers*** at

The Arctic Express of 1989

The Puget Sound area experienced extremely cold temperatures in February 1989, resulting in the highest electricity use ever recorded for this geographic region. This peak load, defined as the greatest electrical demand over a stated 15-minute period of time, severely strained the transmission system and confirmed that peak loads had grown faster than expected. The unusual cold spell, dubbed the Arctic Express, was followed in December 1990 by another bout of extremely cold temperatures and record-breaking electricity use. Such cold snaps are certain to re-occur in the future.

➲ For Your Information

Voltage *is the driving force that causes a current to flow in an electrical circuit.*

A line becomes ***overloaded*** *when it carries too much electric current, which causes the line to overheat. As a line heats it expands or sags (comes closer to the ground), which must be limited for safety and reliability reasons. The electric current a line carries is limited to the current level at which the line reaches the minimum clearance to ground for the specific ambient temperature at the time.*

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

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

one of BPA's substations and lower ***voltage*** transmission lines in the area would ***overload***. This overload would require immediate reduction of load in the King County area to prevent system collapse.

Normally, during power outages system operators selectively ***drop*** or ***shed*** loads to prevent equipment damage or widespread loss of load. This is accomplished by implementing a ***curtailment plan*** (see Section 2.3.3.2, **Load Curtailment Plan**). However, since the curtailment plan cannot be carried out fast enough to protect the system, voltage on the transmission lines can drop below acceptable levels, causing a ***brownout***. If voltage continues to drop, automatic devices would disconnect lines and Seattle area utilities could be without means to serve their customers, causing a ***blackout***. According to BPA system planners, this scenario could occur as early as winter 2002-03. BPA must find a way to prevent this scenario from happening and to serve the growing loads in the Puget Sound area.

1.2 Background

Major high-voltage transmission lines originating at hydroelectric generating stations east of the Cascade Mountains serve the Puget Sound area. In addition, there are 500-kV lines to Canada and many 500-kV and 230-kV lines heading south to Portland, Oregon. The Puget Sound load center is also served by local hydropower and gas turbine generation. Customers served by BPA's transmission system in the area are Seattle City Light (**SCL**), Puget Sound Energy (**PSE**), Snohomish County Public Utility District (**SNOH PUD**), Orcas Power & Light, Whatcom County PUD, Tanner Electric Cooperative, BC Hydro, the cities of Blaine and Sumas, and Intalco (a direct-service industry). In addition, the transmission system serves Tacoma City Light and customers on the Olympic Peninsula.

A major use of electricity is for heating. Heating loads in the winter create heavy electrical demand, so winter is the most critical time for operating the transmission system in this area. Winter loads in the

➲ For Your Information

*A **megawatt** is one million watts, or one thousand kilowatts. A megawatt is enough power to light 10,000 100-watt lightbulbs.*

Puget Sound area over the next 10 years are forecasted to increase 150-200 ***megawatts (MW)*** per year (1.6 percent growth/year).

1.2.1 Power Flow Studies

BPA conducts region-wide transmission planning studies annually. Looking several years into the future to ensure reliable electric service, the studies use a computer model called a "power flow" to represent the system as it is expected to operate. (Study assumptions are continually updated as new information becomes available. See box and Appendix H. Appendix H is available on request.) Among the scenarios explored is how various parts of the system will handle extremely cold weather conditions (such as the Arctic Express of February 1989), and resulting high demand, or peak load. Besides modeling the system's function while all facilities are operational, the studies also look at system function during possible outages of one or more lines, transformers or other electrical facilities. Then, results are compared to the reliability criteria set by the North American Electric Reliability Council (**NERC**) and the Western Electricity Coordinating Council (**WECC**) (see box), which spell out acceptable system performance standards for different classes of outages.

These performance standards require council members to serve their customers as long as no more than one single transmission element (transmission line or transformer) is lost. System planners prepare for the loss of a transmission element and use established criteria to determine what additional new facilities are required.

The data used for the power flow studies for this project were a compilation of all customers' load forecasts, the existing transmission system's capacity, expected generation forecasts and expected interchange of power among utilities. BPA annually compiles this data, which is used extensively by other Northwest utilities. The following assumptions were also used for this project: extreme cold weather load in the Northwest; all available thermal generation in the Puget Sound area is running (at lower generation levels the project would be needed earlier); and Intalco's load is on. (Intalco presently holds a transmission contract with BPA. Although currently operating at two-thirds capacity, BPA has included Intalco's entire load in studies because that load could return at any time, meaning the transmission capacity must be available.) At the time of the studies, the joint study utilities (SCL, SNOH PUD, Tacoma City Light [**TCL**] and Puget Sound Energy [**PSE**]) approved these assumptions. BPA must plan for peak loads because it is obligated to serve its customers' total demand at any one time.

Planning Horizon

Until recently, the electric industry has used a 10-year planning horizon to determine transmission needs. While some utilities also looked out 20 years, there are many unknowns looking that far into the future. With deregulation of the electric industry, which requires functional separation of generation and transmission, planning for transmission needs has become much more difficult. Since most new generation is owned by independent power producers (**IPPs**) and not utilities, and many more generation projects are proposed than will actually be built, transmission planning can only consider the planning horizon for expected generation additions, which is about five years. Planning beyond five years is only as good as your vision of what will happen in the first five years since all projects interact and affect each other. At this time, transmission planning beyond five to seven years has limited value.

Western Electricity Coordinating Council (WECC)

The purpose of BPA participating in WECC is to promote electric reliability and security. Since the electric systems in the West are so interconnected, an event (*e.g.,* line outage, short circuit, equipment failure, etc.) that happens in one western state will be felt in all western states within fractions of a second. If the event is severe enough, an outage in one state could cause lines to overload 1,000 miles away in another state and lead to loss of load or blackouts. This is what happened on Aug. 10, 1996, when an event in the Northwest caused the worst load loss in California, Arizona and Nevada in history.

WECC is not, however, a regulatory agency and cannot direct or restrict a transmission line that any member builds. Its members are "self-policing." (WECC is one of 10 regional councils under the North American Electric Reliability Council. NERC was formed as a voluntary organization in 1968 following a huge Northeast blackout.www.wecc.biz/main.htmlhttp://www.nerc.com/) While it is true that BPA, as a member of the WECC Reliability Management System (**RMS**), has agreed to meet RMS standards and can be sanctioned for not meeting them, RMS standards do not apply to the planning criteria for the proposed Kangley-Echo Lake line. BPA's commitment to meeting WECC's planning criteria is based on preventing catastrophic failure of the electric system and the severe consequences that would result to its customers and the region.

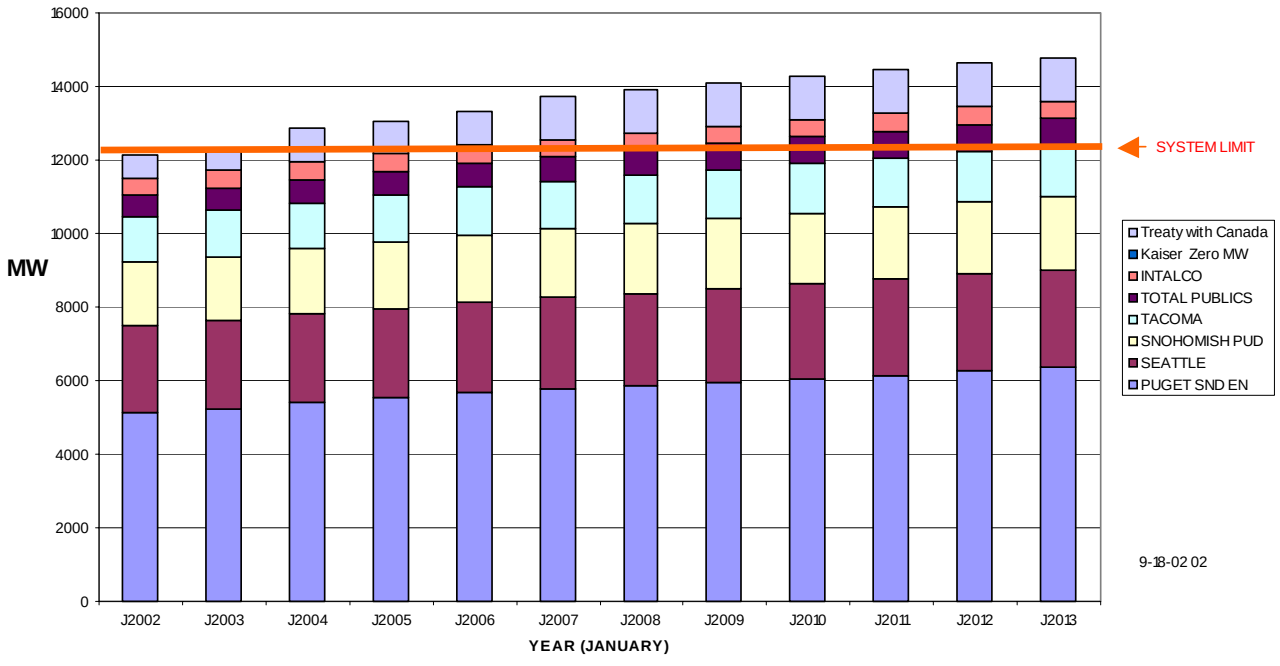
Reliability Criteria

Reliability is a measure of the transmission system's ability to meet customer demands. It is measured by how often power outages occur, how long they last, and how many customers are affected. Utilities use past experience to develop rules for transmission systems. These rules, called reliability criteria, set standards to ensure cost-effective, reliable service. A reliable system should provide electrical service under both normal and emergency conditions. Transmission line outages caused by wind, fire, ice, lightning or other uncontrollable events are examples of system emergencies. If reliability standards cannot be met, then transmission service would have to be curtailed or a new line (or other fix) would be needed.

Figure 1 displays projected electric loads in the Puget Sound area. Forecasts represent January peak loads under Arctic Express conditions as experienced in February 1989 and December 1990. These weather conditions, which greatly increase loads, are projected to occur once in 20 years. The horizontal line represents the maximum amount of load that can reliably be served, about 12,000 MW. The forecast is projected to exceed the reliable level if an Arctic Express would occur in January 2003. In this case, the studies indicated a new line is needed by winter 2002-03 to reliably serve potential peak load in the Puget Sound area during an "extreme" cold weather event and by winter 2005-06 to serve even "normal" peak winter load. Based on this information, an energization date of fall 2002 for a new line was proposed.

Loads for the larger utilities including SCL, TCL, SNOH PUD, and PSE are forecasted by the individual utilities. The forecasts were reduced 198 MW from previous projections based on the most recent information received from the utilities. Loads for Intalco are the maximum plant consumption, which is the demand covered by its transmission agreement (this does not mean that the power will be purchased from BPA). Kaiser Aluminum-Tacoma loads are at zero. There is a block below the top (Total Publics) that represents the remaining smaller public utilities as forecasted by BPA. Finally, the Downstream Benefit (DSB) return to Canada shows the amount of power that must be delivered under the Columbia River Treaty to the Canada-U.S. border near Blaine, Washington.

Figure 1 — Modified Heavy Winter Load Forecasts (1 in 20)



The power studies show that though BPA and other Puget Sound utilities have made many transmission investments over the last several years, this load growth is putting a strain on the region's transmission system. System reinforcement measures already taken include upgrading lines to higher capacity and energizing a double-circuit 230-kV line that was not being used. Also, system reliability has been enhanced by adding circuit breakers and ***bus sectionalizing breakers*** to existing substations and removing tap lines from low capacity lines to higher capacity lines. Still, with this assumed load growth, a new 500-kV transmission line and other transmission equipment would be required by the 2002-03 winter season to support the area in the event a major transmission facility is forced out of service.

Specifically, the loss of a local 500-kV line could cause overloads on two BPA 230/500-kV transformers and to several Seattle City Light 230-kV lines under Arctic Express conditions as early as the winter of 2002-03. By the winter of 2003-04, the Tacoma 500/230-kV bulk transformer could also overload. The overloads would be such that continued safe operation of this equipment could not be expected and violent failure of the equipment would be possible. This failure would very possibly lead to voltage collapse and cascading failure of other system elements such as transformers and lines, which would impact people and businesses in the Puget Sound area. Because of the time required to replace these transformers, power supply to a large part of the Seattle area would not be available for weeks. By 2006, the normal system load will equal the extreme cold winter load for 2002-03. This means that this same scenario could occur for the far more common condition of normal winter peak loads by 2006.

1.2.2 Columbia River Treaty

Besides serving firm loads in the Pacific Northwest, BPA is also required by law to return firm energy to Canada to meet the requirements of the Columbia River Treaty. This firm load, called the Canadian Entitlement, is one half of the increase in U.S. hydropower generated by water released from Canadian storage dams attributed to the construction of those dams. (See box and Appendix I for more detail.) Any reliability problems affecting Northwest customers would also affect BPA's ability to meet these Treaty requirements.

Consequently, BPA has a need to improve its transmission system to ensure continued reliable electrical power for Puget Sound area customers and to meet the requirements of the Columbia River Treaty.

Columbia River Treaty and the Canadian Entitlement

The Columbia River is the most powerful river in North America. Although only 15 percent of the ***Columbia River Basin*** is in Canada, up to 50 percent of peak flows in the river basin comes from Canada. In the past these large flows created floods that caused damage in Canada and in the northwestern United States (U.S.). Through planning and negotiations that spanned 16 years, Canada and the U.S. agreed to build dams for flood control and power generation that would benefit each country. (See Figure 2.) The resulting Columbia River Treaty was approved by both governments by 1964.

The additional 20.5 million-acre feet of storage at the three dams built in British Columbia and one dam (Libby) built in the U.S. more than doubled storage capacity in the Columbia River Basin. The Treaty specified that the resulting ***downstream power benefits*** – the increase in firm power production capability – are to be shared equally between the two countries. Canada's share is called the ***Canadian Entitlement***. Canada sold its rights to these benefits for 30 years to a consortium of utilities in the Pacific Northwest (***Columbia Storage Power Exchange*** [***CSPE***]). This consortium exchanged the entitlement with BPA for firm power.

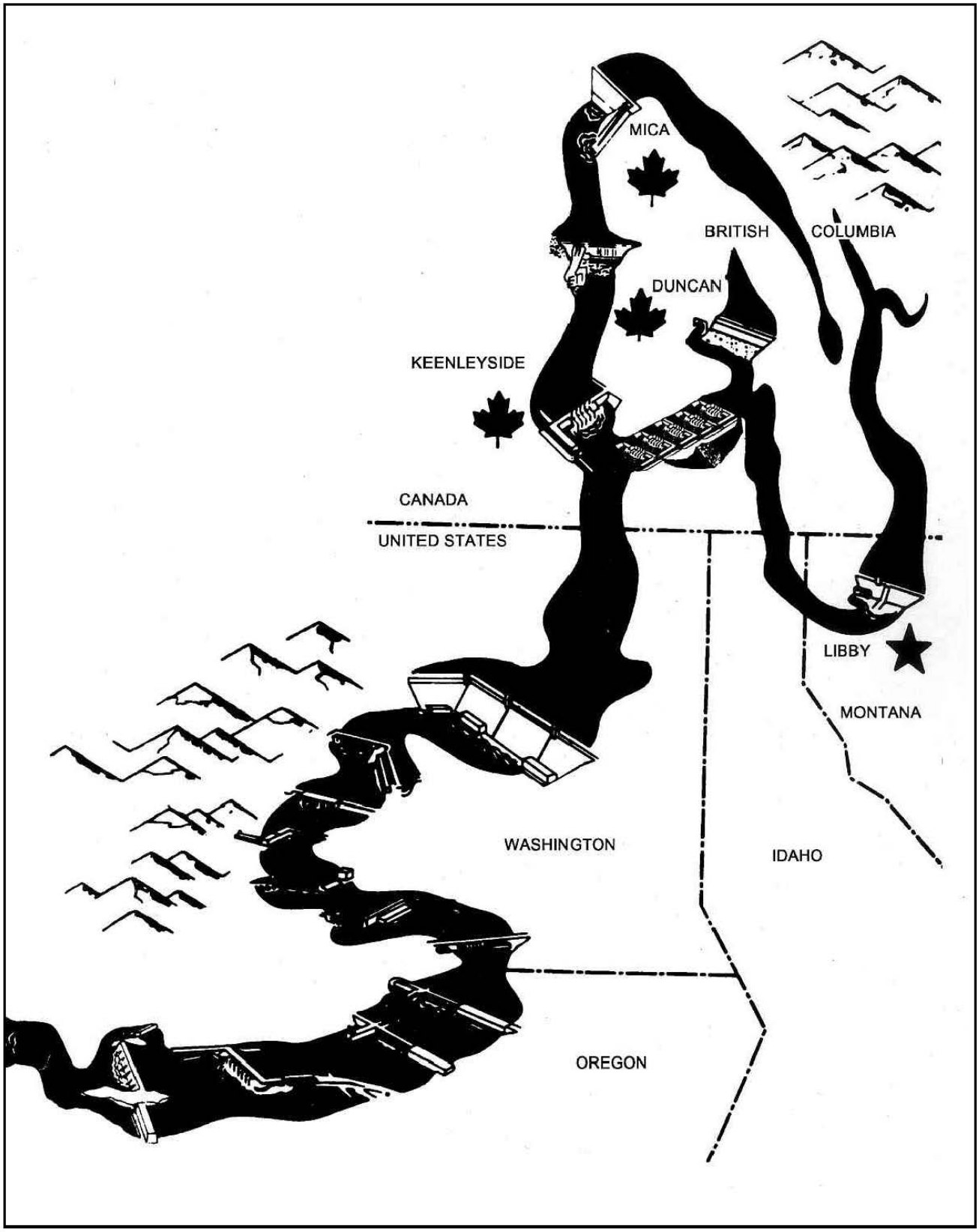
On April 1, 1998, Canadian Entitlement power began returning to Canada at the U.S.-Canada border (this was 30 years after completion of the first Canadian dam built under the agreement). Full amount of the Canadian Entitlement – around 536-537 ***average annual megawatts*** **(aMW)** – must be returned to Canada beginning April 1, 2003, (when the CSPE agreement fully expires) through at least Sept. 16, 2024, the earliest expiration date of the Treaty. During times of peak demand, the entitlement may be scheduled at rates of between 1,100 and 1,500 MW. BPA's transmission system must be able to handle this capacity, as well as that needed to serve the nearby growing Puget Sound area.

1.2.3 Consequences of Project Delay

Considering other alternatives and committing to this SDEIS has delayed BPA's decision on this project. With electrical loads in the Puget Sound area projected to reach the limits of the power system by the winter of 2002-03, delaying energization of the Kangley-Echo Lake Transmission Line Project leaves the area at some risk. In the event of a potential serious outage in the area during a critical time, BPA may need to reduce loads before the outage to prevent system collapse. Fortunately from a reliability perspective, the economic downturn has slowed electrical load growth, moderating the risk. Nevertheless, there are signs of recovery. For example, production at the Intalco aluminum smelter near Ferndale has restarted.

In the spring of 2003, the Canadian Entitlement obligation increases by more than 400 MW. In addition, Puget Sound area electrical loads are projected to grow about 200 MW per year. For the winter of 2003-04 the system is about 5 percent over its capability to

Figure 2 — Dams in Canada Built as Part of the Columbia River Treaty



safely serve the load. This means that a forced load reduction could occur before or during a much less severe event than the Arctic Express of 1989. And as noted earlier, by the winter of 2005-06 the region is at risk even during a "normal" cold winter. For a secure energy supply and continued economic recovery, BPA would need to have a solution to this problem by fall 2003.

1.3 BPA's Purposes

The purposes in the "purpose and need" statement are goals to be achieved while meeting the need for the project. These goals are used to evaluate alternatives proposed to meet the need. BPA will use the following purposes to choose among the alternatives:

- Facilitate the orderly planning of the region's power system [Northwest Power Act (16 USC section 839(3)(B)];
- Increase BPA system capacity to meet growing customer demand for electricity (Northwest Power Act 16 USC section 839(4) and 16 USC 839a(4)(A)(i);
- Maintain BPA transmission system reliability [Federal Columbia River Transmission Act (16 USC 838b(d); Northwest Power Act 16 USC section 839(2) and 16 USC 839a(4)(A)(i)];
- Maintain environmental quality [Northwest Power Act 16 USC 839(3)(C)];
- Minimize impacts to the human environment through site selection and transmission line design (National Environmental Policy Act 42 USC 4321 et seq., and Endangered Species Act 16 USC 1531 et seq.)
- Minimize costs to BPA's ratepayers [Northwest Power Act 16 USC 839(2) and 16 USC 839a(4)(A)(ii)] while meeting BPA's long-term transmission system objectives for the area.

1.4 Developing Alternatives

After identifying existing and future electrical needs in the area, BPA began to develop alternatives that would meet the need. BPA undertook long-range (5- to 10-year) studies to determine what actions could meet the needs, what each would cost, and how each would affect the transmission system (see Appendix H, available on request).

This SDEIS will help refine these alternatives based on comments from agencies and the public. It identifies the environmental resources that could be affected, and discloses the potential impacts to the resources associated with these alternatives. Chapter 2, **Proposed Action and Alternatives**, describes the alternatives.

1.5 Scoping and Major Issues

➲ For Your Information

*The **Notice of Intent** is in the Federal Register. The Federal Register publishes regulations and legal notices issued by federal agencies.*

Scoping refers to a time early in a project when the public tells us what issues to consider in an EIS. On March 28, 2000, BPA published a ***Notice of Intent*** to prepare an EIS and to a conduct a public scoping meeting for the project. A second scoping meeting was subsequently held. Two letters (dated March 22, 2000, and August 29, 2000) were mailed to people potentially interested in or affected by the proposal. These letters explained the proposal, the environmental process, and how to participate. A comment sheet was included so people could mail their comments to BPA. Scoping meetings were held in the following locations: North Bend, Washington, April 11, 2000; and Maple Valley, Washington, September 20, 2000. BPA also met with local Indian tribes who have traditionally used the project area.

Written and verbal comments were collected. Comments covered many issues:

- Purpose and need for the project;
- Economic benefits and impacts;
- Adverse environmental impacts of a transmission line;
- Impacts to value, use and enjoyment of private property;
- Possible routes for the transmission line;
- Conflicts between transmission lines and current land uses including parklands and the Cedar River Municipal Watershed;
- Impacts on people, fish and wildlife, including threatened and endangered species;
- Impacts on cultural resources; and
- Concerns about the decision-making process.

This is a partial list of issues identified from the comments received. All comments received were logged in, categorized by subject, and forwarded to resource specialists to include in their environmental impact analysis.

Most issues identified during the scoping process were discussed in the Draft EIS. The Draft EIS was distributed to agencies, tribes, groups, individuals and libraries in June 2001. A 45-day public review period was extended until September 4, 2001 based on requests for more time to review and comment on the document. A public meeting was held on August 1, 2001 in Maple Valley, Washington to accept public comment on the draft document. During the comment period BPA received over 700 comments. Issues raised in the comments included the following: the need for the project; the alternatives considered; impacts to the Cedar River Municipal Watershed (**CRW**) and water quality; fish and wildlife; cultural resources; and other subjects. Copies

of comments made on the Draft EIS and BPA's responses to those comments will be included in the Final EIS.

After reviewing the comments and refining the cost estimates associated with BPA's preferred alternative, BPA decided to prepare this SDEIS that re-evaluates four route alternatives not analyzed in detail in the DEIS. The added route alternatives, all located outside of the Cedar River Watershed, were initially considered, but dropped from detailed analysis because they did not meet the project need to be cost effective, or for other reasons. They are identified as Alternatives A, B, C, and D and are shown on Map 1. BPA also initiated a study of non-transmission line alternatives to consider (see Section 2.2.9, **Non-Transmission Alternative** and Appendix J).

On May 16, 2002, BPA published a Notice of Intent to Prepare a Supplemental Draft Environmental Impact Statement and to a conduct additional public scoping meetings for the project. Letters (dated May 15, 2002, and June 20, 2002) were mailed to people potentially interested in or affected by the proposal. These letters explained the proposal, the environmental process, and how to participate. A comment sheet was included so people could mail their comments to BPA. Scoping meetings were held in the following locations: Seattle, Washington (June 5); North Bend, Washington (June 6); Black Diamond, Washington (June 8); Kent, Washington, June 12; Maple Valley, Washington, June 13; and Snoqualmie Pass, Washington (July 11). BPA also met with local Indian tribes who have traditionally used the expanded project area.

Written and verbal comments were collected. Comments covered many issues:

- Potential impact to property values
- Costs of alternatives
- Line characteristics, including tower heights
- Resource protection and preserving rural lifestyle
- Public health and safety, including health effects of line and vandalism concerns
- Impacts of Alternative 1 to the Cedar River Watershed, and the current condition of the CRW
- Parity between rural and urban residents, and between people and nature
- Land use impacts on developed land
- Non-transmission alternatives

This is a partial list of issues identified from the comments received. In addition to these issues, the issues identified in the first scoping period were raised again. All comments received were logged in, categorized by subject, and forwarded to resource specialists to include in their environmental impact analysis. Most issues raised during scoping are addressed throughout the document.

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Project Area *– The original project area was the area in the vicinity of Alternatives 1-4. Since other alternatives (A-D) have been added to the analysis, the project area now is a 750 square mile area of west-central Washington and includes portions of the Puget Sound lowlands as well as the Cascade Range Mountain Range and adjacent foothills. The project area includes the municipalities of Covington, Maple Valley, and North Bend, and the unincorporated communities of Black Diamond, Ravensdale, Hobart, Kangley, Selleck and Halmar Gates. However, in the descriptions of resources in Chapters 3 and 4, project area is also used as the general area around one alternative.*

1.6 Decisions to be Made

Federal agencies will use the information contained in this EIS and comments from the public to make the following decisions:

➲ For Your Information

*A **right-of-way** is an easement over the land of another owner.*

- BPA must decide whether to build the proposed transmission line. If the decision is to build a new transmission line, BPA must choose which route to use. Then BPA must decide where new ***right-of-way*** *(**ROW**)* would be needed, what ***structures*** to use, and where to locate structures and ***access roads***. BPA will also need to determine the type and amount of mitigation necessary to minimize environmental impacts.
- The U.S. Fish and Wildlife Service (***USFWS***) must decide if the project would have adverse impacts to listed wildlife species. BPA sent USFWS a ***Biological Assessment*** *(**BA**)* for the Proposed Action. The BA included BPA's determination of impacts to ***federally-listed*** wildlife species. USFWS has concurred with BPA's determination that it is unlikely that there will be adverse effects on marbled murrelet, bull trout, bald eagle, gray wolf, grizzly bear, and Canada lynx. However, USFWS did not concur with BPA's determination of "may affect, but is not likely to adversely affect" for the northern spotted owl. BPA subsequently initiated formal consultation with the USFWS under the Endangered Species Act for the northern spotted owl. (See Section 5.2.)

Biological Assessment *— A document required by the Endangered Species Act, which requires an evaluation of potential effects on listed species and critical habitat prior to implementing a proposed action. A proposed action is defined as any activity authorized, funded or carried out by a federal agency.*

- The National Marine Fisheries Service (***NMFS***) must decide if the transmission line and related facilities would have adverse impacts to listed fish species. BPA sent a copy of the BA for the Proposed Action alternative to NMFS. NMFS subsequently concurred with BPA's determination that the proposed project "may affect, but not likely to adversely affect" ***anadromous*** fish species (chinook salmon and their designated critical habitat).

Anadromous fish *— Chinook, coho and sockeye salmon and steelhead trout, which hatch in fresh water, spend part of their life at sea, and then migrate up rivers to their home waters to spawn.*

- If an alternative is chosen that crosses National Forest land, the USFS (Mt. Baker-Snoqualmie and Wenatchee National Forests) must decide if the project complies with currently approved forest plans and if special use permits for construction, operation and maintenance of project facilities should be approved. If the project does not comply, forest plan(s) may need to be amended. The effects to other National Forest uses, such as recreation, timber, mining, and wildlife protection are discussed under land use in Chapter 4, Environmental Consequences of this SDEIS.

Puget Sound

Lake Washington

Lake Sammamish

Seattle

Bellevue

Issaquah

Renton

North Bend

Maple Valley

Kent

Black Diamond

Enumclaw

Kangley

Tacoma

Tacoma

Sunrise Lake

Puyallup Reservation

Muckleshoot Reservation

Cedar River

Green River

Maple Valley Substation

Echo Lake Substation

Covington Substation

Raver Substation

Preferred Alternative

1

A

B

C

D

Cedar River Watershed

Snoqualmie Pass

Stampede Pass

5 405 90 900 202 203 167 515 516 18 169 164 410

Map 1

ADDITIONAL ALTERNATIVES to be CONSIDERED

Legend

- Existing BPA Transmission Lines
- Proposed Transmission Line Alternatives Under Consideration
- ▲ BPA Substations

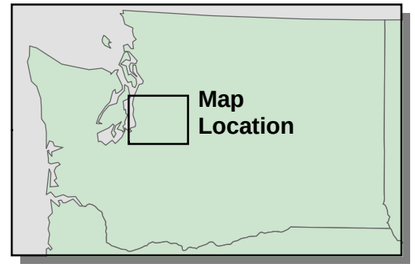
Alternatives

A Construct New Single-Circuit 500-kV Line from tap near Kangley to Covington Substation. Rebuild portion of Covington - Maple Valley 230-kV to Double-Circuit 500-kV.

B Rebuild Portion of Rocky Reach-Maple Valley 345-kV to Double-Circuit 500-kV from East of Stampede Pass to Echo Lake Substation.

C Construct New Single-Circuit 500-kV Line West of the Cedar River Watershed to the Echo Lake - Maple Valley Lines.

D Construct New Single-Circuit 500-kV Line from East of Stampede Pass Adjacent to Rocky Reach-Maple Valley Line.



N

0 3 6 9 12

Miles

November, 2002

Each agency will follow its established decision-making process and either independently or with another agency provide a record of its decision.

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

1.7 Other Projects in the Area

BPA built a 115-kV wood pole line in unincorporated King County near the City of Snoqualmie into the City of North Bend, Washington in 2001. The new transmission line was needed to satisfy the present and future needs of Tanner Electric Cooperative and the future needs of Puget Sound Energy in the North Bend area. BPA anticipates adding a transformer at a substation northeast of Seattle, which is near the project area. This project will also require changing relays or other minor modifications at two other local substations, and some transmission line changes. Relay changes will also be required at one of PSE's substations. This system addition would increase the reliability of the transmission system in the Puget Sound area.

BPA planners are studying whether another transmission line east of Seattle may be needed in the future. The purpose and need for the potential new 500-kV line would be to ensure reliable service to Puget Sound area loads and to integrate potential new generation projects. The need depends in part on the decisions of generation developers. BPA is examining alternatives, including approaches that do not require transmission construction. System planners have not determined yet if a line would be needed and no alternative routes for a possible line have been identified. A decision on the need is expected in 2003.

1.8 Organization of the EIS

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

- Chapter 1 states the purpose and need for the project. Decision-makers use the purposes and need to make their decision about a project.
- Chapter 2 describes the proposed action and alternatives, including taking no action. It summarizes the differences among alternatives, especially in potential environmental impacts.

- Chapter 3 describes the existing environment that could be affected by the project. The existing environment includes the social and natural environment.
- Chapter 4 describes the possible environmental consequences of the proposed action and alternatives. Impacts can range from no or low impact to high impact.
- Chapter 5 discusses the licenses, permits and other approvals or conditions the alternatives must obtain or meet.
- Chapters 6 through 9 list individuals who helped prepare the EIS, references used, individuals, agencies, and groups the EIS was sent to, and a glossary.
- An index is included as Chapter 10.
- Supporting technical information is in appendices.

Chapter 2 — Proposed Action and Alternatives

In this Chapter:

- BPA's Proposed Action
- Alternatives
- No Action Alternative
- Alternatives Eliminated from Detailed Consideration
- Comparison of Alternatives and Summary of Impacts

This chapter describes the alternatives being considered to meet the need, summarizes how the environmental consequences differ among alternatives, and compares the alternatives against decision factors. BPA is considering the Proposed Action — a new 500-kV transmission line that would run about nine miles between a point near Kangley, Washington, to a BPA substation near North Bend, Washington, along with alternative routes; a non-transmission alternative, and a No Action Alternative. Constructing a new transmission line would require an expansion of BPA's Echo Lake Substation. Under the No Action Alternative, BPA would not build a new 500-kV line nor add new equipment to Echo Lake Substation.

This chapter also describes other suggested alternatives that have been eliminated from detailed consideration for technical or economic reasons (see Section 2.3, **Alternatives Considered and Eliminated from Detailed Study**). It concludes with a comparative analysis of BPA's alternatives. This analysis provides an overview and introduction to more detailed information presented in Chapters 3 and 4.

2.1 BPA's Proposed Action

➲ For Your Information

Words in bold are defined in sidebars or in Chapter 9, Glossary and Acronyms.

***Tap** — The point at which a transmission line is connected to a substation or other electrical device to provide service to a local load.*

The Proposed Action would ***tap*** an existing transmission line near Kangley, Washington, (see Map 2). At this tap point, the existing circuit would be severed (de-energized) so the power would flow towards Echo Lake Substation instead of Raver Substation. Other action alternatives would either tap this line or originate out of Raver Substation. Redirecting power to Echo Lake Substation either before or after it enters Raver Substation would make existing transmission equipment much more efficient and reliable while increasing capacity in the area. If something were to happen to the new segment between the tap point and Echo Lake Substation to cause an outage of the line, the new line could be manually disconnected from the tap point (removing jumper cables at the tower), and the existing

line to Raver Substation could be re-energized by manually connecting jumper cables.

2.1.1 Proposed 500-kV Transmission Line

BPA proposes to build a ***single-circuit*** 500-kV transmission line from a tap point on an existing 500-kV line near Kangley to its Echo Lake Substation (see Map 2). The proposed route for this line is Alternative 1, which is about nine miles long. In addition, Echo Lake Substation would be expanded about three acres to the east and new equipment would be installed to accommodate the new line. Five miles of the proposed route would go through the Cedar River Municipal Watershed.

This alternative was proposed because it would be located immediately east and parallel to an existing BPA 500-kV transmission line, the Raver-Echo Lake Transmission Line. Locating a new line next to this existing line would minimize the area impacted by the new line and minimize the need to build additional access roads. At the same time, building an adjacent line poses less risk than ***double circuiting*** (sharing a tower) with the existing 500-kV line. (See sidebar.)

➲ For Your Information

Double circuiting *— Maximizing use of a right-of-way (ROW) sometimes requires that two circuits be installed on a double-circuit tower. While efficient, this increases the likelihood that a storm or other event could cause an outage of both circuits. Consequently, national and regional transmission planning standards restrict when double circuiting can be used, and these standards directly apply to the Proposed Action and other alternatives that parallel the existing Raver-Echo Lake Transmission Line. Building a parallel line was considered a tolerable risk – just meeting the threshold for exemption to planning standards for adjacent lines. The Proposed Action and Alternatives 4A and 4B would have a very small portion double-circuited — the part that crosses the Cedar River — but that represents only 3 percent of the nine-mile line and is also considered a tolerable risk. Double-circuiting through the entire Cedar River Municipal Watershed, however, would increase risk exposure by 30 times for the length of the line, violating planning requirements.*

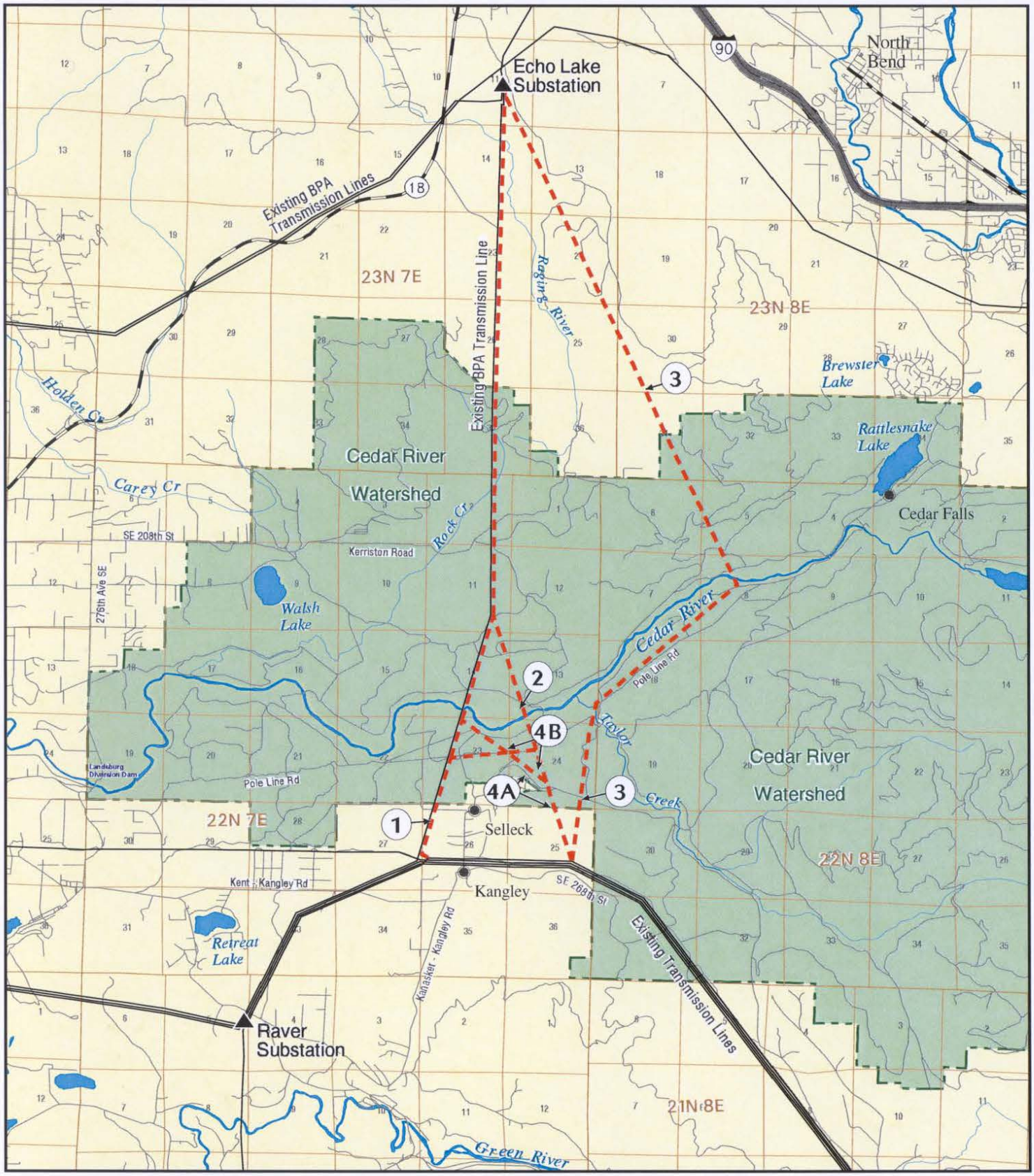
The following facilities and equipment would be part of the Proposed Action.

2.1.1.1 Transmission Structures

Forty-seven ***lattice steel*** transmission ***towers*** would support the 500-kV transmission line. These structures average 135 feet high, with the average span between towers of 1,150 feet (see Figure 3).

BPA would use two different kinds of 500-kV lattice steel towers to build this line, 42 ***tangent structures*** and five ***dead-end structures***. Tangent structures are used to elevate wires (***conductors***) a safe distance above the ground on relatively straight stretches of a line without sharp angles. Dead-end structures elevate the conductors above the ground and equalize tension of the conductors between two segments of transmission line where the line makes a turn. Dead-end structures are much stronger and heavier than tangent structures and cost more. A typical tangent structure would cost about $75,000; a dead-end structure could cost about $300,000 or more. Because of their high cost, engineers try to avoid sharp turns and angles when designing 500-kV transmission line routes.

Transmission towers are attached to the ground by burying a metal assembly within the ground at each of four tower corners. These are called ***footings***. Three types of footings are commonly used: ***plate, grillage***, and ***rock anchors***. Plate footings are 4 foot x 4



PROPOSED ACTION and ALTERNATIVES on the CEDAR RIVER WATERSHED

Map 2

Existing Transmission Lines

Proposed Transmission Line Alternatives Under Consideration

BPA Substation

(1) Alternative

BONNEVILLE POWER ADMINISTRATION GIS GEOGRAPHIC INFORMATION SYSTEM

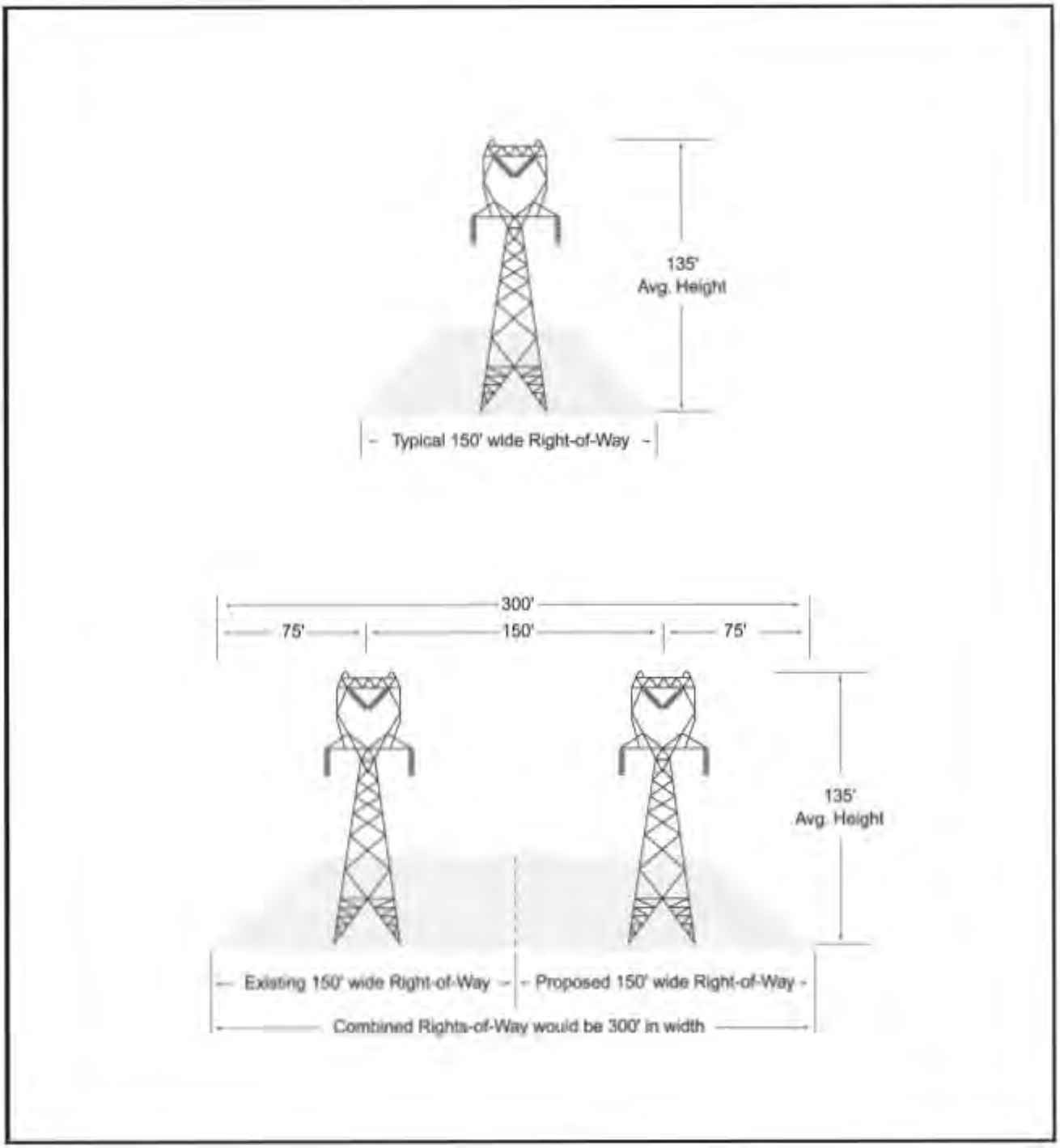
November 22, 2002

0mi 1mi 2mi

0km 1km 2km 3km

N

Figure 3 — Existing and Proposed 500-kV Towers and Rights-of-Way (looking north)



foot steel plates buried 10–12 feet deep. Grillage footings are a 12.5 foot x 12.5 foot assembly of steel I-beams that have been welded together and buried 14–16 feet deep. Grillage footings are used to support heavier structures, such as dead-end structures. Rock anchor footings are used when a tower is built on ***bedrock***. Holes are drilled into the bedrock, steel anchor rods are secured within the holes with concrete, then the tower footings are attached to these rods.

A trackhoe is used to excavate an area for the footings. The excavation sidewalls would be sloped or shored to prevent collapse. All the soil and rock materials removed are later used to backfill the excavated area once the footings are installed.

For the Proposed Action, BPA is proposing a new type of footing that requires less ground disturbance. The new footing design would use what are known as ***micropiles*** instead of the standard footing designs described above. Micropiles are a footing that involves augering holes about 8–10 inches in diameter to a depth of approximately 30–50 feet, inserting a single steel bar into each of the holes, then grouting the bar in place using pressurized cement grout. One hole would typically be used to support each tower leg for the tangent structures, three to four for the deadends. The micropiles would be installed with a lightweight, track-mounted drill rig. Site grading would not be required. Brush clearing would only be necessary for the tracked equipment to operate. Most vegetation would not need to be uprooted, but could be crushed, bent over, broken or trimmed to the ground. Tree stumps at footing sites may need to be ground down to ground level or removed. The tower leg normally embedded in the ground would be above ground, so limited excavation would be required other than drilling. This method of securing the footing to the tower leg would typically disturb an area of about 10 square feet per tower leg for a total of 40 square feet at each tower site. No leveling of the tower sites should be required. BPA estimates that this new design would reduce the area of site disturbance within the CRW by about 16 acres, and about 16 acres on land outside the CRW.

Transmission towers are normally assembled in sections at a tower site and lifted into place by a large crane (30–100 ton capacity). The construction of a tower and its footings could disturb an area about 150 feet x 200 feet using plate and grillage footings. Occasionally transmission towers are assembled at a remote staging area and placed on the footings by large sky crane helicopters. Using helicopters enables towers to be constructed more quickly and reduces ground disturbance. Helicopter construction can be more costly than conventional crane construction, but time saved by faster tower assembly sometimes reduces the cost difference. BPA would require the contractor building the project to use helicopter construction techniques on this project in the CRW to reduce ground-disturbing

impacts. The contractor could use track hoes and cranes outside the CRW.

Using a combination of helicopter construction and micropile footings would reduce the amount of ground disturbance at each tower site from up to 30,000 square feet to 40 square feet.

2.1.1.2 Conductors and Insulators

The wires that carry electrical current in a transmission line are called ***conductors***. BPA's proposed line has three sets (called phases) of conductors arranged in a triangular design on the towers. Each of the three phases consists of three ***subconductors*** held in a triangular arrangement (18–20 inches apart) by spacer brackets. Each subconductor is 1.3 inches in diameter. Arranging electrical conductors this way reduces magnetic field strength and noise. It also decreases the width of ROW needed, which in forested area would reduce the need to clear trees, compared to a flat configuration of conductors.

Conductors are suspended from towers with ***insulators***. Insulators are made of nonconductive materials (porcelain or fiberglass) that prevent electric current from passing through the towers to the ground. Insulator strings of non-reflective material for BPA's line would be 6 inches in diameter, and 15 feet long.

Conductors and insulators are installed after the towers have been built. A pulling cable called a "sock line" is placed on pulleys or travelers that are attached to the insulators on the structures. The sock line is pulled through the pulleys, usually by a helicopter. The end of the sock line is attached to a conductor on large reels mounted on trucks equipped with a brake system that allows the conductor to be unwound under tension. The sock line is used to pull the conductors through the series of pulleys mounted on the towers. Conductor tensioning sites are usually located every two to three miles. Conductor tensioning sites typically disturb an area of about one acre. Disturbance is temporary. Any disturbed area would be restored to pre-construction conditions and reseeded. (See Section 5.15, **Discharge Permits under the Clean Water Act**.)

Over the length of the line, sections of the conductor must be spliced together. BPA uses two methods to splice conductor together. The first method, hydraulic compression, uses a large press and pump that closes a metal clamp or sleeve onto the conductor. This method requires heavy equipment and is time consuming.

The second method, implosive fittings, uses explosives to compress the metal together. The implosive fittings do a better job of compressing the sleeve onto the conductor and actually weld the metals together. Implosive fittings do not require heavy equipment,

but do create noise similar to a shotgun blast when the primer is struck. BPA is proposing to use implosive fittings on this project.

Two smaller wires, called ***ground wires***, would also be attached to the top of the transmission towers. Ground wires are used for lightning protection. There is also a series of wires (called ***counterpoise***) buried in the ground and a grounding well at each structure. These wires are used to establish a low resistance path to earth, usually for lightning protection. BPA would install "bird flight diverters" on the overhead ground wire to make the wires more visible to migratory birds, where necessary.

One 72-strand ***fiber optic*** cable needed for communications would be strung on the new line and would continue south into Raver Substation.

2.1.1.3 Right-of-Way

BPA would acquire ***easements*** to build, operate and maintain a transmission line across public and private properties. The Proposed Action would require 150 feet of new right-of-way (ROW) width over about nine miles.

➲ For Your Information

Danger trees *— Trees (or high growing brush) in or alongside the right-of-way, which are hazardous to the transmission line.*

The transmission line easements would also include rights that would allow BPA to remove trees (called ***danger trees***) outside the 150-foot easement that pose a hazard to the new line now or in the future (see Section 2.1.1.4, **Right-of-Way Clearing**). BPA would also acquire access road easements on existing roads to access the transmission line ROW. When no existing roads are near the ROW, BPA would acquire easements that allow new roads to be built.

2.1.1.4 Right-of-Way Clearing

For safe and uninterrupted operation of a transmission line, vegetation within a ROW is not allowed to grow above a certain height. Management of ROW vegetation varies depending on many factors, including line voltage, vegetation species, vegetation height, vegetation growth rates, ground slope, topography, conductor elevation above ground, clearance distance required between the conductors and other objects, and electrical loading on the line. BPA would develop contract specifications to guide the construction contractor hired for the clearing. The specifications would identify the area within and adjacent to the ROW where existing vegetation would need to be removed and specific types and locations of vegetation that could be left. Additional clearing may be required for new roads built off the ROW.

As a general rule, all tall-growing vegetation would be removed from the 150-foot ROW at the time of construction, but low-growing vegetation would be left where possible. If there were danger trees next to the newly cleared ROW, these trees would be removed or

made into snags depending on the height and health of the trees (see Table 2-1). The greatest potential for the taking of danger trees for this project would be in cases where the line crosses lands that are classified as ***mid-regeneration coniferous*** forest (20- to 35-year-old trees). In these locations, danger trees could be taken from as far away as 200 feet from the edge of the ROW, depending on the topography and condition of the trees. The Proposed Action is next to an existing line, so it would only require that danger trees be removed east of the outside edge of the ROW. Tall-growing trees may be left or topped where the ROW crosses drainages or stream crossings if there is adequate safety clearance between the trees and the transmission line including a number of years of growth. Fewer danger trees are cleared where the line crosses recent clearcuts, ***early-regeneration coniferous*** forest (less than 20-year-old forest), and both ***hardwood*** forest types, although care must be taken not to overlook scattered large trees or snags that may be found long distances away from the ROW.

Table 2-1 — Example of Clearing Criteria Based on a 150-foot Right-of-Way (ROW) Width*

Cover Type	Typical Tree Height	Total Clearing Within ROW (slope distance**)	Partial Clearing Distance on Either Side of ROW*** (slope distance)	Range of Potential Area With Clearing (slope distance)	Notes
Recent Clearcut	7 feet	150-175 ft	0	Minimum 150 ft Maximum 175 ft	Watch for Danger Trees Outside ROW
Mid-regeneration Coniferous Forest	200 feet	150-175 ft	113 ft downhill + 146 ft uphill = 259 ft	Minimum 150 ft Maximum 434 ft (175 + 259)	Maximum clearing distance would be 321 feet if new line located adjacent to existing cleared ROW
Riparian/Floodplain Hardwood Forest	80 feet	150-175 ft	33 ft downhill + 52 ft uphill = 85 ft[a]	Minimum 150 ft Maximum 260 ft (175 + 85)	Maximum clearing distance would be 227 feet if new line located adjacent to existing cleared ROW. Watch for Danger Trees Outside ROW
Hardwood Forest – Alder and Maple	80 feet	150-175 ft	33 ft downhill + 52 ft uphill = 85 ft[a]	Minimum 150 ft Maximum 260 ft (175 + 85)	Maximum clearing distance would be 227 feet if new line located adjacent to existing cleared ROW. Watch for Danger Trees Outside ROW
Urban	< 40 feet	150-175 ft	Individual Tree Basis	Minimum 150 ft Maximum 175 ft	Watch for Danger Trees Outside ROW

* **Assumes a "window" of safety and reliability that includes five years of tree growth and a minimum allowable flashover distance of 27 feet over the next five years. Rights-of-way are mapped and recorded as horizontal distance.**

** **Slope distance varies with the degree of slope. The steeper the slope, the greater the slope distance which would need to be cleared. Maximum shown here is on a 60% slope. (On a 60% slope, 150 ft horizontal distance is equal to 175 ft slope distance.) Slope distance is the same as horizontal distance on flat ground. See Figure 4 for a description of slope distance.**

*** **Individual danger trees would be cut beyond the edge of the ROW. In some locations, danger trees may be clumped. Clearing of danger trees can occur on both sides of the ROW, although a greater slope distance is required to maintain safety and reliability on the uphill side.**

a **Assumes a maximum tree height of 120 feet outside the ROW.**

Throughout the project, BPA would use "stable tree" criteria for selecting danger trees. To aid in this determination, a clearing advisory table has been developed that reports calculated safe tree heights at various distances from the centerline. This advisory is generated from a number of data gained in the field and through the design process. This data includes:

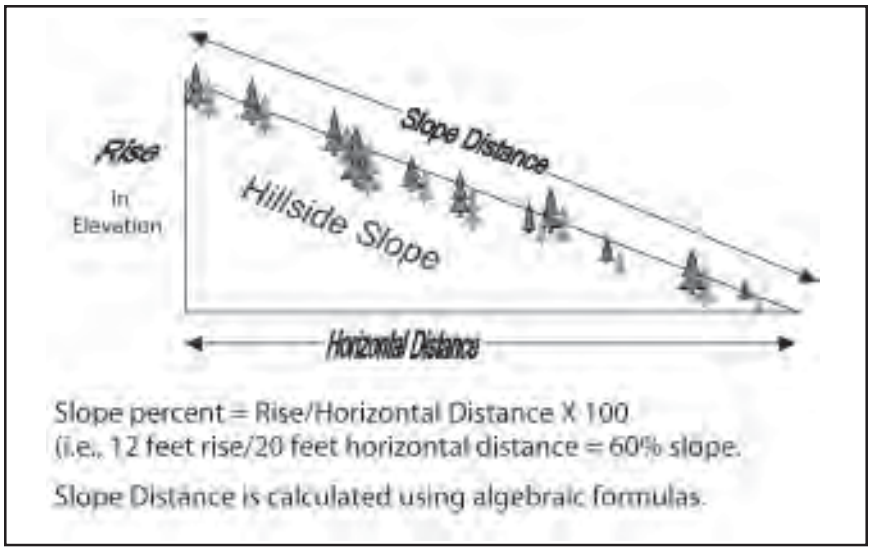
- topography at various distances from centerline (ground elevations);
- structure design, which includes phase spacing and elevation of the conductor;
- conductor design, which includes sag and swing;
- minimum acceptable clearance between the conductor and the trees, typically 27 feet for 500-kV lines;
- growth factor of five years (which is enough time for the new trees to adapt to their new environment and become more "wind firm").

The clearing advisory is only one of the tools that would be used to select danger trees. Data was gathered along the Proposed Action route to determine past tree failures and wind direction. Aided by this information, personnel familiar with tree failures would select danger trees. Only those trees deemed to have a high risk of failure within the first five years would be marked for removal or made into snags. Examples of high risk trees include trees leaning heavily toward the proposed line location, trees with signs of wood decay or root disease, dead or diseased trees, trees with multiple stems, trees growing on old stumps or logs, trees on unstable soils, and other danger indicators. Any tree deemed stable would remain even if its failure could result in its falling into the transmission line. By using this clearing criterion, BPA would assume more risk that falling trees could cause an outage and the loss of BPA facilities as compared to removing all trees that could potentially fall into the facility.

After construction, maintenance crews would be responsible for managing vegetation under and next to the line. Disturbed areas would be seeded and low-growing vegetation would be encouraged to grow within the ROW. Native grasses would be planted to provide cover and forage for wildlife, to guard against erosion, and to prevent noxious weeds from gaining a foothold. Where possible, tall-growing vegetation would be allowed to grow in deep canyons. Under maintenance criteria, healthy, stable trees outside the ROW would be left in place. Only those trees that pose a hazard to the transmission line would be removed.

Disposition of merchantable timber (including timber for poles, posts and firewood) would be determined through an agreement with

Figure 4 — Slope Distance and Horizontal Distance



the landowner. Logging activities would be conducted following applicable regulations intended to minimize environmental damage. Non-merchantable timber may be chipped, lopped and scattered or removed by other means, if regulations allow. For the Proposed Action, no burning would be allowed because smoke from burning could disrupt the operation of the adjacent existing energized transmission line, which would remain in service during construction of the line.

At transmission line structure sites, stumps may need to be removed, including root systems. Each site may be graded; however, at the tower sites where micropiles would be used, little or no grading would be necessary (see Section 2.1.1.1, **Transmission Structures**).

2.1.1.5 Access Roads

BPA normally acquires access road easements and develops and maintains permanent road access to each of its transmission line structures. Access roads are designed to be used by cranes, excavators, supply trucks, boom trucks, log trucks, and line trucks for construction (including tree removal) and maintenance of the transmission line. Truck size and weight class help determine road specifications. BPA prefers road grades of 5 to 10 percent or less for highly erodible soils (silts), and 12 to 15 percent or less for erosion-resistant soils (earth and broken rock). For short distances, maximum acceptable road gradients are 15 to 18 percent for trunk or main roads, and 18 percent for ***spur roads*** (roads that go to a structure if the structure is not located on a trunk road). However, if an existing road has a steeper grade and the terrain is very steep and difficult to traverse, BPA could use the steeper existing road to reduce ground disturbance.

➲ For Your Information

Spur roads *— Short roads that are built to access a structure if the structure is not located on a trunk road.*

Easements for new roads outside the proposed transmission line ROW would be 50 feet wide. Typically, new or existing access roads would be graded to provide a 16-foot travel surface, with an additional 4–6 feet to accommodate curves. However, due to the use of the new tower footing design (micropiles) and use of helicopter tower erection, there would be no need for heavy equipment (track hoe and crane) for all but one of the transmission towers. Ground crews would require only smaller vehicles, including track-mounted or multi-tire vehicles, such as log trucks, to complete clearing and installation. As a result, access road requirements can be reduced in the Cedar River Watershed, in particular the width of the roads (from 16 feet to 10–14 feet). This means most existing roads do not need to be widened and BPA can reduce road requirements by 10–15 acres. (In those areas where access is or would be inadequate for a logging truck, trees would either be left on the ground or taken out by helicopter.)

Access roads would be surfaced with crushed rock. About 10 feet on both sides of the road would be disturbed for drainage ditches, etc. Some would only be needed temporarily for access to reel and pulling sites or for clearing and would later be abandoned. The ground would be restored to its pre-construction condition after the transmission line is built. The exact location of temporary roads, if any are needed, would not be known until a construction contractor defines their access needs. All other roads would remain to provide access for line maintenance. Access road locations would be coordinated with landowners, to the extent practical, to minimize impacts on property.

The Proposed Action has been surveyed and tower sites have been located. As a result, a detailed access road plan has been developed and would include the following (numbers are approximate and include spur roads):

- access road construction with ditching (6,350 linear feet).
- access road construction without ditching (8,880 linear feet).
- access road abandoned (taken out of service) (2,900 linear feet).
- access road improvement with ditching (67,000 linear feet).
- access road improvement without ditching (15,100 linear feet).
- ***water bar*** construction (45 each).
- install tubular frame gates (9 each).
- construct five barbed wire fences (600 linear feet).

- place filter fabric for road construction (1,000 linear feet).
- 1-1/2 inch minus crushed rock (450 cubic yards).
- 3 inch minus crushed rock (10,110 cubic yards).
- pit run rock (19,325 cubic yards).
- 6 inches of crushed light rip-rap rock (80 cubic yards).

See also Photomap 1 (available on request) for information about access roads. About 2.9 miles of new access road would need to be constructed and 0.6 miles of access road would be abandoned (see **Road Removed from Service**, below). No water-crossing culverts need to be replaced or installed for the construction of the Proposed Action. BPA is pursuing permits for replacing the following existing culverts to allow for fish passage. If successful in obtaining the necessary permits, BPA would replace these culverts at an appropriate time to allow for the least disturbance to fish and their habitat. These culverts would likely be replaced after transmission line construction has been completed.

Rock Creek (survey station 325+70)

Deep Creek (survey station 460+00)

Deep Creek (survey station 475+00)

Some existing culverts north of the CRW that are crushed may be replaced. These culverts are not in wetlands or waters, but in ditches that drain water away from access roads.

Road Removed from Service — BPA would abandon (remove from service) about 100 feet of access road from about Station 432+00 to Station 435+00 (see Photomap 1, available on request). This access road is an old power line construction access road that is no longer needed. Some individuals have been using this road to gain unauthorized access into the northern portion of the CRW. By removing this road, access to the CRW by vehicle would no longer be possible. Access would be blocked by rootwads.

Another 2,700 linear feet of existing access road would be removed from service along two segments located at Station 274+50 to 292+25, mile 79 and Station 336+25 to 345+75, mile 80. These portions go through extensive wetland areas. Finally, an additional road segment could be removed from service at Station 425+00.

New roads would be constructed to replace the roads removed from service. The new roads would be on uplands except for one 150-foot long segment where access would be made through a wetland to two towers: 79/2 and 79/3. No fill would be placed in this wetland. If soil conditions are too wet during construction, temporary vehicle matting could be used where needed to cross the wetland.

➲ For Your Information

Tower numbers refer to a specific tower in a given mile (from south to north) of an existing line. For example, tower 87/4 is the fourth tower in mile 87 of the transmission line.

At one structure site, 80/2, access is blocked by a wetland. If soil conditions are too wet during construction, temporary vehicle matting would also be used there.

The Proposed Action is next to an existing transmission line. Existing access roads minimize the need to build new access roads. For most of the proposed line, only short spur roads within the ROW would be built to each tower site. A detailed access road plan that defines the locations and design of access roads would be completed if a decision were made to build the transmission line.

BPA has met with the manager of the Cedar River Municipal Watershed and other landowners to determine access road design standards and impact-minimizing techniques that have been successfully used in the project vicinity. BPA would adhere to any access road requirements established within the Watershed. Access road design and mitigation standards incorporated in BPA's Proposed Action are described in greater detail in Chapter 4.

2.1.1.6 Stream Crossings

Existing and proposed access roads may cross both ***perennial*** and ***intermittent*** streams. Each location where a road may cross a river or stream was examined to determine if a new road crossing was needed or if a nearby existing road crossing could be used. No new bridges or stream crossings would be constructed and no new culvert locations across streams are needed for this project. As noted earlier, BPA would replace some existing culverts on existing access roads where necessary to improve fish passage.

The transmission line would also occasionally span across streams. In instances where a river or stream is within a deep canyon and the transmission line conductors are high enough, no clearing or ground disturbance would occur near the creek. Some trees may be topped. In areas where the topography is flat, only low-growing trees and shrubs would be permitted to grow at a stream crossing.

2.1.1.7 Gates

Access roads used to build and maintain the proposed transmission line would cross private rural residential and timberlands and lands managed by the Cedar River Municipal Watershed. Some landowners/land managers have policies regarding public access to their properties. Locked gates are commonly used to restrict public access. BPA cooperates with landowners and would build gates and provide locks in accordance with their wishes. BPA would install nine gates.

2.1.1.8 Staging Areas

During transmission line construction, tower steel, electrical conductors, insulators and hardware are often stockpiled at sites called staging areas. The contractor(s) hired to construct the line could secure temporary rights to establish staging areas somewhere near the center and at both ends of the proposed line. To facilitate construction efficiency, staging areas tend to be located next to major highways and often are former industrial storage yards. When helicopters are used to build the transmission line structures, staging areas are typically used to pre-assemble the towers for helicopter delivery to tower sites and are used as fueling sites for those helicopters. Staging areas are only used during construction. Although the staging area locations have not yet been determined, none would be located within the CRW.

2.1.2 Substation Facilities

Substations contain electrical equipment that enables BPA to interconnect several different transmission lines, disconnect lines for maintenance or outage conditions, and regulate voltage. Additions to the existing Echo Lake Substation are required for the proposed 500-kV transmission line.

BPA's Echo Lake Substation is east of Highway 18, near the city of North Bend, in King County, Washington (see Map 1). Space for a new 500-kV ***bay*** (terminal) is available on BPA property east of the existing substation, so new equipment can be added without acquiring additional property. The new 500-kV terminal would be added on the east side of the yard. The size of the expansion would be approximately 150 feet by 750 feet.

The existing road around the substation would be relocated. The site would be fenced and graded.

The principal equipment that would be installed at Echo Lake Substation is described below.

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, trees or tree limbs falling on the line or other unusual event. The breakers would be installed at the substation to redirect power as desired. Several types of breakers have been used in BPA substations over the years. The two breakers planned for this project, called gas breakers, are insulated by special non-conducting gas (sulfur hexafluoride). These breakers would contain no oil, except a small amount of hydraulic fluid used to open and close the electrical contacts within the gas insulated breakers.

Switches — These devices are used to mechanically disconnect or isolate equipment. Switches are normally located on both sides of

circuit breakers. Switches are planned on each side of the substation dead-end tower.

Bus tubing, bus pedestals — Power moves within the substation and between breakers and other equipment on rigid aluminum pipes called bus tubing. This tubing is supported and vertically elevated by pedestals called "bus pedestals."

Substation dead-end towers — These are the towers within the confines of the substation where incoming and outgoing transmission lines end. Dead-ends are typically the tallest structures in a substation. A substation dead-end structure would be installed east of the existing structures within the substation. The 500-kV line would terminate on this tower.

Transmission dead-end towers — The last transmission towers on lines entering the substation are called dead-end towers. These towers are built with extra strength to reduce conductor tension on substation dead-ends and to provide added reliability to the substation.

Substation fence — A chain-link fence with barbed wire on top is placed around the substation to provide security. Space to maneuver construction and maintenance vehicles is provided between the fence and electrical equipment.

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 electrical danger during substation electrical failures.

2.1.3 Communication Facilities

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

One 72-strand fiber optic cable needed for communications would be strung on the new line and continue into Raver Substation. BPA is replacing its microwave communication system with fiber optic cable. The fiber optic cable is designed to meet BPA's long-term communication needs.

2.1.4 Cost Estimate

The estimated construction cost for the transmission line is $23.5 million, plus the estimated $6.5 million for expanding the substation. The additional cost of mitigation measures would increase the Proposed Action's overall cost by about $5 million, for a total project cost of $35 million. The following mitigation measures are proposed:

- use of special design elements such as micropile footings;
- erection of towers in the Cedar River Watershed using a helicopter;
- use of vegetable oil in place of hydraulic fluids within the CRW;
- use of temporary mats to cross wetlands instead of permanent fill;
- use of special surveying techniques to minimize vegetation cutting;
- use of special clearing criteria to minimize clearing;
- use of helicopter within the CRW to remove cut trees to designated central areas, then removal by log trucks;
- restricting ground-disturbing activities to the dry season (May through September);
- use of erosion specialists and monitors for erosion control;
- purchasing land as replacement habitat for habitat affected by the proposed project;
- purchasing insurance for the unlikely event that drinking water quality is degraded;
- wetland mitigation including careful cutting and removal of only vegetation that are tall-growing species, reseeding where vegetation has been removed, and purchase of lands that contain wetlands and creeks and have other environmental/social benefits;
- special mitigation (best management practices) within the CRW concerning noxious weed removal/control and general vegetation management for wildlife habitat;
- special care along creeks important to fish habitat and water quality by removing only tall-growing vegetation within and immediately next to the ROW and replanting/seeding low growing vegetation;

- no vehicular crossing of the Cedar River within the CRW including no vehicular use of the current bridge within the CRW and no crossing of the Cedar River by a helicopter with a load of logs;
- use of two double-circuit towers to cross the Cedar River within the CRW and no clearing of vegetation near the Cedar River. Remove two existing towers and put the new line and the existing 500-kV line onto the new double-circuit towers.

➲ For Your Information

The transmission line alternatives would have a minimal effect on transmission rates. The highest cost transmission line alternative could result in a 1-2 percent increase in rates for use of the transmission network, if there were no additional transmission sales to offset the increase. Rates have increased considerably in the last few years and BPA is actively pursuing cost cutting to bring expenses in line with revenues.

2.1.5 Maintenance

BPA manages vegetation on its ROWs and substation sites to prevent high voltage electricity from arcing from transmission lines to trees and other vegetation. This arcing, called ***flashover***, can cause an outage or fire. Four primary techniques are commonly used to control vegetation: manual (typically hand-cutting with chainsaws), mechanical (big brush-cutters and mowers), biological (using insects that eat certain ***noxious weeds*** such as tansy ragwort), and chemical (herbicides).

Noxious weeds *— Plants that are injurious to public health, crops, livestock, land or other property.*

Where conditions allow, herbicides are typically used in combination with other control techniques to control noxious weeds or prevent cut vegetation from resprouting. Within substations, vegetation is controlled with herbicides to prevent fires and keep the rock surface (which prevents serious shocks to workers) clear of vegetation. To manage ROWs, BPA uses an integrated vegetation management (**IVM**) approach. This approach looks at existing environmental conditions along a ROW and selects a vegetation management strategy that is best suited to these conditions. If threatened or endangered fish, animal, or plant species listed under the Endangered Species Act are found along a transmission line route, buffer zones are defined around these areas and no herbicides are used within the buffer zones. Herbicides are also not commonly used within riparian areas. SPU has requested that no herbicides be used in the CRW. BPA has not used herbicides there for the past 16 years.

BPA recently reexamined and updated its entire vegetation management program. The resulting BPA Transmission System Vegetation Management Program Final Environmental Impact Statement was released in June 2000. The methods and conclusions reached through that EIS would be applied to this project. For more information about the Vegetation Management EIS, please see Appendix K.

2.1.6 Energization Date and Expected Life of the Project

➲ For Your Information

Each of the alternatives is expected to serve system needs for about 30 to 40 years. Possible exceptions are Alternatives A and C, which would use an existing vacant 500-kV circuit running from Echo Lake to Maple Valley Substation. Since BPA was considering using this vacant circuit sometime in the near future to increase capacity of the Maple Valley Substation, Alternatives A and C might require additional investment in local system capacity sooner than the other alternatives.

The present project schedule calls for the BPA Administrator to make a decision and disclose it in a Record of Decision (**ROD**) in August 2003. If the Administrator chooses this alternative, and assuming all necessary permits are in place, construction could begin immediately after the ROD is published. Clearing the proposed ROW, and building the necessary access roads could begin as soon as BPA acquires land rights to construct the project. Depending on how soon land rights could be acquired, it may be possible that all of the clearing, access road work, and footings for the towers could be completed by fall 2003. Tower assembly, tower erection and conductor stringing would follow. Once the conductors were strung, and the substation equipment installed, testing would begin. Following successful testing of the conductors and substation equipment, the line could be energized. Barring no unforeseen problems with installation and assembly of the footings, tower steel, substation equipment and testing program, the new transmission line could be energized by the end of 2003 or early 2004.

The Proposed Action is expected to serve system needs for at least 30 years. The length of time any line will be useful also depends on the amount of new generation built in the Puget Sound area in the future. While unknown at this time, a large amount of new generation would substantially increase the new line's longevity.

It is impossible to predict what system additions will be needed beyond the Proposed Action's 30–40 year life. The last 40 years of electric industry history in the West has seen many fundamental changes. Many possible developments could affect future transmission needs, such as on-site generation with fuel cells, more efficient generators, new transmission technologies, and changed patterns of electrical use.

2.2 Alternatives to BPA's Proposed Action

2.2.1 Alternative 2

Alternative 2 would originate from a tap point about 1.5 miles east of the tap point for the Proposed Action (see Map 2). The line would traverse northwest about three miles before continuing north, paralleling the existing 500-kV transmission line into Echo Lake Substation. This alternative would be approximately nine miles long.

Alternative 2 has all the components of the Proposed Action, but would require 2.7 miles of new access roads. About 0.6 miles of existing access roads would be removed from service. It would

require additional clearing because part of the route would be on new ROW, not next to the existing line. Alternative 2 was explored because it would avoid impacting two residences and a small subdivision near the tap point of the Schultz-Raver No. 2 Transmission Line that would be impacted by the Proposed Action.

The estimated cost for Alternative 2 is $22.5 million, plus the estimated $6.5 million for the substation expansion. The cost of mitigation measures would increase the overall cost for Alternative 2 by $4 million, for a total project cost of $34 million. Mitigation measures would largely be the same as those proposed for the Proposed Action.

2.2.1.1 Energization Date

If Alternative 2 were to become BPA's preferred alternative, BPA would initiate survey activities and preliminary design. Cultural resource surveys would follow, along with reinitiating Section 7 consultation with two federal agencies (U.S. Fish and Wildlife Service and the National Marine Fisheries Service). Wetland delineations would need to be completed so that sensitive areas could be avoided when siting the transmission towers and access roads. Assuming a Record of Decision in the summer of 2003, the earliest BPA could energize the line would be in 2005, due to time necessary to acquire additional land rights.

2.2.2 Alternative 3

Alternative 3 would begin at the same tap point as Alternative 2. From this point, it would traverse northeast, then turn north-northwesterly to Echo Lake Substation (see Map 2). This alternative would be about 10.2 miles long, or about one mile longer than the Proposed Action. It would also require additional clearing because none of the route is next to an existing line. Alternative 3 was considered to better meet Western Electricity Coordinating Council reliability criteria, which requires its members to study all outages of two parallel lines on the same ROW if the outage has a statistical frequency of more than one occurrence in 300 years. The benefit of this routing alternative is that it provides enough separation from the existing line to provide increased reliability.

Alternative 3 has the same components as the Proposed Action, but requires about 6.4 miles of new access roads. No roads would be abandoned.

The estimated cost for the transmission line is $25.5 million, plus the estimated $6.5 million for the substation expansion. Mitigation measures similar to those proposed for the Proposed Action could increase costs by an additional $5 million, for a total project cost of around $37 million.

2.2.2.1 Energization Date

Implementing this alternative would require steps similar to those discussed under Alternative 2. However, since none of this alternative has been designed, it would not be energized until 2006.

2.2.3 Alternative 4A

Alternative 4A would begin at the same tap point as Alternative 2. About one-third of the way along Alternative 2, this alternative turns northwest to connect with the Proposed Action (see Map 2). Alternative 4A has the same components as the Proposed Action, with about the same transmission line length (9.5 miles), and similar new access road requirements (2.7 miles). About 0.6 miles of existing access roads would be removed from service. This alternative would require more clearing than the Proposed Action because part of the route would be on new ROW separated from an existing ROW. It was considered because it would avoid the two residences and the small subdivision adjacent to Alternative 1, while avoiding a second separate crossing of the Cedar River farther upstream from the existing crossing where Alternatives 2 and 3 would cross.

The estimated cost for Alternative 4A is the same as the Proposed Action, $23.5 million plus the estimated $6.5 million for expanding the substation. Mitigation measures could add $5 million more in costs to bring the overall project cost for Alternative 4A to $35 million. Proposed mitigation measures for this alternative are largely the same as those for the Proposed Action.

2.2.3.1 Energization Date

The date this alternative could be energized would be similar to Alternative 2 (2005).

2.2.4 Alternative 4B

Alternative 4B would also begin at the same tap point as Alterative 2. About half way along Alternative 2, this alternative would traverse southwest to connect with the Proposed Action (see Map 2). Alternative 4B has the same components as the Proposed Action, with an equivalent transmission line length (9.2 miles). It would require about 2.2 miles of new access roads. About 0.6 miles of existing access roads would be removed from service. It would require more clearing than the Proposed Action because part of the route would be on new ROW, not next to an existing line. Alternative 4B was considered for the same reasons identified in Alternative 4A; the benefits of taking advantage of the existing clearing that has already taken place on the CRW for the existing 115-kV transmission line

parallel to Pole Line Road; and the benefit of using this county road for access to the proposed power line.

The estimated cost for Alternative 4B is the same as the Proposed Action, $23.5 million plus the estimated $6.5 million for expanding the substation. The cost of mitigation measures could increase Alternative 4B's costs by $5 million, for a total project cost of $35 million. The mitigation measures proposed for Alternative 4B are largely the same as those for the Proposed Action.

2.2.4.1 Energization Date.

The date this alternative could be energized would be similar to Alternative 2 (2005).

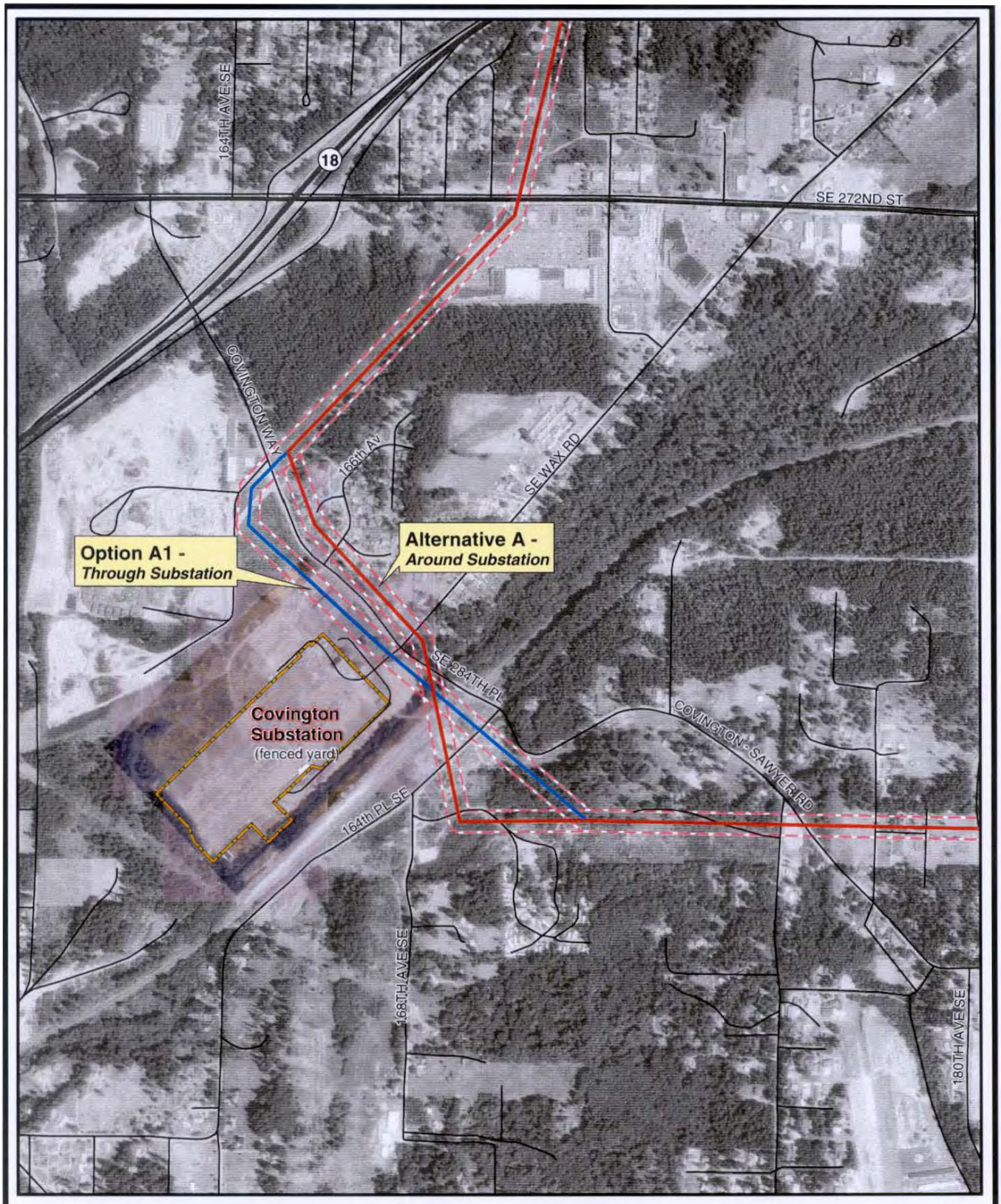
2.2.5 Alternative A

2.2.5.1 Transmission Line

Alternative A would require construction of about 20 miles of new 500-kV transmission line on mostly rural residential land, on mostly existing ROW. The alternative would use a vacant ROW between the tap point along the existing transmission line near Kangley, to a point near Covington Substation, immediately north of a portion of an existing 230-kV transmission line (see Map 1). Some new ROW would need to be acquired around the northeast side of Covington Substation to connect two transmission line ROWs, which is adjacent to Covington Substation. Connecting these two existing transmission line ROWs may require removing/relocating approximately 25 homes and displacing two undeveloped tax lots. In all, Alternative A impacts 401 tax lots along its route, 242 of which are developed.

BPA is considering an option for this alternative (Option A1) that would impact fewer homes. This option would run through Covington Substation (see Map 3) on mostly BPA-owned land. An existing BPA warehouse/office building that contains offices for 15–25 employees and other facilities would be under this option's transmission line. These employees would need to be relocated to a new building that would be built elsewhere on the same parcel or on private lands near by. The new line would also occupy currently vacant BPA land near the substation where BPA is planning to construct a new large maintenance headquarters. If the maintenance headquarters needs to be built in another area, the cost would increase by $1.5–2 million due to inefficiencies of utilities such as cabling for communications.

The existing single-circuit 230-kV line from Covington Substation to the north to a tap point on an existing double-circuit 500-kV transmission line would need to be torn down and replaced with a new double-circuit transmission line. This new transmission line would have



Proposed Alternative A - Near Covington Substation

Map 3

Proposed Alternative A

Proposed Alternative A1

Proposed Right-of-way - 150 ft.

Feet

0 250 500 750 1,000

N

November, 2002

a 230-kV line on one side and a 500-kV line on the other. The 500-kV circuit would tap one of the vacant 500-kV circuits, on an existing double-circuit 500-kV line coming from the west to take the power into Echo Lake Substation (see Map 1).

Alternative A has been modified from the alternative described in the DEIS. In the DEIS, Alternative A started from Covington Substation using an existing 230-kV line corridor. The existing 230-kV line would have been replaced with a double-circuit 500-kV line. Covington Substation would have expanded to include a new 500-kV yard and associated equipment. It would have also used an existing 500-kV vacant circuit between Raver and Covington. BPA intends to use this vacant circuit in the near future, as more transmission capacity is needed. BPA believed that it would be difficult to take the existing 230-kV line out of service for the duration of the construction period for the erection of the double-circuit 500-kV towers. This alternative was also very expensive. Due to the short-term solution of the transmission system and the cost, the original Alternative A was eliminated from further consideration.

The Alternative A as described in this SDEIS fixes many of the problems of the original Alternative A. The new Alternative A does not use the vacant circuit between Raver and Covington substations, does not place any 500-kV equipment at Covington Substation, and costs less though more transmission line would need to be constructed. The new Alternative A is considered to be a longer-term solution to the need.

Alternative A would still use the vacant 500-kV circuit on its northern end that would allow it to terminate at Echo Lake Substation. This circuit is also part of a near term plan to be used for local service loads as they increase.

2.2.5.2 Transmission Structures

The single-circuit 500-kV line between the tap point near Kangley would be supported by single-circuit towers approximately 135 feet high, and the double-circuit line between Covington and the vacant circuit of the Maple Valley-Echo Lake line would be supported by towers approximately 180 feet high (see Figures 5–7). Tangent structures and several dead-end structures would be used (see Section 2.1.1.1). For most of this alternative, BPA would use plate, grillage, and rock anchor footings (see Section 2.1.1.1). BPA would use micropile footings in the city of Kent's watershed.

Figure 5 — Covington-Maple Valley Corridor

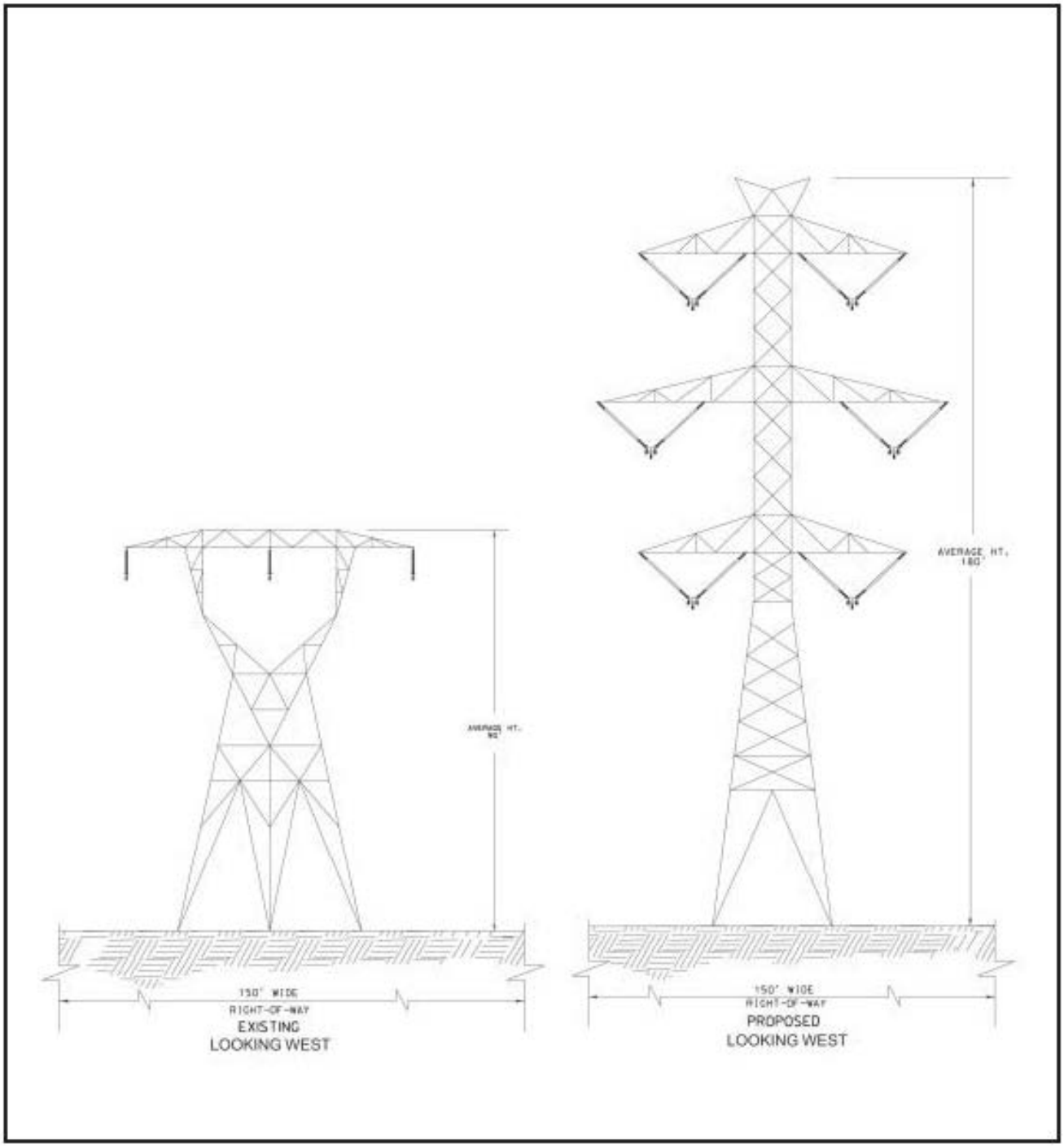


Figure 6 — East of Covington

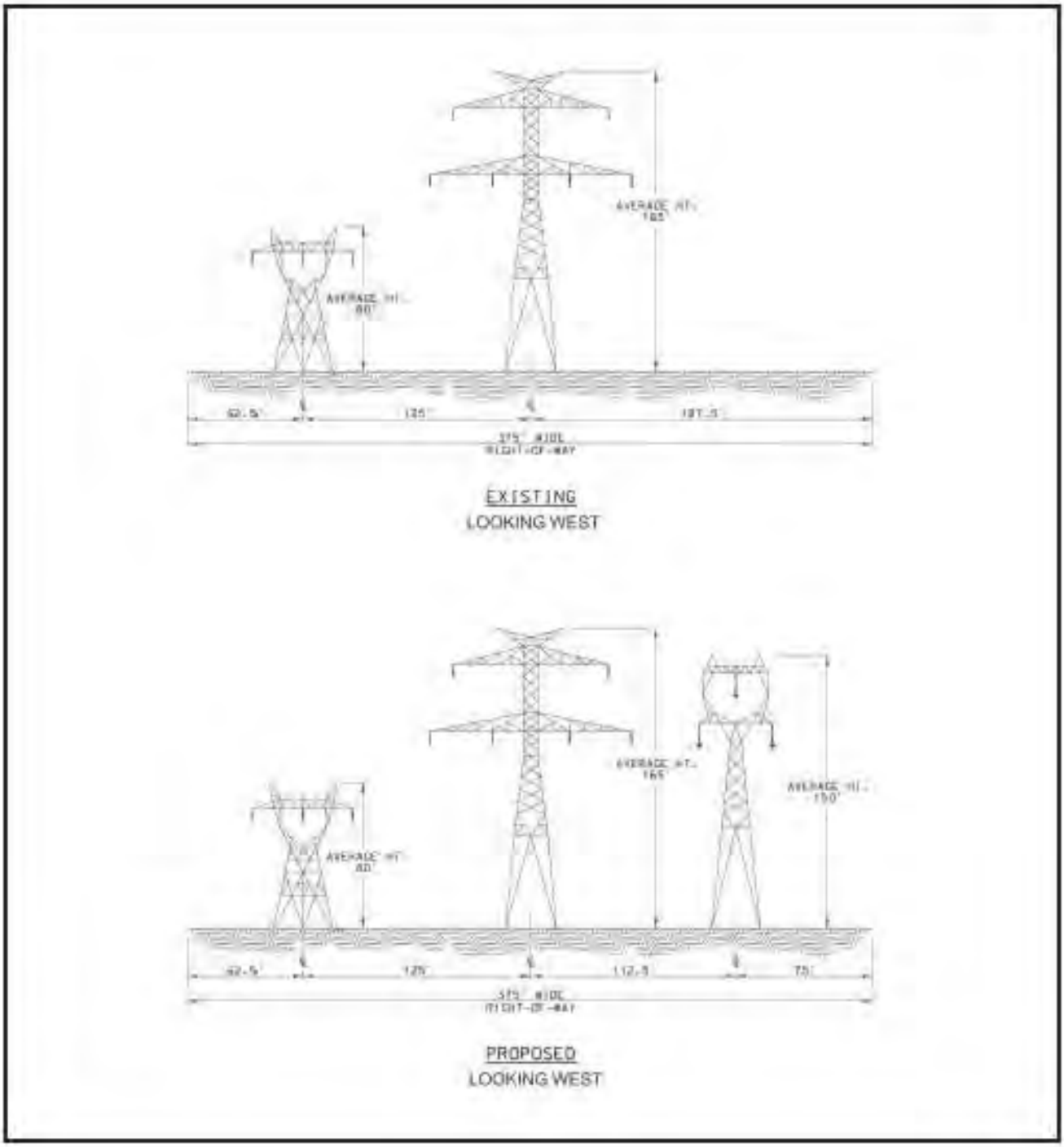
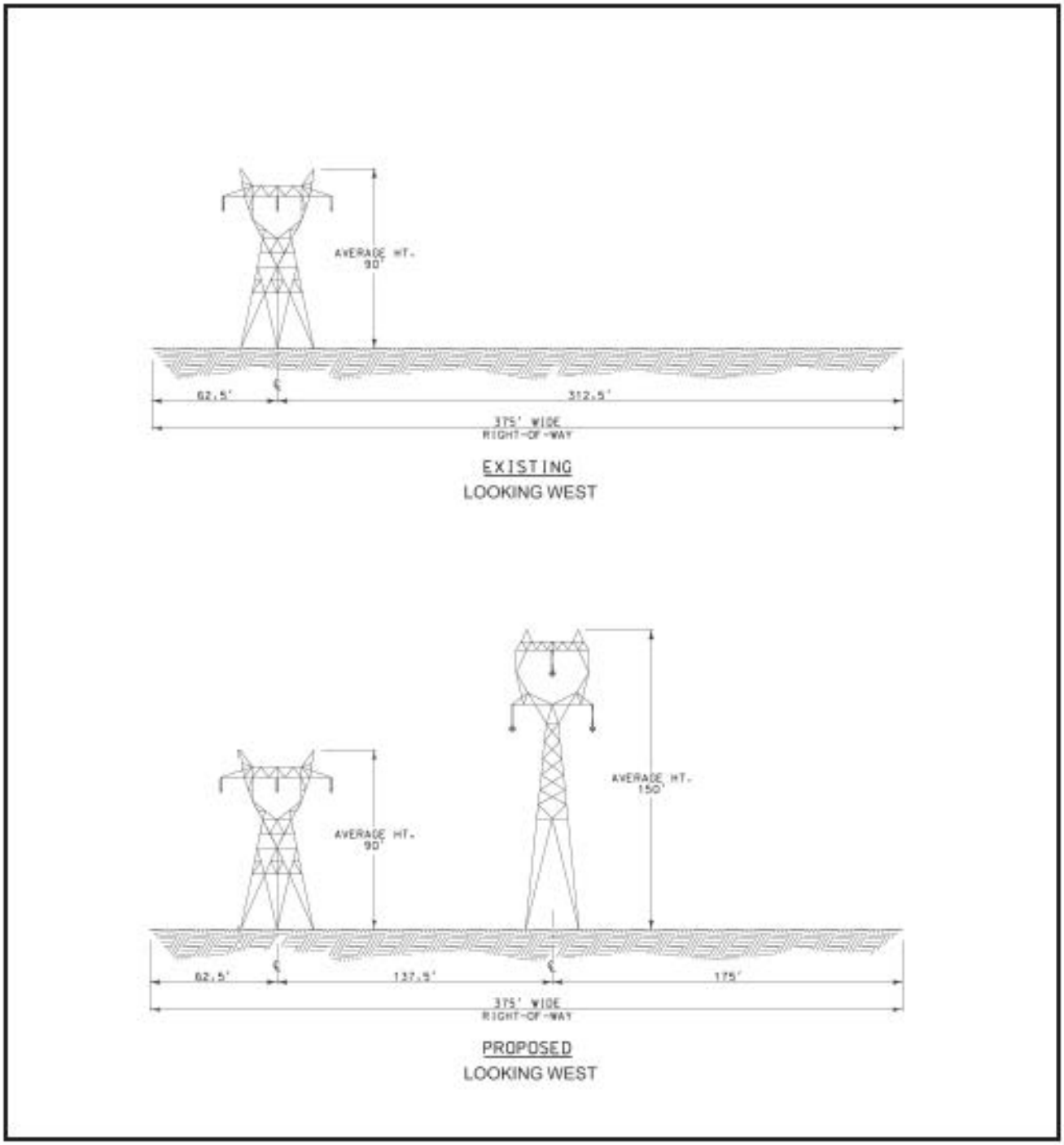


Figure 7 — Kangley West toward Covington



2.2.5.3 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action (see Section 2.1.1.2).

2.2.5.4 Right-of-Way

BPA would acquire easements to build, operate and maintain a transmission line across public and private properties where BPA does not already own these rights. Alternative A would require 150 feet of new ROW width over about one mile. For Option A1, about one-quarter mile of new ROW would be needed.

The transmission line easements would also include rights that would allow BPA to remove danger trees outside the 150-foot easement that pose a hazard to the new line (see Section 2.1.1.4, **Right-of-Way Clearing**).

BPA would also acquire access road easements on existing roads to access the transmission line ROW. When no existing roads are near the ROW, BPA would acquire access road easements that allow BPA to construct new roads. Any small structures or buildings currently encroaching on BPA's vacant or occupied ROW would need to be removed.

2.2.5.5 Right-of-Way Clearing

Clearing would be required within the existing ROW where trees have been allowed to grow. Some trees outside the ROW, if determined to be unhealthy or danger trees, would need to be removed. A total of 397 acres of vegetation would be impacted by clearing (118 acres, or 30 percent of this total, would be forested stands permanently converted to non-forest use).

Merchantable timber purchased from private owners would be marketed and non-merchantable timber would be either lopped and scattered, piled, and/or chipped and left onsite, or would be taken offsite. Non-merchantable timber may or may not be burned because of air quality constraints. Contractors would be required to use brush blades that leave low-growing vegetation in place instead of dirt blades on bulldozers for clearing. Other specialized brushing/mulching equipment may also be required. Additional best management practices (**BMP**s) for timberland would also be used.

2.2.5.6 Access Roads

About 6.6 miles of new access road would need to be acquired to build and maintain the new transmission line.

2.2.5.7 Stream Crossings

Existing and proposed access roads may cross both perennial and intermittent streams (see Section 2.1.1.6). If this alternative were chosen, each river or stream would be examined to determine if a new road crossing was needed or if a nearby existing road crossing could be used.

2.2.5.8 Gates

Access roads used to build and maintain the proposed transmission line would cross private land. Some landowners/land managers have policies regarding public access to their properties. Locked gates are commonly used to restrict public access. BPA cooperates with landowners and would build gates and provide locks in accordance with their wishes.

2.2.5.9 Staging Areas

See Section 2.1.1.8 for a description of staging areas. Staging areas for this alternative have not been determined.

2.2.5.10 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line (see Section 2.1.2). Components would be the same as the Proposed Action.

2.2.5.11 Communication Facilities

See Section 2.1.3 for a description of communication facilities. One 72-strand fiber optic cable needed for communications would be strung on the new line.

2.2.5.12 Cost Estimate

The estimated construction cost for Alternative A is $44.5 million, plus the estimated $6.5 million to expand the substation. General mitigation measures (described below) could boost this cost by $2.5 million, for a total project cost of $53.5 million. In addition, the use of tubular poles to mitigate views from homes very near the new line would add $3.5 million in costs, bringing the total to $57 million for this alternative.

If Option A1 (crossing mainly BPA land near Covington Substation) were pursued, the estimated construction cost is $37 million. This is less than the original Alternative A because of reduced property acquisition costs. The substation expansion and general mitigation measures would boost this total by about $8.5 million and tubular poles would cost an additional $3.5 million, for a potential total project cost of $49 million.

The following mitigation measures are proposed for Alternative A:

- minimizing wetland impacts and mitigate for any fill and tree removal in wetlands;
- use of special clearing criteria;
- restricting the construction period to the dry season;
- use of erosion specialists and monitors for erosion control;
- use of special care and design for crossing fish-bearing streams;
- use of special care and mitigation for crossing the City of Kent's watershed;
- measures needed for the approximately 401 landowners potentially affected;
- special care for construction near residences, particularly when removing small existing buildings and disrupting areas currently used as extensions of residents' properties (such as extending backyards into the vacant ROW).

As previously noted, Alternative A uses a vacant circuit on the Maple Valley-Echo Lake line. As loads grow, BPA would normally use this circuit. If Alternative A were selected, a new 500-kV single-circuit line may need to be built in the future at an estimated cost of $19 million. This cost also needs to be considered when evaluating this alternative.

2.2.5.13 Maintenance

See Section 2.1.5.

2.2.5.14 Energization Date.

The energization date would be similar to Alternative 2 (2005).

2.2.6 Alternative B

2.2.6.1 Transmission Line

For this alternative, 35.6 miles of the existing 345-kV single-circuit transmission line and towers between Stampede Pass and Echo Lake Substation would be torn down and new double-circuit towers erected to accommodate two new 500-kV lines. Alternative B would tap an existing 500-kV line just east of Stampede Pass and divert power to Echo Lake Substation (see Map 1). The new double-circuit line would operate on one side at 345-kV (like the existing line) and the other at 500-kV. The new double-circuit line would be built mostly on existing ROW, but would impact 110 tax lots, of which 20 are developed. No homes would be displaced. This alternative does cross the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests.

The existing 500-kV line from where Alternative B taps it to the west would be left in place, but would no longer carry any power (see Section 2.1, **Proposed Action**). However, this circuit would still be available for emergency purposes if an outage were to occur along Alternative B.

2.2.6.2 Transmission Structures

Alternative B would replace the existing 150-foot double-circuit towers that are over 50 years old with 180-foot double-circuit towers (see Figures 8–10). Tangent structures and several dead-end structures would be used (see Section 2.1.1.1).

BPA would use plate, grillage, and rock anchor footings for this alternative (see Section 2.1.1.1).

2.2.6.3 Conductors and Insulators

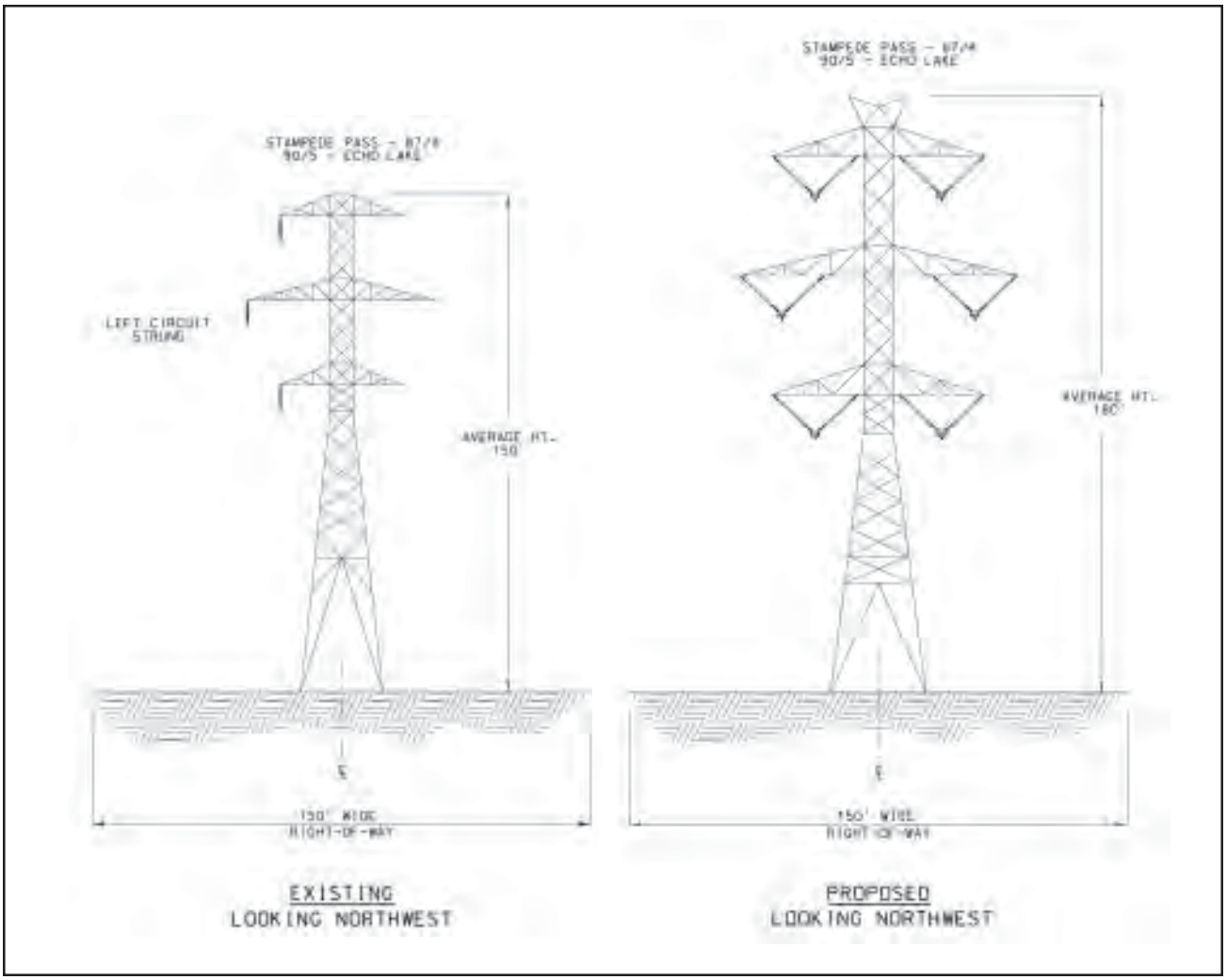
The number of conductors would increase six-fold from 3 to 18, since BPA uses three conductors per phase on a 500-kV line, and only one was commonly used on 345-kV lines (BPA no longer constructs 345-kV lines).

Conductors, insulators, ground wire and fiber optic cable used would be the same as the Proposed Action (see Section 2.1.1.2).

2.2.6.4 Right-of-Way

The new transmission line would be built mostly on existing ROW with the exception of a short segment within the Wenatchee National Forest, where the line would tap the Schultz-Raver No. 2 500-kV Transmission Line. BPA would acquire special use permits from the Forest Service and easements from other property owners where BPA does not already have a permit or easement.

Figure 8 — Rocky Reach-Maple Valley Corridor



The transmission line permits or easements would also include language allowing BPA to remove danger trees outside the 150-foot easement that pose a hazard to the new line (see Section 2.1.1.4, **Right-of-Way Clearing**). BPA would remove danger trees in locations where BPA already owns these rights, or acquire the right to remove danger trees where BPA does not already own these rights. For identification of danger trees outside the ROW, BPA would use the stable tree criteria as described in Section 2.1.1.4.

2.2.6.5 Right-of-Way Clearing

About 250 acres of vegetation would need to be cleared within and adjacent to the existing Rocky Reach-Maple Valley line ROW to accommodate the double-circuit line. Of that total, 210 acres, or 84 percent, would be forested stands permanently converted to non-forest use.

Figure 9 — Rocky Reach-Maple Valley Corridor from Tower 87/4 to Tower 90/5

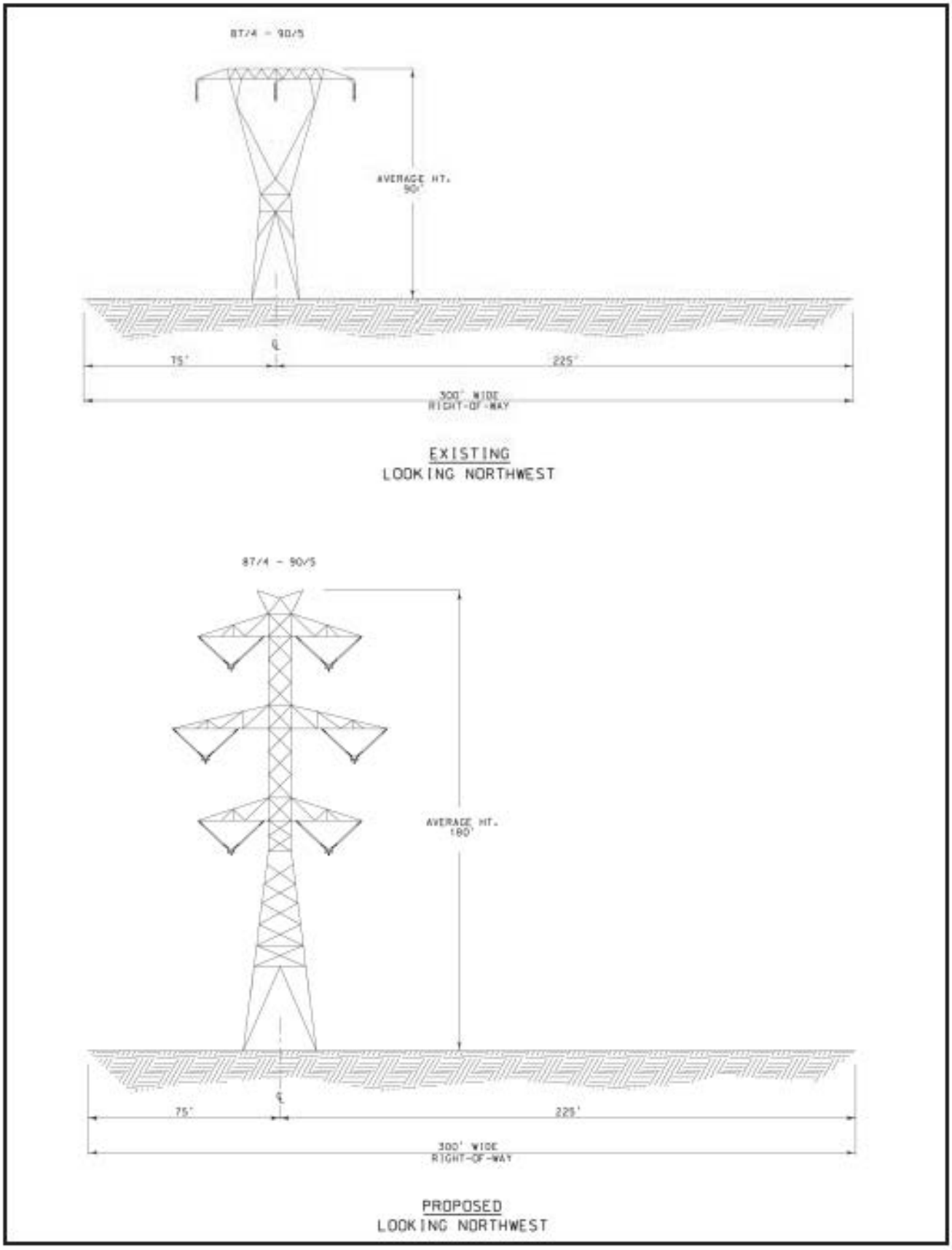
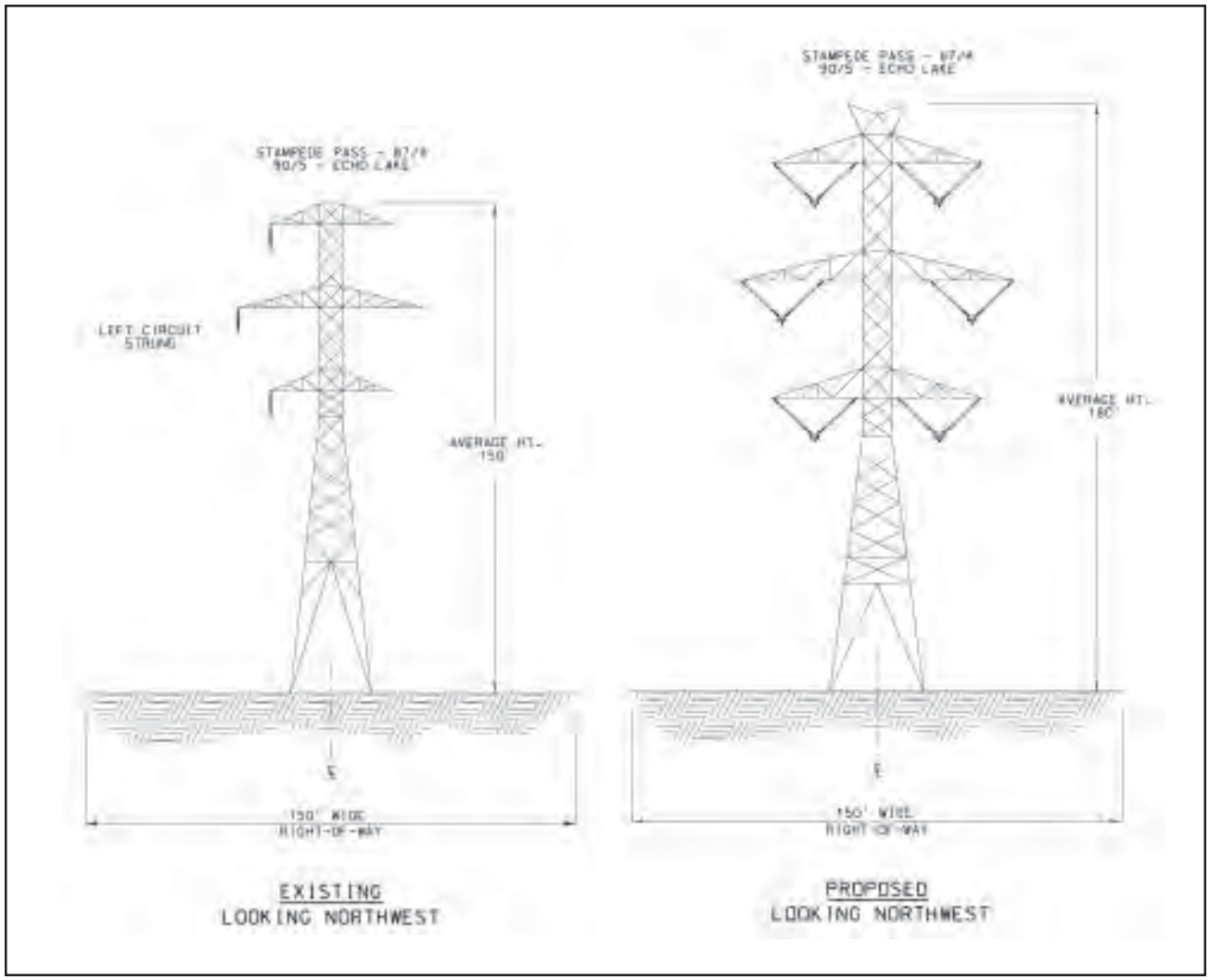


Figure 10 — Rocky Reach-Maple Valley Corridor from Tower 90/5 to Echo Lake Substation



Merchantable timber purchased from private owners would be marketed and non-merchantable timber would be either lopped and scattered, piled, and/or chipped and left onsite, or would be taken offsite. Non-merchantable timber may or may not be burned depending on air quality constraints. Contractors would be required to use brush blades that leave low-growing vegetation in place instead of dirt blades on bulldozers for clearing. Other specialized brushing/ mulching equipment may also be required. Additional BMPs for timberland would also be used.

2.2.6.6 Access Roads

Alternative B would follow an existing transmission line ROW; therefore, new access road construction would be limited to improving the existing trunk access and spur roads, reconstructing some spur roads to improve drainage, and constructing some new, short spur roads to any new tower locations. About two miles of new access road would

need to be acquired to build and maintain the new transmission line. BPA would acquire access road easements on existing roads to access the transmission line ROW or road use permits from the Forest Service. When no existing roads are near the ROW, BPA would acquire special use permits allowing construction of new roads.

Many of the existing roads would need upgrading. It is likely several culverts would need to be replaced.

2.2.6.7 Stream Crossings

Existing and proposed access roads may cross both perennial and intermittent streams (see Section 2.1.1.6). If this alternative were chosen, each stream would be examined to determine if a new road crossing was needed or if a nearby existing road crossing could be used.

2.2.6.8 Gates

Access roads used to build and maintain the proposed transmission line would cross National Forest and private land. Some landowners/land managers have policies regarding public access to their properties. Locked gates are commonly used to restrict public access. BPA cooperates with landowners and would build gates and provide locks in accordance with their wishes.

2.2.6.9 Staging Areas

See Section 2.1.1.8 for a description of staging areas. Staging areas for this alternative have not been determined.

2.2.6.10 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line (see Section 2.1.2). Components would be the same as the Proposed Action.

2.2.6.11 Communication Facilities

See Section 2.1.3 for a description of communication facilities. One 72-strand fiber optic cable may be needed for communications and could be strung on the new line. A portion of the capacity of this fiber may be leased for private use.

2.2.6.12 Cost Estimate

The estimated construction cost for Alternative B is $77 million, plus the estimated $6.5 million to expand the substation. Mitigation measures (described below) could boost this cost by $4 million, for a

total project cost of $87.5 million. The following mitigation measures would likely be required for this alternative:

- compensatory mitigation for wetland impacts and timber removed in sensitive/critical areas;
- seasonal restrictions on construction operations for wildlife protection;
- special design elements;
- special construction techniques;
- improvement of existing BPA roads to meet standards of operation and maintenance on USFS-managed lands;
- special environmental considerations associated with the line's location near I-90;
- measures needed for the approximately 110 landowners potentially affected;
- surveys required for Survey and Manage and Threatened and Endangered species (see Sections 2.2.6.14 and 2.2.6.15).

2.2.6.13 Maintenance

See Section 2.1.5. Agreements for operation and maintenance of the rights-of-way and access roads on National Forest lands would be negotiated and implemented.

2.2.6.14 Survey and Manage Survey Requirements

Selection of this alternative would require BPA to undertake surveys for Survey and Manage Species (defined in the Northwest Forest Plan) in the areas that may be affected on two National Forests. Detailed surveying, design and material orders would have to be completed and may take up to two field seasons to complete.

2.2.6.15 Threatened and Endangered Species Surveys

Selection of this alternative would require BPA to undertake surveys for threatened and endangered species such as northern spotted owl and marbled murrelet in the areas that may be affected on two National Forests. Detailed surveying, design and material orders would have to be completed and may take up to two field seasons to complete.

2.2.6.16 Energization Date

In addition to the wildlife and plant survey requirements listed above and the time required to engineer, survey, and design the line, the line would cross difficult terrain at high altitudes over the Cascade

Mountains and could possibly take two field seasons to construct. It is unlikely that the transmission line could be energized before 2006.

2.2.7 Alternative C

2.2.7.1 Transmission Line

Alternative C has two options, Option 1 and Option 2. Option C1 is approximately 10.1 miles long and Option C2 is approximately 10.6 miles long (see Map 1). Both would require new ROW away from existing transmission lines. Option C1 would begin at Raver Substation and proceed 2.5 miles west immediately north of and parallel to an existing double-circuit 500-kV transmission line on new 150-foot-wide ROW, before turning north and traveling about 7.6 miles on new 150-foot ROW through the rural residential areas of Ravensdale and Hobart. The proposed line would then tap the vacant circuit on an existing double-circuit 500-kV transmission line, west of Echo Lake Substation, just north of State Route 18 (**SR 18**). Power would be carried by this existing transmission line into Echo Lake Substation, following the completion of a short segment at Echo Lake Substation similar to that described at the north end of Alternative A (see Section 2.2.5.1).

Option C2 would begin at a tap point on an existing 500-kV double-circuit transmission line near Kangley, about 2.8 miles northeast of Raver Substation, and traverse about 4.5 miles west within a vacant transmission line ROW immediately north of a 230-kV transmission line, before turning north and continuing on the same alignment as Option C1 into Echo Lake Substation.

Both options would cross primarily private land. Option C1 would cross 128 tax lots, of which at least 54 are developed; 30–35 homes could be displaced. Option C2 would cross 134 tax lots, of which 56 are developed; 23–28 homes could be displaced.

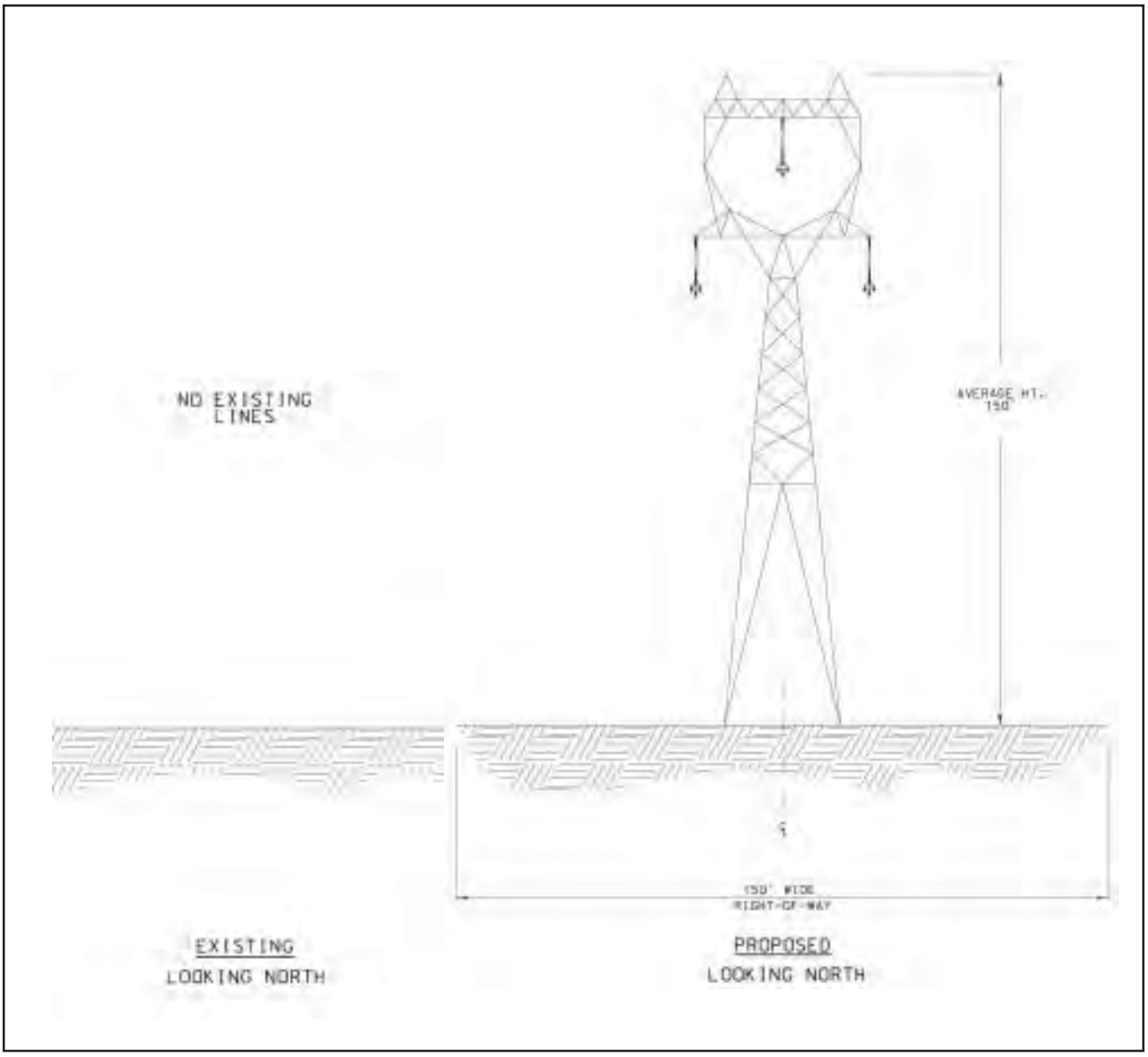
2.2.7.2 Transmission Structures

Both options would use single-circuit 500-kV towers approximately 135 feet high (see Figures 11–13). Tangent structures and several dead-end structures would be used (see Section 2.1.1.1). BPA would use plate, grillage, and rock anchor footings for both options (see Section 2.1.1.1).

2.2.7.3 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as the Proposed Action (see Section 2.1.1.2).

Figure 11 — Alternative C



2.2.7.4 Right-of-Way

BPA would acquire easements to build, operate and maintain a transmission line across public and private properties where BPA does not already own these rights. Option C1 would require 150 feet of new ROW width over about 10.1 miles. Option C2 would require 150 feet of new ROW over about 6.1 miles.

The transmission line easements would also include rights allowing BPA to remove danger trees outside the 150-foot easement that pose a hazard to the new line (see Section 2.1.1.4, **Right-of-Way Clearing**). For identification of danger trees outside the ROW, BPA would use the stable tree criteria as described in Section 2.1.1.4.

Figure 12 — Option C1

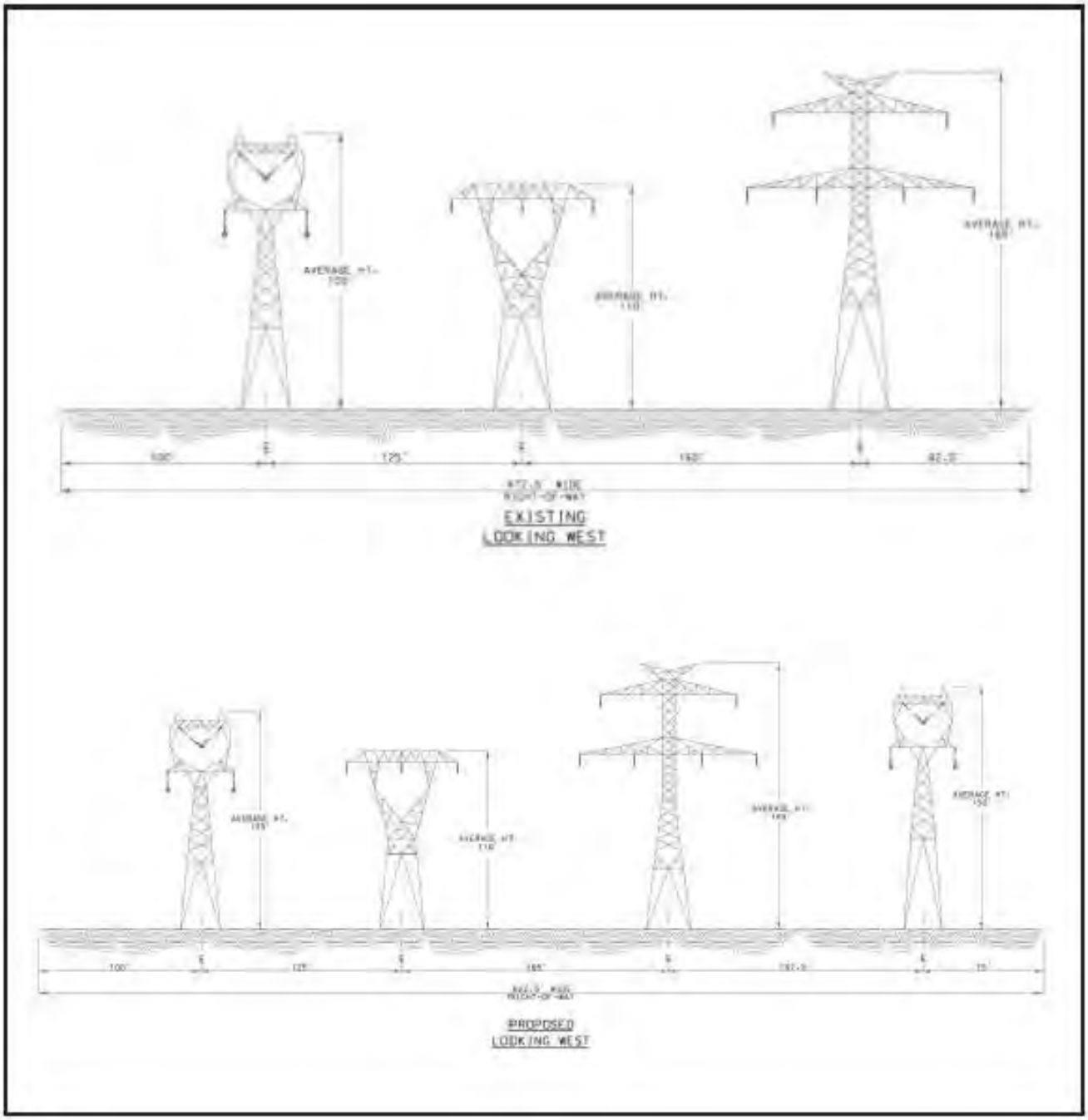
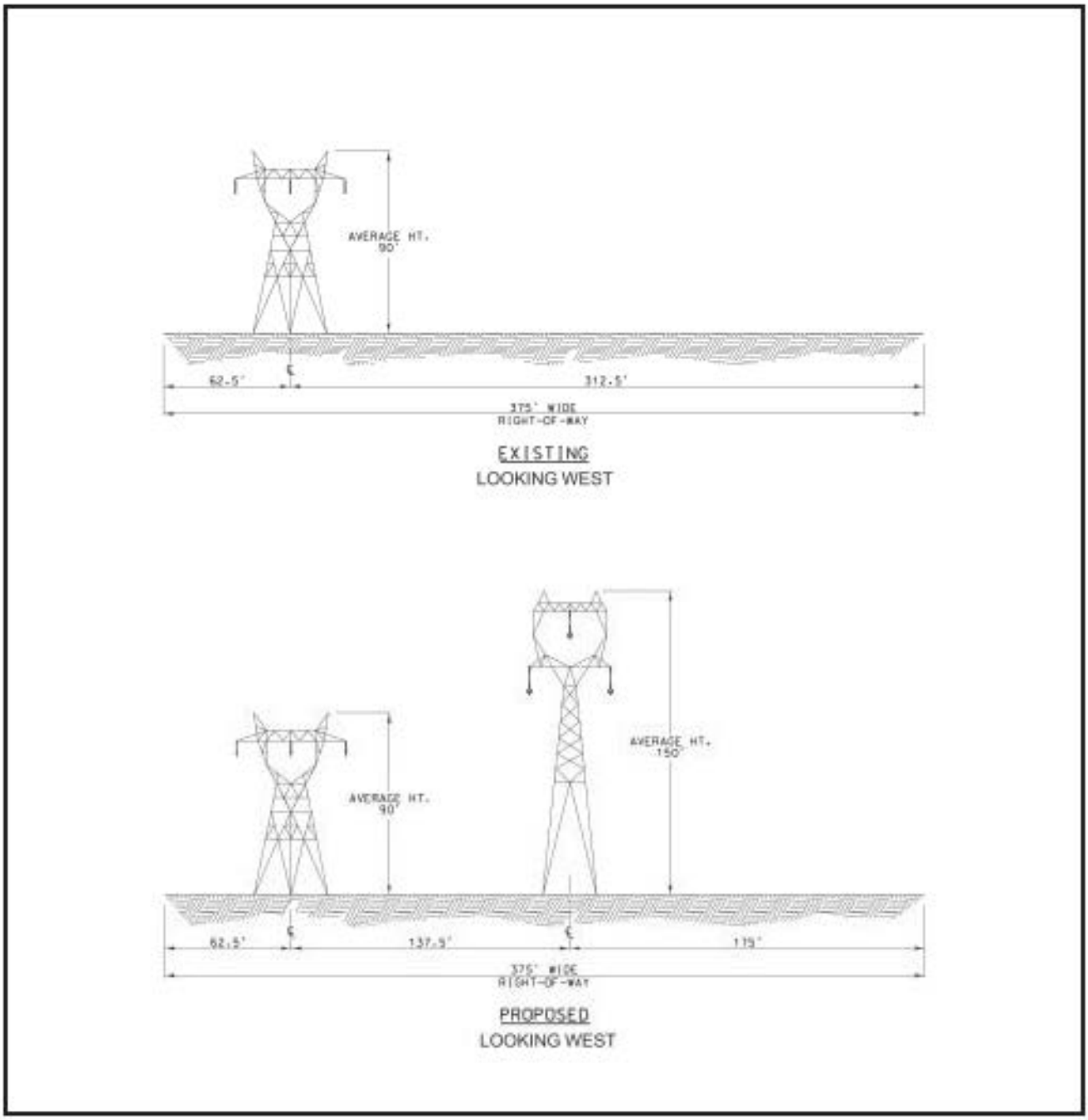


Figure 13 — Option C2



2.2.7.5 Right-of-Way Clearing

For Option C1, about 195 acres of vegetation would need to be cleared, of which about two-thirds (130 acres) would be forested stands permanently converted to non-forest use. For Option C2, about 206 acres of vegetation would need to be cleared, of which 56 percent would be permanently converted forested stands.

Merchantable timber purchased from private owners would be marketed and non-merchantable timber would be either lopped and scattered, piled, and/or chipped and left onsite, or would be taken offsite. Non-merchantable timber may or may not be burned depending on air quality constraints and nearness of an energized transmission line. Contractors would be required to use brush blades that leave low-growing vegetation in place instead of dirt blades on bulldozers for clearing. Other specialized brushing/mulching equipment may also be required. Additional BMPs for timberland would also be used.

2.2.7.6 Access Roads

Option C1 would require approximately 8.7 miles of new access roads, while Option C2 would require about 8 miles of new access roads. BPA would acquire access road easements on existing roads to access the transmission line ROW. When no existing roads are near the ROW, BPA would acquire easements that allow BPA to construct new roads.

2.2.7.7 Stream Crossings

Existing and proposed access roads may cross both perennial and intermittent streams (see Section 2.1.1.6). If this alternative were the preferred alternative, each stream would be examined to determine if a new road crossing was needed or if a nearby existing road crossing could be used.

2.2.7.8 Gates

Access roads used to build and maintain the proposed transmission line would cross private land. Some landowners/land managers have policies regarding public access to their properties. Locked gates are commonly used to restrict public access. BPA cooperates with landowners and would build gates and provide locks in accordance with their wishes.

2.2.7.9 Staging Areas

See Section 2.1.1.8 for a description of staging areas. Staging areas for this alternative have not been determined.

2.2.7.10 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line (see Section 2.1.2). Components would be the same as the Proposed Action. Option C1 would start at Raver Substation and similar equipment as is proposed at Echo Lake Substation would be installed at Raver Substation.

2.2.7.11 Communication Facilities

See Section 2.1.3 for a description of communication facilities. One 72-strand fiber optic cable may be needed for communications and could be strung on the new line.

2.2.7.12 Cost Estimate

The estimated construction cost for Option C1 is $46.5 million, which includes the estimated $6.5 million to add new equipment to Raver Substation. Adding the estimated $6.5 million to expand Echo Lake Substation and $5.5 million in estimated general mitigation costs would boost the total project cost to $58.5 million. In addition, the use of tubular poles to mitigate views from homes near the new line would add $1.2 million in costs, bringing the total to $59.7 million for this alternative.

If Option C2 were pursued, the estimated construction cost is $32.5 million, plus the estimated $6.5 million cost of expanding Echo Lake Substation. General mitigation measures could boost this total by $4 million and tubular poles would cost an additional $1.2 million, for a potential total project cost of $44.2 million.

The following mitigation measures are proposed for both Alternative C options:

- minimizing wetland impacts;
- use of special clearing criteria;
- restricting the construction period to the dry season;
- use of erosion specialists and monitors for erosion control;
- use of special care and design for crossing fish-bearing streams;
- use of special care and mitigation for crossing the city of Kent's watershed;
- measures needed for the landowners potentially affected (128 under Option C1; 134 under Option C2);
- special care for construction near residences, particularly when removing trees adjacent to the ROW.

As previously noted, Alternative C uses a portion of the vacant circuit on the Maple Valley-Echo Lake line. As loads grow, BPA would normally use this circuit. If Alternative C were selected, a new 500-kV single circuit line may need to be built in the future at an estimated cost of $9 million. This cost also needs to be considered when evaluating this alternative.

2.2.7.13 Maintenance

See Section 2.1.5.

2.2.7.14 Energization Date

The energization date would be similar to Alternative 3. Construction of Alternative C could be accomplished in a single year if the work could begin early in the construction season. However, because this line has not been surveyed or designed, the earliest the line could be completed and energized would likely be fall 2006.

2.2.8 Alternative D

2.2.8.1 Transmission Line

Alternative D would tap an existing 500-kV line just east of Stampede Pass and divert power to Echo Lake Substation over 35.6 miles of new single-circuit 500-kV transmission line. The existing line from the tap point to the west would be left in place, but de-energized (see Section 2.2.6.1). The circuit would still be available for emergency purposes, if an outage were to occur along the new transmission line into Echo Lake Substation.

Alternative D has two options, Option D1 and Option D2. Option D1 is located immediately adjacent to and south of the existing 345-kV line; Option D2 is located immediately adjacent to and north of this line. Either option would entail acquiring and clearing a new 150-foot wide ROW and building a new 500-kV single-circuit transmission line. Option D1 crosses 134 tax lots, of which 32 are developed; 11–14 homes would be displaced. Option D2 crosses 121 tax lots, of which 22 are developed; eight homes would be displaced. Both options cross the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests.

2.2.8.2 Transmission Structures

Alternative D (either option) would be supported by steel towers approximately 150 feet tall, about the same height as most of the existing towers supporting the Rocky Reach-Maple Valley line that would be next to this new line. (See Figures 14–15 showing Option D2; Option D1 would have the new towers on the other side of the

existing line.) BPA would use tangent structures, several dead-end structures, and plate, grillage, and rock anchor footings for this alternative (see Section 2.1.1.1).

Figure 14 — Option D2 Stampede Pass to Tower 87/5, and Tower 90/5 to Echo Lake Substation

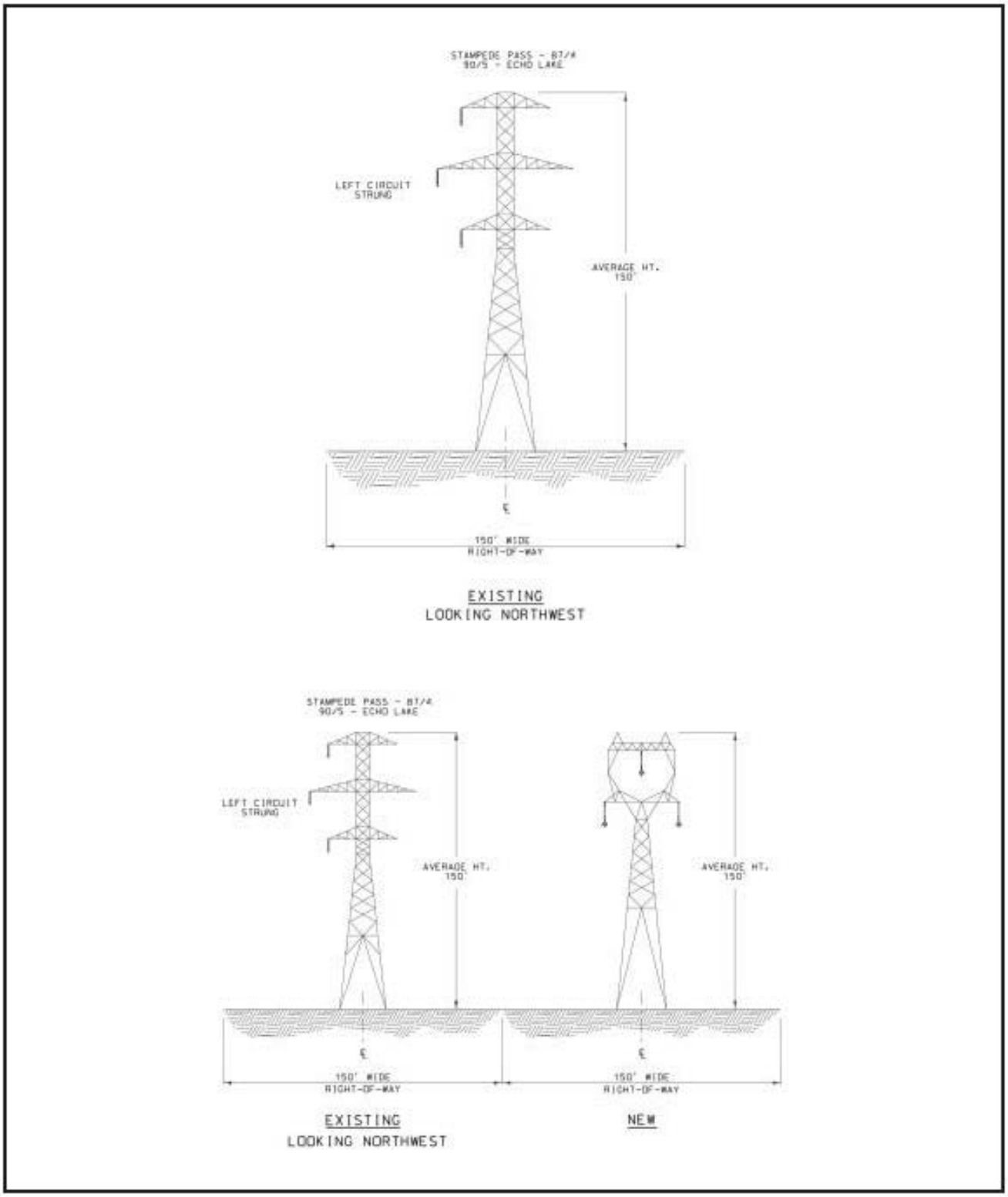
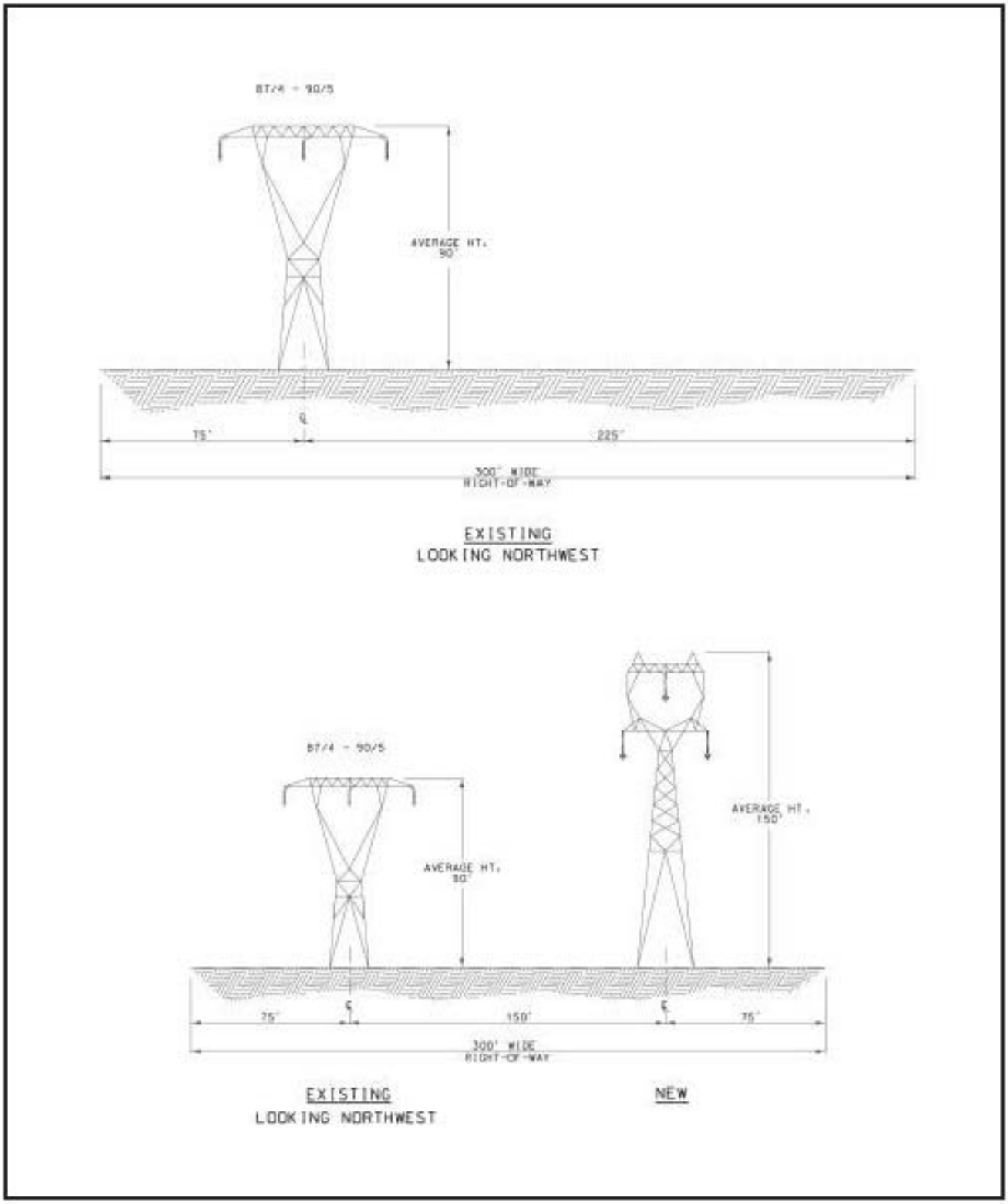


Figure 15 — Option D2 Tower 87/5 to Tower 90/5



2.2.8.3 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as the Proposed Action (see Section 2.1.1.2).

2.2.8.4 Right-of-Way

The new transmission line would be built on new ROW. BPA would acquire a special use permit on National Forest land and easements on private land where BPA does not already own these rights. Options D1 and D2 would require 150 feet of new ROW width over about 35.6 miles.

The transmission line easements or permits would also include language allowing BPA to remove danger trees outside the 150-foot easement that pose a hazard to the new line (see Section 2.1.1.4, **Right-of-Way Clearing**). For identification of danger trees outside the ROW, BPA would use the stable tree criteria as described in Section 2.1.1.4.

2.2.8.5 Right-of-Way Clearing

In general, where new ROW is obtained, a strip of land about 150 feet wide would be cleared to allow for tower construction and conductor clearance. About 769 acres of vegetation would need to be cleared within the new ROW for Option D1. Of that amount, 82 percent (632 acres) would be forestland permanently converted to non-forest use. For Option D2, 776 acres of vegetation would be cleared, of which 89 percent (694 acres) would be permanently converted forestland.

Modern logging methods, including the use of cable logging and low ground pressure equipment, would be used where appropriate to reduce the amount of access road building and ground disturbance. A low ground cover of vegetation consisting of shrubs and grasses would remain following logging, and the cleared area would not be burned. Over the years, the vegetation would grow to a taller and denser condition. Consequently, the benefits of vegetation, including root strength, soil cover, interception of precipitation, and ***evapotranspiration*** would remain to some extent during and following construction.

➲ For Your Information

Evapotranspiration *— The total water loss from the soil, including that by direct evaporation and that by transpiration from the surfaces of plants.*

Merchantable timber purchased from private owners would be marketed and non-merchantable timber would be either lopped and scattered, piled, and/or chipped and left onsite, or would be taken offsite. Non-merchantable timber may or may not be burned depending on air quality constraints and nearness of an energized transmission line. Contractors would be required to use brush blades that leave low-growing vegetation in place instead of dirt blades on bulldozers for clearing. Other specialized brushing/mulching

equipment may also be required. Additional BMPs for timberland would also be used.

2.2.8.6 Access Roads

About 13.6 miles of new access road would need to be acquired to build and maintain the new transmission line for Option D1 and 13.2 miles for Option D2. This would result in the clearing of 33 acres for Option D1 and 32 acres for Option D2. BPA would acquire access road easements on existing roads to access the transmission line ROW. When no existing roads are near the ROW, BPA would acquire easements that allow BPA to construct new roads.

Many of the existing roads would need upgrading. It is likely several culverts would need to be replaced.

2.2.8.7 Stream Crossings

Existing and proposed access roads cross both perennial and intermittent streams (see Section 2.1.1.6). If this alternative were selected, each stream would be examined to determine if a new road crossing was needed or if a nearby existing road crossing could be used.

2.2.8.8 Gates

Access roads used to build and maintain the proposed transmission line would cross National Forest and private land. Some landowners/land managers have policies regarding public access to their properties. Locked gates are commonly used to restrict public access. BPA cooperates with landowners and would build gates and provide locks in accordance with their wishes.

2.2.8.9 Staging Areas

See Section 2.1.1.8 for a description of staging areas. Staging areas for this alternative have not been determined.

2.2.8.10 Substation Facilities

Additions to the existing Echo Lake Substation are required for the proposed 500-kV transmission line (see Section 2.1.2). Components would be the same as those described under the Proposed Action.

2.2.8.11 Communication Facilities

See Section 2.1.3 for a description of communication facilities. One 72-strand fiber optic cable needed for communications would be strung on the new line.

2.2.8.12 Cost Estimate

The estimated construction cost for Option D1 is $55.5 million, plus the estimated $6.5 million to expand Echo Lake Substation. Mitigation measures could increase costs by $10.5 million, for a total project cost of $72.5 million.

The estimated construction cost for Option D2 is $53 million, plus the estimated $6.5 million to expand Echo Lake Substation. Mitigation measures could increase costs by $11 million, for a total project cost of $70.5 million.

The following mitigation measures would likely be required for this alternative:

- compensatory mitigation for wetland impacts and timber removed in sensitive/critical areas;
- seasonal restrictions on construction operations for wildlife protection;
- special design elements;
- special construction techniques;
- improvement of existing BPA roads to meet standards of operation and maintenance on Forest Service managed lands;
- potential relocation of roads;
- special environmental considerations associated with the line's location near I-90;
- measures needed for the approximately 134 landowners potentially affected by Option D1 and 121 landowners potentially affected by Option D2.
- surveys required for survey and manage and threatened and endangered species (see Sections 2.2.8.14 and 2.2.8.15);
- requirements to mitigate for potential impacts to threatened and endangered species and survey and manage species that are discovered.

2.2.8.13 Maintenance

See Section 2.1.5. Agreements for operation and maintenance of the rights-of-way and access roads on National Forest lands would be negotiated and implemented.

2.2.8.14 Survey and Manage Survey Requirements

Selection of this alternative would require BPA to undertake surveys for Survey and Manage Species (defined in the Northwest Forest Plan) in the areas that may be affected on two National Forests. Detailed surveying, design and material orders would have to be completed and may take up to two field seasons to complete.

2.2.8.15 Threatened and Endangered Species Surveys

Selection of this alternative would require BPA to undertake surveys for threatened and endangered species such as northern spotted owl and marbled murrelet in the areas that may be affected on two National Forests. Detailed surveying, design and material orders would have to be completed and may take up to two field seasons to complete.

2.2.8.16 Energization Date

In addition to the wildlife and plant survey requirements listed above and the time required to engineer, survey, and design the line, the line would cross difficult terrain at high altitudes over the Cascade Mountains and could possibly take two field seasons to construct. It is unlikely that the 35.6-mile long transmission line could be energized before 2006.

2.2.9 Non-Transmission Alternative

Some commentors suggested that a variety of non-transmission alternatives such as Demand-Side Management (**DSM**), Distributed Generation (**DG**), large-scale generation (**G**) and Demand Response (**DR**), could defer or eliminate the need for a new transmission line. To examine these alternatives, BPA engaged a team of experts from Energy and Environmental Economics (E3), Awad & Singer, Nexant, Inc., and Tom Foley Consultants (see Appendix J for their full report). The goals of this evaluation were to:

1. Identify technologies that would be cost effective alternatives to the Proposed Action.
2. Evaluate the sensitivity of the cost effectiveness analysis to variations in key input assumptions.
3. Estimate whether achievable load reduction from those cost effective alternatives would be sufficient to defer the need for the line.

2.2.9.1 Required Load Reduction

The need for the project is discussed in Chapter 1 (see Sections 1.1 and 1.2). Loadings on the Covington Substation transformer banks are a key indicator of the extent of the problem. Transmission alternatives that reduce loadings on the transformer banks below the limit will also prevent overloads on other elements. The Covington transformers have a combined emergency rating of 2,850 MW. BPA conducted load flow studies for extreme cold weather conditions in winter 2003–04, and concluded that an outage would cause an overload of 122 MW on the transformer banks. Table 2-2 shows the forecast of load reduction requirements on the transformers based on the needs assessment. If this amount of load reduction can be achieved during the critical periods, BPA can maintain its system reliability criteria and defer the project. The amounts required increase each year, due to load growth and increases in the amount of Canadian Entitlement power that must be returned to Canada.

Table 2-2 — Overload of the Covington Transformers

Year	Peak Load (MW)
2002	-
2003	122
2004	190
2005	269
2006	397
2007	449
2008	505

The load forecasts represent total load in the Puget Sound area, from Tacoma in the south to the Canadian border in the north. However, load reduction at different locations will have a different effect on transformer loadings due to network power flow interactions. For example, a 230-kV line connects Covington Substation with the heavy industrial area south of downtown Seattle. A 100 MW load reduction in this area reduces loadings on the Covington transformers by 42 MW. Load changes in other areas have a lesser effect. The same reduction in Tacoma would only achieve a 20 MW reduction at Covington.

When applying these factors, the 122 MW that are required to bring the peak load of Covington below overload levels translates to approximately 381 MW of load reduction or additional generation within the Puget Sound Area in the first year assuming an average distribution factor of 32 percent.

2.2.9.2 Non-Transmission Alternatives Examined

Demand Response (DR) Programs — DR programs are a potential source of load reduction that could be exercised during an "Arctic Express" event to prevent overloads on the Covington transformers. These options include Direct Load Control (**DLC**), interruptible/curtailable (non-firm) rates, and demand bidding (i.e., the Demand Exchange) to reduce loads when needed during system peaks. These types of solutions are an effective approach to achieve load reductions because they directly address the capacity nature of the problem.

DR programs can be categorized into two major types: 1) price-based dispatch programs that offer customers incentives to voluntarily curtail load during the peak; and 2) pre-arranged contracts with customers (such as interruptible/curtailable rates or direct load control) that would require a customer to reduce loads during the system peak for a fixed price at BPA's request. These programs differ in their implementation and potential for providing load relief as discussed below. In this analysis we evaluate both price-based dispatch and interruptible/curtailable for their capability to provide the needed capacity to BPA.

Price-based dispatch programs are voluntary programs in which the price for curtailment or interruption is determined through a price convergence mechanism (i.e., auction, bidding system, etc.) between load serving entities and customers. Customers can choose the point at which the price available to them is high enough to offset their productivity losses from reducing or shutting-off their load. If the price offered by the load serving entity is high enough, then sufficient load reduction can, in all probability, be purchased at that price. While price-based dispatch programs result in a particularly efficient process of load reduction, they do not provide firm or guaranteed reductions in system load when needed.

Interruptible/curtailable contracts differ from the price-based dispatch programs because the terms (i.e., number of times/year the customer can be curtailed, maximum hours per interruption, and notification period for interruption) and the price (fixed component) are pre-determined and bound with an enforceable contract. By securing a contract for the load reduction, the available peak load relief is more certain for planning purposes. This type of program is better suited for the type of system conditions driving the need for the transmission line, where extreme but infrequent weather conditions result in high levels of load relief required over relatively few hours of the year.

Demand-Side Management Measures — DSM measures are typically considered energy efficiency measures rather than peak shaving programs. However, certain measures such as heating efficiency and weatherization will reduce heating loads and have an

impact on peak demand reduction so they were included in the economic screen. We used DSM cost and performance measures from the Northwest Power Planning Council Database.

Generation and Distributed Generation — There are a variety of generation options that could help to defer the transmission line, including both existing and new generation. In the course of this study we identified 277 MW of additional capacity that could potentially be available from existing generators in the Puget Sound area. An additional 270 MW of capacity is currently under construction. Together, these plants could provide up to 170 MW of relief at Covington Substation. Another 2,700 MW of capacity are either permitted or planned, although it is uncertain how much, if any, of this capacity will eventually be constructed.

BPA makes assumptions about the disposition of existing generators when it conducts its studies of the power flows across critical transmission system elements. BPA generally assumes that all generators in the Puget Sound area would be running to meet the extremely heavy loads during an Arctic Express event. However, this analysis uncovered approximately 390 MW of capacity at several generating stations in the area that is not running for BPA's load flow studies. This capacity could potentially be called upon by BPA during the target hours.

In addition to the existing facilities, a number of new, large power plants have been proposed for the Puget Sound area since the late 1990s. Nearly all of these plants would be large natural gas-fired, combined-cycle combustion turbine plants. Together, these plants would add approximately 3,000 MW of generating capacity. Of course, many if not most of these projects will never be built. Still, even one of the larger projects could reduce the need for the transmission project.

Regional Availability of Natural Gas — One issue is the availability of natural gas, and the ability of the region's natural gas system to deliver the gas to all of the existing and new natural gas-fired generators in the Puget Sound area. As generating capacity would be needed by BPA during the highest loads of an Arctic Express event, this time period would almost certainly experience extremely high coincident demand for natural gas. Like electricity transmission, the natural gas delivery system has a fixed peak delivery capacity; once the limits of the system are reached, there is very little that can be done on short notice to increase deliveries. BPA relies on gas-fired generators to operate to avoid a Puget Sound-area blackout during an Arctic Express event. Whether generators would be able to obtain firm gas supplies with the incentive level BPA can offer might not be known until the implementation phase.

Existing Distributed Generation — In addition to the existing large generation discussed above, there are also small-scale distributed generators in the Puget Sound region. According to estimates, existing idle DG at local industrial sites, banks, hospitals etc., amounts to approximately 60 MW in the region. This translates to less than 20 MW available at Covington Substation after applying the appropriate load flow factors. This idle capacity could potentially be called upon by BPA during the target hours.

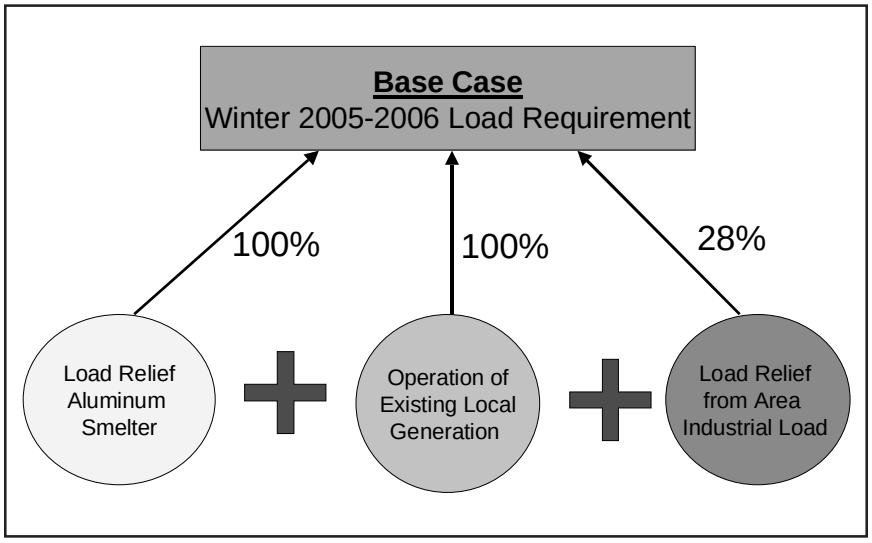
New Distributed Generation — Small-scale, distributed generation can often serve as a substitute for investment in transmission or distribution circuits. However, in this case, the potential overload is sufficiently large and the load area sufficiently diverse such that distributed generation does not appear to be an economically viable alternative.

Renewable Generation and Emerging Technologies — Renewable generation such as wind and solar were not considered for this study, because their resource characteristics are a poor match for BPA's needs to defer the project. Wind energy was excluded because the Puget Sound Area is not home to a commercial-grade wind resource. Solar was excluded because the critical hours occur during the winter months when solar radiation is scarce, and many of the target hours occur during the evening. Fuel cells do not suffer from these disadvantages, and were considered for the high-level screen. However, their extremely high cost makes them unattractive as a substitute for the project.

2.2.9.3 Findings

A high level of load reduction or additional generation is required — A three-year deferral of the transmission project requires 269 MW of load reduction or additional generation at Covington, or 841 MW within the Puget Sound Area. As shown in Figure 16, this would call for 100 percent of the available load relief from the large aluminum smelter in the area, plus operation of all existing generation not expected to be on-line (absent a contract obligation to BPA), plus load relief from 28 percent of industrial load in the area. To put this in perspective, based on information from 13 utility demand response programs, only four were found with participation rates above 5 percent.

Figure 16 — Load Relief and Generation Requirements for a 3-Year Deferral of the Transmission Line (Base Case Assumptions)



Transmission avoided costs are low — The avoided cost of the transmission project, assuming a cost of $25 million and annual operations and maintenance (O&M) costs of $50,000 for the line, is approximately $1.49 million per year. Therefore, to prevent increasing costs, 122 MW of demand reduction at Covington Substation must be purchased for $1.49 million or less. This equates to approximately $12.25 per kW at Covington Substation per year or $3.92 per kW-year in the Puget Sound Area based on average load flow distribution factors.

Constructing the transmission line reduces power losses on the transmission system by 11 MW at the time of system peak or 5.5 MW on average over the year. This results in annual energy savings of 48,180 MWh, valued at nearly $2 million. The economic value of the energy savings is greater than the cost of the line.

Incentive Levels are low compared to other programs — The likelihood of achieving significant participation in demand response programs with incentive levels based on the avoided cost of deferring the transmission line cannot be determined precisely without a detailed assessment. The consultants compared incentive levels and penetration rates for 19 programs across the United States with the incentive levels and penetration rates required for cost-effective deferral of the line. From this comparison they conclude that it is unlikely the available incentive payments based on the value of deferring the line would be sufficient to achieve the significant penetration required in this case. Any demand response program designed to meet the load relief needs at Covington Substation would need to achieve higher penetration with a lower incentive level than the programs observed in the survey.

Demand Response is the most cost-effective alternative from a transmission rate perspective — Of the alternatives considered, demand response programs are most likely to be cost-effective from the transmission rate perspective and to participants. Demand Response is well suited to solving the capacity problem without causing significant revenue loss since it focuses load reduction on only the hours when needed for system reliability. Demand response is not cost effective from the Total Resource Cost perspective because of the significant energy loss savings that the line provides.

Alternatives could be cost effective only if demand is lower than forecast — To provide a comprehensive assessment of the potential for cost effective alternatives to the line, the consultants conducted a scenario analysis. The purpose of the analysis was to evaluate the sensitivity of cost effectiveness results to changes in key economic inputs. They tested the entire range of alternative technologies under three sets of economic assumptions. These included the base case, which was largely derived from BPA's transmission planning work, an "optimistic" case that improves the cost-effectiveness and penetration requirements of alternatives, and a "pessimistic" case that reduces the cost-effectiveness of alternatives. The base case represents the best estimate of the future, and the optimistic and pessimistic cases represent extremes that have a low probability of occurring.

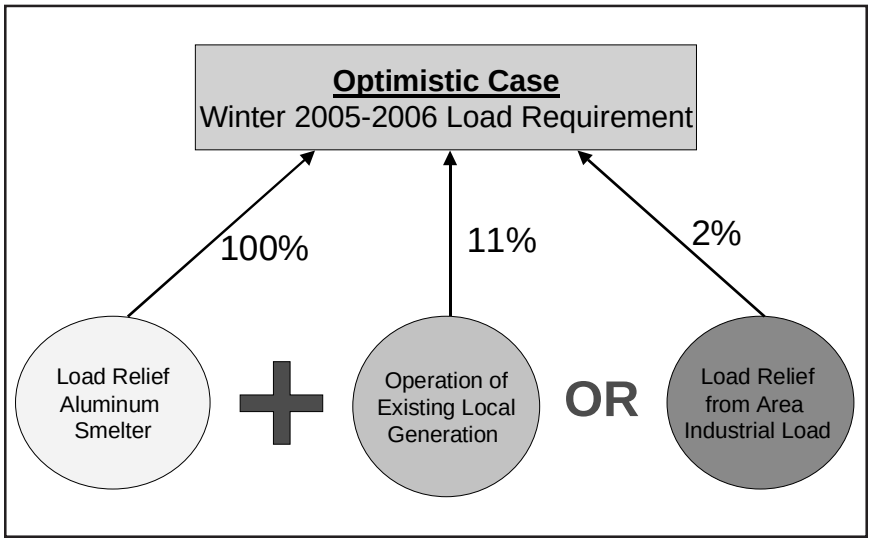
The transmission line is the most cost effective solution to capacity constraints in both the base and pessimistic cases. In the optimistic case, demand reduction and generation were cost effective from both the ratepayer and participant perspectives.

In this optimistic case BPA would require 82 MW of load reduction at Covington Substation to defer the line for 3 years or 256 MW within the Puget Sound Area. As illustrated in Figure 17, this can be achieved through 100 percent of available load relief from the large aluminum smelter in the area, plus either operation of 11 percent of existing generation not expected to be on-line or load relief from 2 percent of industrial load in the area.

2.2.10 No Action Alternative

The No Action Alternative is often called the no-build alternative. The environmental impacts described for each of the alternatives described above would not occur. The No Action Alternative does not mean there would never be a need for future transmission projects, only that no line would be considered for construction in this general area in the near future.

Figure 17 — Load Relief and Generation Requirements for a 3-Year Deferral of the Transmission Line (Optimistic Assumptions)



2.3 Alternatives Considered but Eliminated from Detailed Study

A wide variety of alternatives were considered for this project. The following were eliminated when they were judged to not meet the purpose and need or were prohibitively more expensive than other alternatives.

BPA looks for alternatives that would help keep its rates low. BPA is mandated by the Northwest Power Act to recover its costs sufficiently to repay the U.S. Treasury after first meeting its other costs. As the electric industry changes, BPA must be able to recover its costs and compete with other suppliers in the western United States. This means balancing its responsibilities to ratepayers, customers and the environment and setting rates at the lowest possible level consistent with sound business principles.

2.3.1 Building an Underground Transmission Line

Some people suggested during the scoping period that BPA consider putting the line underground. BPA considers and at times has used underground transmission cables for new lines. Transmission line cables are highly complex in comparison to overhead transmission lines. Even with current technologies, transmission cables normally exceed the cost of overhead transmission lines by many times; for 500-kV circuits, underground cable may be 10 times as costly.

The average cost of $800,000 to $1 million per mile for building overhead transmission lines balloons to $10 to $15 million when going underground. This would add at least $80 million to the estimated cost for building the preferred alternative. In addition, if an underground cable goes out, it takes a long time to fix — days or weeks instead of hours for an overhead line. Finally, digging an adequate trench along the length of any alternative would cause much greater disruption to the environment than ROW clearing for overhead lines.

Because of the cost, BPA uses underground cable in limited special reliability or routing situations. Examples of these situations are locations where unusually high circuit reliability is required, such as near nuclear power stations and locations where high capacity lines must cross. Underground cables are also considered where an overhead route is not practical, such as at long bay crossings or in some urban areas. Underground cables are also considered for lower voltage lines when this would provide a route for a new higher capacity line and minimize the cost of the new line. Transmission cables used by BPA are short in comparison to typical overhead transmission lines. BPA's longest underground transmission cable (at 115-kV) is eight miles. BPA once used a 600-foot-long underground transmission 500-kV cable at a crossing of three 500-kV lines, but this cable has since been removed. The Bureau of Reclamation operates two 500-kV underground cable circuits at Grand Coulee Dam. These circuits are about 6,000 feet long.

BPA has kept abreast of transmission cable technologies, but these have not advanced as fast as the industry anticipated they would 10 years ago, nor have costs declined as expected. Cable remains a tool available for special situations, but because of its high cost it would not meet one of the project's purposes, that is: "Minimize costs while meeting BPA's long-term transmission system planning objectives for the area."

2.3.2 Energy Conservation, Load Curtailment and Transmission Pricing

2.3.3.1 Energy Conservation

Several commentors suggested that energy conservation could be used to reduce demands on the existing transmission system and defer the need for a new 500-kV line. Conservation programs are typically used to solve problems and modify electricity use patterns in limited geographic areas at specific times of the day and year.

BPA has extensive experience with energy conservation in the Pacific Northwest. Regionwide, conservation savings from BPA-sponsored programs have reduced energy loads by more than 725 ***average megawatts*** *(**aMW**)* since 1982.

In February 2001, BPA's Power Business Line announced a $200 million energy conservation and renewable resource development program to help relieve the Northwest's critical electricity shortage that year. Regional utilities that buy power from BPA and chose to participate received a discount on their wholesale energy bill if they invested in conservation measures or renewable resources. As a result, by June 29 of that year power customers throughout BPA's service area had committed to reducing loads by up to 2,115 aMW for the 2002 fiscal year, a record single-year energy conservation savings. (BPA, 2001 Progress Report, Appendix B.) (Note: those were commitments based on shortages in 2001. With return of sufficient power supplies in 2002, most of these commitments were not needed.)

In its current Energy Efficiency Plan, BPA proposes to obtain 220 aMW of cost-effective energy load reduction for the region during 2002–2006. Existing programs include the Conservation & Renewable Discount, Northwest Energy Efficiency Alliance, Marketing Campaign for Sustainable Energy Efficiency Behavior, and Low-Income and Existing Conservation Augmentation Initiatives. Other Conservation Augmentation Initiatives being considered include a Residential Loan Program, Manufactured Home Duct Sealing, Equipment Replacement Program, Small Business Chain and Franchise Initiative, Institutional Market Initiative, Strategic Energy Plans for Large Industries, and Waster/Wastewater Treatment Facilities Initiatives.

Load projections used for this project already include projected conservation savings through these and other programs. Conservation programs can successfully slow the growth of demand and reduce the need for power throughout the BPA's service area; however, the magnitude of savings that can be accomplished in the Puget Sound area alone is too small to defer the need for the proposed Kangley-Echo Lake new transmission line. (See Section 2.2.9, **Non-Transmission Alternative**.)

2.3.3.2 Load Curtailment Plan

BPA's Transmission Business Line has instituted a ***curtailment plan*** that calls for cuts across all firm transmission customers in the northern Puget Sound area when system conditions, including emergencies, require. These cuts, which take between 30 and 90 minutes to perform, are needed to mitigate potential problems during outage conditions. This curtailment only protects for outages that allow at least one half hour before curtailments are needed. (During transmission line overloads, it takes about one-half hour for a line to sag to a point where loading has to be reduced.) Cuts would be made to firm transmission schedules in the northern Puget Sound area including the Canadian border for Canadian Entitlement returns. These cuts of firm transmission would be made after all ***non-firm***

transmission uses are cut first. Curtailments would affect northern Puget Sound transmission customers including the following utilities: Seattle City Light, Puget Sound Energy, Snohomish PUD, Orcas Power & Light, Whatcom County PUD, Tanner Electric Cooperative, BC Hydro, the cities of Blaine and Sumas, and Intalco (a direct service industry).

A curtailment can reduce transmission use enough on a temporary basis to protect the system against safety or reliability violations or equipment damage. However, this method of reducing load would not protect the system for loss of the Kangley-Echo Lake line because it could not be done fast enough (within a minute or two) to protect the Covington transformers from failing (transformers do not have one-half hour limits like transmission lines). The only solution that can protect the Covington transformers from failure is to reduce the total area load *in anticipation of the outage*. Curtailing load for many days during an Arctic Express would threaten the health and welfare of those without power. Economic consequences could be great.

Curtailment alone is not a long-term alternative to meet the region's energy need and was eliminated from further consideration. (See also Section 2.2.9, **Non-Transmission Alternative**.)

2.3.3.3 Transmission Pricing Alternatives

Like all utilities in the Northwest, BPA charges for transmission services using a fixed price for each MW of power delivered. The price is determined in a formal process known as a rate case. Alternative approaches such as locational pricing and time-of-use rates provide price signals to encourage parties to use limited transmission capability more efficiently. Most Regional Transmission Organizations (**RTO**s) essentially change the price of transmission when the grid becomes constrained, an approach called congestion pricing.

BPA considered these alternative pricing structures during the rate case that determined the transmission rates currently in effect. Rate case participants argued that these pricing approaches were best developed in a region-wide RTO environment and should be deferred until the proposed RTO West is operational. (See box.) BPA's current rates expire Sept. 30, 2003. BPA will assess the situation and examine alternative rate schedules in the next rate case.

Congestion pricing works to reduce congestion by allowing generation on the surplus side of a constraint (in this case, east of Covington) to shut down and purchase replacement power (or controllable demand) on the deficit side (west of Covington). This approach is effective when there are competitive markets for generation or controllable demand on both sides of the transmission constraint.

The planning studies for this project assumed that all available utility generation in the Puget Sound area is running to meet load during an extreme cold weather event. Therefore, no additional utility generation is available to alleviate constraints following an outage. For this reason, transmission pricing alternatives alone were dropped from further consideration because they could not meet the project's purpose. (See also Section 2.2.9, **Non-Transmission Alternative**.)

2.3.4 Other Non-Transmission Alternatives

BPA invests in technological improvements that boost transmission capacity whenever it is cost efficient. Known as Flexible AC Transmission Systems (**FACTS**), these advances in power electronics enhance the controllability and usable capacity of alternating current (**AC**) transmission systems.

BPA installed the world's first 500-kV Thyristor Controlled Series Capacitor (**TCSC**), co-funded by the Electric Power Research Institute (**EPRI**), to provide a test of concept and system benefits. In 1992, BPA installed Static Var Compensators (**SVCs**) in the Seattle and Portland areas. The SVCs allowed BPA to defer a Cross-Cascade transmission line, which was driven by a voltage stability problem.

The current problem in the Puget Sound area, however, is lack of surplus transmission capacity. If the existing line goes out of service during a cold weather event, existing transformers and the underlying low voltage (230-kV) system will be overloaded. While it is theoretically possible to reroute power flow through other transformers and lines in the area with one or more FACTS devices, this would be a temporary solution at best. There is little margin left in the system. Remaining capacity, if any, will run out shortly. At that point a new line would be needed.

FERC to Review RTO West Formation, Implementation Plan

A Regional Transmission Organization (RTO) under development in the West was ruled on by the Federal Energy Regulatory Commission (FERC) in September 2002. FERC stated that the RTO West proposal met its Order 2000 characteristics and functions and asked for more detail on some issues. In its Order 2000, FERC asked utilities that sell wholesale energy to join in RTOs to promote competition and improve the reliability and efficiency of the power grid. RTO West members expect the organization to enable more efficient electrical operations, and to improve coordinated planning and expansion efforts to serve the rapidly growing West. Besides FERC, the organization's formation is subject to regulatory approvals from the states served by member investor-owned utilities.

If RTO West becomes operational — by 2006 at the earliest — it would operate 62,000 miles of wholesale electric transmission lines for BPA and nine electric utilities throughout Oregon, Washington, Idaho, Utah, Nevada, most of Montana and Wyoming, a small portion of California, and Southwestern Canada. As an Independent System Operator (ISO) governed by a separate board of directors, the non-profit entity would not own any poles and wires. Rather, RTO West would operate through transmission operating agreements with each member utility.

BPA did not conduct a detailed analysis of installing more FACTS devices as an alternative to building the Kangley-Echo Lake line because of FACTS' costs. The estimated cost to build the proposed transmission line project, including mitigation costs, is about $25 million. The cost to install enough FACTS devices to defer the line would be tens of millions of dollars, and would only be deferring the need for a new line. In addition, when the line is later built, the FACTS devices would no longer be of value.

2.3.5 Columbia River Treaty

During the scoping process for the SDEIS, some commentoers recommended that BPA renegotiate the terms of the Columbia River Treaty (see Section 1.2.2).

As with all adopted U.S. treaties, the Columbia River Treaty is a contract between two governments with the force of law. It is not a variable in the Northwest power picture; it is an obligation. Neither BPA nor any other U.S. or Canadian entity has the authority to ignore or change this complicated agreement forged by hundreds of U.S. and Canadian diplomats and technical representatives over the course of 16 years.

The treaty was created in response to mutual U.S./Canadian needs to control flooding and boost power production. The Canadian Entitlement is a fair return for what Canadians brought to the table when the treaty was drafted. Canada agreed to build three large storage dams, putting thousands of acres of farm and forestland under water, and to operate those dams for flood control and power purposes in Canada and the U.S. The treaty also permitted the U.S. to build and operate the Libby Dam in Montana, whose reservoir backs up into British Columbia and outflows go through Canada and then into the Columbia River.

The new dams created new firm power capability in the U.S. system. The amount resulting from Canadian storage is split 50-50 in ownership between the two countries. Since Canada had no immediate need for their power in 1964, it sold it in a 30-year block to a consortium of U.S. utilities at an average cost of about $3 per MWh. (Current prices are $20–$30 per MWh; in 2000–01 some prices topped $750/MWh). That sale began phasing out in April 1998, giving Canada (technically, the Province of British Columbia) the right to receive it at the border as agreed and use it or sell it as it wishes. The amount of firm power Canada receives for any one year is determined six years earlier in annual studies called the Determination of Downstream Benefits. Once determined, that amount of power cannot be unilaterally changed regardless of changing climate, hydropower operations, or economic conditions.

Any treaty can be changed if the governments involved want to make the change. Redrafting a treaty involves lobbying policy-makers in the U.S. and Canada to direct the U.S. State Department and Canadian Department of Foreign Affairs and International Trade to negotiate the proposed changes, usually over a period of years. The changes must then be signed by the President and the Prime Minister and forwarded to the U.S. Senate and Canadian Parliament for confirmation.

BPA does not have authority to unilaterally change the terms of the treaty. The only recent change, made in 1999 through an exchange of diplomatic notes between each country as permitted (but not required) by the treaty, allows Canada to receive its power directly in the U.S. for sale in the U.S., rather than taking it at the border. Canada has not elected to implement this Disposal Agreement, however, and so the U.S. obligation to deliver entitlement power to the border continues. Canada has also not elected to enter negotiations with any party for long-term sales of entitlement power, instead preferring to make profits in the lucrative short- and near-term markets. Current projections are that the full amount of entitlement firm power will be consumed by internal customers in British Columbia by 2007–09 so that the return of the Canadian Entitlement could not be delayed or delivered on a different part of the system.

2.3.6 Transmission Line Route Variations

BPA considered several transmission line routes described in the following sections, including recommendations from the public during scoping, that were later eliminated from detailed review.

2.3.6.1 Building Closer to Urban Areas

The alternative routes are proposed in and around the Cedar River Watershed because that is where increased capacity is physically needed — to support the existing 500-kV system. Any location closer to developed areas would disrupt/remove more residences, businesses and other developments. In addition, the ROW costs would increase dramatically unless existing ROWs are available. Two options identified during scoping are located closer to urban areas: Alternatives A and C. Each could remove many homes and create other impacts to remaining residences. Besides Alternative A (mostly existing ROW) and C (mostly new ROW), no other alternatives closer to Puget Sound were studied.

2.3.6.2 Increase Capacity North of Echo Lake Substation

Increasing transmission capacity anywhere north of Echo Lake Substation will not fix the problem of a potential outage of an existing

500-kV line south of Echo Lake Substation, which is the proposed line's chief purpose. Increasing capacity north of Echo Lake and north of Seattle may fix some other system issues, but would not serve the area's immediate local loads.

2.3.6.3 Use the Existing Railroad ROW

Railroad routes in general do not provide a good location for 500-kV transmission lines. First, railroad ROWs are usually not wide enough. Second, if railroad ROWs have been abandoned, sometimes houses have generally been built immediately adjacent or landowners have purchased the ROW. Third, railroad tracks are built to accommodate the scale and mechanical needs of trains — with large sweeping curves and a route that tries to avoid unnecessary elevation changes. Due to the many angles, building a transmission line along a railroad ROW would require heavier structures and/or additional ROW acquisition, likely raising a project's cost.

2.3.6.4 Build the Proposed Action West of the Existing Line

BPA initially studied proposing a new line on the west side of the existing 500-kV line south of Echo Lake Substation but dismissed it because building the new line there meant it would need to cross the existing line at least twice to connect with the tap point and to enter Echo Lake Substation. Due to reliability concerns, BPA likes to avoid having one large capacity line cross over another. If an upper conductor on a cross-over span fails it would take out its own circuit as well as the lower circuit, causing a large outage. In this case, brownouts or even blackouts in the Seattle area would result. In addition, a west location would have greater impact on a gravel pit and require removing a residence.

2.3.6.5 Cross-Cascade Route

A route that would parallel Highway 2 or the Cross-Cascade line would cross the Cascade Mountains through Stevens Pass. Like other routes to the north of Seattle, this would not fix the immediate need of supplementing existing lines south of Echo Lake Substation. A new line across the Cascades through either Snoqualmie or Stampede passes would work but would be costly and fix only an immediate problem, not long-term issues. This would be very similar to Alternatives B and D as described in the EIS.

Long term, a line may not be needed from east of the Cascades to Echo Lake. BPA is instead thinking a long-term fix across the Cascades will likely need to go through Stevens Pass to the existing Monroe Substation northeast of Seattle where it would present a better fix to the

transmission system. The earliest date this new Cross-Cascade line would be needed is 2008–10.

2.3.6.6 Move Lines West of the Raging River Crossing

Regarding moving existing lines and those proposed in the preferred alternative to the west of the Raging River crossing, BPA will not consider moving both lines over one position to the west due to the expense, which would include four additional angle structures at a cost exceeding $250,000 each and additional costs of moving the existing line. BPA will study impacts to the Raging River and prepare plans to minimize potential erosion, possibly by minimizing clearing where possible and replanting low-growing vegetation.

2.3.7 Adding Equipment at Substations

In lieu of the proposed project, adding more transformers at existing substations and rebuilding existing 230-kV transmission lines in the area would be much more costly than constructing the proposed transmission line and would concentrate too much bulk power transformation at any one location. For instance, adding a third transformer would force additional power into the 230-kV system, both for normal (no outage) and for outage conditions. The 230-kV transmission system in the area was planned to only distribute power to the local area, not to serve as the only system connection between north and south Seattle and thus be required to transmit large blocks of power for an outage of an existing 500-kV line. Over time, this action would simply shift the need for transmission from the single Kangley-Echo Lake line to existing 230-kV lines, which would then need to be rebuilt, or require the addition of multiple new 230-kV lines in more congested areas between the Covington and the Maple Valley areas. All Puget Sound area transmission planners agree such a plan would not meet long-term needs and would result in a far less efficient and more costly system.

Another reason BPA prefers to not add a third transformer is that during the Olympia earthquake a few years ago, existing transformers were knocked out of service. If a third transformer had been in service, it likely would have suffered an outage also. The system is not designed for the loss of three bulk transformers at any one location.

For these reasons, this alternative was eliminated from further consideration.

2.3.8 Double Circuiting the Existing 500-kV Single-Circuit Line between Kangley and Echo Lake Substation

For this alternative, the existing towers used for this line would be removed and double-circuit towers would be built in the existing ROW. These towers would be used to carry the conductors for the existing 500-kV line and for a new 500-kV line.

BPA's ability to double-circuit some transmission lines depends on the function and location of those lines — particularly, whether both lines serve the same purpose (if one line is needed to back up the loss of the other line). As a general rule, transmission providers throughout North America do *not* double-circuit two 500-kV lines when they are both crucial to serving a single area, unless an outage of both those lines can be tolerated while still meeting reliability standards. Doing so would violate national and regional transmission planning standards because the required system performance could not be met and the project would not bring any benefits to the system.

In this case, the existing 500-kV line is a primary transmission line bringing power to the south Seattle area (power is received from generation east of the Cascade Mountains and from other generation to the south of Seattle). The new Kangley-Echo Lake 500-kV line is needed to add transmission capacity serving the same purpose. Because the two lines will constitute a primary power artery for Puget Sound customers, they need to be on separate circuits so that if one goes down, the other is still functional. Hanging them on the same towers is not a tolerable risk because, in the event a tower along the double-circuit line is compromised (*e.g.,* felled in a severe storm, earthquake, or otherwise damaged) and both lines experience an outage, there is not sufficient capacity elsewhere in BPA's transmission system to bring that power into northwest Washington. That is why the preferred alternative is to build a new single-circuit line parallel to the existing 500-kV line for nine miles, on adjacent rights-of-way to minimize environmental impacts and costs, but on separate towers along 97 percent of the route. (One span is proposed to be double-circuited across the Cedar River for environmental protection.) Analysis by BPA, which has more than three decades of experience building and operating 500-kV transmission lines, showed that the probability of the new line and existing line experiencing a simultaneous outage is sufficiently low to meet planning standards. BPA recently received an exemption from the Western Electricity Coordinating Council for this proposed configuration.

Even in the short-term, the existing line cannot be taken out of service for the time needed to rebuild it as a double-circuit line

without severe impacts to electrical transmission reliability in Washington and required delivery of power to Canada. (See Section 1.2.2.)

New double circuiting can be proposed for two of the other alternatives for the following reasons:

- **Alternative A** — In this case, the new 500-kV line would be double-circuited with an existing 230-kV line that has much less significance to the region's transmission system. An outage of the new line and the existing 230-kV line would not have significantly more impact to customers than the loss of the new line alone. Also, existing 500-kV lines would remain in service when Alternative A's proposed double-circuit experiences an outage, ensuring that at least one major north/south transmission line is still functional.
- **Alternative B** — In this case, the new 500-kV line would be double circuited with a 345-kV line that serves primarily the same purpose as the new 500-kV line, transferring power across the Cascades Mountains. However, the outage of the new double circuit line would be acceptable because the 500-kV system is still in service.

2.3.9 Privatize Lines

During scoping, commenters suggested privatizing lines as an alternative. Privatizing lines would not change the level of load, generation or international treaties. Power would still flow the same as before. Privatization would have no effect on the problem.

2.4 Comparison of Alternatives and Summary of Impacts

2.4.1 Environmental Comparison

BPA hired a team of environmental consultants to evaluate the impacts associated with each alternate transmission line route. Each consultant was asked to develop an impact assessment methodology that would express the level, magnitude and significance of their impact findings. The following table (Table 2-3) summarizes the environmental impacts for each alternative. The consultants' detailed findings are contained in Chapter 4, **Environmental Consequences** and appendices.

2.4.2 Comparison of Alternatives for Planning, and Increasing and Maintaining System Reliability

This section compares the alternatives against some of the purposes in Section 1.3.

Facilitate the orderly planning of the region's power system — The Proposed Action meets the overall system planning needs the best because it does not use vacant 500-kV circuits and could be energized sooner. Alternatives 2, 3, 4A, and 4B are a close second for they also do not use a vacant 500-kV circuit, but would take longer to energize. Alternatives A and Options C1 and C2 would use an existing vacant 500-kV circuit that was reserved for use in the near future as system expansion is needed, and would take considerably longer to energize. The No Action and the Non-Transmission Alternatives do not meet system needs at all in the longer term (more than three years at best).

Increase BPA system capacity to meet growing customer demand for electricity — The Proposed Action along with Alternatives 2, 3, 4A, 4B, B, and D would all increase system capacity the best and would solve the system needs the longest. Alternatives A and C would be a shorter-term system fix, because they would use a vacant 500-kV circuit that is reserved for near future use as local system loads increase, possibly requiring the construction of additional 500-kV lines in the future.

Reliability — Double circuit of any two 500-kV lines on one tower (the 500-kV circuits having similar termination points) is a concern if both circuits go out at the same time. This could cause a very severe outage condition on the transmission system, possibly causing brownouts or even blackouts. The method of double circuiting was used in the past by BPA and will be used in the future for some applications. Planning standards of the North American Electric Reliability Council (NERC) require that transmission planners consider the outage of any double-circuit line to be credible and therefore, its use is restricted by BPA to those uses that do not compromise system reliability.

Similar concerns are also directed towards two 500-kV lines located adjacent to each other for extended distances as established by the Western Electric Reliability Council. Exceptions are allowed if a statistical analysis of existing parallel 500-kV lines in the same general area determines that the probability of a multiple 500-kV line outage is unlikely.

The following descriptions are listed in order with the most reliable first and the least last.

Alternative 3 is entirely on new ROW with no portion adjacent to existing 500-kV lines and it does not use any vacant 500-kV circuits. Alternative 3 would be considered the most reliable.

Alternative D (Options D1 and D2) would be constructed on single-circuit towers parallel to an existing 345-kV line. These options would be considered to be some of the more reliable alternatives. However, they do parallel an important 345-kV line for almost 40 miles. Due to the extended length of parallel, the outage of both lines is credible and would pose some reliability problems during extreme cold weather conditions. Alternative D would be slightly less reliable as compared to Alternative 3.

Alternative B would be constructed using double-circuit 500-kV towers with one side for the existing 345-kV line and the other side for the new 500-kV line. Like Alternative D, the outage of both the 345- and 500-kV lines must be considered credible (double-circuit and parallel circuits outages are both credible for these alternatives) and poses reliability problems during extreme cold weather. Alternative B would not be quite as reliable as Alternative 3.

Alternative 2 has fewer parallel 500-kV line miles as compared to the Proposed Action. The parallel portion would be statistically acceptable with current standards. Alternative 2 does not use an existing vacant 500-kV circuit. Alternative 2 would not be as reliable as Alternative 3.

Alternatives 4A and 4B would be similar to Alternative 2 and slightly more reliable than the Proposed Action. Alternative 4A and 4B do not use any vacant 500-kV circuits.

The Proposed Action (Alternative 1) would parallel an existing 500-kV line for its entire 9 miles. This is statistically acceptable with current WSCC standards. It is still not as reliable as a new 500-kV located entirely away from existing 500-kV lines such as Alternative 3.

Alternative C (Options C1 and C2) would be constructed on single-circuit towers. Option C1 would parallel an existing 500-kV line for about 2.5 miles and Option C2 would parallel an existing 230-kV line for about 4 miles. Alternative C does use the same vacant 500-kV circuit west of Echo Lake Substation as Alternative A. Alternative C would be equivalent to or slightly less reliable than the Proposed Action.

Alternative A would use existing double-circuit towers from Echo Lake Substation to the west. This would put two critical 500-kV circuits on the same tower. Alternative A also double circuits with a very important local 230-kV line. Alternative A would be separated from the existing 500-kV line south of Echo Lake Substation. Alternative A would be slightly less reliable than the Proposed Action.

The Non-Transmission Alternative would meet the system needs for one or two years at best and would not be in service as early as a transmission alternative could. All other transmission alternatives meet the system needs for at least 20 to 30 years.

The No Action Alternative is the least reliable because no additional transmission facilities or other measures would be built or implemented.

Table 2-3 Summary of Impacts from Alternatives

Resource	Proposed Action	Alternative 2	Alternative 3	Alternative 4A	Alternative 4B	Alternative A	Alternative B	Alternative C1	Alternative C2	Alternative D1	Alternative D2	Non-Transmission Alternative	No Action Alternative
Land Use	**Moderate impact**, because two residences and a barn would be displaced. Majority of land crossed is forestland, where impact would be low. Project will parallel ROW of existing transmission line, converting only negligible amounts of forestland to utility use. Requires 2.9 miles of new access roads. About 0.6 miles of existing access road would be abandoned. Project length: 9 miles.	**Low impact**. Crosses only forestland. Parallels existing ROW along most of route. Converts negligible amounts of forestland to utility use. Requires 2.7 miles of new access roads. About 0.6 mile of existing access road would be abandoned. Project length: 9 miles.	**Low impact**. Requires clearing of separate new ROW along entire route, but crosses only forestland, converting negligible amounts to utility use. Requires 6.4 miles of new access roads. Project length: 10.2 miles.	**Low impact**. Crosses only forestland, converting negligible amounts to utility use. Parallels existing ROW along most of route. Requires 2.7 miles of new access roads. About 0.6 mile of existing access road would be abandoned. Project length: 9.5 miles.	**Low impact**. Crosses only forestland, converting negligible amounts to utility use. Parallels existing ROW along most of route. Requires 2.2 miles of new access roads. About 0.6 mile of existing access road would be abandoned. Project length: 10.1 miles.	**High impact**, because as many as 25 homes & 2 tax lots would be displaced near Covington Substation. Option A1 could avoid some of this impact. Most of route runs within existing ROW. Crosses 401 tax lots, of which 242 are developed. Requires 6.6 miles of new access roads. Project length: 20 miles.	**Low impact.** Crosses mainly forestland in existing ROW. Crosses 110 tax lots, of which 20 are developed, but no homes displaced. Requires 2 miles of new access roads. Project length: 35.6 miles.	**High impact**, because 30-35 homes would be displaced. Crosses 128 tax lots, of which 54 are developed. Requires clearing for new ROW & 8.7 miles of new access roads. Project length: 10.1 miles.	**High impact**, because 23-28 homes would be displaced. Crosses 134 tax lots of which 56 are developed. Requires clearing for new ROW and 8 miles of new access roads. Project length: 10.6 miles.	**High impact**, because 11-14 homes and 5 tax lots would be displaced at west end. Crosses 134 tax lots, including 32 that are developed. Requires extensive clearing for new ROW mainly through forest (including National Forest land, where clearing conflicts with Forest Plan goals). Requires 13.6 miles of new access roads. Project length: 35.6 miles.	**High impact**, because 8 homes would be displaced at west end. Crosses 121 tax lots, including 22 that are developed. Requires extensive clearing for new ROW mainly through forest (including National Forest land, where clearing conflicts with Forest Plan goals). Requires 13.2 miles of new access roads. Project length: 35.6 miles.	**No impact**	**No impact**.
Transportation	**No impact**. Placement of new towers will not restrict future expansion or acquisition of public road or railway ROWs, and does not impact navigable airspace.	**No impact**. Same as Proposed Action.	**No impact**. Same as Proposed Action.	**No impact**. Same as Proposed Action.	**No impact**. Same as Proposed Action.	**Low impact.** Will require converting part of easement used to access Covington Square Shopping Center.	**No impact**. Same as Proposed Action.	**No impact**. Same as Proposed Action.	**No impact**. Same as Proposed Action.	**No** or **beneficial impact**, if new vegetation mgt. and access road agreements reached with Forest Service.	**No** or **beneficial impact**, if new vegetation mgt. and access road agreements reached with Forest Service.	**No impact**	**No impact.**
Recreation	**No functional impact**, because there are no developed recreation sites in the project area. **Low experiential impact** to limited number of hikers, hunters and other recreationalists.	**No to low impact.** Same as Proposed Action.	**No to low impact**. Same as Proposed Action.	**No** to **low impact.** Same as Proposed Action.	**No** to **low impact.** Same as Proposed Action.	**No** to **low functional & experiential impacts.** Crosses few recreation sites.	**No** to **low functional or experiential impacts**. Crosses several recreation sites, but in already cleared ROW.	**No** to **low impact.** Crosses no developed recreation areas. Same as Pro-posed Action.	**No** to **low impact.** Crosses few recreation sites. Same as Alternative A.	**Moderate experiential impact**, because **it** crosses several recreation areas in newly cleared ROW, but **low functional impact** because it does not restrict these activities.	**Low** to **moderate impacts**. Same as Alternative D1.	**No impact**	**No impact.**

Table 2-3 Summary of Impacts from Alternatives

Resource	Proposed Action	Alternative 2	Alternative 3	Alternative 4A	Alternative 4B	Alternative A	Alternative B	Alternative C1	Alternative C2	Alternative D1	Alternative D2	Non-Transmission Alternative	No Action Alternative
Geology and Soils (Erosion)	**Low impact**. 82% of route crosses soils with low erosion hazard. One new access road may cross a stream. Most impacts would occur during construction and be short term. Revegetation and other mitigation measures can reduce any minor, localized increases in erosion.	**Low impact**. 82% of route crosses soils with low erosion hazard. New access roads would generally not cross streams. Impacts would be short term & largely offset by mitigation measures.	**Moderate impact**. 78% of route crosses soils with low erosion hazard, but greater number of new access roads increases erosion potential. Rock blasting may be required during construction.	**Low impact**. 82% of route crosses soils with low erosion hazard. New access roads would generally not cross streams. Impacts would be short term & largely offset by mitigation measures.	**Low impact**. 82% of route crosses soils with low erosion hazard. New access roads would generally not cross streams. Impacts would be short term & largely offset by mitigation measures.	**Moderate impact.** 68% of route crosses soils with moderate erosion hazard; 21% with low erosion hazard, but clearing would be min-imal because it runs mainly within existing ROW. New spur roads may cross small intermittent streams. Most impacts short term & mitigable.	**Low impact.** 70% of route crosses soils with low erosion hazard;28% with moderate erosion hazard. Minimal new clearing required, but new spur roads may cross small streams. Construction could require rock blasting. Most impacts short term and mitigable.	**Low impact.** 60% of route crosses soils with low erosion hazard; 32% with moderate erosion hazard, but requires substantial clearing for new ROW. New access & spur roads may cross small intermit-tent streams. Most impacts short-term & mitigable.	Slightly worse than C1. Most impact short term and mitigable, however, clearing will be reduced. Most impacts short-term and mitigable.	**High impact.** Although 70% of route crosses soils with low erosion hazard & only 28% with moderate erosion hazard, extensive clearing of new ROW across steep slopes with many streams means greater potential for sediment delivery to streams. Rock blasting may be required during construction.	Same as D1.	**No impact**	**No impact.**
Floodplains	**No** to **low impact**. No towers or roads would be built in designated floodplains. Construction activities above stream channels may cause more peak runoff, but only in the short term.	**No** to **low impact**. Same as Proposed Action.	**No** to **low impact**. Same as Proposed Action.	**No** to **low impact**. Same as Proposed Action.	**No** to **low impact**. Same as Proposed Action.	**Low impact**. Some new towers & roads would be built in Cedar River floodplain, but in existing ROW. Any peak runoff increases due to construction would be short term.	**Low impact**. Some new towers & road upgrades would occur in Yakima & South Fork Snoqualmie river flood-plains, but in existing ROW. Construction impacts would be short-term.	**No** to **low impact**. Same as Proposed Action.	Same as C1.	**High impact**. Some new towers & roads would be built in Yakima & South Fork Snoqualmie river flood-plains. Due to extensive clear-ing for new ROW, peak and total runoff volumes would likely increase.	Same as D1.	**No impact**	**No impact.**

Table 2-3 Summary of Impacts from Alternatives

Resource	Proposed Action	Alternative 2	Alternative 3	Alternative 4A	Alternative 4B	Alternative A	Alternative B	Alternative C1	Alternative C2	Alternative D1	Alternative D2	Non-Transmission Alternative	No Action Alternative
Water Quality - Streams	**Low impact.** A relatively small portion (less than 1%) of streams within newly cleared ROWs would be exposed to direct sunlight, potentially raising water temperature. (Potential stream sedimentation impacts were addressed under ***Geology and Soils***.)	**Low impact.** Largely the same as Proposed Action, but project crosses Cedar River at a lower bank, requiring removal of most trees and brush at this site. Still, relative amount of river exposed to direct sunlight would be small	**Moderate impact.** Project crosses Cedar River at a lower bank, requiring removal of most trees and brush at this site, and crosses a large number of streams not now disturbed. Relative amount of stream exposed to direct sun would be small, but erosion factor is moderate.	**Low impact.** Same as Proposed Action.	**Low impact.** Same as Proposed Action.	**Low impact.** Runs mainly along existing ROW, so requires minimal clearing that would affect streams. Similar to Proposed Action.	**Low** to **Moderate impact.** Crosses the Yakima & South Fork Snoqualmie rivers at existing crossings & spans the many streams crossed, leaving streamside vegetation undisturbed. A higher risk of landslides and erosion on steep ground, however.	**No impact.** Crosses Cedar River and many streams, but spans them so streamside vegetation is undisturbed	Same as C1.	**Moderate impact.** Crosses South Fork Snoquamie River twice in newly cleared ROW, requiring vegetation removal along riverbank. Greater expo-sure of river to sunlight could increase water temperatures	Same as D1.	**No impact**	**No impact**
Water Quality - Ground-water	**Low impact.** Majority of route passes through forestland not tapped by wells. South end of route crosses aquifers possibly serving some residential wells. Application of herbicides would be EPA-approved and only done outside safe buffer zones around wells. Preventive measures would be taken to avoid fuel and other contaminant spills.	**Low impact** for majority of its route (passing through forestland). Potential **moderate impact** at south end where it passes east of residential well users in Selleck, because of the remote chance an accidental contaminant spill could migrate into groundwater.	**Low impact.** There are no groundwater wells along the project route.	**Low impact** for majority of its route. Same as Alternative 2.	**Low impact** for majority of its route. Same as Alternative 2.	**High** to **moderate impact.** Crosses private land with many wells & land under city of Kent well-head protection program, considered highly susceptible to groundwater contamination. See Proposed Action re: herbicide use and preventive measures.	**Low impact** for majority of route because it crosses mainly unpopulated areas. **Moderate impact** where it crosses area of denser development, and greater well use, southeast of North Bend.	**High** to **moderate impact.** Same as Alternative A, although crosses smaller proportion of area under wellhead protection program.	Same as C1.	**Low to moderate impact.** Similar to Alternative B although greater amount of clearing for new ROW could have more impact on small developed area crossed.	Same as D1.	**No impact**	**No impact.**
Fisheries	**Low** to **moderate impact**, with extensive mitigation measures. All actions potentially affecting fish habitat - riparian vegetation removal, road construction, culvert installation, bedrock blasting, and other soil disturbances - would meet or exceed applicable regulations.	**Low** to **moderate impact**, with extensive mitigation measures. Same as Proposed Action.	**Low** to **moderate impact**, with extensive mitigation measures. Same as Proposed Action.	**Low** to **moderate impact**, with extensive mitigation measures. Same as Proposed Action.	**Low** to **moderate impact**, with extensive mitigation measures. Same as Proposed Action.	**Low** to **moderate impact**, with extensive mitigation measures. Same as Proposed Action.	**Low** to **moderate impact** along most of route with extensive mitigation. **High impact** from clearing riparian reserves on National Forest land.	**Low** to **moderate impact**, with extensive mitigation measures. Same as Proposed Action.	**Low** to **moderate impact**, with extensive mitigation measures. Same as Proposed Action.	**Low** to **high impact with extensive mitigation.** Same as Alternative B, plus additional impact from potential erosion from cleared upland areas.	**Low to high impact.** Same as Alternative B.	**No impact**	**No impact.**

Table 2-3 Summary of Impacts from Alternatives

Resource	Proposed Action	Alternative 2	Alternative 3	Alternative 4A	Alternative 4B	Alternative A	Alternative B	Alternative C1	Alternative C2	Alternative D1	Alternative D2	Non-Transmission Alternative	No Action Alternative
Wildlife	**Low** to **moderate impact** from vegetation and tree clearing in ROW, with extensive mitigation measures. Impacts on specific species would be: • Threatened, endangered, or sensitive species: **moderate.** • Forest species: **low.** • Riparian species: **low** to **moderate.** • Aquatic species: **moderate.** • Unique habitat species: **low.** • Early regeneration species: **no** or **low.**	**Low** to **moderate impact.** Same as Proposed Action.	**Low** to **moderate impact.** Same as Proposed Action, although creation of a lengthy new cleared corridor through an area not currently disturbed means greater habitat fragmentation.	**Low** to **moderate impact.** Same as Proposed Action.	**Low** to **moderate impact.** Same as Proposed Action.	**Low** to **moderate impact.** Same as Proposed Action.	**Low to high impacts**. Clearing in National Forest lands would have high impact on several sensitive USFS "Survey & Manage" species, particularly coniferous forest, riparian and unique habitat species.	**Low** to **moderate impact.** Same as Proposed Action.	**Low** to **moderate impact.** Same as Proposed Action.	**Low** to **high impact.** Same as Alternative B.	**Low** to **high impact.** Same as Alternative B.	**No impact**	**No impact.**
Vegetation	**Low impact** on individual vegetation communities; **moderate impact** on coniferous forested communities; potentially **high impact** from noxious weed colonization in disturbed areas (**low impact** with mitigation). ROW clearing and soil compaction/ movement in forested areas would create most impact. 152 acres affected.	**Low** to **high impact**, depending on vegetation type. Same as Proposed Action. 155 acres affected.	**Low** to **high impact**, depending on vegetation type. Same as Proposed Action. 187 acres affected.	**Low** to **high impact**, depending on vegetation type. Same as Proposed Action. 164 acres affected.	**Low** to **high impact**, depending on vegetation type. Same as Proposed Action. 175 acres affected.	**Low** to **high impact**, depending on vegetation type. Same as Proposed Action, except **low impact** on coniferous forest type. 397 acres affected of which 30% (118 acres) would be forestland permanently converted to non-forest use.	**Low** to **high impact**, depending on vegetation type. Same as Proposed Action. 250 acres affected, of which 84% (210 acres) would be forestland permanently converted to non-forest use.	**Low** to **high impact**, depending on vegetation type. Same as Proposed Action. 195 acres affected of which 67% (130 acres) would be forestland permanently converted to non-forest use.	**Low** to **high impact**, depending on vegetation type. Same as Proposed Action, except **low impact** on coniferous forest type. 206 acres affected, of which 56% (115 acres) would be permanently converted forestland.	**Low** to **high impact**, depending on vegetation type. See Proposed Action. 769 acres affected, of which 82% (632 acres) would be permanently converted forest. This is still a small proportion of forestland in the vicinity.	**Low** to **high impact**, depending on vegetation type. See Proposed Action. 776 acres affected, of which 89% (694 acres) would be permanently converted forest. This is still a small proportion of forestland in the vicinity.	**No impact**	**No impact.**
Wetlands	**High impact** on forested wetlands due to ROW clearing; **no** to **moderate impact** on scrub-shrub and open water wetlands. Overall **low impact** on wetland water quality and wildlife. 14 acres of wetlands affected.	**Low** to **high impact**. Same as Proposed Action. 14 acres of wetlands affected.	**Low** to **high impact**. Same as Proposed Action. 6 acres of wetlands affected.	**Low** to **high impact**. Same as Proposed Action. 14 acres of wetlands affected.	**Low** to **high impact**. Same as Proposed Action. 15 acres of wetlands affected.	**No impact** on forested wetlands; **moderate impact** on scrub-shrub and open water wetlands, although mitigation could offset this. 17 acres of wet-lands affected.	**No impact** on forested wetlands; **moderate impact** on scrub-shrub and emergent wetlands, which could be offset with mitigation. 27 acres of wet-lands affected.	**No** to **moderate impact.** Same as Alternative B. 10 acres of wetlands affected.	**No** to **mod-erate impact.** Same as Alternative B. 8 acres of wetlands affected.	**High impact** on forested wetlands; **no impact** on scrub-shrub & emergent wetlands. 18 acres of wetlands affected.	**No** to **high impact.** Same as Option D1. 16.5 acres of wetlands affected.	**No impact**	**No impact.**

Table 2-3 Summary of Impacts from Alternatives

Resource	Proposed Action	Alternative 2	Alternative 3	Alternative 4A	Alternative 4B	Alternative A	Alternative B	Alternative C1	Alternative C2	Alternative D1	Alternative D2	Non-Transmission Alternative	No Action Alternative
Visual Resources	**Moderate** to **high impact** on some Kangley area residents for whom the transmission lines would be dominant visual features. **Low impact** on occasional recreationalists visitors, or employees in CRW. **Low** to **moderate impacts** on views from cars or aircraft in near vicinity.	**Moderate impact** on some Selleck residents. **Low impact** on occasional recreationalists, or visitors/employees in CRW. **Low impacts** on local motorists' or aircraft views.	**Low** to **moderate impact** on some Kerriston Road residents. **No** to **low impact** on occasional recreationalists visitors, or employees in CRW. **No** to **low impacts** on local motorists' or aircraft views.	**Moderate impact** on some Selleck residents. **Low impact** on occasional recreationalists visitors, or employees in CRW. **Low impacts** on local motorists' or aircraft views.	**Moderate impact** on some Selleck residents. **Low impact** on occasional recreationalists visitors, or employees in CRW. **No** to **low impacts** on local motorists' or aircraft views.	**Moderate** to **high impact** on residents in & around Maple Valley and Covington, for whom taller towers would be dominant visual features. **Moderate impacts** on local recreationalists & motorists; **low impact** on aircraft views.	**Moderate impact** on limited number of residents along route due to slightly taller towers. **Moderate impact** on recreationalists at nearby ski/ wilderness areas & motorists on I-90. **Low impact** on aircraft views.	**Moderate** to **high impact** on some Ravensdale, Hobart & Landsburg/ South Hobart residents, for whom new towers would be dominant visual features. **High impacts** on recreationalists along Cedar River and Tiger Mountain trails & on local motorists. **Low impact** on aircraft views.	**Moderate** to **high impact** on Hobart area (including Landsburg/South Hobart) residents, for whom new towers would be dominant visual features. **High impact** on recreationalists along Cedar River and Tiger Mountain trails. **Moderate** to **high impact** on local motorists. **Low impact** on aircraft views.	**Moderate** to **high impact** on residents near Twin Falls State Park, in the Edgewick area, & along Upper Yakima River, due to second set of towers. **Moderate** to **high impacts** on recreationalists at nearby ski/ wilderness areas & on motorists on I-90 & local roads near North Bend & Twins Falls State Park. **Low impact** on aircraft views.	**Low** to **high impacts.** Same as Option D2.	**No impact**	**No impact** .

Table 2-3 Summary of Impacts from Alternatives

Resource	Proposed Action	Alternative 2	Alternative 3	Alternative 4A	Alternative 4B	Alternative A	Alternative B	Alternative C1	Alternative C2	Alternative D1	Alternative D2	Non-Transmission Alternative	No Action Alternative
Socio-economics	**No impact** on local lodging, employment (tech report unclear if **no** or **low** impact), population, or business access. **Low impact** on local spending, removal of timberland from production, community values.	**No** to **low impact**. Same as Proposed Action.	**No** to **low impact**. Same as Proposed Action.	**No** to **low impact**. Same as Proposed Action.	**No** to **low impact**. Same as Proposed Action.	**No** to **moderate impact.** Same as Proposed Action except for **low** to **moderate impact** on community values due to number of displaced homes & **no** impact on timber resources.	**No** to **low impact**. Same as Proposed Action.	**No** to **moderate impact**. Same as Proposed Action except for **low** to **moderate impact** on community values due to number of displaced homes.	**No** to **low impact**. Same as Proposed Action.	**No** to **low impact**. Same as Proposed Action.	**No** to **low impact**. Same as Proposed Action.	**Low** to **high** impact to area employment. If increased capacity were needed, it is unlikely the line could be built in time to avoid outages.	**High impact** due to potential for transmission system collapse, brownouts and black-outs affecting a widespread Northwest population.
Cultural Resources	**Low impact**. No cultural resource sites inventoried or identified in the project area. Potential for unknown sites minimal due to steep terrain.	**Moderate impact.** Route crosses western proposed site boundary of the Japanese Camp at Barneston townsite and passes within 1/2 mile of the Selleck National Historic District.	**Moderate impact.** Southern third of route runs near flat land on which historic-period cultural resources are identified on archival maps.	**Low** for most of route shared with Proposed Action. **Moderate impact** on section of route crossing highly sensitive landform north of Selleck National Historic District.	**Low** for most of route shared with Proposed Action. **Moderate impact** on section of route crossing highly sensitive landform north of Selleck National Historic District.	Estimated **Moderate** to **High impact.** Two-thirds of route crosses relatively flat ground with high potential for culturally sensitive areas, both historic & prehistoric, particularly in Cedar River Valley.	Estimated **Low to moderate impact.** Nearly half of route crosses steep terrain with little potential for culturally sensitive sites or resources. Further surveys would be necessary to confirm.	Estimated **Moderate** to **High impact.** Has highest potential among alternatives for encountering cultural sites. Crosses flat land through Cedar River valley with potential prehistoric resources & crosses developed areas with potential historic-period resources.	Estimated **Moderate** to **High impact.** Same as Alternative C1.	Estimated **Moderate impact.** Substantially higher level of ground disturbance and vegetation clearing increase the risk of impacting cultural resources. Further surveys would be necessary to confirm.	Estimated **Low impact.** Same as Alternative B.	**No impact**	**No impact.**
Noise	**No** to **low impact**. Incremental noise from new line would not be discernible in most cases.	**No** to **low impact**. Same as Proposed Action.	**Low impact.** Because the route does not parallel an existing line like the other alternatives, some new low-level noise may be discernible	**No** to **low impact**. Same as Proposed Action.	**No** to **low impact**. Same as Proposed Action.	**No** to **low impact**. Same as Proposed Action.	**No** to **low impact**. Same as Proposed Action.	**No** to **Low impact**. Largely the same as Alternative 3, but potentially greater impacts because it runs through more populated areas.	**No to Low impact**. Same as Alternative C1.	**Low impact**. Line does not share ROW with an existing line & so would introduce new low-level noise, but runs mainly through unpopulated areas.	**Low impact**. Same as Alternative D1	**No Impact**	**No Impact**

Table 2-3 Summary of Impacts from Alternatives

Resource	Proposed Action	Alternative 2	Alternative 3	Alternative 4A	Alternative 4B	Alternative A	Alternative B	Alternative C1	Alternative C2	Alternative D1	Alternative D2	Non-Transmission Alternative	No Action Alternative
Public Health and Safety	**Low impact** from incremental EMF generated by new line, because majority of route is through unpopulated areas. **No impact** from toxic or hazardous substances. **Low** fire impact with mitigation. Instances of radio or television interference can be mitigated.	**No** to **low impact.** Same as Proposed Action.	**No** to **low impact.** Same as Proposed Action.	**No** to **low impact.** Same as Proposed Action.	**No** to **low impact.** Same as Proposed Action.	**Low impact** from incremental EMF**.** Total EMF generated by existing plus new line would be comparable to levels from existing line alone. (Can we say?)Other impacts same as Proposed Action, although more potential for interference with electronic devices due to proximity of more residents.	**No** to **low impact.** Same as Proposed Action.	**Low** to **Moderate? impact** from EMF**.** The new line would introduce EMF where none currently exists, including in more populated areas, although at levels meeting BPA limits. Other impacts same as Proposed Action, although more potential for interference with electronic devices due to proximity of more residents.	**Low impact.** Same as Alternative C1**.**	**Low impact** from EMF**.** While new line would introduce new source of EMF, it runs through few populated areas. Other impacts same as Proposed Action.	**Low impact.** Same as Alternative D1.	**Impact could be the same as no action if the capacity were needed and the line could not be built and energized in time to avoid brownouts/blackouts**	**High impact** due to potential for transmission system collapse, brownouts and black-outs affecting a widespread Northwest population.
Air Quality	**No long-term impact**. Minimal, short-term construction impacts limited to dust, engine exhaust. No burning of cleared vegetation would be allowed.	**No long-term impact**. Same as Proposed Action.	**No long-term impact**. Same as Proposed Action.	**No long-term impact**. Same as Proposed Action.	**No long-term impact**. Same as Proposed Action.	**No long-term impact**. Same as Proposed Action.	**No long-term impact**. Same as Proposed Action.	**No long-term impact**. Same as Proposed Action.	**No long-term impact**. Same as Proposed Action.	**No long-term impact**. Same as Proposed Action.	**No long-term impact**. Same as Proposed Action.	Could create more emissions due to greater use of wood stoves by residents or operation of new gas-fueled power plants in region.	**No impact.**
Project Costs*	$23.5 million plus $6.5 million for the substation expansion – a total of $30 million..	$22.5 million plus $6.5 million for the substation expansion – a total of $29 million.	$25.5 million plus $6.5 million for the substation expansion – a total of $32 million.	Same as the Proposed Action.	Same as the Proposed Action.	$37 million if BPA land is used around Covington Substation; $44.5 million if private land is used. Adding the $6.5 million cost for the substation expansion brings the total to $43.5 million or $51 million.	$77 million plus the $6.5 million cost for the substation expansion – a total of $83.5 million.	$46.5 million plus the $6.5 million cost for the substation expansion – a total of $53 million.	$32.5 million plus the $6.5 million cost for the substation expansion – a total of $39 million.	$55.5 million plus the $6.5 million cost for the substation expansion – a total of $62 million.	$53 million plus the $6.5 million cost for the substation expansion – a total of $59.5 million.	**N/A**	**No immediate impact.** Delay of needed transmission system expansion could mean higher future costs.

Table 2-3 Summary of Impacts from Alternatives

Resource	Proposed Action	Alternative 2	Alternative 3	Alternative 4A	Alternative 4B	Alternative A	Alternative B	Alternative C1	Alternative C2	Alternative D1	Alternative D2	Non-Transmission Alternative	No Action Alternative
Potential Additional Costs**	Additional costs could run as high as $5 million, increasing total project cost to approximately $35 million.	Additional costs could run as high as $5 million, increasing total cost to about $34 million.	Additional costs could run as high as $5 million, increasing total cost to about $37 million.	Same as Proposed Action.	Same as Proposed Action.	Additional costs could run $5.5-$6 million, increasing total cost to $49-$57 million, depending on the exact route taken.	Additional costs could run as high as $4 million, increasing total cost to about $87.5 million.	Additional costs could run as high as $6.7 million, increasing total cost to about $59.7 million.	Additional costs could run as high as $5.2 million, increasing total cost to about $44.2 million.	Additional costs could run as high as $10.5 million, increasing total cost to about $72.5 million.	Additional costs could run as high as $11 million, increasing total cost to about $70.5 million.	N/A	See above.

* Project costs do not reflect BPA overhead costs of approximately 25 percent.
** Potential additional costs include those for mitigation measures, property condemnation and other unknowns. Alternatives running in new ROW have higher unknown costs. For those alternatives running through more populated areas, potential costs also include tubular poles used for visual mitigation.

Chapter 3 — Affected Environment

In this Chapter:

- Existing human environment
- Existing natural environment
- Protected resources

This chapter describes the existing environment that may be affected by the alternatives. Some alternatives are divided into segments, so that individual resources in each segment can be described (see Map 8). More detailed information about resources is included in appendices.

➲ For Your Information

Project Area *— The original project area was the area in the vicinity of Alternatives 1-4. Since other alternatives (A-D) have been added to the analysis, the project area now is a 750 square mile area of west-central Washington and includes portions of the Puget Sound lowlands as well as the Cascade Range Mountain Range and adjacent foothills. The project area includes the municipalities of Covington, Maple Valley, and North Bend, and the unincorporated communities of Black Diamond, Ravensdale, Hobart, Kangley, Selleck and Halmar Gates. However, in the descriptions of resources in this chapter and Chapter 4, project area is also used as the general area around one alternative.*

The ***Cedar River Municipal Watershed*** *is owned and managed by Seattle Public Utilities (SPU), an entity of the City of Seattle. The Cedar River provides two-thirds of the drinking water for SPU's 1.3 million customers. In accordance with the Cedar River Watershed Habitat Conservation Plan (HCP), timber may not be harvested for commercial purposes, so land within the CRW is managed as an ecological reserve (City of Seattle, 2000). See additional details in Section 3.1.3 and Chapter 5.*

3.1 Land Use

3.1.1 General

Most of the ***project area*** lies within unincorporated King County. The easternmost one-third of Alternatives B and D runs through Kittitas County from the King County border near Snoqualmie Pass to Stampede Pass. A small portion of Alternatives A and C are in the vicinity of two small incorporated cities, Maple Valley and Covington. With the exception of land within those municipalities, local land use planning is under each county's jurisdiction.

Table 3-1 and Maps 4–7 identify the land use designations for the transmission alternatives. As shown, Alternatives 1 through 4, B, and D primarily cross forested land that is managed for natural resource conservation (National Forests), watershed protection and/or timber production. For example, two-thirds of Alternatives B and D are located within the boundaries of the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. Alternatives 1 through 4 cross the Cedar River Municipal Watershed.

Other uses in the vicinity of some alternatives are rural residential development, urban areas, and mineral extraction (aggregate). A rural residential use is defined as having a dwelling unit on a large lot, *e.g.*, 2.5 to 20 acres. For example, the unincorporated communities of Kangley and Selleck are near the south end of the project area for Alternatives 1 through 4 (see Map 4). Kangley has many rural-residential uses primarily near the intersection of Kent-Kangley Road (SR 516) and north along Kangley-Selleck Road. Many residences have barns and pastures for livestock. Selleck is near the northern end of Kangley-Selleck Road, near the southern boundary of the Cedar River

Watershed. Selleck also has rural-residential uses, though some homes are on smaller lots, particularly some older homes near an abandoned school building in the easternmost portion of Selleck.

Other rural-residential uses in the vicinity of various alternatives include:

- Development around the cities of Maple Valley and Covington, such as the area along Highway 18 from Hobart south to Black Diamond
- Halmar Gates where there are about 30 homes primarily along Kerriston Road
- The area just south of North Bend
- The area adjacent to recreational development at Snoqualmie Pass
- The area near Lake Keechelus.

Only Alternative A crosses any incorporated land: 3.6 miles within the cities of Covington and Maple Valley.

Table 3-1 — Land Uses Crossed by Alternatives (in miles)

Alternative	Urban Area	Rural Residential	Forest	Mineral	Total
Alternative 1	**None**	**1**	**8**	**None**	**9**
Alternative 2	**None**	**None**	**9**	**None**	**9**
Alternative 3	**None**	**None**	**10.2**	**None**	**10.2**
Alternative 4A	**None**	**None**	**9.5**	**None**	**9.5**
Alternative 4B	**None**	**None**	**9.2**	**None**	**9.2**
Alternative A	**3.6**	**13.8**	**None**	**1.6**	**19**
Alternative B	**None**	**6.2**	**28.8**	**None***	**35.0**
Alternative C (Option C1)	**None**	**6.4**	**3.6**	**None**	**10.1**
Alternative C (Option C2)	**None**	**8.9**	**0.7**	**1**	**10.6**
Alternative D (Option D1)	**None**	**6.2**	**28.8**	**None ***	**35.0**
Alternative D (Option D2)	**None**	**6.2**	**28.8**	**None ***	**35.0**

*** Though not currently reflected on the King County Land Use map, Alternatives B and D (Options D1 and D2) will cross the proposed Cadman Northbend Gravel Site just east of North Bend. About 1 mile of the existing and proposed ROW along the route will cross property included in the current proposal.**

LAND USE: ALTERNATIVES 1 - 4

Map 4

Echo Lake Substation

Raver Substation

North Bend

Hobart

Cedar River Watershed

Halmar Gates

Selleck

Kangley

Landsburg Diversion Dam

Walsh Lake

Retreat Lake

Brewster Lake

Rattlesnake Lake

Raging River

Rock Cr

Cedar River

Taylor Creek

Kerriston Road

Pole Line Rd

SE 208th St

276th Ave SE

Kent - Kangley Rd

Kanasket - Kangley Rd

SE 268th St

1

2

3

4A

4B

Existing BPA Transmission Lines

Proposed Transmission Line Alternatives

Existing BPA Substations

Forest

Municipal Watershed

Rural Residential

Mining

Source: King County GIS, 2000

Project Location

Seattle

King

Chelan

Pierce

Kittitas

map area

BONNEVILLE POWER ADMINISTRATION

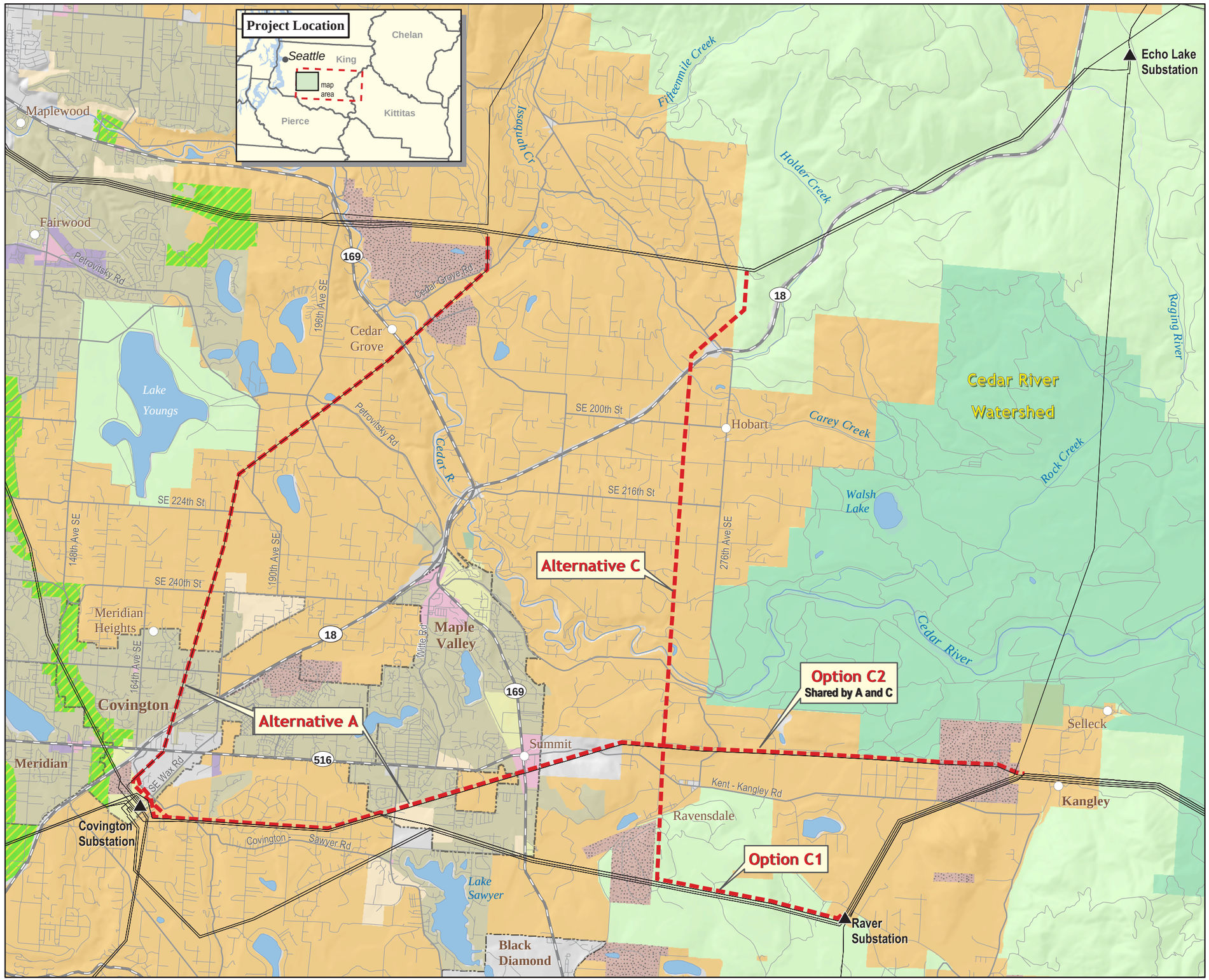
GIS

GEOGRAPHIC INFORMATION SYSTEM

November, 2002

N

0 0.5 1 2 3 4 Miles



Map 5

LAND USE

Alternatives A and C

Legend

- Proposed Transmission Line Alternatives
- Existing BPA Transmission Lines
- Existing BPA Substations
- Forest
- Greenbelt/Open Space
- Rural Residential
- Urban Residential - Low Density
- Urban Residential - Med. Density
- Urban Residential - High Density
- Commercial
- Light Industrial
- Mining
- Municipal Watershed

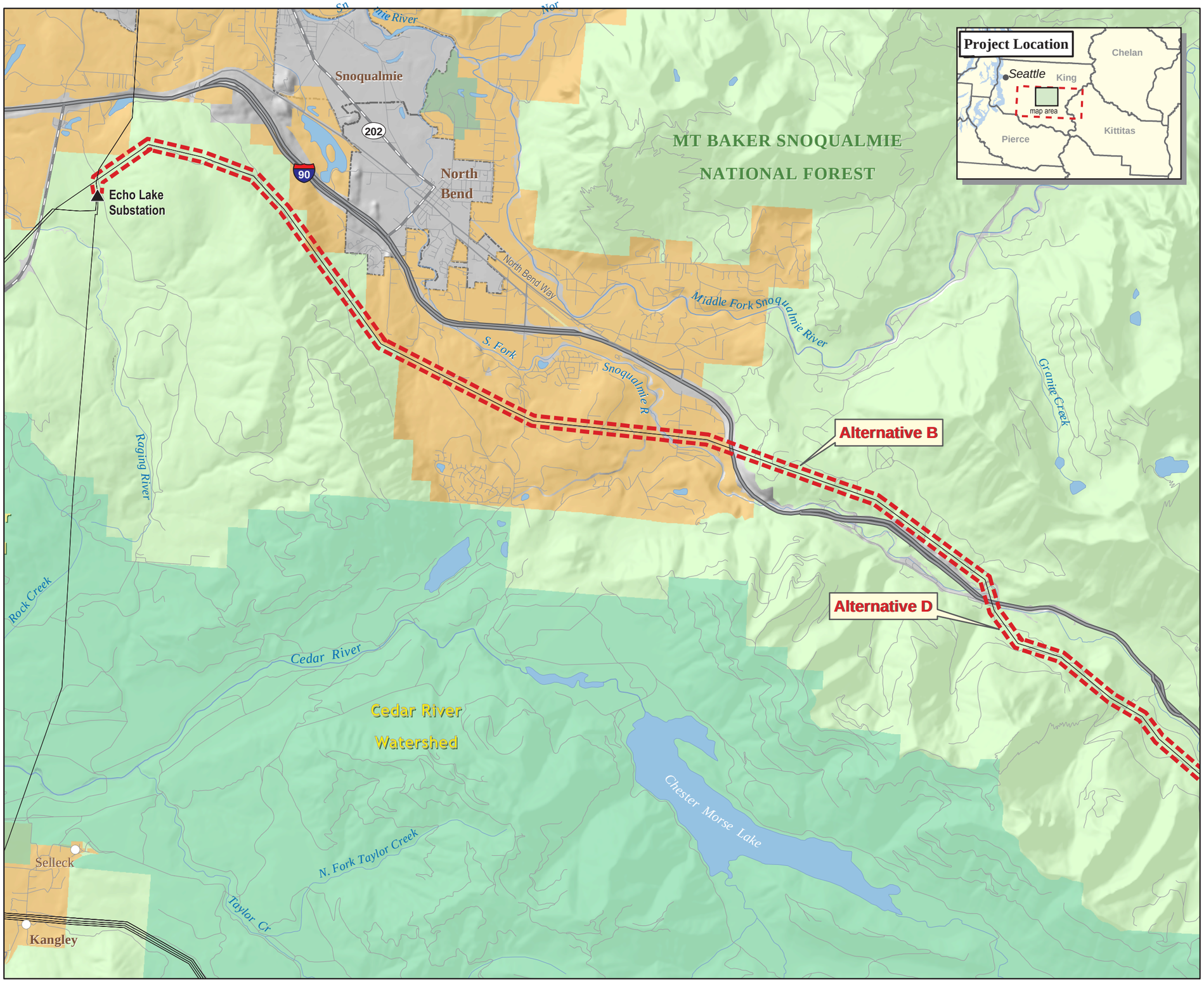
Source: King County GIS, 2000.

N

0 1 2 3

Miles

November, 2002



Map 6

LAND USE

Alternatives B and D

Western Portion

Legend

Proposed Transmission Line Alternatives

Alternative B Rebuild Portion of Rocky Reach-Maple Valley 345-kV to Double-Circuit 500-kV from East of Stampede Pass to Echo Lake Substation.

Alternative D

Option D1: Construct New Single-Circuit 500-kV Line from East of Stampede Pass Adjacent to and on the South Side of Rocky Reach-Maple Valley Line.

Option D2: Construct New Single-Circuit 500-kV Line from East of Stampede Pass Adjacent to and on the North Side of Rocky Reach-Maple Valley Line.

Existing BPA Transmission Lines

Existing BPA Substation

Forest

Municipal Watershed

Rural Residential

Commercial

Light Industrial

Agriculture

Source: King County GIS, 2000.

N

0 1 2 3

Miles

November, 2002

Map 7

LAND USE

Alternatives B and D

Eastern Portion

Legend

Proposed Transmission Line Alternatives

Alternative B Rebuild Portion of Rocky Reach-Maple Valley 345-kV to Double-Circuit 500-kV from East of Stampede Pass to Echo Lake Substation.

Alternative D

Option D1: Construct New Single-Circuit 500-kV Line from East of Stampede Pass Adjacent to and on the South Side of Rocky Reach-Maple Valley Line.

Option D2: Construct New Single-Circuit 500-kV Line from East of Stampede Pass Adjacent to and on the North Side of Rocky Reach-Maple Valley Line.

Existing BPA Transmission Lines

Forest

Forest Recreation

Rural Residential

Commercial

Light Industrial

Municipal Watershed

Source: King County GIS, 2000, and Kittitas County GIS, 2002.

N

0 1 2 3

Miles

November, 2002

Snoqualmie Pass

ALPINE LAKES WILDERNESS

Gold Creek

Mineral

90

To Echo Lake

KING Co.

KITTITAS Co.

Keechelus Lake

MT BAKER SNOQUALMIE NATIONAL FOREST

Seattle Cr

Cedar River

Cedar River Watershed

North Fork Cedar River

South Fork Cedar River

Yakima River

Alternative B

Alternative D

Stampede Pass

Project Location

Seattle

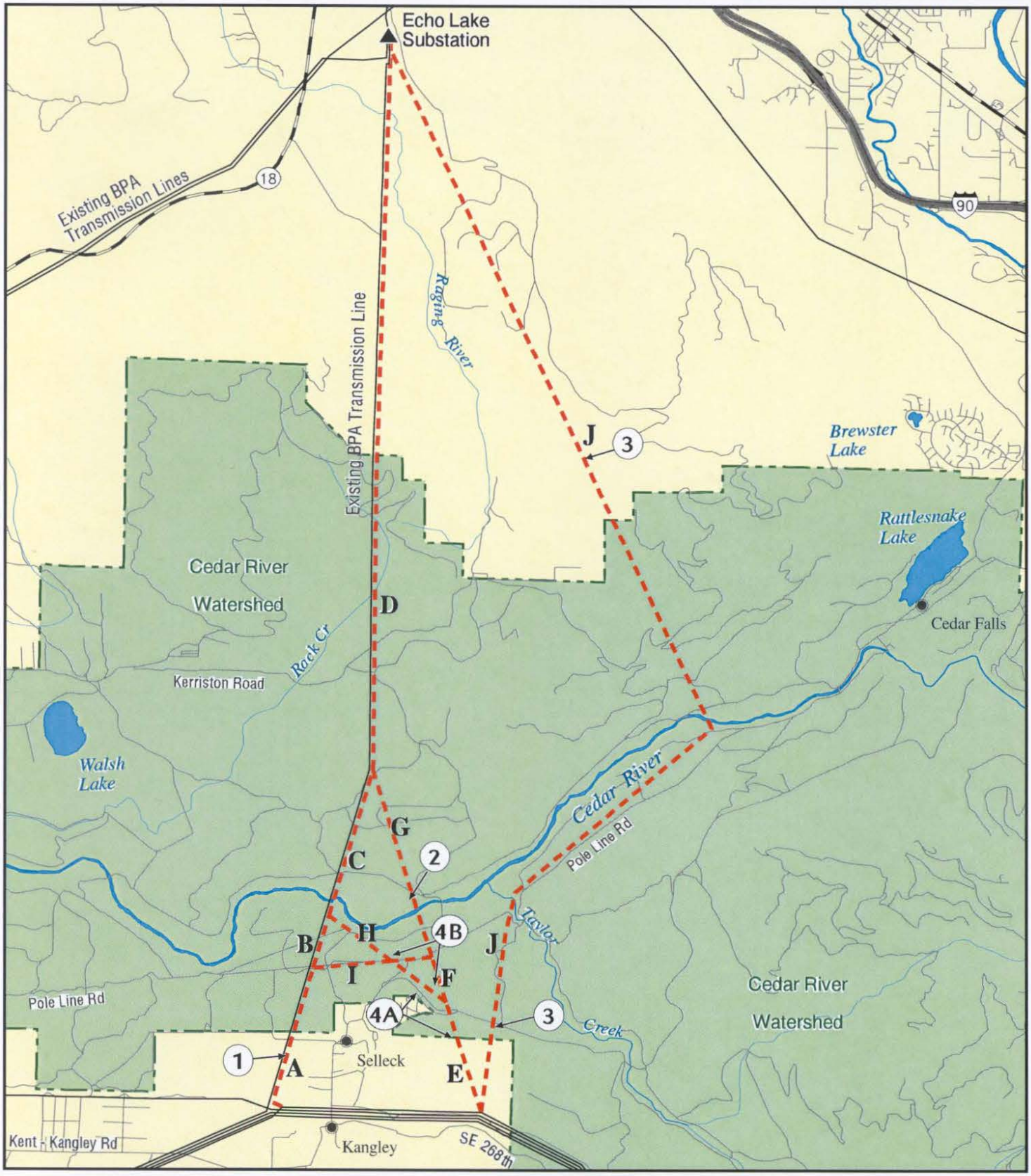
King

Chelan

map area

Pierce

Kittitas



ALTERNATIVES 1 - 4 with SEGMENTS

Map 8

N

0mi 1mi 2mi

0km 1km 2km 3km

Existing Transmission Lines

Proposed Transmission Line Alternatives Under Consideration

▲ BPA Substation

A Segment (1) Alternative

BONNEVILLE POWER ADMINISTRATION GIS GEOGRAPHIC INFORMATION SYSTEM

November 22, 2002

3.1.2 Existing Transmission Facilities

Four BPA transmission lines run generally east to west across the southern portion of the project area. The lines run between BPA's Schultz Substation to the east and Raver Substation to the west and are referred to as the Schultz-Raver transmission lines. Schultz Substation is east of the Cascade Mountains, about 78 miles from the project area. Raver Substation is south of Retreat Lake, about 2.5 miles southwest of the project area. The Raver-Echo Lake 500-kV Transmission Line runs generally north-south through the project area. The Proposed Action parallels this line (see Map 4).

At the northern end of the project area is Echo Lake Substation and BPA's Rocky Reach-Maple Valley 345-kV Transmission Line connecting the substation on the west to the Schulz-Raver line east of Stampede Pass. The substation is on 140 acres of BPA fee-owned land.

The Cedar Falls-Fairwood 115-kV transmission line, owned by Seattle City Light, parallels Pole Line Road (Road #50) within the Cedar River Watershed and extends from the Cedar Falls power plant to Fairwood.

3.1.3 Cedar River Municipal Watershed

As noted, SPU, a City of Seattle entity, owns title to that portion of the Cedar River Watershed that lies upstream of Landsburg (see Map 4). The primary use of the watershed is to provide a reliable, high-quality supply of drinking water to the region. The Cedar Falls Hydroelectric Plant, operated by Seattle City Light, has a capacity of 30 megawatts (MW), providing less than 1 percent of the total energy needs of the utility (U.S. Fish and Wildlife Service [USFWS], et al., 1999). The plant is east of the project area near Rattlesnake Lake. Seattle City Light plans to continue operation of the power plant, but has no plans to expand the plant (Backiel, pers. comm., 2000).

The City of Seattle restricts human access in the CRW. Watershed boundaries are posted, and all road access points are gated and locked.

The City of Seattle prepared a multi-species Habitat Conservation Plan to comply with the federal ***Endangered Species Act (ESA)*** and to address a variety of natural resource issues (City of Seattle, 2000). The plan covers the City's entire 90,546-acre watershed, including the City's water supply and hydroelectric operations on the Cedar River. (See box.) In general, the HCP is not for planned development but is a set of ***mitigation*** and conservation commitments related to ongoing water supply, hydroelectric power supply, and watershed management activities intended to offset any harm caused to individual listed ***threatened*** and ***endangered species*** and selected unlisted species by

➲ For Your Information

Mitigation *— Steps taken to lessen the effects predicted for each resource, as potentially caused by the transmission project. They may include reducing the impact, avoiding it completely, or compensating for the impact. Some mitigation, such as adjusting the location of a tower to avoid a special resource, is taken during the design and location process. Other mitigation, such as reseeding access roads to desirable grasses and avoiding weed proliferation, is taken after construction.*

Threatened species *— Those species officially designated by the U.S. Fish and Wildlife Service that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.*

Endangered species *— Those species officially designated by the U.S. Fish and Wildlife Service that are in danger of extinction throughout all or a significant portion of their range.*

City of Seattle Cedar River Watershed Habitat Conservation Plan

HCP Planning Objectives

In preparing its HCP, the City developed a number of specific objectives related to the Endangered Species Act, other laws and regulations, constraints resulting from its public utility obligations, environmental stewardship, prior city initiatives, and sustainable management. Additionally, in response to recent attention to HCPs by the public and scientists, the City has modified some of the original objectives and incorporated others to address some of the key issues raised.

Overall Goal of the HCP

The overall goal of the HCP is to implement conservation strategies designed to protect and restore habitats of all species of concern that may be affected by the facilities and operations of the City of Seattle on the Cedar River, while allowing the City to continue to provide high quality drinking water and reasonably priced electricity to the region.

Objectives

The objectives of the HCP related to the ESA include the following:

- Meet all requirements of the Endangered Species Act with respect to water supply operations, hydroelectric operations, and land management by the City in the Covered Area (as defined in the Implementation Agreement);
- Meet all legal requirements for an Incidental Take Permit for species addressed in the HCP;
- Make an appropriate contribution to the conservation of unlisted species covered by the HCP and treat them as if they were listed, with the intent of reducing the likelihood that listing may become necessary for some species;
- Provide a net benefit, compared to current conditions, for both listed and unlisted species covered by the plan, contributing to the recovery of any species that is now or, in the future, may be listed as threatened or endangered;
- Obtain agreement that no additional commitment of resources would be required of the City should unlisted species covered by the HCP become listed during the term of the HCP;
- Develop scientifically sound conservation strategies for at-risk species and their habitats, and provide adequate monitoring to ensure the HCP is working as intended during its implementation; and
- Recognize uncertainty, and develop and implement an HCP that can be adaptive enough to (1) respond to changes in regulations or conditions, (2) incorporate and make use of the discovery of new scientific information, and (3) address contingencies, yet at the same time provide an improved degree of certainty for purposes of water supply planning.

The objectives of the HCP related to the Instream Flows include the following:

- Implement a beneficial instream flow regime, based on the best current scientific information, that will help provide high quality fish habitat throughout the potential range of anadromous fish in the Cedar River from Lake Washington to the natural migration barrier formed by lower Cedar Falls;
- Reduce the risks of stranding juvenile salmonids and dewatering salmonid redds to levels that will help promote the full recovery and persistence of anadromous salmonid populations in the Cedar River;
- Provide an instream flow regime that significantly improves existing habitat conditions for all four species of anadromous salmonids in the Cedar River over existing conditions; and
- Help support measures that will contribute to improving downstream migration conditions for juvenile salmonids at the Hiram Chittenden (Ballard) Locks.

Objectives of the HCP related to public utility functions and constraints include the following:

- Ensure the ability of the City to provide a reliable water supply of high quality drinking water to local residents, commercial and industrial users, and wholesale water customers in the region, and to provide reasonably priced electricity to customers;
- Maintain the existing water supply capacity from the Cedar River Municipal Watershed, as measured by average annual firm yield, and preserve the operational flexibility necessary to water supply operations;

- Develop and implement a program for managing instream flows that is consistent with the City of Seattle Water Shortage Contingency Plan (Appendix 10 of HCP);
- Protect and improve the quality of the raw drinking water supplied from the City's Cedar River Municipal Watershed;
- Preserve flexibility to meet water needs for people and fish that may be identified in the future;
- Develop cost-effective conservation strategies that control overall costs of the HCP, yet accomplish its fundamental purposes.

Objectives of the HCP related to prior City initiatives include the following:

- Develop and implement an HCP that builds upon existing City of Seattle laws, regulations, policies, and initiatives, including but not limited to: (1) Ordinance #114632, which established specific policies for managing the Cedar River Municipal Watershed (Appendix 12); (2) Ordinance #115204, which directed negotiation of a comprehensive settlement for the blockage to anadromous fish at Landsburg Diversion Dam; and (3) development of a technically sound, multi-agency agreement on instream flows based on cooperative studies begun in 1986.

Objectives of the HCP related to mitigation for fish blockage at Landsburg Diversion Dam include the following:

- Allow passage of selected species of anadromous fish upstream of the Landsburg Diversion Dam and water supply intake to the extent possible without jeopardizing the quality of the City's drinking water supply;
- Implement biologically sound, short- and long-term solutions that help provide for the recovery and persistence of healthy, harvestable runs of sockeye, coho, and chinook salmon and steelhead trout in the Cedar River in a manner that maximizes the reproductive fitness of these fish populations while minimizing genetic, ecological, and demographic risks to wild salmonid populations in the Lake Washington Basin; and
- Develop and implement anadromous fish restoration measures that fully mitigate for future impacts of the anadromous fish migration barrier created by the Landsburg Diversion Dam.

Objectives of the HCP related to public and scientific concerns about HCPs include the following:

- Involve the public, scientists, and other agencies in implementation of the HCP, including monitoring the effectiveness of the HCP;
- Address public concerns about such issues as protection of water quality and aquatic habitats, and contribute to the long-term survival and recovery of at-risk species;
- Use the best scientific information available to develop the HCP, conduct key studies where important information is lacking, and, where feasible, develop conservative strategies in cases for which risk is high;
- Use scientific and other technical information effectively in developing and implementing the HCP;
- Develop an HCP that provides a net benefit for species covered by the HCP and contributes to recovery of threatened and endangered species; and
- Provide adequate monitoring, based on measurable biological objectives, to ensure compliance with the plan; determine effectiveness of mitigation; track trends in habitats and key species populations; verify that the biological goals of the HCP are being met; and provide for flexible, adaptive management of conservation strategies.

Objectives of the HCP related to sustainable management include the following:

- Develop an HCP that supports sustainable management of the watershed as a source of high quality drinking water and an adequate supply of municipal and industrial water;
- Develop an ecosystem-based HCP that provides for human use of natural resources, particularly for water supply, but sustains natural processes that create and maintain habitats for at-risk species; sustains small- to moderate-scale processes and disturbances important to a healthy watershed; maintains biological diversity with respect to species and communities; protects native species; and does not reduce the adaptive potential of species; and
- Incorporate an approach to watershed management that, as practicable, helps avoid catastrophic events such as forest fires that would jeopardize drinking water or habitats for at-risk species.

Source: Information provided by the City of Seattle.

promoting conservation of populations as a whole. The City has commitments for these activities: 1) watershed management and restoration, 2) anadromous fish mitigation (for blockage to fish passage at the Landsburg Diversion Dam), 3) instream flows, and 4) research and monitoring to support the first three components. The HCP is intended to conserve habitat of anadromous fish (chinook, coho and sockeye salmon and steelhead) and many species of wildlife, including listed species such as the northern spotted owl and marbled murrelet.

The HCP allows no commercial logging (Mayor of Seattle, 1999). The watershed is managed as an ecological reserve. See also Section 5.5.8.5, **City of Seattle Cedar River Watershed Habitat Conservation Plan**.

3.1.4 Private Property Owners

All transmission alternatives cross property owned by individuals or corporations (see Maps 4–7).

Weyerhaeuser Timber Company owns property along Segment D (Alternatives 1, 2, 4A and 4B; see Map 8), and Alternatives B, C and D. Weyerhaeuser does not have management plans for these properties, which are primarily kept in timber production. The company harvests on a 40- to 45-year rotation and replants within a year of harvest (Johnson, pers. comm., 2000). Under the company's program, the area is replanted with Douglas fir. Hemlock, alder, and Western red cedar often volunteer within the planted areas.

Weyerhaeuser also owns a parcel east of North Bend just north of I-90 that is permitted for expanded mineral extraction. The North Bend Gravel Mine planned to begin extraction in 2002 and run for approximately 20 years. Some recreational access is allowed on forested Weyerhaeuser properties, but general access is controlled by locked gates (Stangle, 2002).

The Weyerhaeuser Real Estate Company (WRECO) owns land directly south of Echo Lake Substation. WRECO does not have a management plan for the property, which the company intends to sell (Voss, pers. comm., 2000). The company is not harvesting timber from the land currently nor plans to in the future.

Fruit Growers Supply owns approximately 5,000 acres of property along the northern portions of Segments D and J. The property is managed by Green Crow. Fruit Growers Supply does not have a management plan for their forestlands, though harvest is typically on a 40-year rotation. Management decisions are based on market, budget, and other factors (Grant, pers. comm., 2000).

Plum Creek Timber Company owns land just south of Selleck in Section 25, 22N, 7E, and elsewhere in the vicinity of several alternatives.

Plum Creek also has no management plan for its properties, which are primarily managed for timber harvest on a 50-year rotation. Most stands are 15 to 25 years old. Some mining sites owned by Plum Creek are also located in the area. Two mineral extraction sites are located at the northern end of Alternative A and another is located at the southern end of Alternative C, where it joins Option C1. Public access occurs informally on Plum Creek property. It is not a permitted system. Hikers, horseback riders, and mountain bikers all use the trails. People drive jeeps and motorcycles on trails in the vicinity of existing transmission lines (Johnson, 2002).

Palmer Coking Coal owns about 310 acres near Landsburg in the vicinity of Alternative C (both Options C1 and C2), but has no management plan. Currently managed for forestry and mineral extraction, the land is targeted for future development (tentatively 25 lots). Public access to Palmer Coking Coal land is allowed by permission only. Recreation uses include horseback riding, hiking, walking, and jogging on informal paths (Kombol, 2002). There are abandoned mine shafts in this area.

The Landsburg Mine on Kent-Kangley Road near Black Diamond and the Hobart Landfill at approximately 24041 276th Avenue SE are located near Alternative C. The Landsburg Mine site is an archived Superfund site. The Hobart Landfill has been closed and no longer accepts waste.

Individual residential and commercial landowners also own parcels on and in the vicinity of several alternatives. These are discussed in more detail in Section 3.3.

3.1.5 U.S. Forest Service

Most of Alternatives B and D pass through the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. Land allocations for federally-owned land in these areas, defined in the Northwest Forest Plan, guide the management of these lands. Additional plans guiding management include the Mt. Baker-Snoqualmie National Forest Land Management Plan, Wenatchee National Forest Land Management Plan, and the Snoqualmie Pass Adaptive Management Area Plan. As a result, land management on National Forest lands is complex. Some newly acquired properties have not yet been assigned an allocation. In these instances, the U.S. Forest Service would work with BPA on a site-specific basis to determine the appropriate allocation for affected land after a route is selected.

Northwest Forest Plan land management objectives along the length of Alternatives B and D are all forest-related with an emphasis

on maintaining scenic quality, preserving the recreational experience, and maintaining and enhancing late-succession forests and their habitat values. A key element in the management objectives is the prohibition on timber harvest within forest stands more than 80 years old west of the Cascade Crest. East of the Cascade Crest there is no age limit on timber harvest, but timber stand treatments would focus on younger stands and must be beneficial to the maintenance and enhancement of late-succession forests.

3.1.6 Washington State Department of Natural Resources (DNR)

DNR owns at least two blocks of land affected by the alternatives within the project area (see Map 4). The first is about 120 acres along Segment D of Alternatives 1–4. The second is 600 acres along Segment J. Both properties are covered under the Rattlesnake Mountain Scenic Area Management Plan and are categorized as "Managed Lands" (McDonald, pers. comm., 2000). DNR manages the properties for timber production in accordance with the DNR's Final Habitat Conservation Plan (September 1997), which provides mitigation for incidental take permits for two federally-listed species, the northern spotted owl and the marbled murrelet.

Activities that may occur on DNR-managed forestlands covered by their HCP include, but are not limited to: forest health activities (*e.g.*, wildfire suppression), timber harvesting, commercial thinning, pre-commercial thinning, site preparation for reforestation, regeneration, vegetation management, and non-timber resource activities, such as granting rights-of-way, collecting special forest products, and mining. See Chapter 5 for additional information.

3.1.7 BPA Land

BPA recently purchased 352 acres from Trillium Corporation along Segment D of Alternatives 1–4.

3.2 Transportation Facilities in the Project Vicinity

Highways and roads — Interstate 90 (I-90) and State Routes 18, 169 and 516 provide major highway access throughout the project area (see Maps 4–7). They are under the jurisdiction of the Washington State Department of Transportation (**WSDOT**).

The City of Seattle owns and maintains most of the roadways and bridges within the Cedar River Municipal Watershed. The transportation network includes four types of roads: core roads, temporary roads, nonessential roads, and deconstructed roads. Core roads are needed to sustain the management of the CRW by supplying

access for water supply, water quality protection and administrative activities. Temporary roads are used for access to restoration and monitoring projects and are abandoned after the completion of a project. Nonessential roads are not used and are available for abandonment. Deconstructed roads are roads in areas that cannot be completely restored to their original condition. All roads identified to be removed are classified as temporary roads.

Other roads in the area are county and city roads, USFS roads, BPA roads, and other roads owned by large private landowners such as Weyerhaeuser and Fruit Growers.

Rail lines — The Burlington Northern Santa Fe Railway (**BNSF**) is the only active rail line adjacent to or intersected by any of the alternatives. Alternatives B and D intersect the BNSF line southeast of North Bend. Alternative A intersects the BNSF at two locations: west of Covington and within the city limits of Covington. Alternative C (Options C1 and C2) intersects the BNSF at one location to the southwest of Maple Valley.

There are also several abandoned railroad ROWs in the area that previously belonged to the Chicago, Milwaukee, St. Paul, and Pacific Railroad (**CMSP&P**). Segments D, G, H and I cross these abandoned railway ROWs. Another ROW running along the southern bank of the Cedar River is crossed by Segments C, G, and J. The ROW has been converted to a trail west of Landsburg Diversion Dam. An abandoned ROW has also been used for the John Wayne Pioneer Trail adjacent to Alternatives B and D.

Airports — Two small landing strips, North Bend and Bandera, and one airport, Crest Airpark, exist within the project area. The landing strips are near Alternatives B and D near I-90. The airport is south of Alternative A near Covington.

Proposed transportation facilities — WSDOT is in the design phase of widening I-90 at Snoqualmie Pass east from four to six lanes. An EIS is scheduled for 2003 and construction is scheduled for summer 2004. The proposed transmission line project (if Alternative B or D) and the WSDOT project are not anticipated to conflict. In addition, the City of Covington's Comprehensive Plan calls for two projects in the vicinity of Alternative A. These include widening SR 18 to four lanes from Covington Way to 180th Avenue SE sometime between 2002 and 2006, and building a new downtown Collector Arterial System, consisting of SR 18, SR 516, Covington Way SE and Wax Road, in the same time frame.

3.3 Existing Land Uses by Alternative

Land uses and transportation facilities within each of the alternatives are further described in this section and shown on Maps 4–7. Alternatives 1 through 4 are described by individual line segments (see Map 8 for segments).

3.3.1 Proposed Action

The Proposed Action includes Segments A, B, C, and D.

3.3.1.1 Segment A

Segment A is about 1.2 miles long. At the southern end, BPA's existing Schultz-Raver transmission line corridor is the primary land use. The corridor is 580 feet wide. Three 500-kV lines and a 287-kV line (which operates at 230-kV) are within the corridor. The transmission lines carry 2,200 MW of electricity on an average day and 3,500 MW on a high-use day.

Segment A follows a portion of the existing Raver-Echo Lake Transmission Line that runs north from Raver Substation. The line is carried on steel towers. Segment A traverses a relatively flat area with rural residential uses west of the unincorporated communities of Kangley and Selleck, zoned RA-5 and RA-10. Two houses and a barn are within 75 feet of the centerline of Segment A. Other structures are near the proposed transmission line but outside of the right-of-way. Map 4 shows King County zoning designations in the vicinity of the proposed project. Though almost the entire segment is zoned for rural residential uses, most land is undeveloped and has early to ***mid-regeneration*** forest stands.

Part of this area is zoned primarily for mineral use. An aggregate extraction operation, owned by Meridian Aggregates Company, is west of the existing transmission line and Segment A.

The northern end of Segment A is just inside the southern boundary of the Cedar River Municipal Watershed.

3.3.1.2 Segment B

Segment B continues to follow the existing 500-kV line corridor through a relatively flat area. It is about 0.5 mile long. The southern end is near Pole Line Road (Road #50); the northern end is just south of the Cedar River. It is entirely within the CRW. It crosses mid-successional forest (City of Seattle, 2000).

Except for the existing transmission towers, no structures exist within 75 feet of the centerline of Segment B.

3.3.1.3 Segment C

Segment C is about 1.3 miles long. It crosses the Cedar River and an abandoned railroad right-of-way that runs along the river's south side, and roads providing access within the Cedar River Watershed. The Burlington Northern Santa Fe Railway Company owns the ROW. Existing roads provide access to Segment C.

The segment is entirely within the CRW. The land is mid-regeneration evergreen forest (City of Seattle, 2000). Except for the existing transmission towers, there are no structures within 75 feet of the corridor centerline.

3.3.1.4 Segment D

Segment D is about six miles long. The southern half of Segment D is within the Cedar River Watershed. It crosses an abandoned railroad right-of-way. The northern half crosses timberland owned by BPA (formerly owned by the Trillium Corporation), Fruit Growers Supply, Weyerhaeuser, WRECO, and other corporations and individuals, and DNR. There are no homes or other structures near the proposed line. Land in the project corridor is zoned for forest use.

Forest stands range from relatively recent clearcuts to early and mid-regeneration forest.

At the northern end of Segment D, Echo Lake Substation is the dominant land use, covering about 140 acres. It is a relatively flat site at the base of a valley. Adjacent land is undeveloped private property.

3.3.2 Alternative 2

Alternative 2 includes Segments D, E, F, and G. Segment D is described in Section 3.3.1.4.

3.3.2.1 Segment E

Segment E is about one mile long. At the southern end of Segment E, BPA's existing Schultz-Raver Transmission Line corridor is the primary land use. The southern two-thirds of Segment E is outside the CRW on land owned primarily by Plum Creek Timber Company. The entire segment is zoned for forest use.

The northern one-third of Segment E is within the CRW boundaries, though it passes within 0.2 mile of rural residential areas in the community of Selleck. Segment E is within forested areas, primarily in early regeneration stages. Other than the Schultz-Raver transmission lines and towers at the south end of Segment E, no structures are within 75 feet of the centerline of Segment E.

3.3.2.2 Segment F

Segment F is about 0.4 mile long and is entirely within the CRW. Segment F is within an area of mid-regeneration forest. The only structures within 75 feet are the steel poles for the 115-kV Seattle City Light transmission line that runs along Pole Line Road.

The area is zoned for forest uses, but in accordance with the HCP for the CRW, it is managed as an ecological reserve and for watershed protection.

3.3.2.3 Segment G

Segment G is about 1.6 miles long and is within the CRW.

Segment G would cross the Cedar River. The topography is gently sloping, with steeper slopes south of the river. Forest stands along the segment are primarily mid-regeneration, with some small areas of early regeneration stands.

The segment crosses an abandoned railroad ROW owned by the Burlington Northern Santa Fe Railway Company.

Other than the BPA transmission towers near the north end of Segment G and the Seattle City Light transmission line at the southern end of the segment, there are no structures within 75 feet of the Segment G centerline.

There are three bridge crossings over the Cedar River on the east side of the proposed alignment. Two bridges are on Rocky Road; one is on Taylor Creek Road.

3.3.3 Alternative 3

Alternative 3 is one segment, Segment J. Segment J is about 10.2 miles long. The southern portion is on land owned primarily by Plum Creek Timber Company. The area is zoned for forest use and has early regeneration forest stands. Within the CRW, Segment J crosses primarily mid-regeneration forest, with a few early regeneration stands (City of Seattle, 2000). North of the watershed, the segment crosses DNR and privately owned property; most is early to mid-regeneration forestland. Just north of the CRW, Segment J crosses private land with some rural residential uses.

Echo Lake Substation is at the northern end of Segment J. The substation is described in Section 3.3.1.4.

The segment crosses an abandoned railroad ROW owned by the Burlington Northern Santa Fe Railway Company.

Except for the existing BPA transmission towers near the north and south ends of Segment J, Echo Lake Substation, and the 115-kV

Seattle City Light transmission line along Pole Line Road (Road #50), no structures or existing homes are within 250 feet of the corridor centerline. One proposed residence would be within 250 feet of the centerline.

3.3.4 Alternative 4A

Alternative 4A includes Segments C, D, E and H. Segments C and D are described in Sections 3.3.1.3 and 3.3.1.4, under Proposed Action. Segment E is described in Section 3.3.2.1, Alternative 2.

3.3.4.1 Segment H

Segment H is about 1.2 miles long and is within the CRW. The land is zoned for forest use and is managed for watershed protection. Forest stands are in mid-regeneration stages.

Other than the Seattle City Light 115-kV transmission line along Pole Line Road and the BPA 500-kV transmission line at the western end of the segment, there are no structures within 75 feet of the Segment H centerline.

3.3.5 Alternative 4B

Alternative 4B includes Segments B, C, D, E, F, and I. Segments B, C and D are described in Sections 3.3.1.2, 3.3.1.3, and 3.3.1.4, under Proposed Action. Segments E and F are described in Sections 3.3.2.1 and 3.3.2.2, under Alternative 2.

3.3.5.1 Segment I

Segment I is within the CRW and is about one mile long. Land is owned by the City of Seattle, is zoned for forest uses, and is managed for watershed protection. Forest stands are primarily mid-regeneration.

Segment I parallels Pole Line Road, and the 115-kV Seattle City Light transmission line. Other than the transmission line poles and the BPA 500-kV transmission line at the western end of Segment I, no structures are within 75 feet of the centerline of the segment.

3.3.6 Alternative A

Unincorporated Areas — Outside of incorporated areas, Alternative A's route primarily encounters rural residential uses, with much of that forested. There are, however, several subdivisions in the vicinity of this route. Beginning near Kangley with Option C2 (Alternative A shares this portion with Alternative C, Option C2), Alternative A crosses alongside two existing unincorporated subdivisions

east of Maple Valley and through the Kangley Pit. Alternative A then passes north of another small subdivision and crosses the City of Kent's Clark Springs parcel before entering the city of Maple Valley. The unincorporated area along the existing ROW between Covington and Maple Valley is an area of established subdivisions. At Covington Substation, Alternative A turns north and enters the city of Covington. The rural residential area north of Covington consists of mixed parcel sizes. These properties are privately owned and larger than lots in the unincorporated subdivisions between Covington and Kangley. Equestrian uses and small-scale farming, such as Christmas tree farms and pumpkin patches, are evident on some of the larger rural residential lots.

Incorporated Areas — The two incorporated areas crossed by Alternative A contain established and proposed commercial areas, existing and proposed subdivisions, apartments, and park spaces. Both Covington and Maple Valley are growing rapidly.

- ***Maple Valley*** — Within a quarter mile of Alternative A at least nine new subdivisions (approximately 1,053 new residential units) are planned or permitted. These units include the 300-lot Rock Creek Meadows Subdivision, which has not yet submitted a completed application, and the 575-lot Maple Ridge Highland Subdivision, which is proposed for annexation. The closest three subdivisions are Shanlemar (35 lots), and Elk Run #6 and #7, which have a combined total of about 50 lots. Commercial uses immediately affected include Les Schwab Tire, Safeway Plaza I and II, and Four Corners Storage. Private and public recreation sites also are located along Alternative A in Maple Valley. These sites are discussed in Section 3.4.
- ***Covington*** — Alternative A's proposed route crosses through the city of Covington's commercial area near SR 18, Kent-Kangley interchange. Alternative A's exact route around the Covington Substation has not yet been decided, but is likely to run to the east and north of the substation and pass through existing residential subdivisions at the intersection of SE Wax Road and Covington Way SE. Other existing developments nearby include a composting and topsoil business, and a commercial plaza anchored by Safeway. The Covington Apartments and a retail center are under construction along the existing ROW. Other potential or planned commercial uses include a "big box" regional commercial center and location of two large, well-known retailers in specific properties along the ROW. The existing ROW serves as primary access to existing and planned uses in the commercial area. North of SR 18 in Covington, land uses

along Alternative A are residential. Three pending subdivisions or short plats (216 units) are located within 0.25 mile of Alternative A. The four-lot short plat called Fox Wood is the only proposed project in this area located along the ROW.

Transportation facilities — Alternative A intersects SR 169, SR 18 and SR 516. It also intersects or runs near several county and city roads that provide access to local homes and the central business districts of Covington and Maple Valley. Alternative A intersects Burlington Northern Santa Fe rail lines at two locations: west of Covington and within the city limits of Covington. Crest Airpark near Covington, to the south of Alternative A, is the only flight facility nearby.

3.3.7 Alternative B

Alternative B does not cross any incorporated areas. It crosses primarily forestland managed for commercial forestry, recreational, and habitat values. Three areas that have rural residential use include an area south of North Bend, an area near Lake Keechelus, and the recreation areas at Snoqualmie Pass. South of North Bend, Alternative B intersects a rural residential subdivision of view lots between the point where it crosses back to the south side of I-90 and where its meets the edge of the Rattlesnake Mountain Recreation area. These parcels are predominantly privately owned.

The rural residential uses, primarily cabins, evident near Lake Keechelus are on private land surrounded by National Forest land. The cabins are on land zoned for forest use (White, 2002) in a development known as Roaring Creek. Cabins and rural residential use near Snoqualmie Pass are also potentially affected because Alternative B passes within one-half mile to the south of some of the development.

Recreational resources, sites, and facilities along the forested lengths of Alternative B are discussed in the Section 3.4. Most of Alternative B passes through the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests.

Transportation facilities: Alternative B intersects I-90 twice and crosses or runs near some unpaved access roads on National Forest land used to service existing transmission lines and provide recreation and resource management access to National Forest land south of I-90 and private forest lands north of I-90. On its west end, Alternative B intersects the BNSF rail lines and several local roadways that provide access to homes and subdivisions south of North Bend. Two small landing strips — North Bend and Bandera — are also in the vicinity.

3.3.8 Alternative C

Alternative C consists of a north-south alignment with two options: Option C1 to Raver Substation or Option C2 to Kangley. Land uses affected by Option C2 are discussed as part of Alternative A. (See Section 3.3.6, Alternative A.) Option C1 runs through a privately-owned area zoned for forest use. There are large blocks of forest currently managed as commercial forest.

Alternative C turns north along the east side of the Plum Creek mineral site. Land on the west side of the proposed ROW is designated for mineral use and land on the east side is designated forest as far north as Ravensdale Way. North of Ravensdale Way, Alternative C runs through rural residential land similar to the land north of Covington along Alternative A. Parcel sizes vary greatly, but are generally larger than in areas characterized by rural residential subdivisions. Equestrian uses and small-scale farm and forest uses such as Christmas tree farms and pumpkin patches, are evident. Many of the larger lots are wooded. At the intersection of Ravensdale Way and 268th Avenue SE, there is a short row of older homes on small parcels. This area is an exception to the large lot rural residential ownership pattern predominant in the area.

The northern section of Alternative C re-enters forestland at Tiger Mountain State Forest, near the SR 18 and Issaquah Hobart Road interchange. Tiger Mountain State Forest is a publicly owned, managed forest offering recreational opportunities.

Transportation facilities — Alternative C crosses SR 18 and SR 516 and several county access roads serving local rural residential areas (including homes in Covington and Maple Valley) and forest and mining uses. Both Options C1 and C2 intersect BNSF rail lines at one location southwest of Maple Valley.

3.3.9 Alternative D

Alternative D's two optional routes, D1 and D2, run on either side of Alternative B and affect the same land uses as Alternative B. See Section 3.3.7, Alternative B for details on affected land uses.

3.3.10 Echo Lake Substation Expansion

Echo Lake Substation is west of an existing access road. The access road crosses property owned by BPA within a 60-foot-wide easement held by Weyerhaeuser. The road has a 16-foot-wide travel surface. It is one of two access roads at the substation, and it also serves the timber industry and companies that use the communication towers on Rattlesnake Mountain. Although there are limited local access roads near the substation, spur roads more than 100 feet from

the existing access road can be found at many locations. The existing access road also provides access to the existing towers on the BPA 500-kV Raver-Echo Lake Transmission Line.

There are no structures within the area identified for substation expansion, other than an existing retaining wall recently installed by BPA.

See Section 3.1.1 for a description of land uses and ownership in the vicinity.

3.4 Recreation

Many recreational resources are located in and around Alternatives A through D, which are described in more detail in this section (see also Appendix L). By comparison, there are no recognized recreation sites within the project areas for Alternatives 1 through 4. Even informal, dispersed recreation is minimal around Alternatives 1 through 4 because public access is restricted in the CRW and on private timberlands traversed by these alternatives. Dispersed recreation uses on property owned by major landowners are addressed briefly later in this section.

3.4.1 Recreational Resources by Alternative

3.4.1.1 Alternative A

The easternmost portion of Alternative A passes just south of the CRW (Option C2) and through the City of Kent's Clark Springs property (see Map 9). Neither of these publicly-owned areas is open to the public for recreational use. Alternative A then continues through Maple Valley where the existing ROW crosses Elk Run Golf Course, a public course located on private land and land leased from King County. About 50,000 rounds of golf are played annually at the course (Humphreys, 2002). On land immediately under the ROW and existing line, Maple Valley plans an active recreation area, including ball fields, and bus barn development. Design has been completed and construction will begin soon. Plans include a perimeter trail that would connect to the Cedar River and planned Cedar to Green River Trails (Starbord, 2002).

As Alternative A turns north at the Covington Substation, it passes through the city of Covington between Gas Line Right-of-Way Park, which is currently being developed, and the Soos Creek Park and Trail, which is planned to extend into Covington. North of Covington, Alternative A passes between Lake Youngs Watershed and Shadow Lake, then crosses through the Peterson Lake Natural Area and the Cedar River Trail, which connects Maple Valley and Renton along Highway 169 and the Cedar River.

3.4.1.2 Alternatives B and D (Options D1 and D2)

Approximately 22 miles of Alternatives B and D (both Options D1 and D2) cross through National Forest land from the Yakima River east of Keechelus Lake to about midway between exits 38 and 42 on the I-90 corridor (see Maps 10 and 11). As discussed earlier in the land use section, the land allocations assigned to public land in this area show maintenance of recreational opportunities is a primary objective. Acquisition and exchange of land have occurred recently, but there are no plans to add to existing recreational facilities (Rogalski, 2002). Federal recreational resources of note in the vicinity include:

- Alpine Lakes Wilderness Area, located north of I-90 near Snoqualmie Pass, which is currently being analyzed for expansion.
- Pacific Crest Trail, which crosses the existing BPA ROW west of Surveyors Lake and east of the Iron Horse State Park Gate.
- Tinkham Campground, located between existing BPA ROW and I-90, east of exit 42.
- McClellen Butte Trail, with its trailhead at exit 42.
- The ski area at Snoqualmie Pass has ski trails and mountain bike trails that run underneath or adjacent to Alternatives B and D.

➲ For Your Information

The Mountains-to-Sound Greenway is a 100-mile section of I-90 crossing public and private lands, including National Forest lands. It is the first interstate highway to be designated a National Scenic Byway. This distinction confirms the priority placed on maintaining and enhancing scenic qualities and recreational opportunities along the I-90 corridor.

The remainder of the length of Alternatives B and D (approximately 14 miles) crosses a mix of public and private land. Though outside the National Forest, this length is located within the Mountains-to-Sound Greenway. The Mountains-to-Sound Greenway Trust, a mix of state, federal, and privately funded recreational resources, has been established.

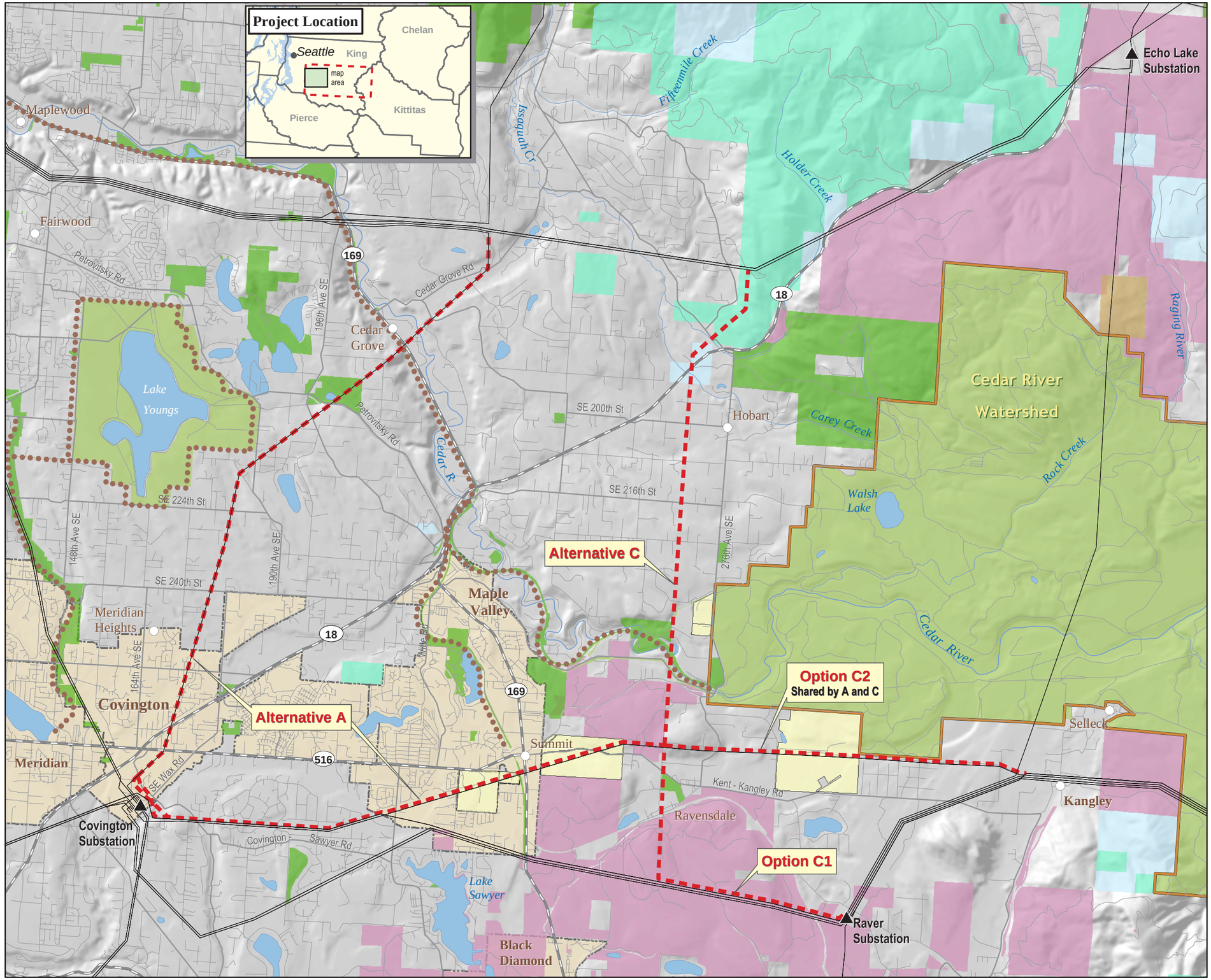
Recreational resources outside the National Forest boundary include the following:

- Iron Horse State Park and John Wayne Pioneer Trail, which parallel the I-90 corridor from Rattlesnake Lake through private lands to National Forest lands near Lake Keechelus and the Yakima River. Parts of this converted railroad line trail parallel the BPA ROW and the proposed alternatives cross the trail in four locations. It is managed cooperatively by the Forest Service and State.
- Ollalie State Park, located east of the Upper Twin Falls Trailhead.
- Upper and Lower Twin Falls Trailhead, Twin Falls Natural Area, and Twin Falls Trail, located east of exit 34 along the south side of I-90.

Map 9

RECREATION and OWNERSHIP

Alternatives A and C



Legend

- Proposed Transmission Line Alternatives
- Existing BPA Transmission Lines
- Existing BPA Substation
- WA Dept. of Natural Resources
- State Park or Recreation Area
- Other State Lands
- USDOE - BPA
- City
- Other Public - City or County
- Private Timber or Other Private Land
- Other Private or Unspecified
- Cedar River Watershed Boundary
- Trail

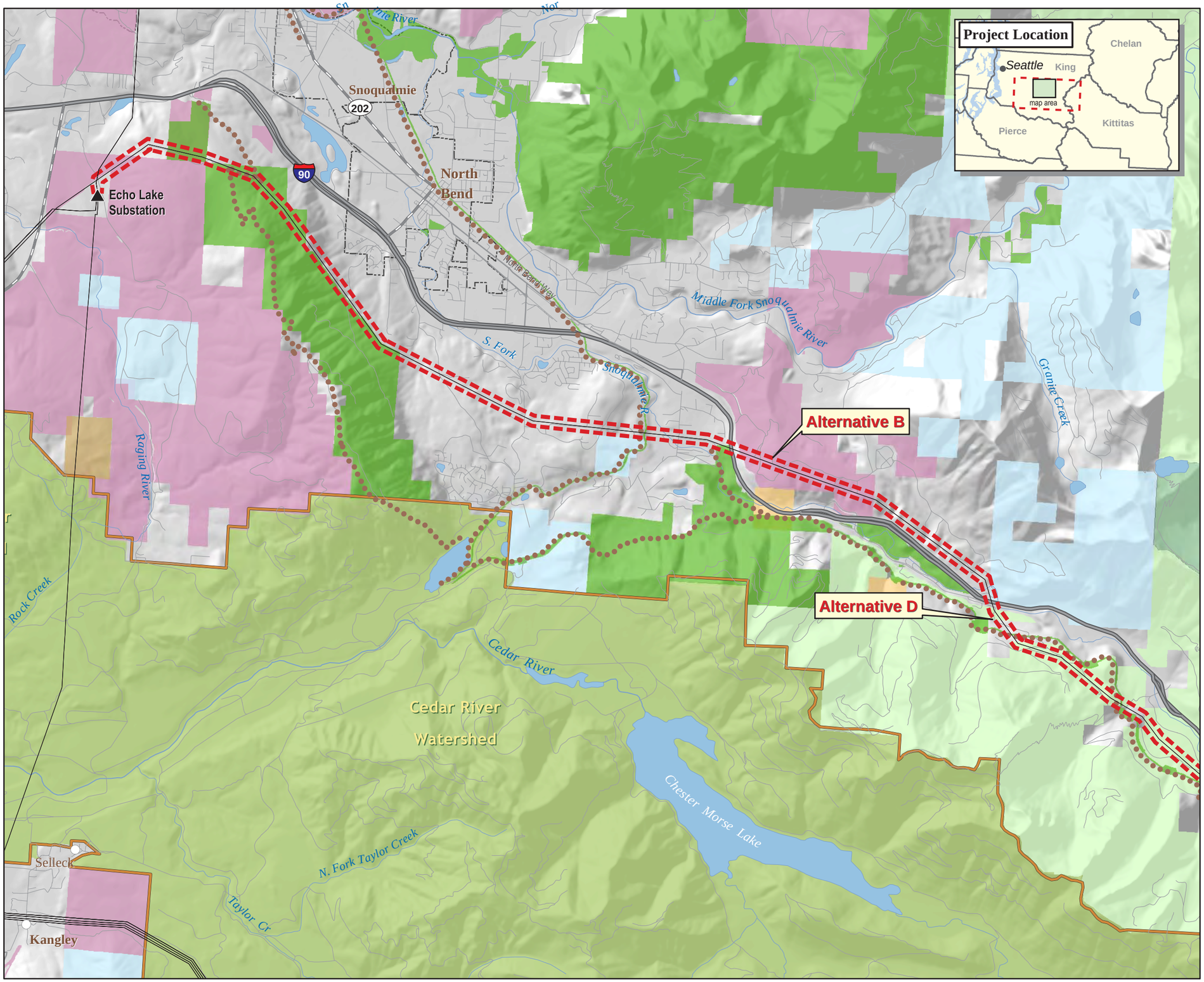
Source: Washington DNR, King County GIS, 2000.

N

0 1 2 3

Miles

November, 2002



Map 10

RECREATION and OWNERSHIP

Alternatives B and D
Western Portion

Legend

Proposed Transmission Line Alternatives

Alternative B Rebuild Portion of Rocky Reach-Maple Valley 345-kV to Double-Circuit 500-kV from East of Stampede Pass to Echo Lake Substation.

Alternative D

Option D1: Construct New Single-Circuit 500-kV Line from East of Stampede Pass Adjacent to and on the South Side of Rocky Reach-Maple Valley Line.

Option D2: Construct New Single-Circuit 500-kV Line from East of Stampede Pass Adjacent to and on the North Side of Rocky Reach-Maple Valley Line.

- Existing BPA Transmission Lines
- Existing BPA Substation
- US Forest Service
- US Forest Service - Recreation Area
- BLM
- USDOE - BPA
- WA Dept. of Natural Resources
- State Park or Recreation Area
- City
- Private Timber or Other Private Land
- Unspecified
- Cedar River Watershed Boundary
- Trail

Source: Washington DNR, King County GIS, 2000.

N

0 1 2 3

Miles

November, 2002

Map 11

RECREATION and OWNERSHIP

Alternatives B and D
Eastern Portion

Legend

Proposed Transmission Line Alternatives

Alternative B Rebuild Portion of Rocky Reach-Maple Valley 345-kV to Double-Circuit 500-kV from East of Stampede Pass to Echo Lake Substation.

Alternative D

Option D1: Construct New Single-Circuit 500-kV Line from East of Stampede Pass Adjacent to and on the South Side of Rocky Reach-Maple Valley Line.

Option D2: Construct New Single-Circuit 500-kV Line from East of Stampede Pass Adjacent to and on the North Side of Rocky Reach-Maple Valley Line.

Existing BPA Transmission Lines

US Forest Service

US Forest Service - Recreation Area

State Park or Recreation Area

City

Private Timber or Other Private Land

Commercial Recreation Area

Unspecified

Cedar River Watershed Boundary

Source: Washington DNR, 2000, King County GIS, 2000, and Kittitas County GIS, 2002.

N

0 1 2 3

Miles

November, 2002

Snoqualmie Pass

Snoqualmie Pass Ski Area

To Echo Lake

Iron Horse State ParkTrail

ALPINE LAKES WILDERNESS

Gold Creek

Mineral

MT BAKER SNOQUALMIE NATIONAL FOREST

KING Co.

KITTITAS Co.

Keechelus Lake

Seattle Cr

Cedar River

Cedar River Watershed

North Fork Cedar River

South Fork Cedar River

Pacific Crest Trail

Yakima River

Alternative B

Alternative D

Stampede Pass

Project Location

Seattle

King

Chelan

Kittitas

Pierce

map area

- Camp Waskowitz, with about 40 acres north of the South Fork along I-90 accessed off of 150th and approximately 330 acres south of the South Fork Snoqualmie River. A portion of the 330 acres extends up to the existing line. Most of the property is used for hiking and outdoor educational sites. Outhouses and "infrequently used shelter houses" are located up along the existing line and some Christmas trees have been planted under the existing line.
- Snoqualmie Valley Trail, which extends from the John Wayne Pioneer Trail and Rattlesnake Lake recreation area down the Snoqualmie River Valley.
- Rattlesnake Mountain Scenic Area, Rattlesnake Mountain Trail, and Rattlesnake Lake Recreation Area. Rattlesnake Lake Recreation Area is more than 1.5 miles south of the existing BPA ROW on Cedar Falls Road off Exit 32. The existing BPA ROW runs along the east side, then passes through the northern end of the Rattlesnake Mountain Scenic Area approximately 0.75 mile south of Snoqualmie Point Trailhead where it crosses the Rattlesnake Mountain Trail.

West of the Rattlesnake Mountain Scenic Area, the existing BPA ROW turns southwest toward Echo Lake Substation after crossing the Rattlesnake Mountain Trail. Here it crosses Weyerhaeuser Real Estate Company land that has been identified for a planned trail connection between the Tiger Mountain State Forest and Rattlesnake Mountain Scenic Area (Konigsmark, 2002).

3.4.1.3 Alternative C (Options C1 and C2)

Alternative C passes just west of Ravensdale Park and along the east side of Big Bend along the Cedar River just north of Kent-Kangley Road. At its north end, this segment crosses Tiger Mountain State Forest.

Option C1 of Alternative C crosses no public recreation areas. Option C2 of Alternative C is described under Alternative A.

3.4.2 Weyerhaeuser Company

The Weyerhaeuser Company (Weyerhaeuser timberlands) owns land crossed by several alternatives. Weyerhaeuser Company allows two types of public recreational access: on foot or horseback without a permit, or by annual permit. No overnight visits are permitted. Weyerhaeuser does not have an estimate of how many people use the property without a permit. However, most users live around the perimeter of the forested area and regularly use the forest for hiking and walking dogs relatively short distances (two to three miles).

Weyerhaeuser sells annual Cascade Recreation Permits. The permits allow visitors to drive and park vehicles in the forest. While there may be some recreation use within the project area, the access pass program only allows access from the Spur 10 gate at the intersection of Spur 10 Road with North Fork County Road from North Bend in the southwest corner of Township 24 North, Range 8 East, Section 12. This access is about six miles from the northern edge of the project area. Therefore, most recreational activity on Weyerhaeuser Company-owned land is concentrated in the Snoqualmie Tree Farm north of the project area.

3.4.3 Weyerhaeuser Real Estate Company

WRECO, which owns land directly south of Echo Lake Substation, does not issue permits for public use of its property and does not allow hunting. It does allow adjacent property owners to pass through the WRECO land to access their properties. There is some recreational use of the WRECO land, however, mainly hiking and other non-motorized use.

3.4.4 Fruit Growers Supply

The Fruit Growers Supply-owned property along the northern portions of segments D and J (about 5,000 acres) is managed by Green Crow. Fruit Growers Supply/Green Crow does not issue permits for public use of the land. Motorized vehicles are not allowed, and access is restricted by the gates at the WRECO property. Access from SR 18 is through the WRECO property. However, recreation does occur on the Fruit Growers Supply property, mainly hiking, mountain biking, hunting, and berry picking.

3.4.5 Bonneville Power Administration

BPA owns property that would be bisected by Segment D, in Township 23 North, Range 7 East, Section 26. BPA has no recreation policy for this parcel.

3.4.6 Plum Creek Timber Company

The Plum Creek Timber Company, which owns properties in the vicinity of several alternatives, has an “open lands” policy. The company does not issue permits for recreational use and does not monitor use unless there is a complaint. Most of the recreation activity that occurs is hunting and berry picking by local people. Hikers, horseback riders and mountain bikers also occasionally use trails on Plum Creek properties. People drive jeeps and motorcycles on trails in the vicinity of existing transmission lines (Johnson, 2002).

3.4.7 Palmer Coking Coal

Public access to Palmer Coking Coal land near Alternative C (Options C1 and C2) is allowed by permission only. Recreation uses include horseback riding, hiking, walking, and jogging on informal paths (Kombol, 2002). There are abandoned mine shafts in this area.

3.4.8 Other Private Lands

Informal recreational use, such as birding and hiking, may occur on private land parcels with landowner permission within the project area. There is relatively little hunting activity.

3.4.9 Washington Department of Natural Resources

As noted in Section 3.4.1.2, the 1,800-acre Rattlesnake Mountain Scenic Area, co-owned by DNR and King County, is in the vicinity of Alternatives B and D. The area is managed for conservation purposes and scenic value while providing opportunities for low-impact public use. A trail traverses the mountain ridge that connects to the Rattlesnake Ledge Trail (also called the Rattlesnake Mountain Trail) and continues through DNR land north of the scenic area, terminating at Snoqualmie Point Park near I-90. The 11-mile trail is open to hiking and non-motorized vehicles and has approximately five viewpoints. Public use in the scenic area is seasonal and light and consists mostly of hiking, mountain biking on logging roads, and horseback riding. Hunting may occur, but is limited by distance from vehicle-accessible roads. Bird watching, cross-country skiing, pet recreation, and photography are also permitted in the scenic area, along designated trails only. The scenic area is open to daytime use only; no overnight camping is permitted.

DNR also owns and manages the Tiger Mountain State Forest. Trails within the forest are open to hiking year-around and open to horses and bicycles April 15 to October 15. Two parking lots are provided for recreation access: one off I-90 at Preston and another at the summit of SR 18 at Township 22 North, Range 6 East, Sections 20 and 21.

Additional recreational resources include Iron Horse State Park and John Wayne Pioneer Trail, which parallel the I-90 corridor from Rattlesnake Lake to Lake Keechelus and the Yakima River. These resources are managed cooperatively by the State and the U.S. Forest Service. Parts of this converted railroad line trail parallel the BPA right-of-way and the proposed alternatives cross the trail in four locations.

3.4.10 King County

In September 1997, King County purchased 1,700 acres on Taylor Mountain to protect the headwaters of a critical fish habitat from a proposed residential development. Formerly known as the Manke property, the site is accessible via SR 18. There is a small parking area. Day-use only is allowed. The site is used by hikers and equestrians.

The County also maintains the Cedar River Trail. The trailhead is across 276th Avenue SE (west side) from the Landsburg Diversion Dam and Landsburg Park. The gravel trail runs to downtown Renton. It is gated (no motorized vehicles are permitted) and for use during daylight hours only.

3.4.11 Cedar River Municipal Watershed

Seattle Public Utilities, an agency of the City of Seattle, has management responsibilities for the watershed, which is traversed by Alternatives 1 through 4. SPU allows only two types of visitors to the watershed, and only under supervision: scientists and contractors performing work within the watershed, and school groups. SPU estimates that fewer than 100 permits per year are issued for scientists and contractors. The agency estimates that 10,000 students enter the Watershed annually for education programs. However, SPU expects this number to rise to approximately 30,000 students per year after an interpretive center opens at Rattlesnake Lake in 2001.

In addition, the CRW is a special resource area used by members of local tribes, including the Muckleshoot Tribe, for tribal activities.

SPU also operates a small, city-owned park at the Landsburg Diversion Dam (Landsburg Park). The park is on the east side of 276th Avenue SE. The park has picnic tables, a picnic shelter, and restrooms. The agency is adding a fish ladder, to be completed in 2002 or 2003**,** and a fish hatchery, to be completed in 2005. SPU will make improvements to the park so the public has opportunities to observe the fish. SPU has been working with several other agencies, including King County, DNR, and others, to construct a trail from Rattlesnake Lake Recreation Area to Landsburg Park that would skirt the watershed's northern boundary. The trail would connect to the John Wayne Trail and the Iron Horse Trail at Rattlesnake Lake and King County's Cedar River Trail. (See also 3.1.3, **Cedar River Municipal Watershed**.)

3.4.12 City of Snoqualmie

The City of Snoqualmie owns Snoqualmie Point Park. It is the site of a former winery that was destroyed by fire in 1999. The city purchased the property in February 2000. There is a parking area at the park. A trail connecting to the Rattlesnake Mountain Trail is a few hundred feet downhill (west) of the parking area. The city does not require a permit for, nor tracks recreational use.

3.5 Geology and Soils

The topography, geology, and soils of the project area are key factors that affect the susceptibility of different areas to erosion and sedimentation. Erosion and sedimentation can cause degradation of water quality and affect fisheries and other habitat. ***Landslides***, ***soil creep*** and other ***mass wasting*** processes can contribute to slope erosion and stream ***sedimentation***. Clearing vegetation, road and tower construction, use, and maintenance can affect these processes. The following sections describe the topography, geology, and soil types present within the project area. More detailed information is included in Appendices F and M.

3.5.1 Topography

➲ For Your Information

Physiographic *— Pertaining to the features and phenomena of nature.*

Glacial drift *— Sand, gravel, boulders, etc., moved and deposited by a glacier or by water arising from its melting ice.*

The project areas can be subdivided into three ***physiographic*** provinces: a southern lowland area (Puget Lowlands) in Green Valley and a northern mountainous area, which includes Taylor Mountain, Brew Hill, Rattlesnake Mountain, and the intervening Raging River Valley (Rosengreen, 1965), and the foothills and peaks of the Cascade Mountains. Proportionally, Alternatives A and C encounter more lowland than the other alternatives. The project area for Alternatives B and D, by comparison, is predominantly mountainous. Lowland areas are underlain by ***glacial drift***; Alternatives B and D are dominated by volcanic rock.

The Puget Lowlands consist of a series of terraces cut by ***glacial meltwaters*** and more recent streams, including the Cedar River and other smaller streams, such as Taylor, Williams and Steele creeks. The terraces consist of nearly flat to rolling drift plain with low elongated ridges, with less than 200 feet of relief. An area of complex topography is then encountered by Alternatives 1 through 4 on the western edge of the Cedar River Watershed between the Cedar River to the south and the northern mountainous area to the north. This area includes several small lakes, bogs and sinks that were formed by ***outwash*** sediment deposited around stagnant ice that remained after the glacier had retreated. Similarly, further west, Alternatives A and C encounter numerous lakes, ponds and wetlands; Alternative A crosses

the Little Soos Creek and its headwater drainage, while Alternative C crosses Carey and Holder creeks (headwaters to Issaquah Creek).

The Cedar River is the principal stream in the southern lowland area and is crossed by all alternatives except B and D. Its headwaters are southeast of the project area. The river flows generally northwest to Renton, where it discharges into Lake Washington. The Cedar River and other streams have cut into the terraces, locally exposing older glacial deposits and bedrock, and creating steep-walled gorges. The Cedar River floodplain in the study area is narrow, but does contain lateral and center channel gravel bars.

The mountainous areas range from relatively low rounded mountains with moderate slopes and intervening valleys on the project's west end to increasingly steep, rugged terrain on the east end where Alternatives B and D approach and cross the Snoqualmie West Ski Area and Cascade Mountains. The Vashon Stade continental glacier overrode almost the entire area, eroding the mountains and depositing a mantle of ***glacial till*** and outwash. Rattlesnake Mountain is the highest point on the project's west side area, with a summit elevation of 3,517 feet. The highest point on the project's east side is Mt. Catherine at 5,029 feet, near Snoqualmie Pass.

➲ For Your Information

Glacial till— *Unstratified, unsorted, glacial drift of clay, silt, sand, boulders, and gravel.*

The Raging, South Fork Snoqualmie and Yakima rivers are the principal waterways in the project's mountainous area. The Raging River, crossed by Alternatives 1, 2, 3, 4A, and 4B, flows north through a broad, glacially carved, U-shaped valley between Brew Hill and Taylor Mountain to the west and Rattlesnake Mountain to the east. The head of this U-shaped valley forms a broad pass between the Cedar River to the south and the Raging River to the north at about elevation 1,500 feet. Several smaller streams drain to the south into the Cedar River, including Rock, Williams, and Steele creeks. These streams typically are deeply incised except where they cross gently sloping terraces of the southern lowland area.

The South Fork Snoqualmie River and Yakima River are crossed by Alternatives B and D. Both rivers flow in similar broad, glacially carved, U-shaped valleys. Keechelus Lake, a Yakima River reservoir, is skirted by Alternatives B and D along its west side. Alternatives B and D also cross many streams and smaller channels.

3.5.2 Geology

The project area is along the western margin of the South Cascade Range (Galster and others, 1989). The South Cascades are composed primarily of Tertiary age volcanic, ***volcaniclastic*** and associated sedimentary rocks. These rock units have been folded and faulted since they were deposited. It is possible that outcrops of these and other types of rocks could be encountered in the project area.

Volcaniclastic *— Pertaining to clastic rocks, containing volcanic material in whatever proportions and without regard to its origin or environment.*

Repeated advances of continental glacial ice sheets into the Puget Sound lowlands have eroded the Cascade foothills and deposited thick sequences of glacial sediments.

➲ For Your Information

Glaciofluvial deposits — *Pertaining to the meltwater streams flowing from wasting glacier ice, and especially to the deposits and landforms produced by such streams.*

Ice-contact deposits — *Stratified glacial drift deposited in contact with melting glacier ice. Normally marked by numerous kettles and hummocky ground.*

Geologic processes profoundly influenced the surface deposits and landforms in the project area. The continental glacier deposited variable thickness of glacial till and glacial outwash in the northern mountainous area. In the Puget Lowlands, the glaciers deposited extensive ***glaciofluvial*** and ***ice-contact deposits***, and reshaped the surface with a series of meltwater channels that formed beneath and in front of the ice sheet as the continental glacial ice advanced and retreated. Following glacial retreat, the landforms were locally modified by erosion and deposition and mass wasting.

The upper limits of ice can be determined from the highest presence of glacial till and erratic boulders. The glaciers advanced across the southern lowland area, terminating against mountains south of Green Valley. As the glaciers advanced over the area, they eroded the underlying bedrock, shaping streamlined, molded forms.

Recent deposits include landslides, ***talus***, ***colluvium***, ***bogs***, ***alluvium***, and volcanic ash. Landslide deposits result from the relatively rapid downslope movement of rock and soil, and are generally found on and at the base of slopes. They usually consist of a remolded, heterogeneous mixture of several soil types and commonly include organic debris. There is a large, ancient, deep-seated (depth of 10 feet or more) landslide complex in the approximate center of the Proposed Action (Frizzell, et al. 1984) and in the vicinity of Alternatives B and D. Recent deep-seated and shallow (less than 10 feet deep) landslide features can be observed on the valley walls above the Cedar River along Alternative A. Landslides are relatively uncommon in the project area, however, because of relatively gentle slopes on the west end and relatively stable bedrock conditions in the mountainous terrain on the east end.

Talus deposits, consisting of nonsorted, angular boulders to gravel derived from rock slopes, are mapped at the east end of Alternatives B and D. Smaller talus deposits are likely also present along the slopes above Keechelus Lake and the South Fork Snoqualmie River Valley.

Colluvium is soil that has been transported downslope, generally by mass wasting processes, including shallow landslides, rainsplash erosion, frost heave, and soil creep. It generally develops on slopes and near the base of a slope. Thickness can range from a few inches to 10 feet or more, with the thickness usually increasing downslope. Colluvium is relatively widespread in the study area.

Bog deposits include peat and organics with ***lacustrine deposits***. They occur in poorly drained, low-lying areas (typically areas designated as wetlands), such as the broad pass near Halmar

Gate, and in areas where stagnant ice was present, such as the ponds and sinkholes north of the Cedar River. Bog deposits are most prevalent along Alternatives A and C, which are characterized by till and enclosed drainages resulting from glacial deposition. No mapped bog deposits occur along Alternatives B and D. Bog deposits can provide poor foundation conditions.

Rivers and streams deposited alluvial sediments in and next to current and historical channels. Alluvium includes fine-grained, overbank deposits and coarse-grained channel deposits. Older alluvial deposits are present along the Cedar River in the form of low, discontinuous terraces that were deposited after the continental glaciers had fully retreated. Extensive alluvial deposits are also present along the Yakima and South Fork Snoqualmie rivers. Terraces formed as the rivers eroded and incised a deeper channel, leaving remnants of the alluvial deposits along the valley sides. Recent alluvial deposits occur in and next to the streams in the project area in the forms of sand, gravel and cobble bars, and alluvial fans.

Volcanic ash was widely deposited over most of western Washington as a result of the catastrophic eruption of Mount Mazama in southern Oregon approximately 6,600 years ago and other less extensive volcanic eruptions. The ash deposits are well preserved in bog deposits. Elsewhere, they typically are mixed with other soil types.

3.5.3 Geologic Structure

The geologic structure of the project area is dominated by a broad zone of northwest-southeast trending faults and folds that comprise the Olympic-Wallowa Lineament (Frizzell, et al., 1984). The once near-horizontally bedded, sedimentary rocks have been uplifted and folded, tilting the bedded rock in various directions and at various angles. Several major folds are present in the project area. They include:

- a northwest-trending trace implied along the Cedar River Valley at the north end of Alternative A.
- a southwest-plunging anticline mapped north of the Cedar River and northwest of Alternative A.
- a northwest-trending Hobart Fault extending across Alternative C's northern route on the south flank of South Tiger Mountain.
- the Rattlesnake Mountain ***syncline*** and the Raging River ***anticline***, respectively east and west of Echo Lake Substation, which are encountered by several alternatives.

➲ For Your Information

*A **syncline** is a fold where the rock layers dip towards the axis or center of the fold. The surface of a rock layer in a synclinal fold forms a concave-upward surface. An **anticline** is the opposite of a syncline. That is, the rock layers dip away from the axis of the fold, such that rock layers form convex-upward surfaces. The axis of the Raging River anticline, for example, follows the Raging River Valley south to just west of Brew Hill.*

- a west-trending fault trace mapped across Alternatives B and D near the center of Keechelus Lake.
- an anticline west of the Snoqualmie West Ski Area, also encountered by Alternatives B and D.
- an east-southeast plunging syncline mapped about one mile south of Alternatives B and D at McClellan Butte.
- a north-trending fault mapped just south of Alternatives B and D across the South Fork Snoqualmie River near Twin Falls State Park.

The age of faulting in the project area is uncertain. However, there is no published evidence that these mapped faults have recently moved.

3.5.4 Soils

The soils in the project area have characteristics typical of the western Cascades of Washington. Most relevant to this study is erodibility. The general soil types based on the processes that formed them include: alluvial soil deposited directly by streams and rivers; glacial soil that was deposited directly by glaciers (glacial till) and by glacial outwash streams (glaciofluvial deposits); residual soils (***residuum***) that formed by weathering in place of the underlying bedrock, alluvium, or glacial deposits; colluvial soil (colluvium) transported downslope, generally by mass wasting (e.g., landslides and soil creep); and volcanic ash from nearby Cascade volcanoes that mixed with the other soil types.

Most of the soils in the lowland areas of the project are more than 5 feet deep, reflecting the depth of underlying glacial and alluvial deposits. Thinner soil, typically between 2 and 4 feet deep, is present in areas underlain by bedrock such as the mountainous terrain traversed by Alternatives B and D. Soils underlain by bedrock are typically thinner on steep slopes underlain by massive, erosion-resistant sandstone and volcanic flow rock. The soil depth can influence surface water runoff and mass wasting potential.

3.5.5 Regional Seismological Setting

Tectonics *— The structure of the crust of a planet (as earth) with the formation of folds and faults in it.*

Subduction zone *— An elongate region along which a crustal block of the earth's surface descends relative to another crustal block.*

The project area is in a moderately active tectonic region that has been subjected to many earthquakes of low to moderate strength, and occasional strong shocks during the brief 170-year historical record in the Pacific Northwest. Recently, the area experienced a 6.8 earthquake centered near Olympia. The ***tectonics*** and ***seismicity*** of the region are the result of ongoing, oblique, relative northeastward subduction of the Juan de Fuca Plate beneath the North American Plate along the Cascadia ***Subduction Zone***. The

subduction zone extends from Northern California to central Vancouver Island in British Columbia. Western Washington is in the continental ***fore-arc*** of the Cascadia Subduction Zone. The fore-arc consists of accreted sedimentary and volcanic rocks (*i.e.*, Olympic Mountains and Puget Lowlands) in front of a landward mountainous, active volcanic arc (Cascade Mountains). The project area is located at the juncture between the accreted rocks and the landward mountainous, volcanic arc.

3.6 Water Resources

3.6.1 Precipitation

Precipitation patterns in the project area are under the prevailing marine influence of the Pacific Ocean, which produces mild, wet falls and winters, relatively dry summers, and mild temperatures year round. Most of the precipitation falls as rain in the southern lowlands of the project area, while a mixture of rain and snow falls on the upper portions of the northern mountainous area. Annual precipitation in the project area averages between 40 and 60 inches in the Kent area along the western extension of Alternative A, to more than 180 inches at Stampede Pass at the east end of Alternatives B and D. In general, the annual precipitation amounts increase from west to east as elevation increases. There is a distinct wet season; over 75 percent of the total annual precipitation falls between October and April.

3.6.2 Floodplains

The Federal Emergency Management Agency (***FEMA***) National Flood Insurance Program mapping program identifies areas that have a 1 percent chance of being flooded in any given year. These areas are called ***100-year floodplains***. FEMA has not mapped floodplains for the entire project area, usually doing so only in populated areas. However, FEMA has mapped the 100-year floodplain along the Cedar River a short distance downstream from the project area. Based on this mapping, it appears that the 100-year floodplain just west of the watershed is initially limited to a narrow area along the active Cedar River channel. Farther downstream, however, in the vicinity of Alternative A's northern route, the Cedar River flows into a broad valley where the floodplain averages 1,000 to 1,500 feet in width.

FEMA has also mapped the floodplain of the South Fork Snoqualmie River in the vicinity of North Bend. Here the floodplain is also generally confined to a narrow area along the active channel and appears to have the same geomorphic conditions upstream where Alternatives B and D cross the river twice. FEMA has not

mapped the reach of the Yakima River Valley where Alternatives B and D cross the Yakima River. However, the valley is generally broad and flat in this area and several bog areas occur, tending to indicate periodic flooding. Flooding in the Yakima River is controlled to a certain degree by operation of the Keechelus Lake Reservoir, which is about four miles upstream of the proposed river crossing.

Remaining waterways in the project area, including the Raging River and its tributaries, and tributaries to the Cedar and South Fork Snoqualmie rivers, are in moderately incised channels. As such, these streams do not have significant floodplains and flooding generally would not rise above the incised channels.

3.6.3 Groundwater

➲ For Your Information

Aquifers *— Water-bearing rock or sediments below the surface of the earth.*

There are no ***sole-source aquifers*** designated or proposed by the Environmental Protection Agency (***EPA***) in the project area. However, there are numerous domestic and public supply wells and wellhead protection programs (City of Kent, City of Covington) located within the project area. The principal groundwater aquifers are in glacial outwash deposits in the southern lowland area. Because Alternatives A and C traverse areas underlain by these deposits, these areas are important local and regional aquifers. These aquifers are also locally developed for domestic and some farm consumption in the communities of Selleck and Kangley. In the northern mountainous area, the community of Halmar Gates, near the end of Kerriston Road, likely uses groundwater for domestic consumption. Wells in this area would produce groundwater from the underlying bedrock. Potential aquifers in alluvium, outwash and ice contact drift deposits also exist between North Bend and Twin Falls Sate Park along the Snoqualmie River Valley. (See Appendix M for more information and maps of these areas.)

Water in the Cedar River, which provides unfiltered drinking water to 1.3 million people, is also partially derived from groundwater sources. As such, contamination of the groundwater could impact the drinking water supplies. Activities in the Watershed that could affect the groundwater supply are strictly controlled.

3.6.4 Surface Water

Activities in the CRW that could affect surface water supply and quality are also strictly controlled. Washington State has designated this watershed in a special category where no waste discharges are permitted. The existing water quality of the Cedar River is high.

Management of the watershed as a source for drinking water is regulated under several rules, including the Safe Drinking Water Act and the Surface Water Treatment Rule. In addition, SPU has recently

adopted a Habitat Conservation Plan that regulates many activities within the Watershed to protect its drinking water supply and fish and wildlife resources. (See also Sections 3.1.3, **Cedar River Municipal Watershed,** 5.5.8.5, **City of Seattle Cedar River Watershed Habitat Conservation Plan,** and 5.16, **Safe Drinking Water Act**.)

3.6.5 Water Quality

3.6.5.1 Federal Clean Water Act

The Federal Clean Water Act requires that states protect the water quality of their rivers, streams, lakes, and estuaries. To accomplish this, Section 303(d) of the Clean Water Act requires that each state develop a list of water bodies that do not meet the standards. The 303(d) list is a means of identifying water quality problems. Once a stream is placed on the list, the Clean Water Act requires that the state develop a plan to reduce pollution. The states must submit the "water quality limited" list to the EPA every two years. In Washington, the Department of Ecology (Ecology) is responsible for developing the standards that protect beneficial uses such as drinking water, cold water for fish, industrial water supply, and recreational and agricultural uses. Ecology is also responsible for compiling the 303(d) list and submitting it to EPA for approval. Parameters that Ecology typically monitors include bacteria, pH, dissolved oxygen, temperature, total dissolved gas, certain toxic and carcinogenic compounds, habitat and flow modification, fecal coliform, turbidity, and aquatic weeds or algae that affect aquatic life.

Water bodies crossed by the transmission line alternatives and listed on the Washington State 303(d) water quality limited list are present in Appendix M, Table 3. The Cedar River is listed for fecal coliform at points two miles and 10 miles downstream (west) of the Alternatives A and C crossings, respectively. The upper Yakima River is listed as temperature-impaired at a point seven miles downstream

Table 3-2 — Special-Status Fish in Streams Crossed by the Transmission Alternatives

Fish	Scientific Name	Federal Status	State Status
Chinook salmon	*Oncorhynchus tshawytscha*	Threatened	Candidate
Coho salmon	*Oncorhynchus kisutch*	Candidate	None
Steelhead	*Oncorhynchus mykiss*	Threatened	Candidate
Bull trout	*Salvelinus confluentus*	Threatened	Candidate
Pacific lamprey	*Entosphenus tridentatus*	Species of Concern	None
River lamprey	*Lampetra ayresi*	Species of Concern	Candidate
Kokanee (landlocked sockeye)	*Oncorhynchus nerka*	Not listed	Species of Concern

from where Alternatives B and D cross it. Two segments of the South Fork Snoqualmie River are listed as pH-impaired at points 1,000 feet upstream from the Alternatives B and D western crossing and 2,000 feet downstream from the Alternatives B and D eastern crossing.

3.7 Fisheries

The fish resources in the project area include resident and anadromous species. Resident species live their life cycles within a watershed. Anadromous species are hatched in freshwater, then spend part of their life at sea before returning to their home waters to spawn. In the project area, not all mainstem rivers and tributaries include both resident and anadromous fish and some that do not currently have one type are anticipated to later. For example, the mainstem Cedar River and its tributaries above Landsburg Dam do not currently have anadromous species, but when a fish ladder and other improvements are made to Landsburg Dam by August 2003, these species would be expected in those streams.

3.7.1 Special-Status Fish Species

Special-status fish species include those that are listed, proposed, or candidates for listing as threatened or endangered under the federal ESA, or that are regarded as species of concern by the USFWS, or that are listed as species of concern (including endangered, threatened, sensitive and candidate categories) according to the Washington Department of Fish and Wildlife (***WDFW***). Table 3-2 lists special-status fish potentially present in streams crossed by the transmission alternatives.

3.7.1.1 Federally-Listed Species

All transmission alternatives could affect two species of fish listed as either threatened or endangered under the ESA: Puget Sound chinook salmon and Puget Sound bull trout. Alternatives B and D (Options D1 and D2) could affect two additional species of fish, Middle Columbia steelhead and Columbia River bull trout, listed as threatened under the ESA.

➲ For Your Information

Evolutionarily Significant Unit (ESU) *— A salmon population or group of populations that are substantially reproductively isolated from other conspecific population units, and contributes substantially to ecological/genetic diversity of the biological species as a whole.*

The Puget Sound ***Evolutionarily Significant Unit*** *(**ESU**)* chinook salmon was listed by NMFS as threatened under the ESA on March 24, 1999 (64 FR 14308). This ESU includes all naturally-spawned chinook populations residing below impassable natural barriers in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula. Chinook salmon are potentially present in streams crossed by each of the transmission alternatives.

In a separate rule, NMFS also designated critical habitat for the chinook salmon on February 16, 2000 (65 FR 7764). All surface waters accessible to chinook salmon in the Puget Sound Basin are included in the listing, as are riparian habitats necessary to support those surface waters. Portions of the CRW upstream of the Landsburg Diversion Dam are specifically excluded from the listing. However, it does include portions of the Raging River Watershed situated downstream of the known anadromous fish passage barriers.

➲ For Your Information

Distinct population segment *— A population that is disjunct and geographically isolated from others with no genetic interchange between them due to natural and man-made barriers.*

The Puget Sound ***distinct population segment (DPS)*** bull trout was listed by the USFWS as threatened under the ESA on November 1, 1999 (64 FR 58910). The Columbia River DPS ***bull trout*** was listed by the USFWS as threatened under the ESA on June 10, 1998 (63 FR 31647). All naturally-spawning populations of bull trout in the continental United States are included in the listing. Critical habitat for this species has not yet been proposed or designated. Bull trout from at least one of these populations are potentially present in streams crossed by each of the alternatives.

The Middle Columbia ESU steelhead was listed by NMFS as threatened under the ESA on March 25, 1999 (64 FR 14517). The ESU includes all naturally spawned populations of steelhead in streams from above the Wind River, Washington, and the Hood River, Oregon, upstream to and including the Yakima River in Washington. Excluded are steelhead from the Snake River Basin. Steelhead are potentially present in one or more streams crossed by each of the alternatives.

3.7.1.2 Federal Candidate Species

All transmission alternatives could affect one species of fish that is a candidate for listing under the ESA, referred to as a candidate species. The Puget Sound/Strait of Georgia ESU coho salmon was proposed for listing by NMFS as threatened under the ESA on July 25, 1995 (60 FR 38011). This ESU includes coho salmon from drainages of Puget Sound and Hood Canal, the eastern Olympic Peninsula (east of Salt Creek), and the Strait of Georgia from the eastern side of Vancouver Island and the British Columbia mainland (excluding the upper Fraser River). Although NMFS, in its proposal, found listing to be "not warranted," the species has not been withdrawn from candidate status and may be listed in the future. Coho salmon are potentially present in streams crossed by each of the transmission alternatives.

3.7.1.3 Federal Species of Concern

The USFWS has identified the Pacific lamprey and river lamprey as species of concern potentially occurring in the project area (USFWS 2000).

The Pacific lamprey is widely distributed in coastal and Columbia River drainages, but the extent of its distribution and population trends are poorly understood. It is thought that destruction of spawning and rearing habitat, as well as reduced numbers of prey (salmonids), have contributed to a reduction in the population of Pacific lamprey. Spawning habitat is similar to salmonids including cool, flowing water and clean gravel. Rearing areas are slow-moving backwaters with fine sediment (ODFW 1995). Pacific lamprey are potentially present in streams crossed by each of the transmission alternatives.

The habitat, distribution, and status of the river lamprey are essentially the same as Pacific lamprey. The two species differ primarily in size; Pacific lampreys may grow considerably larger (to 30 inches) than river lampreys (to 12 inches) (Wydoski and Whitney, 1979). River lamprey are potentially present in streams crossed by each of the transmission alternatives.

3.7.1.4 Essential Fish Habitat

➲ For Your Information

Essential Fish Habitat (EFH) — *Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (Magnuson Fishery Conservation and Management act).*

All transmission alternatives could affect two fisheries protected by the ***Essential Fish Habitat*** (***EFH***) provisions of the Magnuson-Stevens Act (16 U.S.C. 1855(b)): the chinook salmon and coho salmon fisheries. All streams in the project area are included in designated EFH for these two fisheries. Some streams are included because they may support spawning, rearing and migratory use by chinook and coho salmon. Other streams are included because they are situated upstream of areas used by salmon, and the salmon are sensitive to water quality in these streams. Since chinook salmon is a federally-listed species and coho salmon is a federal candidate species, the analyses of current conditions and potential impacts to these species also serve to describe all potential impacts to EFH.

3.7.1.5 Washington State Special-Status Species

Chinook salmon, bull trout, and river lamprey are state candidates for listing by the Washington Department of Fish and Wildlife (WDFW) (2002). Pygmy whitefish and kokanee are both state species of concern found in Lake Keechelus within a quarter mile of the proposed alignments for Alternatives B and D (Options D1 and D2).

3.7.2 National Forest Plan Fish Protection Strategies

The U.S. Forest Service manages two National Forests in the project area, the Mt. Baker-Snoqualmie National Forest and the Okanogan-Wenatchee National Forest. USFS also manages lands on the fringes of these two National Forests within the project area. In 1993, USFS and the Bureau of Land Management (**BLM**) developed the Northwest Forest Plan to set guidelines for the

management of the natural environment in Pacific Region National Forests. The goals of the Northwest Forest Plan are designed to protect forest ecosystems and allow renewable use of forest material, but they also include protection for riparian areas and waters. As part of the plan, the Aquatic Conservation Strategy (**ACS**) was developed. This strategy protects salmon and steelhead habitat on federal lands managed by USFS and BLM. The Northwest Forest Plan Standards and Guidelines define the process by which proposed projects are determined to be in compliance with the ACS objectives (**ACSO**s). If either Alternative B or D (Options D1 or D2) is chosen as the preferred alternative, USFS-managed lands would be involved, and the appropriate level of analysis for ascertaining impacts to ACSOs would need to be completed.

3.7.3 Transmission Line Alternatives

The following sections discuss existing fisheries resources in drainages crossed by the transmission alternatives. Streams within the 750-foot study corridor (extending 300 feet on either side of the alternatives' 150-foot ROWs) are listed in detail with documented fish presence data in Appendices A and N. These streams occur within five watersheds — those of the Yakima, Snoqualmie, Raging, Cedar and Green Rivers.

In Washington, streams are commonly classified from Type 1 to 5, according to a system established by the DNR and summarized in Table 3-3. Kittitas County uses these same classifications for streams in its jurisdiction. King County and the cities of Kent and Covington share a slightly different classification system. In this document, the DNR classification system is used.

Table 3-3 — DNR Stream Classification System (WAC 22-16-030)

Stream Type	Definition
Type 1	Major streams: waters inventoried as "shorelines of the state" under RCW 90.58.
Type 2	Waters that are not Type 1 and are used for domestic water supplies, or that are used by fish hatcheries, or that have a bankfull width of more than 20 ft. and a gradient of less than 4%, or are lakes larger than 1 ac., or are used by salmonids for off-channel habitat.
Type 3	Waters that are not Type 1 or 2 and have major fish use. Streams with a bankfull width of 2 ft. or more and a gradient of less than 16% are assumed to have major fish use. If the basin is larger than 50 ac., major fish use is assumed for streams with a gradient less than 20%. Ponds smaller than 1 ac. are also Type 3 waters.
Type 4	Waters that are not Type 1, 2, or 3 and have perennial flow.
Type 5	Waters that are not Type 1, 2, 3, or 4 and have a defined channel.

3.7.3.1 Proposed Action

The Proposed Action would cross nine fish-bearing (Type 1, 2, or 3) streams and an unknown number of non-fish-bearing (Type 4 or 5) streams. See Appendix A for details of streams along this alternative.

Segment A — Segment A lies within the Green River and Cedar River watersheds. One fish-bearing stream has been identified within the short (1.2 mile) segment. It is possible that non-fish-bearing seasonal streams also occur.

The topography of Segment A is mostly flat, and most of the land has been developed for agricultural or rural residential purposes. Any surface waters in this segment have little shading by vegetation.

Segment B — Segment B is part of the Proposed Action and Alternative 4A. This short (0.5 mile) segment also is within the CRW. No streams have been identified within this segment, although it is possible that non-fish-bearing seasonal streams occur here.

The topography of Segment B is mostly flat. Most of the land is conifer forest within the ecological reserve of the CRW. Any surface waters in this segment are likely well shaded by vegetation.

Segment C — Segment C is part of the Proposed Action and Alternatives 4A and 4B. This segment crosses the Cedar River and its floodplain. No other fish-bearing streams have been identified within this short (1.3 mile) segment, although it is possible that non-fish-bearing seasonal streams occur.

The topography of Segment C includes a steep, north-facing slope above the south side of the Cedar River floodplain, the relatively flat floodplain, and a dissected area of former gravel mines near the north side of the floodplain. The entire area is largely forested by mixed hardwood and conifer stands. Trees are large enough to provide recruitment of functional ***large woody debris (LWD)*** to the river, with many trees larger than 20 inches ***diameter breast height (dbh).*** However, the river and its floodplain are wide enough that the existing forest can provide only about 10 percent riparian shade, so that riparian shade likely is not a primary control on stream temperature in this reach (see Appendix A for more detail). The river in this area has deep pools and a gravel bed very well suited for salmon spawning. The floodplain is not confined, contains a complex of gravel bars and back channels, and is well suited as anadromous fish-rearing habitat. Currently, this reach of the Cedar River supports rainbow trout and a small population of cutthroat trout. Once passage around the Landsburg Diversion Dam has been established (in August 2003), it is likely that this reach would support anadromous species now prevented from upstream migration by the Landsburg Diversion Dam: chinook and coho salmon, and steelhead. Under the terms of the CRW HCP, sockeye salmon would continue to

➲ For Your Information

Large woody debris (LWD) — *Any piece of downed wood larger than 4 inches in diameter and 6 feet long.*

be prevented from migrating upstream past Landsburg Diversion Dam.

Segment D — Segment D is part of the Proposed Action and Alternatives 2, 4A, and 4B. From south to north, this segment crosses Rock Creek in the Walsh Lake Subbasin of the CRW, and the Raging River and several of its tributaries in the Raging River Watershed. This segment is six miles long. An undetermined number of non-fish-bearing streams occur including tributaries to Rock Creek and Williams Creek in the CRW, and Deep Creek and Raging River in the Raging River Watershed.

The topography of Segment D consists primarily of a long rise on a slope of approximately 20 to 40 percent to the Cedar-Raging Watershed divide, and a long descent of comparable gradient to the Raging River. The Raging River runs in a canyon about 250 feet deep with slopes of 60 to 70 percent. North of the Raging River, the Proposed Action climbs over uneven moderate slopes to a terminus at Echo Lake Substation. Most of the segment is largely forested by mixed hardwood and conifer stands with closed canopies but varying ages ranging from very young (about 10 years) to old growth (about 200 years), although submature stands predominate. Trees adjoining fish-bearing streams are large enough to provide recruitment of functional LWD to the stream, with most stands dominated by trees larger than 12 inches dbh. Forest stands adjoining fish-bearing streams are capable of providing more than 80 percent shade to the stream, and in such settings, shade is likely a primary control on water temperature both directly, by preventing solar radiation from striking the stream, and indirectly, by providing relatively low air temperatures in the riparian area.

➲ For Your Information

Pool-riffle morphology *— The study of a fast moving stream, including its characteristics and composition of materials forming its substratum.*

The affected streams have a ***pool-riffle morphology*** with bed materials varying from gravel to small boulders; the Raging River additionally has a gravel floodplain about 165-feet wide. Thus, these streams likely provide suitable spawning and rearing habitat for anadromous and resident fish. Rock Creek, in this segment, is known to be a fish-bearing stream; once fish passage is established at the Landsburg Diversion Dam in August 2003, the creek is expected to be accessible to anadromous fish (Wells pers. comm.). Rock Creek downstream of this segment is used by cutthroat trout. The Raging River and its tributaries in this segment are used by rainbow trout, cutthroat trout and their hybrids ("cutbows"), as well as by coho salmon and steelhead (McHenry pers. comm., November 6, 2000).

3.7.3.2 Alternative 2

From south to north, Alternative 2 begins within the Green River Watershed, crosses the CRW, and ends in the Raging River Watershed. See Appendix A for more details about streams along this alternative.

Segments E and F — Segment E is part of Alternatives 2, 4A, and 4B. Segment F is part of Alternatives 2 and 4B. These short (1.0 and 0.4 mile) segments are within the Green River and Cedar River watersheds. No streams have been identified. It is possible that non-fish-bearing seasonal streams occur.

The topography of Segments E and F is mostly flat. Most of the land is conifer forest within the ecological reserve of the CRW. Any surface waters in this segment are likely well shaded by vegetation, and runoff from them would have a beneficial impact on downstream fish habitat.

Segment G — Segment G crosses the Cedar River and its floodplain. No other fish-bearing streams have been identified within this short (1.6 mile) segment. It is possible that non-fish-bearing seasonal streams occur.

The topography is generally flat, except for relatively steep slopes at the north and south margins of the Cedar River floodplain, which is about 400 feet wide in this location. The entire area is largely forested by mixed hardwood and conifer stands. Trees are large enough to provide recruitment of functional LWD to the river, with many trees being 16 to 24 inches dbh. However, the river and its floodplain are wide enough that the existing forest can provide only about 20 percent riparian shade, so that riparian shade likely is not a primary control on stream temperature in this reach. The river in this area has scattered pools associated with boulders and a gravel bed very well suited for salmon spawning. The floodplain is not confined, contains a complex of gravel bars and back channels, and is well suited as anadromous fish-rearing habitat. Currently, this reach of the Cedar River supports rainbow and cutthroat trout. Once passage around the Landsburg Diversion Dam has been established in August 2003, it is likely that this reach would support anadromous species now prevented from upstream migration by the dam, including chinook and coho salmon, and steelhead. Under the terms of the CRW HCP, sockeye salmon would continue to be prevented from migrating upstream past Landsburg Diversion Dam.

Segment D — See Section D discussion in Section 3.7.2.1, Proposed Action.

3.7.3.3 Alternative 3

From south to north, Alternative 3 begins within the Green River Watershed, crosses the CRW, and ends in the Raging River Watershed. See Appendix A for more details about streams along this alternative.

Segment J — Segment J first travels nearly due north from its southern terminus, crossing Taylor Creek in approximately 1.6 miles and then turning northeast to parallel the Cedar River for about 2.2 miles. Alternative 3 then turns north-northwest to cross the Cedar River and its floodplain, as well as a major tributary, Steele Creek (crossed twice), before crossing into the Raging River Watershed. In that watershed, Alternative 3 crosses Canyon Creek, and several unnamed creeks that are potentially fish-bearing. In addition, it is likely that non-fish-bearing seasonal streams occur and would be crossed by this segment.

Taylor Creek is known to contain small numbers of cutthroat trout and resident rainbow trout. A natural falls near its mouth renders the stream inaccessible to anadromous fish. Within the project area, the stream has a steep gradient and a highly confined channel, and thus provides poor fish habitat despite high riparian shade and abundant in-stream LWD.

➲ For Your Information

Riffle-glide morphology *— Characteristic of a calm stretch of shallow, smoothly flowing water.*

The Cedar River, in the project area, has a ***riffle-glide morphology*** with few pools. The bed is predominantly gravel and large cobble, and the stream may provide good anadromous spawning once passage is established at the Landsburg Diversion Dam. The river in this area has about 35 percent shade and water temperature is not likely to be affected much by changes in riparian shading. The riparian forest has many large conifers, mostly more than 20 inches dbh, which are capable of providing functional LWD to the river. Currently, this reach of the Cedar River supports rainbow and cutthroat trout.

3.7.3.4 Alternative 4A

From south to north, the Alternative 4A ROW begins within the Green River Watershed, traverses the CRW, where it joins with the Proposed Action, and ends in the Raging River Watershed. See Appendix A for more details about streams along this alternative.

Segment E — See Section 3.7.2.2**, Alternative 2**.

Segment H — Segment H is within the CRW. No streams have been identified within this short (1.2 mile) segment. It is possible that non-fish-bearing seasonal streams occur within the project area.

Segments C and D — See Section 3.7.2.1**, Proposed Action**.

3.7.3.5 Alternative 4B

From south to north, Alternative 4B begins within the Green River Watershed, traverses a portion of the CRW, where it joins with the Proposed Action, and ends in the watershed of the Raging River (a tributary to the Snoqualmie River). It follows the route of an existing Seattle City Light 115-kV transmission line between the Proposed Action and Alternative 2. See Appendix A for more details about streams along this alternative.

Segments E and F — See Section 3.7.2.2, **Alternative 2**.

Segment I — is within the CRW. No streams have been identified within this short (one mile) segment. It is possible that non-fish-bearing seasonal streams occur within the project area.

Segments B, C and D — See Section 3.7.2.1**, Proposed Action.**

3.7.3.6 Alternative A

From east to west, the alignment for Alternative A begins in the Lower Cedar River Basin, crosses the Rock Creek Basin, and ends in the Soos Creek Basin in the Green River Watershed. The south-to-north segment of the alignment crosses Jenkins Creek at Covington Substation and the Soos Creek Basin, terminating in the Lower Cedar River Basin. The following sections summarize fisheries in the basins crossed by the Alternative A ROW. See Appendix N for details of streams along this alternative.

The topography of Alternative A is relatively flat, with one major ridge at the Soos Creek-Lower Cedar River Basin boundary. Forested areas of the alignment are dominated by mixed hardwood and conifer stands with closed canopies ranging in age from early growth (less than 20 years old) to mature growth (greater than 75 years old), providing shade and temperature control for adjoining fish-bearing streams. Riparian conditions on the Lower Cedar River are primarily forested with generally increased riparian buffer upstream towards the Landsburg Diversion Dam. The majority of large pools in the Cedar River mainstem occur in the immediate vicinity of the proposed alignment, generally along the base of high bluffs. Several of these bluffs, especially in the vicinity of the mouth of the artificially created Walsh Lake Diversion Channel immediately downstream of the proposed ROW, are important sources of spawning gravel (Kerwin 2001). Streambank erosion is common throughout the Soos Creek Basin and spawning gravels occur as patches rather than extensive beds in most of the basin tributaries (King County 1990).

The Lower Cedar River Basin, including Peterson Creek, provides the majority of the current spawning habitat for chinook in the Cedar-Sammamish Watershed. The proposed ROW crosses Peterson Creek at Peterson Lake and the lake's associated wetland complex. The lake and associated wetlands have LWD that provides habitat complexity (Kerwin 2001). The accumulation of fine sediments near the lake and wetlands likely precludes spawning in the immediate vicinity of the proposed ROW.

The mainstem Cedar River environments below Landsburg Dam are used by chinook salmon and bull trout. In the Soos Creek Basin, chinook are known to be present in Jenkins and Little Soos Creek.

Resident cutthroat trout and rainbow trout are known to be present or likely to be present in all fish-bearing streams in the study area (Kerwin and Nelson 2000). Rock Creek is also known to be an anadromous fish-bearing stream and will be crossed just outside the City of Kent Watershed.

3.7.3.7 Alternative B

From east to west, the Alternative B ROW begins within the Upper Yakima River Watershed, crosses the crest of the Cascade Range into the South Fork Snoqualmie River Watershed, and ends in the drainage of the Raging River (a tributary to the Snoqualmie River). The proposed alternative is a rebuild of an existing 350-kV BPA transmission line within a maintained ROW. See Appendix N for details of streams along this alternative.

Yakima River Watershed — Within the Yakima River Watershed, the topography of the Alternative B ROW is highly varied, but is characterized by the westward ascent to Stampede Pass (elevation 4,000 ft.). The watershed is currently dominated by mature (older than 75 years) second-growth forest, although considerable variation in vegetation cover has resulted from past land use practices. Streams in the Keechelus Lake area within the proposed ROW are typically high gradient, intermittent streams. Below Keechelus Dam, the mainstem of the Yakima River is characterized by numerous side channels, logjams, and braided channels, and is generally considered to be high quality spawning and rearing habitat with little influence from development (Haring 2001). Most potential spawning habitats are in the lower reaches of tributaries and within the floodplain of the mainstem Yakima River within the proposed alignment.

The Bureau of Reclamation operates three storage dams in the upper portion of the Yakima River Watershed including the Keechelus Lake Dam. The storage function causes flooding of mainstem and tributary habitat upstream of the dam and contributes to reduced habitat complexity. The Keechelus Reservoir seasonally floods most of historic anadromous habitat on the west side of the lake.

South Fork Snoqualmie River Watershed — The South Fork Snoqualmie River Watershed topography within the existing BPA ROW is characterized by the westward descent from the Pacific Crest. Snoqualmie Falls is an impassable barrier to anadromous fish. Consequently, the entire 31 miles of the South Fork Snoqualmie River and all of its tributaries currently support only resident cutthroat and rainbow trout. Eastern brook trout are stocked in several lakes in the basin. However, more than 75 percent of the streams in the watershed are classified as seasonal non-fish-bearing streams (USFS 1995).

Most of the segment is vegetated by mixed hardwood and conifer stands with closed canopies. Stand ages are variable, ranging from very young (approximately 10 years) to old-growth forest (greater than 250 years old). Submature (less than 75 years) stands predominate. Most of affected fish-bearing streams in the basin have 25 percent or less mature or old-growth vegetation available for LWD recruitment in the riparian corridor.

The Alternative B ROW climbs over Rattlesnake Mountain (elevation 1,800 feet) to its end point at Echo Lake Substation in the Raging River Basin. The streams associated with Rattlesnake Mountain have a pool-riffle morphology with bed materials varying from gravel to small boulders and a gradient averaging more than 10 percent. The Raging River additionally has a gravel floodplain approximately 165 feet wide. Thus, low gradient streams in the lower reaches of the basin likely provide suitable spawning and rearing habitat for anadromous and resident fish. The Raging River and its tributaries in this segment are used by rainbow trout, cutthroat trout, and their hybrids ("cutbows"), as well as by coho salmon and steelhead (McHenry pers. comm.).

3.7.3.8 Alternative C

Option C1 — Option C1 would run south to north, originating in the Green River Watershed, but not crossing any perennial water bodies before entering the Lower Cedar River Basin. The alternative ends in the upper portion of the Issaquah Creek Basin. See Appendix N for details of streams along this alternative.

The topography of Option C1 consists of two ascents in the first east-to-west segment of the alignment before turning north and descending into the rural community of Ravensdale in the Rock Creek Basin. The topography of the south-to-north segment is relatively flat with one major ridge at the Rock Creek-Lower Cedar basin boundary. The Rock Creek drainage has been sparsely developed. Much of the riparian vegetation has a high proportion of large second growth conifers in the vicinity of the cleared (east-west) ROW. In many reaches the habitat can best be typified as continuous debris complexes, within which complex pool and riffle habitats have developed (King County 1993). Riparian conditions on the Lower Cedar River are also primarily forested. Riparian buffer generally increases closer to the Landsburg Diversion Dam. The majority of large pools in the Cedar River mainstem occur in the immediate vicinity of the proposed alignment, generally along the base of high bluffs. Several of these bluffs, especially near the mouth of the artificially created Walsh Lake Diversion Channel immediately downstream of the proposed ROW, are important sources of spawning gravel (Kerwin 2001). Vegetation clearing in forested areas would be necessary in the construction of the south-north alignment.

The upper sections of the Issaquah Creek Basin, including Carey and Holder creeks, are in variable condition with good spawning habitat (Kerwin 2001). The lower sections of the basin are highly degraded with as many as eight culverts and the Issaquah State Fish hatchery presenting barriers for resident and anadromous fish migration into the upper basin reaches (Kerwin 2001).

The Lower Cedar River Basin near the proposed ROW, including the Walsh Lake Diversion Channel, provides the majority of the current spawning habitat for chinook in the Cedar-Sammamish Watershed. The mainstem Cedar River environments, below Landsburg Dam, are used by chinook salmon and bull trout. In the Issaquah Creek Basin, the presence of chinook is documented in Carey Creek and as far as 11 miles upstream in Holder Creek. Resident cutthroat and rainbow trout are present or likely to be present in all fish-bearing streams in the study area.

Option C2 — Option C2 would run south to north with an east-west segment originating from the Shultz-Raver No. 2 line. The proposed alignment originates in the Lower Cedar River Basin and terminates in the upper reaches of the Issaquah Creek Basin. See Appendix N for details of streams along this alternative.

The topography of Option C2 consists of two ascents in the first east-to-west segment of the alignment before turning north and descending into the rural community of Ravensdale in the Rock Creek Basin to follow the south-to-north alignment of Alternative C. The aquatic resources found in the Option C2 ROW are discussed in the description of Option C1, above, with the exception of the Green River Watershed, which is crossed only by Option C2. No fish-bearing streams would be crossed in this east-west portion of the Option C2 ROW. Vegetation clearing would be necessary in the construction of the alignment except in the Hobart and Georgetown communities where clearing for agriculture and residential development has already occurred.

3.7.3.9 Alternative D

From east to west, Alternative D (both Options D1 and D2) begins within the Upper Yakima River Watershed, crosses the crest of the Cascade Range into the South Fork Snoqualmie River Basin, and ends in the basin of the Raging River (a tributary to the Snoqualmie River). The routes would parallel the south side (D1) or north side (D2) of an existing 500-kV BPA transmission line. Almost all of the eastern 23 miles of the proposed alignment is within USFS-managed lands that are largely forested. The western 15 miles of the alignment lies within rural developed areas in unincorporated King County and clearing would also be required for most of this segment. Cleared areas do exist along the proposed alignment in the vicinity of

Snoqualmie Summit and in checkerboard private holdings within Kittitas County. No riparian zones of fish-bearing streams are crossed within private property in Kittitas County.

The aquatic resources found in Option D1 and D2 are discussed in the description of Alternative B. However, riparian conditions in Options D1 and D2 are more forested than in Alternative B because there is no existing transmission line within Options D1 or D2. These alternatives would also vary in relative position to the mainstem of both the Yakima and Snoqualmie rivers as compared with Alternative B. The proposed lines cross the Yakima River at about the halfway point between the start of their alignment and the Keechelus Reservoir. This alignment brings Options D1 and D2 closer to the Yakima River between the crossing of I-90 and Keechelus Lake. Both Alternative D options cross the South Fork Snoqualmie River twice as they parallel the river valley. Thus Options D1 and D2 more closely approach the South Fork Snoqualmie River for one-third of the distance the alignment parallels the South Fork Snoqualmie River valley. See Appendix N for details of streams along this alternative.

3.7.4 Echo Lake Substation Expansion

One fish-bearing stream crosses Echo Lake Substation property. This tributary to Lake Creek has no documented anadromous fish presence, but is used by resident salmonids. The stream channel has been historically modified and now runs through a detention pond facility on the site.

3.8 Wildlife

Wildlife species and their habitats occurring or potentially occurring within the affected environment are discussed at two levels. The first is the broad project vicinity, encompassed by Kent-Kangley Road to the south; SR 18, I-90, and Rattlesnake Ridge to the north; the unincorporated Puget Lowlands and cities of Covington and Maple Valley on the west; Stampede Pass on the east, and the Cedar River Watershed in the center. Discussion of this area is general and is intended to address issues related to wide-ranging species, migratory species, and species with large home ranges. A more detailed regional overview can be found in Appendix O. The project area addressed in more detail includes only the area within 0.25 mile of the proposed transmission line ROWs. This distance was chosen because data were readily available, and the majority of direct and indirect impacts from the proposed project would occur within this area. Where impacts are expected outside of this focused project area, they are discussed at the project vicinity level.

3.8.1 Wildlife Habitats Within the Project Area

➲ For Your Information

Habitat types *— Lands capable of producing similar plant communities at climax.*

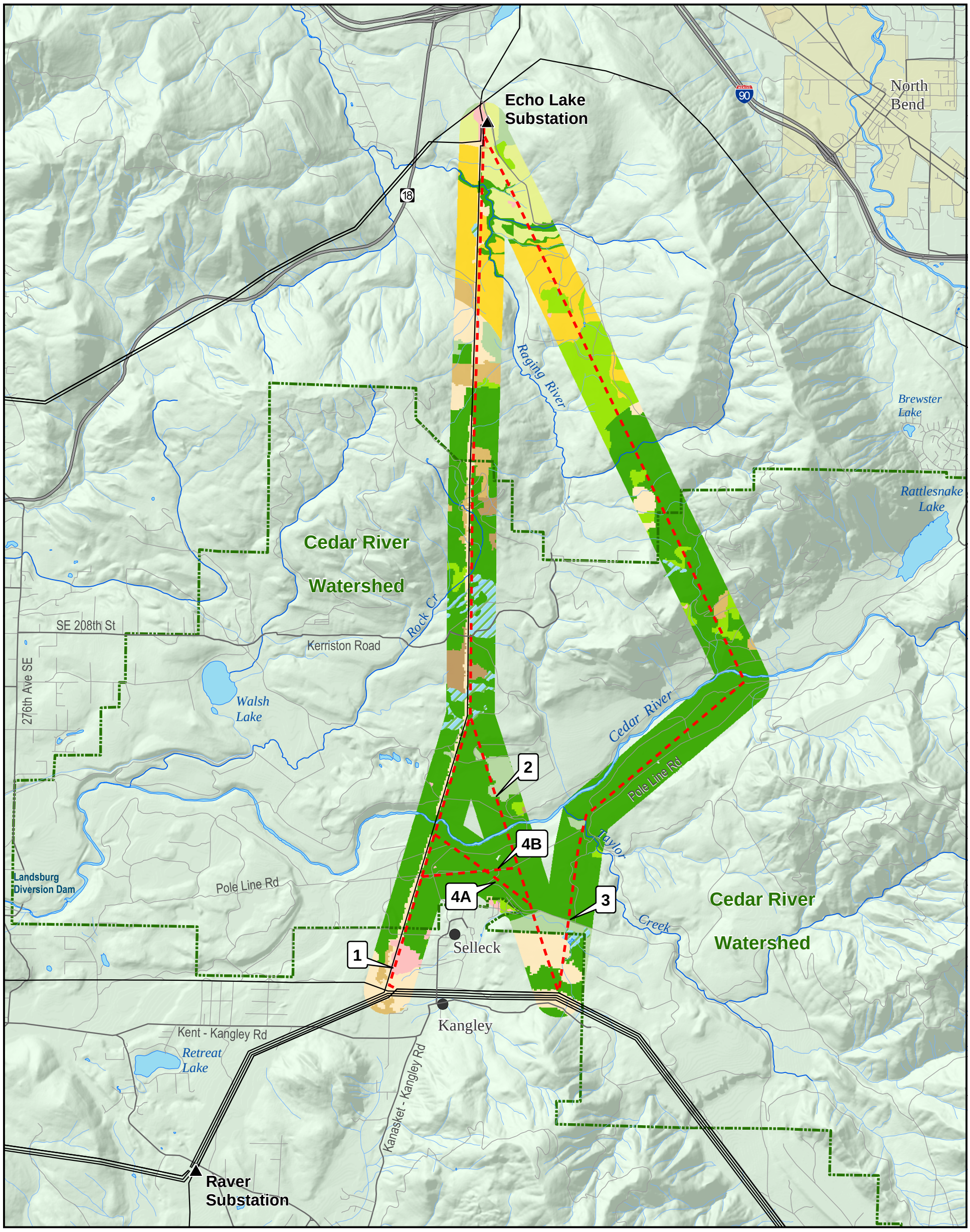
Vegetation type maps were developed for the project area (see Map 12 and maps in Appendix P). ***Habitat types*** within the proposed ROWs are presented in Table 3-4. For a more complete description of these vegetation types, refer to Section 3.9, **Vegetation**.

The ESA requires that NMFS and USFWS designate critical habitat for federally-listed species at the time of their listing. The proposed routes of some alternatives contain designated critical habitat for some species, including the northern spotted owl and the marbled murrelet. Additionally, the King County Comprehensive Plan (King County 2000) identifies wildlife network corridors as important habitat components to be protected within the comprehensive planning area. These corridors have been mapped within King County, and several occur within the proposed project area. One corridor follows the Cedar River and would be crossed by Alternatives 1 through 4. Another corridor in the area splits from the corridor along the Cedar River downstream of the point where Alternative 3 crosses the river, and runs west and north. This corridor would be crossed by Segment D, which is common to the Proposed Action, Alternatives 2, 4A, and 4B. Alternative C (both Options C1 and C2) would cross three designated wildlife corridors, while Alternatives B and D (both Options D1 and D2) would cross two.

3.8.2 Species Analyzed

Species that are federally-listed as threatened or endangered; federal species of concern; USFS "***Survey and Manage" species***, sensitive and proposed sensitive species, ***Management Indicator Species (MIS)***, and species of interest; and Washington State-listed threatened, endangered, sensitive or ***monitor species*** with the potential to occur on the west side of the Cascade Mountains were selected for analysis. This resulted in a list of 56 species. Based on the habitat requirements of these species and the availability of habitat within the project area, 15 of these species are not expected to occur within the project area, reducing the list to 41 species. In addition, six species identified in the King County Comprehensive Plan (King County 2000) as being of local concern, and which may occur in the project vicinity, were included. Black-tailed deer were also included in response to local concern in comments received during public scoping for the proposed project, bringing the final number of species analyzed to 48.

All of these species have been sorted by their primary habitat associations, defined as forest communities, aquatic communities, riparian communities, early regeneration communities, and special or



VEGETATION: ALTERNATIVES 1 - 4

Map 12

Existing BPA Transmission Lines

Proposed BPA Transmission Line Alternatives

Existing BPA Substations

Vegetation cover classification

- Early Regeneration, Open Coniferous Canopy
- Mid-Regeneration, Closed Coniferous Canopy
- Mature Coniferous Regeneration
- Mid-Regeneration, Closed Deciduous Canopy
- Mature Deciduous Regeneration
- Early Regeneration, Open Mixed Canopy
- Mid-Regeneration, Closed Mixed Canopy
- Managed Grass/Forb/Shrub
- Forested Wetland
- Developed

BONNEVILLE POWER ADMINISTRATION GIS GEOGRAPHIC INFORMATION SYSTEM

November, 2002

N

0 0.5 1 2 3 4 Miles

Vegetation data shown within 1/4 mile of the project alternatives.
Sources: Seattle Public Utilities, 1998 and the Weyerhauser Company.

Table 3-4 — Wildlife Habitat Types within the Project Area

Habitat Type	Description
Mid-regeneration deciduous	Mid- regeneration second- or third-growth deciduous forest. Deciduous coverage is over 70%. Sapling to pole-size between 10 and 30 years old. Tree height is between 25 and 40 ft.
Mature deciduous	Mature second- or third-growth deciduous forest. Reaching mature stage but not late-successional habitat. Deciduous coverage is over 70%. Stands dominated by mature trees over 30 years old. Tree height is between 40 and 80 ft.
Early regeneration coniferous	Early regeneration second- or third-growth coniferous forest. Conifer coverage is over 30%. Young plantation less than 20 years old. Tree height is between 15 and 30 ft. Understory herb and shrub coverage is generally low, due to the stand density.
Mid-regeneration coniferous	Mid-regeneration second- or third-growth coniferous forest. Medium-age between 15 and 35 years old. On National Forest lands, some of these forests are unmanaged stands of natural origin. Tree height is between 40 and 80 ft.
Mature coniferous regeneration	Mature regeneration of a managed second- or third-growth coniferous forest. On National Forest lands, these forests are predominantly unmanaged stands of natural origin. Reaching a mature stage but not late-successional habitat. Between 36 and 75 years old. Tree height is between 100 and 130 ft.
Mature coniferous	Natural forested areas dominated by older conifers between 80 and 250 years old. Two-storied to multi-storied stands. Medium to high density of snags and down woody material.
Old forest	Stands dominated by mature trees, greater than 250 years old. Canopy closure exceeding 60%, multi-storied stands, abundant snag and down woody material, and at least two tree species.
Managed early regeneration coniferous	Volunteer growth of young conifers within managed areas that are kept clear of trees. These trees will be removed before maturity and are less than 20 years old and under 15 ft. tall.
Early regeneration mixed	Early regeneration second- or third-growth mixed deciduous and coniferous forest in areas that have been harvested within the last 10 years—typically clearcuts. More than 30% cover of deciduous trees present. Tree height is between 8 and 15 ft.
Mid-regeneration mixed	Mid-regeneration second- or third-growth stands comprised of roughly even coverage of conifers and hardwoods. Conifers are between 10 and 30 years old. Hardwoods are under 30 years old. Tree height is between 35 and 45 ft.
Mature mixed regeneration	Mature regeneration second- or third-growth stands with mixed deciduous and coniferous coverage each exceeding 30%. Reaching a mature stage but not considered late-successional habitat. Average age of trees is over 30 years old. Tree height exceeds 45 ft.
Lake/river/stream	Lakes, ponds or other natural impoundments of water, and drainages with perennial flows.
Wetlands	Wetlands.
Rural residential/ managed landscape	Areas with scattered, low-density single-family housing on larger lots, including small-scale farms and horse pastures. High percentage of the pre-construction landscape is relatively intact and highly managed. Tree coverage is under 30%.
Developed	Developed areas for commercial, industrial, and residential purposes including large residential developments and associated lawns, roads, and parking lots.
Natural non-vegetated	Naturally non-vegetated areas such as rock outcrops or natural slides. Less than 10% vegetative cover.
Managed grass/ forb/shrub	Habitat types that are maintained in an early regeneration condition.
Natural non-forest shrubland	Naturally non-forested habitat with a significant shrub layer. Forested cover is less than 10%; shrub cover is over 40%.
Natural non-forest grassland	Naturally non-forested habitat with significant grass/forb cover such as prairies and alpine meadows. Forested cover is less than 10%; grass and forb cover is over 60%.
Cliff/talus	Either cliff habitat or talus.

unique habitats and are shown in Appendix O, Table 2. Species are addressed in these groups throughout this document. Table 3 in Appendix O describes the species excluded from analysis, their primary habitat associations, and the rationale for not including them.

3.8.2.1 Forest Community Dependent Species

A number of wildlife species, including ***invertebrates***, were identified as potentially occurring within the project area and as having a primary association with forested community habitat, as discussed below.

Northern spotted owls — Surveys were conducted during the nesting period along Alternative 1 in the Cedar River Watershed in the spring of 2002 (March 15th through June 15th) and no owls were found. These surveys were conducted at 26 stations following the current protocol established by the USFWS. Additional surveys are planned for the spring 2003 nesting period.

There is one known spotted owl nest near Twin Lakes that is close to Alternatives B and D. Thorough surveys have not been conducted in much of the study area (WDFW 2000), including the CRW (Paige pers. comm., 2000). Mature coniferous forest is potential nesting habitat for northern spotted owls and occurs in limited amounts in the project area. Mature coniferous regeneration and mature coniferous forest may provide foraging habitat for spotted owls. In addition, areas of mid- to mature coniferous regeneration and mature coniferous forest in this area could be important for dispersal between suitable nesting habitat adjacent to the study area and future potential nesting habitat within the study area.

An historic spotted owl sighting occurred on lands owned by the Weyerhaeuser Company. This single owl reported in 1993 was over a half mile from proposed Alternative 3 and was not within the project area. Suitable nesting habitat is lacking in the vicinity of the historic sighting although, as noted above, the riparian buffers remaining on the industrial forestlands may provide a dispersal corridor for spotted owls.

Great gray owls — may occur in the vicinity of the proposed project, particularly in the higher elevation areas; however the probability of occurrence is low. Great gray owls inhabit a range of high elevation, forested habitats including coniferous and deciduous forests and are suspected to occur in the Cascade Range (The Owl Pages 2002). They generally nest in islands of deciduous trees within conifer stands and forage in forest clearings, bogs and swamps with scattered trees or other perches. During migration they may be found along farm fields, in mountain meadows, and in estuaries and wetlands. Currently, the only confirmed and probable locations of breeding

evidence recorded in Washington are along the U.S./Canadian border between Okanogan and Ferry Counties in the northeast portion of the state (WDFW 2002). An unconfirmed nest site has been identified near Elk Heights (Garvey-Darda 2002).

Marbled murrelet — may occur within the project area because it includes stands of mature coniferous and mature regeneration coniferous forest that may contain structures large enough to support nesting habitat. There has been a sighting at Gold Creek and other locations along the South Fork Snoqualmie River (Garvey-Darda 2002).

Northern goshawks and **pileated woodpeckers** — may nest in portions of the project area. There are documented nests on the Cle Elum Ranger District near the location of Alternatives B and D (USFS 2002), but no evidence of nesting was observed during field surveys for this project. Late second growth stands in the project area are approaching conditions that would make them suitable nesting habitat for goshawks and pileated woodpeckers. Mid-regeneration and mature regeneration forest types present in the project area are potential dispersal habitat for both pileated woodpeckers and northern goshawks, and potential foraging habitat for northern goshawks.

Vaux's swifts — are generally lacking but may nest within the study area because their favored nesting sites — large hollow trees — may be found in the limited amount of mature coniferous forest present. Abandoned chimneys in the residential areas could potentially provide nesting habitat (Smith et al. 1997). All forest types within the study area are suitable as foraging habitat for Vaux's swifts because they are known to feed on flying insects in all forest regeneration stages (Rodrick and Milner 1991). In addition, late regeneration and mature forests within the project area are potential nesting and foraging habitat for **black swifts**.

Merlins — are rare in Washington. Nesting in the Cascades occurs in high-elevation forests (Smith et al. 1997). Merlins could potentially nest in the higher elevations near Stampede Pass, although their presence there is unlikely. Forest within the project area may contain potential dispersal or migratory habitat for merlins.

Olive-sided flycatchers and **red-tailed hawks** — nest in forested habitat and use edges and openings for foraging. All forested stands within the project area are potential nesting habitat for these species, and vegetated open areas are potential foraging habitat. Rural residential/managed landscape areas are not included for olive-sided flycatchers because they are not areas of primary use; however, such areas are included for the red-tailed hawk, which often occurs near areas of human activity (Smith et al. 1997).

Black-backed woodpecker — occurs in the general vicinity of the proposed project (WDFW 2002). It inhabits high elevation (above 3,000 feet) coniferous and coniferous-deciduous mixed forests, especially those with burned areas, windfalls, and many standing dead trees. The species can also be found in swamps at a high elevation. During the winter the species travels into lower elevation forests (below 3,000 feet) (Pacific Biodiversity Institute 2002).

Band-tailed pigeons and **blue grouse** — occur in forest habitats ranging from early regeneration to mature (Smith et al. 1997); all forested types in the project area may be habitat for them. Band-tailed pigeons are migratory and nest at lower elevations, moving upslope with the fruit and berry crops in late summer and then migrating south for the winter (Rodrick and Milner 1991). In the project area, then, band-tailed pigeon habitat would likely be used for nesting. Blue grouse, however, would occur in the project area year-round because they are not migratory (Rodrick and Milner 1991).

Fisher — are most commonly associated with late-successional forest with an abundant supply of large downed wood and snags available for breeding and resting, but they will travel through any type of forested habitat and avoid openings (Maser 1998, Johnson and Cassidy 1997). For this reason, all forest types in the project area were included as potential travel habitat for fisher. These types are also considered potential foraging habitat because the foraging behavior of fisher appears to be largely opportunistic (Maser 1998).

Six species of bats — have been identified as potentially occurring in the project area. Four of these are species within the genus myotis and are associated with forested habitat. Three of these species (**Keen's myotis, long-eared myotis, and long-legged myotis**) are also known to use structures such as buildings and bridges for roosting (Johnson and Cassidy 1997, Barbour and Davis 1969). For these reasons, all forest types and developed areas were included as potential habitat. Rural residential/managed landscape and developed areas were not included for **fringed myotis** because they are less likely to use human structures (Johnson and Cassidy 1997). Within forested areas, these bats are most likely to use older forest containing snags that are either hollow or have loose bark for roosting or for maternity colonies. The forest types occurring within the project area are potential foraging habitat for these species (Maser 1998).

In addition to the myotis species, the **Townsend's big-eared bat** occurs in forested habitats but is strongly associated with caves, mines, and buildings for roosting, maternity colonies, and hibernation (Christy and West 1993, Johnson and Cassidy 1997, Rodrick and Milner 1991). This species forages in forest habitats, often along edges (Christy and West 1993), and so all forested types were included as potential habitat. Rural residential/managed landscape

and developed areas were also included due to the association of this species with human structures.

The **silver-haired bat** has not been recorded in the vicinity of the proposed project, although they have been found in locations in northwestern King County (WDFW 2002). This species probably lives, breeds and hibernates in the vicinity of the proposed project, especially in older coniferous or mixed coniferous and deciduous forest habitat and around rocky cliffs and caves. The animals feed predominantly in disturbed areas, sometimes at treetop level, but often in small clearings and along roadways or watercourses (Bat Conservation International 2002).

Seven species of terrestrial mollusks — may occur within the study area: two snails (**Puget Oregonian** and **Oregon megomphix**) and five slugs (**Panther jumping slug**, **blue-gray tail-dropper, keeled jumping slug, warty jumping slug, and evening field slug**). These mollusks are all associated with forested communities, particularly conifer and mixed conifer/deciduous forest, and are often found associated either with leaf litter or with woody debris (Frest and Johannes unpub., Frest and Johannes 1993). The Puget Oregonian and blue-gray tail-dropper are found in a wider variety of forest types. They prefer moist low- to mid-elevation forests, preferably undisturbed or late-successional forest in riparian areas.

The keeled jumping slug, warty jumping slug, and Oregon megomphix occur in the Western Cascade Range of Washington, including the Mt. Baker-Snoqualmie National Forest (Burke et al. 1999). They are known to inhabit mesic to moist conifer forests, typically with a moderate hardwood component, and can also be found in riparian zones. Key habitat features include litter and debris, heavy ground cover of low vegetation and conifer logs. These species are found at low to mid-elevations (sea level to 3,000 feet). To date, there has been only one panther jumping slug identified. It was found in deep forest floor litter near a stream. It is assumed to use similar habitat as other jumping slugs (Furnish et al. 1997).

The evening field slug also occurs in the western Cascade Range of Washington, and is suspected to inhabit areas of the Mt. Baker-Snoqualmie National Forest (Burke et al. 1999). This species has been found in forest and riparian habitat including coniferous and mixed coniferous and deciduous forest types in areas below 2,000 feet. Key habitat features include a variety of low shrubs, litter, debris, and rocks.

One species of butterfly, **Johnson's (mistletoe) hairstreak**, may occur in the project area. This butterfly is associated with mistletoe in the genus *Arceuthobium*, which occurs primarily in low elevation old-growth and late-successional second growth stands containing western hemlock (Larsen et al, 1995).

3.8.2.2 Riparian Community Dependent Species

Nine wildlife species were identified as potentially occurring within the project vicinity and having a primary association with riparian community habitat. A riparian buffer of 100 feet was established along each side of streams identified within the study area by the Stream Net Database.

Bald eagles — are known to occur within the project area, but only as migratory visitors (City of Seattle 2000). This species was proposed for delisting in 1999 (64 FR 36453) and was tentatively scheduled to be delisted in July 2000. To date, the bald eagle has not been delisted and remains a federally-listed threatened species. However, delisting may occur during the lifetime of the proposed project. No bald eagle nests are known to occur within the project area (City of Seattle 2000, WDFW 2000). Nest trees, usually in uneven-aged stands containing old-growth components, often have broken or forked tops to support the nest. An uneven canopy is important for allowing flight into and out of both the nest and perch trees within the nest stand (Rodrick and Milner 1991). The mature coniferous forest habitat located within the project area may contain nesting habitat.

Mid-regeneration through mature forest stands may provide perch sites for bald eagles foraging along rivers within the project area. Migratory or dispersing bald eagles are more likely to occur in the forested riparian areas within the project area.

Great blue herons — are not known to nest within the project area (City of Seattle 2000, WDFW 2000). However, potential nesting and foraging habitat occurs in forested riparian areas next to wetlands, lakes, rivers and streams.

Osprey — Osprey nesting habitat is similar to that of the bald eagle, usually occurring near a large body of water in snag or a tree with a broken top (Smith et al. 1997). Potential nesting habitat within the project area occurs in mid-regeneration to mature forest types within riparian areas. Mid-regeneration forest stands may also be used for perching during foraging activity or dispersal and migration.

Willow flycatchers — may occur in the project area and are known to nest in wetlands containing shrubs or young trees, in shrub or forested areas containing appropriate wetland microhabitats, and in rural residential/managed landscape and developed areas (Smith et al. 1997). Potential nesting and dispersal habitat may occur in wetlands in and surrounding shrub or early regeneration habitat in the project area.

Harlequin ducks — these ducks nest in forested habitats along fast-moving streams and rivers; all forested riparian habitat in the project area may be suitable nesting habitat for this species.

Aleutian Canada goose — is found throughout King County (WDFW 2002). This species may occur in the area of the proposed project in and around bodies of water, grassland, and agricultural fields. They nest and feed in various habitats that are in and around the shoreline of streams, rivers, ponds, lakes, and reservoirs. However, they can also be found feeding in upland habitats including agricultural land, pastures, and meadows (Csuti et. al. 1997).

Mink — occur in all vegetation types within the riparian areas of streams, lakes, rivers, ditches and wetlands (Johnson and Cassidy 1997); all riparian habitats in the project area may be year-round habitat for this species.

Hoary bat — is found in northern King County, although there are no recorded locations of the species in the vicinity of the project area (WDFW 2002). The hoary bat inhabits coniferous and deciduous forests and roosts in the open during the day by hanging from a branch or twig (Csuti et al. 1997); it is rarely found roosting in urban areas (Tuttle 1995). The species feeds over riparian areas and bodies of water (Csuti et. al. 1997). It may occur in the in coniferous or mixed coniferous and deciduous forest habitat within the project area.

Van Dyke's salamanders — are terrestrial salamanders usually found near the edges of streams in association with large woody debris (Corkran and Thoms 1996). Potential habitat for this species occurs in the project area where mature forest types occur in riparian areas.

3.8.2.3 Aquatic Community Dependent Species

Nine wildlife species were identified as potentially occurring within the project vicinity and having a primary association with aquatic community habitat.

Common Loon — occurs within the project area. This species requires large lakes, with minimal human disturbance (Rodrick and Milner 1991). Potential habitat may occur within lakes near the project area.

Bat species yuma myotis — is found in King County and more specifically in the general vicinity of the proposed project (WDFW 2002). This species may occur in the area of the proposed project around rocky cliffs, walls, caves, and urban/residential areas that are adjacent to bodies of water. They feed at night in the vicinity of ponds, streams, or lakes. Night roosts include buildings, caves, and mineshafts. Daytime roosts include rock or tree crevices and under siding and shingles in urban environments (Whitaker 1980).

Cascades frog — is found in the Olympic and Cascade Mountains of Washington and Oregon; above 2,600 feet in elevation,

and in mountain meadows, slow-moving streams, lakes, and ponds. It has also been recorded at elevations as low as 1,600 feet in the CRW. The **northern red-legged frog** is found in wetlands and forests at lower elevations west of the Cascade Mountains. Both frog species require ponds or wetlands for egg laying and development of tadpoles (Leonard et al. 1993). These species are common and would be expected to occur in the project area in higher elevation wetlands near lakes, rivers and streams.

Cascade torrent salamander — lives in small streams and seeps in moist conifer forests or in nearby splash zones. They require cold, moving water but may move short distances into forests in wet weather. Stream habitat for torrent salamanders exists in the project area and they may occur there, although the northern limit of their range is reported to be south of Mount Rainier (Larsen 1997, Leonard et al. 1993).

➲ For Your Information

Emergent *— Plants that have their bases submerged in water.*

Oregon spotted frog — is highly aquatic, breeding in shallow ***emergent*** wetlands and remaining in wetland and riparian areas as adults. The Oregon spotted frog was once common in the lowlands of western Washington but is found only at three sites in southwest Washington (Nordstrom and Milner 1997). Wetlands within the project area may be potential habitat for the spotted frog.

Tailed frog — is endemic to the Pacific Northwest, occurring in Washington in fast-flowing mountain streams on the west side of the Cascades. The adults generally stay in or near streams but may use nearby forests in wet weather (Leonard et al. 1993). The species appears to be associated with mature forest habitats that can produce cold streams free of fine sediment, and so is considered susceptible to loss of old-growth forests (Blaustein et al. 1995). Watershed alterations such as road building and timber harvest are suspected to have caused declines in some areas (Leonard et al. 1993). Tailed frogs are known to occur in the project area because of the presence of stream and forest habitat.

Western toad — is widely distributed over all but the most arid regions of the western United States, and it can use a wide variety of habitats from sea level to over 7,000 feet (Blaustein et al. 1995, Leonard et al. 1993). The adults can disperse through forest, grass, and shrub habitats but are most common near lakes, ponds, and wetlands. They require open water ponds or wetlands for breeding. Toads can be very abundant locally but have appeared to decline in overall population, especially in the lowlands of western Washington and some high-elevation habitats (Leonard et al. 1993). They are known to occur in wetlands and forests in the project area.

Fender's soliperlan stonefly — is endemic to western Washington. The nymphs are largely predatory and live in seeps and

small streams with clean, clear water. The adults are poor fliers and live in riparian zones of small streams, feeding on algae and vegetation. They may occur in and near streams in the project area, although the only confirmed sightings have been in Pierce and Skamania counties (Pacific Biodiversity Institute 2000).

3.8.2.4 Species Dependent on Unique Habitats

Two wildlife species, the **Larch Mountain salamander** and the **peregrine falcon** — were identified as potentially occurring within the project vicinity and having a primary association with unique habitat types.

Larch Mountain salamander — is associated with forested and talus environments that provide cool, moist conditions. The species occupies early to mature regeneration forests, non-forested talus, caves, and occasionally seeps (Crisafulli 1998). Its core distribution is along the Columbia River Gorge at elevations ranging from 2,000 to 4,000 feet, but because Survey and Manage requirements have been in place, scattered additional populations of this species have been found on the Mount Baker-Snoqualmie National Forest in the Green River Watershed and in the Wenatchee National Forest, Cle Elum Ranger District. The species may occur in the project area where suitable talus habitat is present. Within the project area, no reliable estimate of the amount of talus habitat is available, because it generally occurs in small patches within other habitat types and is not mapped separately. Mature coniferous regeneration forest may be used by this species if an adequate downed wood component exists.

Peregrine falcons — are associated with cliffs, which they use for nesting habitat. Peregrines forage on other species of birds, and forage primarily in areas where there are large concentrations of waterfowl or flocking birds (Johnsgard 1990). Peregrines have been documented within the project area (WDFW 2000). Because peregrines are known to have hunting territories that extend up to 15 miles from nest sites, peregrines may use the project area as foraging habitat.

3.8.2.5 Early Regeneration Community Dependent Species

Seven wildlife species were identified as potentially occurring within the project vicinity and having a primary habitat association with early regeneration community habitat types.

Elk — are known to occur throughout the project area (City of Seattle 2000, WDFW 2000) and are expected to use all the different habitat types within the project area during some part of the year. Mid- to mature forest types provide potential cover, including hiding

and thermal cover, during all seasons and provide foraging habitat where an understory is present. Early regeneration forests provide foraging habitat and wetlands provide both foraging and cover habitat. Calving is likely to occur in areas away from human disturbance where hiding cover is available, most likely in wetlands and early regeneration forests (Thomas and Toweill 1982).

Black-tailed deer — are more closely associated with forested habitats than elk, and are expected to use all forested habitat types within the project area. They may also use the early regeneration forests, but prefer smaller openings or edges (Johnson and Cassidy 1997).

Western bluebirds — are cavity-nesting birds that forage in open habitats (Rodrick and Milner 1991). The mature coniferous forest stands found within the project area may provide nesting habitat where open foraging grounds are located nearby. Potential habitat occurs where mature forests are beginning to contain snags and in areas where remnant snags remain. No reliable estimate of acreages exists for this habitat type.

Four species of butterfly — may occur in the project area. They are the **western sulphur butterfly, mardon skipper butterfly, great arctic butterfly** (all found in King County), and **valley silverspot**. They may occur in grasslands, meadows, sub-alpine glades, mid-elevation roadsides, pre-existing power line corridors and other clearings (USGS 2002a, b, c; WDFW 2000).

The proposed expansion of Echo Lake Substation would be located east of the existing substation. Habitat types in this area are early coniferous forest and early mixed forest and grass/forb/scrub; and so are most likely to provide habitat for early regeneration community dependent species or forest community dependent species that use early regeneration forest.

A portion of this area is already developed as a road accessing lands beyond the substation. A short section of the existing road around the substation would be realigned to the east. Given the amount of human activity already in this area, associated with both the existing substation and the presence of the access road, wildlife species sensitive to human disturbance would not be expected to use the area.

The amount of each type of wildlife habitat present along the alternatives is shown in Table 3-5.

Alternatives A and C (both Options C1 and C2) are in the "Puget Sound" vegetation area, which is further recognized as a "special type" within the western hemlock zone. Plant communities in the Puget Sound area have the basic characteristics of the western hemlock zone, with additional features not normally found further

south or east within the zone (Franklin and Dyrness 1973). In the vicinity of Alternatives A and C, the most noticeable of these features are numerous poorly drained wet areas interspersed with wooded upland habitats. The portions of Alternatives B and D (both Options D1 and D2) from approximately seven miles east of North Bend to Stampede Pass are in the Pacific silver fir subalpine forest zone. This zone tends to be cooler and wetter than the western hemlock zone, with deeper, more persistent snowfall (Franklin and Dyrness 1973). The specific composition of vegetation communities typically includes a canopy dominated by Pacific silver fir (Abies amabilis), western hemlock, and Douglas fir; however, most western Washington conifers can be found in this zone (Kruckeberg 1991). The shrub layer tends to be dense and diverse, dominated by various huckleberry species, salal, and rhododendron (Franklin and Dyrness 1973).

3.9 Vegetation

3.9.1 Regional Overview

Vegetation communities found in the vicinity of the transmission line alternatives vary considerably in their general characteristics and species composition. The project area for Alternatives 1 through 4 is almost entirely within forests that have been maintained in timber production for most of the last 150 years. Located further west, Alternative A is generally characterized by highly disturbed, intensely managed vegetation communities typically found in cleared and maintained transmission line corridors and surrounding residential and commercial development. Alternative B is also a highly disturbed, intensely managed transmission line corridor; however, the area immediately adjacent to the corridor is relatively undisturbed and infrequently managed. Alternative C (Options C1 and C2) is typified by moderately disturbed managed vegetation communities typical of rural and suburban development. Alternative D (Options D1 and D2) generally contains vegetation communities with low-to-moderate disturbance and low management intensity.

Vegetation within this part of Washington is characterized on the basis of physiographic provinces and vegetation zones. According to this classification system, the project area for Alternatives 1 through 4 is within the Southern Washington Cascades Province and the Western Hemlock Zone (Franklin and Dyrness 1973); for Alternatives A and C, the Puget Trough Province; and for Alternatives B and D, the North Cascades Province.

Another general description of the predominant vegetation within the project area uses vegetation classification methods developed by the USFS for the Mount Baker-Snoqualmie National

Table 3-5 — Wildlife Habitat Present along Transmission Line ROW by Alternative

Habitat Type	Acres of Habitat Present by Alternative										
	1	2	3	4A	4B	A	B	C (Option C1)	C (Option C2)	D (Option D1)	D (Option D2)
Forested Communities											
Mid-regeneration deciduous	183	154	26	154	154	50	146	155	135	149	147
Mature deciduous	110	108	0	110	110	133	374	366	374	379	373
Early regeneration conifer	77	205	91	137	137	541	1,098	38	528	1,145	1,056
Mid-regeneration conifer	41	56	440	54	47	541	1,688	599	134	1,699	1,657
Mature regeneration conifer	1,467	1,406	1,943	1,583	1,766	272	2,048	91	82	2,054	2,035
Mature conifer	0	0	0	0	0	0	1,918	25	25	1,935	1,901
Managed early regeneration conifer	0	0	0	0	0	0	59	0	0	59	59
Early regeneration mixed	157	157	319	157	157	80	590	221	25	591	592
Mid-regeneration mixed	319	319	319	319	319	572	903	377	500	871	937
Mature mixed regeneration	0	0	0	0	0	972	695	263	309	669	720
Totals	**2,354**	**2,405**	**3,138**	**2,514**	**2,690**	**3,161**	**9,519**	**2,135**	**2,112**	**9,551**	**9,477**
Riparian Communities											
Mid-regeneration deciduous	19	19	4	19	19	3	27	16	16	24	28
Mature deciduous	11	11	0	11	11	0	20	15	19	19	20
Early regeneration conifer	10	20	13	20	20	0	54	0	0	60	48
Mid-regeneration conifer	5	7	62	8	7	13	41	7	7	42	41
Managed early regeneration conifer	0	0	0	0	0	0	3	0	0	3	3
Mature regeneration conifer	143	161	215	161	156	<1	94	0	0	90	93
Mature conifer	0	0	0	0	0	0	85	0	0	88	81
Early regeneration mixed	16	16	45	16	16	0	23	3	3	23	24
Mid-regeneration mixed	26	26	58	26	26	15	57	13	13	56	57
Mature mixed regeneration	0	0	0	0	0	15	58	11	11	56	60

Rural residential/managed landscape	0	0	0	0	0	40	23	4	4	23	22
Developed	2	2	0	2	2	4	19	0	0	18	18
Lakes/rivers/stream	0	0	0	0	0	8	88	0	0	73	106
Natural non-vegetated	0	0	0	0	0	0	1	0	0	3	1
Managed grass/forb/shrub	43	68	29	68	68	8	13	<1	3	15	12
Natural non-forest shrubland	0	0	0	0	0	<1	3	0	0	3	3
Natural non-forest grassland	0	0	0	0	0	0	0	0	0	0	0
Totals	**275**	**330**	**426**	**331**	**326**	**108**	**609**	**70**	**76**	**596**	**616**
Aquatic Communities											
Lakes/rivers/stream	6	7	20	10	6	27	138	10	8	89	205
Wetlands[a]	141	142	27	142	142	40	67	37	30	70	62
Totals	**147**	**149**	**47**	**152**	**148**	**67**	**205**	**47**	**38**	**159**	**267**
Unique Habitats											
Rural residential/managed landscape	0	0	0	0	0	1,797	354	604	776	353	353
Developed	80	27	30	33	28	1,063	252	130	139	243	261
Natural non-vegetated	0	0	0	0	0	0	75	0	0	78	67
Total	**80**	**27**	**30**	**33**	**28**	**2,860**	**681**	**734**	**915**	**674**	**674**
Early Regeneration Communities											
Managed grass/forbs/shrubs	425	439	197	463	475	410	431	294	301	432	426
Natural non-forest shrubland	0	0	1	1	1	81	115	102	78	119	116
Natural non-forested grassland						1	14	5	5	20	8
Totals	**425**	**439**	**198**	**464**	**476**	**492**	**560**	**401**	**384**	**571**	**551**

[a] Besides being part of aquatic community habitat types in the project area, wetland acreage can be found within a variety of forested, unique and early regeneration community habitat types. This acreage is already included in the figures given for other community habitat types.

Forest (Henderson et al. 1992). Under this methodology, the project area lies predominantly in the western hemlock zone. Characterized by coniferous forests dominated by Douglas fir and western hemlock, it is the largest vegetation zone in the Pacific Northwest. The project areas for Alternatives 1 through 4 most closely adhere to common western hemlock zone characteristics. Vegetation in this area is dominated by Douglas fir. Based on measurements of stumps found across the CRW, trees within the forest reached diameters of over 82 inches diameter breast height (dbh), and were probably over 200 feet tall prior to the initiation of logging in the region. However, such mature trees are no longer found in the project area. The vegetation types in the towns and rural areas at the southern end of the project area are disturbed, but there is still much native vegetation such as Douglas fir, hemlock, red alder and various brush species. The private timberlands at the northern end of Alternatives 1 through 4 are also disturbed, but they have been replanted with native tree species and are intensively managed.

3.9.2 Project Area and Approach

The project area for vegetation is a quarter-mile corridor centered on the ROWs of the alternatives. This includes areas within the ROW where vegetation would be cleared for construction, and areas beyond the ROW where trees would be observed and removed from time-to-time to prevent "danger trees" from interfering with the safe and reliable operation of the line, facilities (*e.g.*, expanded substation), or access roads. ROWs are generally 150 feet wide. However, for Alternative B, only the northern 20 feet of the existing 150-foot ROW would be cleared of vegetation, as the majority of the alignment has been maintained for conductor clearance.

In this report, vegetation is classified by vegetative cover type and by age class. Vegetation cover type, for the purposes of this report, is a description of the type and average size of the plants growing on a specific site. An age class distribution was used to reflect the project area's long history of timber production.

Vegetation cover types were determined by the type of dominant plants (*e.g.*, tree, grass, shrub), the species of dominant plants (e.g., Douglas fir, alder, and maple), and the regeneration stage of a given forested stand. For Alternatives 1 through 4, vegetation cover types in the CRW HCP database were reviewed and consolidated into 12 categories. The vegetation along Alternative A is dominated by rural-residential and suburban development cover types, and by the managed shrubland communities typical of existing transmission line corridors. For Alternatives B and D (Options D1 and D2), analyses of existing vegetation communities were based on USFS stand data, resulting in six additional categories for mature forests and managed rural-residential

areas. The vegetation for Alternative C, particularly Option C1, presents an intermediate condition between development-dominated Alternative A and the forest dominated Alternatives 1 and D (Options D1 and D2). The rural residential managed cover type is most prevalent of any cover type along
Option C2.

3.9.3 Vegetation Cover Types

Eighteen major vegetation cover types were defined and mapped for this project (see Map 12 and maps for Alternatives A–D in Appendix P). Cover types include forested and non-forested areas. The forested stands within the project area have been managed for timber production in the recent past. Timber production has recently been discontinued over some of the project area, especially within the Cedar River Watershed. Nevertheless, the forested stands found in the project area can still be differentiated by recent timber management practices. As a result, the definitions of forest cover types are based primarily upon the state of regeneration in managed forested stands. All cover types are described below and the acreage summary for each type presented for each alternative in Table 3-6.

Early regeneration coniferous forest — young plantations of Douglas fir in sufficient densities to preclude more than 30 percent hardwood coverage. Stands are generally less than 20 years old and range in height from 15 to 30 feet. Understory herb and shrub coverage is generally low due to the stand density.

Managed early regeneration coniferous forest —are found within managed transmission line corridors. This cover type is found only within Alternative B, and reflects volunteer growth of young conifers, mostly Douglas fir, within areas of the transmission line corridor that are normally kept clear of trees. Because of their location under the power lines, these trees will be removed well before maturity. These trees are generally less than 20 years old and under 15 feet tall.

Mid-regeneration coniferous forest — is composed of medium-age coniferous stands dominated by Douglas fir, with occasional hemlock and western red cedar. At higher elevations, subalpine fir and Pacific silver fir become components of the overstory and understory; elsewhere, understory trees are dominated by western hemlock. Herb and shrub coverage is dominated by sword fern and salal, with occasional vine maple. Individual canopy trees in this cover type range in size from 12 to 20 inches dbh and average 40 to 80 feet in height. Ages of these stands are generally in the range of 15 to 35 years. On National Forest lands, some of these forests are unmanaged stands of natural origin.

Table 3-6 Percent of Vegetative Cover Type in Study Area by Transmission Alternative

Cover Type	Percent Cover in Study Area by Alternative										
	1	2	3	4A	4B	A	B	C (Option C1)	C (Option C2)	D (Option D1)	D (Option D2)
Early regeneration coniferous	2.6	6.8	2.7	4.3	4.1	8.3	10.0	1.2	15.4	10.5	9.6
Managed early regeneration coniferous	0	0	0	0	0	0	0.5	0	0	0.5	0.5
Mid-regeneration coniferous	1.4	1.9	12.9	1.7	1.4	8.3	15.0	18.3	3.9	15.2	14.7
Mature coniferous regeneration	48.8	46.5	56.7	50.0	52.8	4.1	18.6	2.8	2.4	18.6	18.5
Mature coniferous	0	0	0	0	0	0	17.4	0.8	0.7	17.6	17.2
Old forest[b]	0	0	0	0	0	0	0	0	0	0	0
Mid-regeneration deciduous	6.1	5.1	0.8	4.9	4.6	0.8	1.5	4.7	4.0	1.5	1.5
Mature deciduous	3.7	3.6	0	3.5	3.3	2.0	3.4	11.2	11.0	3.5	3.4
Early regeneration mixed	5.2	5.2	9.3	5.0	4.7	1.2	5.3	6.7	0.7	5.3	5.3
Mid-regeneration mixed	10.6	10.6	9.3	10.1	9.5	8.7	8.3	11.5	14.6	8.1	8.6
Mature mixed regeneration	0	0	0	0	0	14.9	6.6	8.0	9.0	6.3	6.8
Managed grass/forb/shrub	14.1	14.5	5.7	14.6	14.2	6.3	3.9	8.9	8.8	3.9	3.8
Natural non-forested grassland	0	0	0	0	0	0[a]	0.1	0.2	0.2	0.2	0.1
Natural non-forested shrubland	0	0	0	0	0	1.2	1.0	3.0	2.3	1.1	1.0
Lake/river/stream	0.2	0.2	0.6	0.3	0.2	0.4	2.0	0.3	0.2	1.4	2.7
Wetlands	4.7	4.7	0.8	4.5	4.3	N/A	N/A	N/A	N/A	N/A	N/A
Developed	2.7	0.9	0.9	1.0	0.8	16.3	2.4	4.0	4.1	2.3	2.4
Natural non-vegetated	0	0	0	0	0	0	0.7	0	0	0.7	0.6
Rural residential/managed landscape	0	0	0	0	0	27.5	3.3	18.4	22.7	3.3	3.3
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

[a] less than 0.1%; all other "0" values represent absolute zero, i.e.; cover type not present.

[b] some of this type is present along Alternatives B and D, but is mapped as Mature Coniferous

Mature coniferous regeneration forest — is the most prevalent cover type in the project area. Within the ROW and the adjacent quarter-mile area, this cover type is usually about 36 to 75 years old and consists of represent late second-growth stands of conifers but can include stands initiated following natural disturbance on National Forest lands. Older trees are present but uncommon. Dominated by Douglas fir, with occasional western hemlock and western red cedar, this cover type represents stands that would be at or near typical harvest age on industrial forest lands, but is an early stage for forests managed as late-successional habitat. In some cases, especially near drainages, stands are co-dominated by Douglas fir and Engelmann spruce. At higher elevations, subalpine fir and Pacific silver fir are components of the overstory. Western hemlock is the dominant species in the understory. The forest floor is dominated by salal and sword fern, with vine maple occasionally present. Individual trees in this cover type range in size from 18 to over 36 inches and average 100 to 130 feet. This cover type also includes coniferous stands that have matured, but do not yet have the complex canopy structure, dense down woody material (**DWM**), and other attributes of old-growth forest.

Mature coniferous forest — is dominated by mid- to large-size trees (12 to 24 inches dbh), 80 to 250 years old, usually in two-storied to multi-storied stands. East of the Cascade crest, some of the stands mapped as this type are up to 700 years old. This classification reflects medium to high density of snags and DWM.

Old forest — is dominated by mature trees (greater than 24 inches dbh) usually greater than 250 years in age, with crown closure exceeding 60 percent, in multi-storied stands, with abundant snag and DWM and at least two tree species. In the project area, the old forest cover type occurs only within isolated pockets of Alternatives B and D (Options D1 and D2). Some of this type is present east of the Cascade crest but is mapped as mature coniferous forest.

Mid-regeneration deciduous forest — is dominated by sapling to pole-size hardwoods. Hardwood coverage is over 70 percent. Dominant species are red alder, black cottonwood and/or bigleaf maple. Stand ages are in the 10- to 30-year range and heights average 25 to 40 feet.

Mature deciduous forest — is dominated by mature hardwoods. Hardwood coverage is over 70 percent. The dominant species is red alder. Black cottonwoods occasionally co-dominate and are usually the largest trees present, often over 25 inches dbh. Bigleaf maple can also occasionally co-dominate. Stand ages are generally over 30 years and heights average 40 to 80 feet.

Early regeneration mixed forest — is primarily stands that have been harvested within the last 10 years. Most of these areas are

clearcuts. This type differs from the coniferous early regeneration stage by having more than 30 percent cover of hardwood trees present. Some also have up to 20 percent retention of mature trees, especially those areas with drainages. The dominant coniferous species is Douglas fir. Hardwood species, including red alder, vine maple, and willows, are also present, often in higher percent coverage than the conifers. Heights of these stands range from 8 to 15 feet, with the hardwood species frequently overtopping the young conifers. Shrub species are dominated by trailing blackberry, salal, and red huckleberry.

Mid-regeneration mixed forest — is another of the more prevalent cover types in the study area. These are stands comprised of roughly even coverage of conifers and hardwoods. The dominant conifer is Douglas fir, though in many areas western hemlock co-dominates. The dominant hardwood is red alder, with occasional black cottonwood and bigleaf maple. Conifers average 5 to 8 inches dbh and are between 10 and 25 years old. Heights of these stands range from 35 to 45 feet.

Mature mixed regeneration forest — is composed of stands with coniferous and hardwood coverage each exceeding 30 percent. Diameters of both hardwoods and conifers vary widely, but are generally over 14 inches dbh. The average age of trees in these stands is over 30 years. Heights generally exceed 45 feet.

Managed grass/forb/shrub — is characterized by mixed grasses and forbs, mostly non-native species. They also include areas of low- to medium-height shrub thickets. These areas are managed to maintain their existing condition and are not allowed to continue typical ecological succession for a western hemlock association. This is the dominant cover type found under existing transmission lines.

➲ For Your Information

Jurisdictional wetlands — *Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.*

Wetlands — are areas that meet the Army Corps of Engineers (***Corps***) and state of Washington criteria for ***jurisdictional wetlands***. The majority of the wetlands present in the project area are ***palustrine*** forested sites dominated by red alder, with salmonberry-dominated shrub strata. They range in size from 1 to 5 acres. Sources of wetland ***hydrology*** include surface runoff, shallow subsurface flow, and, occasionally, hillside seeps. Wetlands are discussed in depth in Section 3.10.

Natural non-forested grassland and **shrubland** — are areas dominated by meadows or dense shrub thickets. These communities tend to have a higher percentage of native species. Grasslands are characterized by grass and forb cover exceeding 60 percent; shrublands are characterized by shrub cover exceeding 40 percent. For both types, forest cover is less than 10 percent.

Lakes/rivers/streams — includes lakes, ponds or other natural impoundments of water, and drainages with perennial flows.

Developed cover types — include any area cleared for the building of commercial or industrial structures, or larger, planned residential communities, including associated lawns and parking lots.

Rural-residential, managed landscapes — are areas with scattered, low-density single-family housing on larger lots, including small-scale farms and horse pastures. This cover type is differentiated from the Developed type in that a higher percentage of the pre-construction landscape is relatively intact, though still highly managed. These areas tend to occur in unincorporated portions of the county. Tree coverage in these areas is generally under 30 percent, but can be locally higher.

Two additional cover types were initially described during the data review and preparation for field surveys. These types were described because of their potential habitat value for wildlife. Small pockets of either type may be present within the project area, including:

Cliff/talus — are areas of extensive exposed rock and aggregations of fractured rock at the base of cliffs and slopes.

Naturally non-vegetated areas — contain bare soil, slope failures, or other eroded-soils features.

3.9.4 Vegetation Along Transmission Line Alternatives

Two general characterizations can be made of the study areas for Alternatives 1 through 4. First, moving south to north, vegetative cover type tends to change from conifer-dominated stands to mixed conifer-deciduous stands. Second, stand age tends to fall as one proceeds north along these alternatives.

Alternatives B and D (Options D1 and D2) encounter predominantly coniferous forest stands. Coniferous forest communities occupy more than 10 times the area that developed or residential uses cover.

Alternative A encounters nearly opposite conditions, running through developed and managed cover types at a rate twice that of coniferous forested communities. Alternative C (Options C1 and C2) represents a transitional type between these two extremes, with more or less even distribution of coniferous, hardwood, and developed vegetative cover types. More detailed descriptions of each alternative follow.

3.9.4.1 Proposed Action

The Proposed Action (Alternative 1) is dominated by coniferous forest stands in the mature coniferous regeneration cover type.

The north leg of the Proposed Action tends to be mixed coniferous-deciduous forest. The south leg of the Proposed Action has more conifer-dominated stands. A thin riparian strip along the Raging River contains several large old conifers, including Douglas fir and western red cedar trees over 35 inches dbh.

3.9.4.2 Alternative 2

Alternative 2 is dominated by coniferous forest stands in the mature coniferous regeneration cover type. The extreme southern end of Alternative 2 passes through a young Douglas fir plantation. Alternative 2 also passes through young Douglas fir plantations just southeast of the point where it joins Segment D along the existing transmission line ROW.

As with the Proposed Action, the portion of Alternative 2 that follows Segment D tends to have more mixed forest to the west and more conifers to the east. This alternative crosses a thin stand of older Douglas fir and western red cedar at the Raging River.

3.9.4.3 Alternative 3

Alternative 3 generally passes through older, more mature coniferous regeneration and mid-regeneration coniferous stands, and less non-forested area. There are no mature deciduous stands. The project area of Alternative 3 includes approximately six acres of wetlands and numerous cover types in the lakes/rivers/streams category.

At least two older, mature Douglas fir stands were found during field studies for Alternative 3. These were off Pole Line Road near Taylor Creek and along Binus Creek Road. Trees in these stands were over 32 inches dbh and averaged 160 feet in height. Increment cores from these trees showed these stands to be over 70 years old.

3.9.4.4 Alternative 4A

Alternative 4A is dominated by mature coniferous regeneration cover type. This alternative also crosses the same young Douglas fir plantation that is crossed at the south end of Alternative 2. Most of the younger stands within the project area were found along Segment D, toward the north end of the alternative. The areas north of Selleck and Pole Line Road, where Alternative 4A crosses from Segment E to Segment C, are dominated by mature coniferous regeneration stands.

3.9.4.5 Alternative 4B

Alternative 4B is dominated by mature coniferous regeneration forest cover type. It is similar to Alternative 4A in that it begins in a young, Douglas fir plantation, then passes through older coniferous areas before joining Segment D. From there, stand age tends to drop and cover type becomes more mixed forest.

3.9.4.6 Alternative A

Alternative A is dominated by rural-residential and suburban development cover types, and by the managed shrubland communities typical of existing transmission line corridors. Over 40 percent of Alternative A's study area is in developed or rural-residential cover types. Less than a quarter of the area is in conifer-dominated forest. Of the coniferous forest present, most is less than 35 years old, and conifers up to 75 years old dominate only 4 percent of the total study area. While remnant older trees are likely present in the Alternative A area, no stands were identified that are dominated by trees older than 75 years.

3.9.4.7 Alternative B

Alternative B lies within the existing transmission line corridor that extends westward from Stampede Pass to Echo Lake Substation. In the eastern two-thirds of Alternative B, vegetation communities adjacent to the existing corridor are dominated by coniferous forest stands. Most of these are mature stands, especially near the eastern end of Alternative B.

Within the portion of Alternative B cleared for operation and maintenance of the transmission line, vegetative cover types are dominated by managed shrublands and patches of managed early regeneration coniferous stands. Most of the young regenerating conifers are Douglas fir. In higher elevations (generally above 3,500 feet), Pacific silver fir seedlings that have volunteered from adjacent mature stands are also present. Since no transmission line is currently hung from the south side of the tower arms, the need to keep that side of the corridor cleared has not been as great as on the north side of the ROW. As a result, most of the young coniferous regeneration stands in the ROW are found along the southern edge of the transmission line corridor.

3.9.4.8 Alternative C

Alternative C (Option C1) — presents an intermediate condition between the development-dominated Alternative A and the other forest-dominated alternatives. Total developed and rural residential area is under 25 percent, and forested communities of any

kind account for approximately two-thirds of the project area. However, as with Alternative A, conifer-dominated communities within the Option C1 area are primarily young stands under 35 years old. Mid-regeneration coniferous stands (20 to 35 years old), mid-regeneration mixed stands (10 to 30 years old), and early regeneration coniferous stands (less than 20 years old) account for 31 percent of the study area. Rural residential managed landscape has the highest percentage cover of any type.

Alternative C (Option C2) — shares the northern portion of the Option C1 alignment and so has similar percentages of cover types: total developed and rural-residential areas account for 25 percent; forested communities of any kind cover about two-thirds of the project area; and rural residential managed landscape has the highest percent cover of any type. Conifer-dominated communities are primarily young stands under 35 years old. Mid-regeneration coniferous and mixed stands, and early regeneration coniferous stands account for 34 percent of the study area.

3.9.4.9 Alternative D

Alternative D (both Options D1 and D2) passes through National Forest land managed by the Okanogan-Wenatchee and Mt. Baker-Snoqualmie National Forests from Stampede Pass heading west toward North Bend. Vegetation within the area of this alternative is 86 percent forested, with 61 percent of the area in coniferous forest. Options D1 and D2 contain the oldest and largest conifer stands of all the alternatives. Almost 18 percent of the conifer stands are in the range of 75 to 250 years in age, and another 18 percent are approaching 75 years old. Development and rural residential areas account for less than 6 percent of the study area.

3.9.4.10 Echo Lake Substation

The area around Echo Lake Substation is grass/forb/shrub, with small mixed coniferous-deciduous stands. The perimeter area to about 100 feet around the substation is surrounded by gravel and non-native grasses.

3.9.5 Threatened, Endangered and Other Special-Status Plant Species

The project area could provide habitat or potential habitat for several plant species that are listed or candidates for listing under the federal ESA or by the state of Washington. However, based on Washington Natural Heritage Program (**NHP**) listings of known occurrences of rare plants in King and Kittitas counties, it is unlikely

any federally-listed plant species occur. Site-specific surveys would be required to verify absence prior to any ground disturbing activity.

Certain vascular and nonvascular plant species and fungal species listed as Survey and Manage species in the Northwest Forest Plan and USFS sensitive plant species may be present within the project area of alternatives occurring on National Forest lands managed by the USFS (Alternatives B and D [Options D1 and D2]). BPA and personnel from the USFS will determine the timing of pre-construction surveys for Survey and Manage species and sensitive species to identify potential occurrence of species, impacts, and mitigation measures, if required.

3.9.6 Noxious Weeds and Other Undesirable Vegetation

Noxious weeds, which are formally designated at the county level by noxious weed control boards (RCW 17.10.205), and at the federal level (7 CFR 360.200), typically include species that pose a major threat of spreading or interfering with agriculture or natural plant communities, and whose growth can be managed. Noxious weed species present within the project area include Scotch broom, Himalayan blackberry, Canada thistle, knapweeds, orange hawkweed, St. Johnswort, tansy ragwort, and small amounts of English holly.

Scotch broom is one of the most pervasive weed species in the project area. It commonly occurs in the highly disturbed areas of clearcuts, and along the existing transmission line from Raver Substation to Echo Lake Substation.

Provisions for the systematic recognition and control of noxious weeds in BPA transmission line corridors are found in the BPA Transmission System Vegetation Management Program (BPA 2000). Noxious weeds and other undesirable plant species on the Rocky Reach-Maple Valley line (Alternative B) and a portion of Alternative A are currently managed following this program. (See Appendix K.)

3.10 Wetlands

3.10.1 Regional Overview

Wetlands within the region are typical of the Puget Lowland and western and eastern Cascade Mountain foothills. Wetland soils are often formed in gravels, sands, and clay and silt tills derived from glacial deposits. Mixed deciduous and coniferous-forested wetlands with pockets of shrub, emergent, and open water communities are common. Wetland water sources include hillside seeps, perched water tables, overland runoff, precipitation, and flows from adjacent streams.

Wetland communities in the project area play a vital role in groundwater discharge, supporting stream base flow, providing flood water storage and capturing sediment and nutrient runoff, and providing habitat for many wildlife and plant species. Likewise, the buffer zones around wetlands protect wetland function, deter human access and degradation, and are equally important to many bird and mammal species. That is why many federal, state and local policies are geared to protect wetlands, and the chosen alternatives would have to comply with these. For example, depending on ownership of wetlands crossed by the chosen alternative, there may be requirements to obtain federal permits before construction (see Section 3.2.1 in Appendix Q or additional analysis may be required under the Northwest Forest Plan Aquatic Conservation Strategy (see Section 3.7.2, **National Forest Plan Fish Protection Strategies**).

Water Resource Inventory Areas (***WRIA***s) designated by the Washington Department of Ecology that are crossed by the proposed alternatives include Lake Washington (#8), Snohomish River (#7), Green River (#9), and Upper Yakima (#39). (See Map 13.)

The study area for wetlands included a 500-foot-wide corridor along all of the transmission line alternatives. The primary focus of the wetlands analysis was on identifying wetlands within the proposed 150-foot ROW centerline of each transmission line corridor.

A total of 90 wetlands were identified within the ROWs of the transmission alternatives. Wetland vegetation classes include palustrine emergent, scrub-shrub, open water, riverine, unconsolidated bottom and forested wetlands as defined by Cowardin et al. (1979). Commonly these wetlands are associated with ***depressional*** areas that receive water from overland runoff and precipitation. They are generally greater than 1 acre and include a mosaic of wetland and upland areas following small variations in topography. Several wetlands were also found to be associated with the riparian area of ***low-gradient*** streams. Wetlands east of Snoqualmie Pass are generally associated with riparian fringes and floodplains of streams. Hydrology of these wetlands depends on stream flows and flooding. Just west of Snoqualmie Pass, wetlands are predominantly located on sloped areas and were fed by groundwater discharge seeps.

➲ For Your Information

Low-gradient *means with gentle slopes.*

Wetland buffers inside the Cedar River Watershed, private timberlands and National Forests are generally intact and dominated by a mix of shrubs and young forest. Wetland buffers within existing power line ROWs have been cut to allow conductor span, and generally have low shrub and herbaceous cover. Wetland buffers in the more urban areas (Alternatives A and C [Options C1 and C2]) typically consist of grasses, shrubs, or trees.

Map 13

WATER RESOURCE INVENTORY AREAS

Legend

- Existing BPA Transmission Lines
- Proposed Transmission Line Alternatives Under Consideration
- BPA Substation
- Watershed Boundary
- Indian Reservation

Map Location

N

0 3 6 9 12 15

Miles

BONNEVILLE POWER ADMINISTRATION

GIS

GEOGRAPHIC INFORMATION SYSTEM

November, 2002

Common dominant wetland plant species include red alder, western hemlock, willow, salmonberry, Douglas' spiraea, soft rush, creeping buttercup, skunk cabbage, piggy-back plant, and slough sedge. (See Appendix D for scientific names of dominant plant species surveyed within the project area.)

Maps in Appendices D and Q show the location of all wetlands surveyed. Table 1 in Appendices D and Q gives wetland identification numbers, ratings, vegetation classes and sizes of wetlands encountered by each alternative. Wetlands were rated and buffer widths were assigned based on the King County Environmentally Sensitive Areas Ordinance, Kittitas County Critical Areas Code, or codes of local cities, as appropriate.

3.10.2 Proposed Action

A total of 10 wetlands, totaling 242 acres, were originally identified within the 500-foot transmission line study corridor for the Proposed Action during the October 2000 reconnaissance. All these wetlands would be crossed by the proposed 150-foot ROW centerline. An April 2001 reconnaissance of the 150-foot Proposed Action corridor identified 31 wetlands totaling 13.9 acres. The discrepancy between the two surveys is attributable to the survey methods described in Appendix Q. However descriptions of wetlands in the text below did not change; the text that follows for the Proposed Action is true for both the 10 wetlands originally identified and the 31 more recently identified.

Large depressional wetlands occupy flat benches on the north and south slopes of Brew Hill within the CRW, often fed by groundwater seeps. Several wetlands are also associated with the riparian area of tributaries to the Raging River to the north and Rock Creek to the south of Brew Hill, within the watershed and within private lands. Many of the wetlands continue outside of the 150-foot corridor into the existing transmission line corridor and beyond.

Most wetlands in this alternative have a palustrine forested vegetation community component dominated by red alder. The depressional wetlands occupying the south and north bench areas of Brew Hill provide important groundwater discharge and recharge functions, while serving as the headwaters for Rock Creek and the Raging River. These forested wetland communities also provide bird, mammal, fish, amphibian, and invertebrate habitat for a variety of species that use seasonally and perennially saturated wetlands and riparian areas for feeding, nesting, and rearing.

No wetlands were identified south of the Cedar River crossing within the Proposed Action.

3.10.3 Alternative 2

A total of 13 wetlands, totaling 261 acres, were identified within the 500-foot study corridor for Alternative 2 (per October 2000 reconnaissance). Three wetlands were identified south of the junction with the Proposed Action. North of this junction (which is within the Proposed Action), within the CRW, there are 10 wetlands (described under the Proposed Action).

All three of the wetlands identified within the southern portion of this alternative are located south of the Cedar River, and all three wetlands are within the proposed 150-foot ROW. All are depressional wetlands with palustrine forested vegetation community components and areas of surface water inundation. Two wetlands have been altered. Tree harvesting has impacted the buffer associated with wetland 2-1, while the location of Pole Line Road has altered the hydrology of wetland 2-2. Wetland 2-3 is located within mid-regeneration coniferous forest and, like the other two wetlands, is associated with a depressional area within relatively flat topography.

3.10.4 Alternative 3

A total of nine wetlands, totaling 75 acres, were identified within the 500-foot study corridor along Alternative 3 (per October 2000 reconnaissance). Wetlands are located to the north and south of the CRW, as well as within the watershed. Seven of nine wetlands identified within the study corridor would be crossed by the proposed 150-foot ROW.

Most of the wetlands are associated with depressions that collect overland flows and precipitation and hold this water over prolonged periods. These wetlands provide water quality, flood storage, and flood water retention functions. Vegetation communities are predominantly palustrine forested with components of palustrine scrub-shrub with low diversity. Wetlands 3-8 and 3-4 contain open water surrounded by red alder-dominated, palustrine forested wetland.

Several wetlands are associated with the riparian fringe of streams that provide wildlife habitat and wildlife travel corridors, as well as water quality improvement, flood storage, and floodwater retention. Wetland 3-9 is a palustrine forested wetland paralleling the north and south sides of Canyon Creek. Wetland 3-5 fringes an unnamed tributary to Raging River. Wetland 3-4 contains a large open water component forming the headwaters to Steele Creek, a tributary to the Cedar River.

3.10.5 Alternative 4A

A total of 12 wetlands, totaling 258 acres, were identified along the entire length of the Alternative 4A 500-foot study corridor (per October 2000 reconnaissance). Wetland 2-3 was identified along the portion of Alternative 4A that begins about one-third of the way along Alternative 2 and traverses northwest to connect with the Proposed Action, over 1 mile further south than where Alternative 2 reconnects.

Ten of the 12 wetlands identified were previously described in Section 3.10.1 for the Proposed Action. The remaining two wetlands (2-1 and 2-3) are described in Section 3.10.2 for Alternative 2. However, wetland 2-3 is not within the proposed 150-foot ROW.

3.10.6 Alternative 4B

A total of 13 wetlands, totaling 261 acres, were identified along the entire length of Alternative 4B (per October 2000 reconnaissance). Wetlands 2-2 and 2-3 were identified along the portion of Alternative 4B that begins slightly north of Alternative 4A, along Alternative 2, and traverses west to connect with the Proposed Action further south than where Alternative 4A reconnects.

Ten of the 13 wetlands identified were previously described in Section 3.10.1 for the Proposed Action. The remaining wetlands are described in Section 3.10.2 for Alternative 2. However, wetland 2-3 is not within the proposed 150-foot ROW.

3.10.7 Alternative A

➲ For Your Information

See Appendix Q for locations of wetlands for Alternatives A–D.

A total of 22 wetlands comprising 40 acres were identified within the 500-foot transmission line study corridor for Alternative A (per June 2002 reconnaissance). The 150-foot ROW would cross 15 of these. Most wetlands are associated with depressions that collect overland flows and precipitation and hold this water over prolonged periods. About half of these wetlands consist of scrub-shrub vegetation communities while the remainder consists of emergent, open water, and forested vegetation communities.

Two wetlands are associated with streams and provide riparian wildlife habitat as well as water quality improvement, flood storage, and floodwater retention. Wetland A-W-20 is associated with Patterson Creek and consists of scrub-shrub, forested, and open water components. Wetland A-W-02 contains an open water component that forms the headwaters of a tributary to Rock Creek.

3.10.8 Alternative B

A total of 41 wetlands comprising 67 acres were identified within the 500-foot study corridor for Alternative B (per June 2002 reconnaissance). The 150-foot ROW would cross 35 of these. The majority of wetlands east of Snoqualmie Pass are dominated by scrub-shrub and/or emergent vegetation, and they are associated with streams that saturate/flood riparian areas during high flow. West of Snoqualmie Pass, wetlands are mostly scrub-shrub and/or emergent associated with seeps, streams, and depressions. Snow melt provides the primary source of hydrology to wetlands during spring, while water from overland flows or discharge from hill slope seeps provides the primary source of hydrology during the summer and fall growing season.

Three wetlands are associated with the Yakima River. Wetlands BD-W-02, -03, and -04 consist of scrub-shrub, forested, emergent, and open water components. Several other wetlands are also associated with tributaries to the Yakima and South Fork Snoqualmie rivers.

3.10.9 Alternative C

Option C1 has 13 wetlands comprising 37 acres within the 500-foot study corridor (per June 2002 reconnaissance). The 150-foot ROW would cross 10 of these. Option C2 has eight wetlands comprising 30 acres within the 500-foot study corridor (per June 2002 reconnaissance). The 150-foot ROW would cross six of these.

For both options, most of the wetlands are associated with depressions that collect overland flows and precipitation and hold this water over prolonged periods. Ten (Option C1) or seven (Option C2) of these wetlands consist of scrub-shrub and/or emergent vegetation communities while three consist of open water. One wetland, W-C-05, is associated with Rock Creek.

3.10.10 Alternative D

Option D1 has 41 wetlands comprising 70 acres within the 500-foot study corridor (per June 2002 reconnaissance). The 150-foot ROW would cross 15 of these. Option D2 has 39 wetlands comprising 62 acres within the 500-foot study corridor (per June 2002 reconnaissance). The 150-foot ROW would cross nine of these.

For both options, the majority of wetlands east of Snoqualmie Pass are dominated by scrub-shrub and/or emergent vegetation, and are associated with streams that saturate/flood riparian areas during high flow. West of Snoqualmie Pass, wetlands are mostly scrub-shrub and/or emergent associated with seeps, streams, and depressions.

Snow melt provides the primary source of hydrology to wetlands during spring, while water from overland flows or discharge from hill slope seeps provides the primary source of hydrology during the summer and fall growing season. Three wetlands are associated with the Yakima River. Wetlands BD-W-02, -03, and -4 consist of scrub-shrub, forested, emergent, and open water components. Several other wetlands are also associated with tributaries to the Yakima and South Fork Snoqualmie rivers.

3.10.11 Echo Lake Substation

No wetlands would be affected by the substation expansion. Wetland E-1 is located at the base of the hill slope within a depressional area to the east and south of the current Echo Lake Substation. The wetland is a mixture of palustrine scrub-shrub and palustrine emergent vegetation communities. Water emerges within the proposed expansion area as a seep, draining over the surface to the west of the proposed substation expansion area into the existing Raver-Echo Lake Transmission Line ROW.

3.11 Visual Resources

The visual project area includes numerous landscape types, including the Cedar River Watershed, private timberlands, National Forest land, rural residential uses and pastureland in unincorporated communities, and some limited higher density uses in incorporated areas. A discussion of visual resources affected by each alternative follows. Greater details including simulated views along alternatives, can be found in Appendices R and S.

3.11.1 Proposed Action

3.11.1.1 Residential Areas

The unincorporated community of Kangley is just south of the existing BPA Schultz-Raver lines. Topography in the area is generally flat, with scattered groups of trees. The transmission lines are relatively close to some houses. All Schultz-Raver lines, and the Raver-Echo Lake line, are clearly visible from almost all the properties. The transmission lines are a dominant visual feature of the landscape. There are several houses along Kangley-Selleck Road north of the community of Kangley, where Kent-Kangley Road turns north toward Selleck. Many of those residences are on the west side of the road, and the Raver-Echo Lake line is visible from the rear of the properties. However, trees provide some screening of the existing lines.

Along Segment A are several houses and accessory structures along an unpaved, private road. Most of the structures are east of the existing BPA Raver-Echo Lake 500-kV Transmission Line. The houses are just south of the Cedar River Watershed. The existing line is visible from five houses and the roadway. Trees in the area are not yet mature enough to screen the existing and proposed lines.

There are no residences within the Cedar River Watershed or within the private timberlands north of the watershed. The community of Halmar Gates is about two miles east of the Proposed Action, near the northern boundary of the watershed. Based on a review of aerial photographs, topographic maps, and the distance of the houses from the Raver-Echo Lake 500-kV Transmission Line, the existing line is likely not visible from the residences in Halmar Gates.

3.11.1.2 Recreation Areas

There are no developed recreation sites along the Proposed Action. ***Dispersed recreation*** may occur within the private and DNR forestlands along Segment D. However, it is unlikely much recreation use occurs because motorized access is restricted and difficult. See Section 3.4 for a more detailed discussion. Users in the timberlands would experience a patchwork of recent (within the past 10 years) and older (within the past 40 years) clearcuts. The existing BPA Raver-Echo Lake Transmission Line is visible wherever users encounter the BPA ROW. There is minimal dispersed recreation in this portion of the Cedar River Watershed.

3.11.1.3 Transportation Facilities

None of the existing transmission lines are visible from I-90 to the east and north of the project area. The existing BPA Raver-Echo Lake 500-kV Transmission Line is not visible from SR 18. However, the Rocky Reach-Maple Valley 345-kV Line, the Echo Lake-Maple Valley 500-kV Lines, and the Echo Lake-Monroe 500-kV Line, are visible from SR 18 where the lines cross SR 18. Otherwise, they are not visible from SR 18 because of the tree cover on both sides of the highway. The four Schultz-Raver lines and the Raver-Echo Lake 500-kV Line are visible from Kent-Kangley Road (SR 516) and Kanasket-Kangley (or Kangley-Selleck) Road. Those roads provide access to the residential areas in Kangley and Selleck. Other than the transmission lines, views of the project area from the highways and local roads are of tree stands, clearcut areas, and some residences. Kerriston Road (SE 208th Street) crosses the Raver-Echo Lake Line on Segment D. The line is visible from the road at the crossing point, but otherwise this part of the Cedar River Watershed is so densely forested that the line is likely not visible. In fact, the tree canopy is so dense that

Kerriston Road is not visible west of Halmar Gates on aerial photographs.

3.11.2 Alternative 2

3.11.2.1 Residential Areas

The unincorporated community of Selleck is west of Segments E and F on Alternative 2. The community is screened by tall trees on all sides except the southwest. No existing transmission lines are visible from the area. The community is developed with closely spaces homes and an unpaved loop road connecting the houses to Kangley-Selleck Road. An abandoned schoolhouse is the largest structure. Selleck is secluded visually by the surrounding tall tree stands.

3.11.2.2 Recreation Areas

There are no developed recreation sites along Alternative 2. Dispersed recreation may occur within the private and DNR forestlands along the northern portion of Segment D. However, it is unlikely much recreation use occurs because motorized access is restricted and difficult. See Section 3.4. Users in the timberlands would experience a patchwork of recent (within the past 10 years) and older (within the past 40 years) clearcuts. The existing BPA Raver-Echo Lake Transmission Line is visible wherever users encounter the BPA right-of-way. There is minimal dispersed recreation in this portion of the Cedar River Watershed. Dispersed recreation may occur within the Plum Creek Timber Company forestlands along Segment E, south of the Cedar River Watershed. Most use is by local people because motorized use is not permitted. Users in the timberlands would experience a very recently logged landscape. The existing Schultz-Raver lines are visible where SE 268th Street users encounter the right-of-way. They are also visible, though in the distance, from the southern edge of the watershed. However, there is no dispersed recreation in this portion of the Cedar River Watershed.

3.11.2.3 Transportation Facilities

See the discussion in Section 3.11.1.3, **Proposed Action**. Southeast 268th Street runs east from Kangley into the Cedar River Watershed. It is a King County road that is mainly used to access the timberlands south of Selleck and the watershed to the east.

3.11.3 Alternative 3

3.11.3.1 Residential Areas

The unincorporated community of Halmar Gates is at the east end of Kerriston Road. There are 27 to 30 residences in the area. Most of the houses and mobile homes are 0.5 mile from Alternative 3. There are two or three houses within 650 feet of the Alternative 3 study corridor. The residences are in a shallow valley, surrounded by heavily forested areas interspersed with recently harvested timberland units.

3.11.3.2 Recreation Areas

Rattlesnake Mountain Scenic Area is about 1.5 miles northeast of Alternative 3. The Rattlesnake Mountain Trail traverses the ridgeline and has four or five overlooks. The trail and overlooks are mainly oriented toward the Snoqualmie River Valley, Mount Si, and the Cascades in the Mount Baker-Snoqualmie National Forest. See Section 3.4.7 for a discussion of Rattlesnake Mountain Scenic Area.

3.11.3.3 Transportation Facilities

Kerriston Road (SE 208th Street) terminates west of Alternative 3. It provides access from several residences (Halmar Gates) and is surrounded by a mixture of forested and harvested land. At the southern end of Alternative 3, the existing BPA Schultz-Raver transmission lines are the dominant visual feature from SE 268th Street. Alternative 3 parallels Pole Line Road until the alternative crosses the Cedar River. This portion of Pole Line Road is within the forested Cedar River Watershed. Pole Line Road is owned and maintained by Seattle Public Utilities and is used primarily by city employees. It is not a public road and is controlled by a permit system. See Section 3.2.1.3 under the **Proposed Action** for a description of other transportation facilities.

3.11.4 Alternative 4A

3.11.4.1 Residential Areas

Segment H would be generally north of the community of Selleck, within the Cedar River Watershed. See Section 3.2.1.1, **Proposed Action**, and Section 3.2.2.1, **Alternative 2**.

3.11.4.2 Recreation Areas and Transportation Facilities

See the Proposed Action and Alternative 2.

3.11.5 Alternative 4B

3.11.5.1 Residential Areas

Segment I would be north of Selleck, entirely within the Cedar River Watershed. See Section 3.2.1.1, **Proposed Action**, and Section 3.2.2.1, **Alternative 2**.

3.11.5.2 Recreation Areas and Transportation Facilities

See the Proposed Action and Alternative 2.

3.11.6 Alternative A

3.11.6.1 Residential Areas

On the southern portion of Alternative A's project area (including Option C2), BPA's existing line is carried on towers averaging 90 feet tall. Along Option C2, around 230th Avenue SE, about a dozen nearby homes can see this line and the parallel, partially cleared ROW where Alternatives A or Option C2 would run. A new 11-lot subdivision under construction along Landsburg Road SE also has partial visibility of the Alternative A and Option C2 southern corridor. Remaining homes along this segment are generally screened from the existing and proposed lines by tall trees.

Heading west toward Maple Valley, Alternative A continues to parallel the existing line through the rural community of Georgetown and a large block of forested land owned by the city of Kent (Clark Springs Watershed). In this area the proposed line, as the existing line, would be visible to a mix of suburban uses, including small shopping centers and subdivisions, some of which back up to the ROW. Tower heights change in this area from 90 to 165 feet tall where the line is joined by another line. The existing line and proposed Alternative A route then travel west, flanking the city of Covington to the south, to arrive at Covington Substation. Along much of this stretch, the ROW is now being used as horse pastures, which are bordered by low-density, single-family homes. Some homes immediately adjoining the ROW have unobstructed views of the existing and proposed lines; others are screened from the ROW by tall trees.

North of Covington Substation, where Alternative A would share towers with the Covington-Maple Valley No. 2 line (increasing tower height from 90 to 180 feet), the existing ROW is bordered by medium-density single-family homes with few large trees for screening. Some parts of the ROW have been integrated into the yards of these homes, or are used as parking lots for adjacent commercial uses. Heading north to the Cedar River, the line travels through clusters of rural homes, small farms and forest where the

ROW is already integrated into landscaping or other land use. Before reaching its northern end point (connecting with the east-west Echo Lake-Maple Valley transmission line), the new line would share towers running through the steep-sided Cedar River canyon where it would be adjacent to three residences and visible from several others.

3.11.6.2 Recreation Areas

Recreational facilities and uses along Alternative A's route (from south to north) include the King County Shooting Sports Park located along the existing BPA ROW on the east side of 292nd Avenue SE; the private Elk Run Golf Course located along the existing ROW along 228th Avenue SE; the Eastwood Forest subdivision's children's playground located in an unused portion of the ROW at 216th Avenue SE; private Ryan Brunner Park in the vacant ROW at 193rd Avenue SE; elementary school play fields backing up to the existing ROW along Covington-Sawyer Road SE and SE Wax Road; unofficial equestrian trails under the ROW in the vicinity of Covington; Peterson Lake Park Natural Area (part of the King County Park System) north of Covington; and the regional Cedar River Trail following along the edge of Highway 169 in the Cedar River Valley.

3.11.6.3 Transportation Facilities

Alternative A, paralleling or sharing the route of existing BPA lines, would cross some locally important roads, such as (moving south to north) Landsburg Road SE, Maple Valley-Black Diamond Road, 216th Avenue SE, Convington-Sawyer Road.SE; Kent-Kangley Road; SE 256th and 224th streets in Covington; Peter Grubb Road; 184th Avenue SE; and Petrovitsky Road. It crosses Highway 18 near Covington at a point where the highway is lined by sound walls restricting drivers' views. Alternative A also crosses Highway 169 in the Cedar River Valley but at such a height that it is not readily visible to drivers.

3.11.7 Alternative B

3.11.7.1 Residential Areas

Alternative B would share the ROW of the existing Rocky Reach-Maple Valley No. 1 transmission line from Stampede Pass on the east to Echo Lake Substation on the west. Double-circuiting would require replacing existing 150-foot towers with 180-foot towers, but additional ROW would not be needed. Homes affected would primarily be those already affected by the existing line.

From Stampede Pass to Keechelus Lake, there are only a few residences along Forest Arterial Road 54. Trees on these properties and along the transmission corridor provide a substantial level of screening of the proposed higher towers. Where the ROW passes near Keechelus Lake, land is primarily under the control of the Okanogan-Wenatchee National Forest and there are few homes. A small concentration of residences is in the vicinity of Snoqualmie Pass at the north end of the lake, although views from these homes toward the transmission corridor are generally limited.

As the Alternative B and existing line ROW descends westward from Snoqualmie Pass, it passes land primarily under control of the USFS (Mount Baker-Snoqualmie National Forest) and Washington Department of Natural Resources. There are few, if any, residences in this area. As the line approaches Cedar Falls Road and the Edgewick area, nearby land is still heavily forested, although there are some developed pockets of rural homes in the vicinity of 468th Avenue SE and east of Cedar Falls Road. Visibility of the corridor from these homes ranges from fully unobscured to partially screened.

On the last portion approaching Echo Lake Substation, Alternative B travels along the flanks of Rattlesnake Mountain. The 3,200-foot peak's upper slopes fall within the boundaries of the Rattlesnake Mountain Scenic Area. Consequently, there are few residences near the transmission corridor. However, there are a large number of homes on the valley floor, particularly in the community of North Bend, from which the transmission corridor is visible on the mountainside one to two miles away. From this distance, the towers tend to be visually absorbed into the background.

3.11.7.2 Recreation Areas

There are many recreation facilities in the vicinity of Alternative B. These include from (east to west) the major interregional Iron Horse/ John Wayne Trail created on an abandoned Milwaukee Road railroad ROW (parallels much of the length of Alternative B, intersecting at some points); dispersed recreational activities, particularly winter snowmobiling and cross country skiing, emanating from snow parks along I-90 in the Cascades; Keechelus Lake recreational areas; and a concentration of recreational activities at Snoqualmie Pass, including The Summit at Snoqualmie downhill and cross country ski areas, a Mountaineers lodge and ski slope, and a variety of supporting commercial services. One of Washington's most important ski activity centers, this area attracts about 445,000 visitors annually. This area is also used for mountain biking, outdoor concerts, and hiking in the summer and fall.

West of Snoqualmie Pass, the existing ROW passes near the USFS operated Asahel Curtis picnic area and Tinkham campgrounds; Ollalie and Twin Falls state parks; and the heavily used Pacific Crest Trail and Snoqualmie Valley Trail. The latter links North Bend and the I-90 corridor to Rattlesnake Lake and the John Wayne/Iron Horse trailhead. Both trails cross the ROW. In some areas, these facilities are shielded from the transmission corridor by trees; from others, the lines are occasionally or highly visible. (See Appendix S for more information.)

Further west, approaching its connection with Echo Lake Substation, the existing ROW passes along the edge of the Rattlesnake Mountain Scenic Area for about 1.5 miles and then crosses it for an additional 4.5 miles. Currently, public use of this scenic area is low, reflecting limited public access and limited parking. Hiking on the Rattlesnake Mountain Trail, which crosses the ROW once, is the primary recreational activity.

3.11.7.3 Transportation Facilities

Alternative B parallels I-90 and crosses it twice, once near Exit 38 East and once near Twin Falls State Park. Because the I-90 corridor is recognized for its natural beauty, is a part of the Mountain-to-Sound Greenway, is a designated Scenic Byway, and its viewshed is managed by the Okanogan-Wenatchee National Forest to protect its scenic qualities, views from this area are considered to be sensitive. Trees and topography obscure the ROW from the highway in some areas, but it is clearly visible in others. (See Appendix S.) The Alternative B existing ROW is also visible to motorists southbound on North Bend Boulevard in North Bend, although the hillside backdrop visually absorbs the towers.

3.11.8 Alternative C (Options C1 and C2)

3.11.8.1 Residential Areas

Option C1 — begins west of the Raver Substation on rolling lands owned by private resource companies and used for commercial forestry. It would be located along unused ROW in an existing 472.5-foot-wide corridor now used by three transmission lines. Existing towers in the area range from 130 to 165 feet tall; the new line's towers would rise about 135 feet. A short section on the north side of this area encompasses the small unincorporated community of Ravensdale, where a small cluster of homes is located around SE Ravensdale Way and 268th Avenue. Additional homes are located along the proposed route north of Kent-Kangley Road, and a large lot subdivision is under development on the west side of SE 268th Ave, across from the proposed alignment.

Where Option C1 turns north, it will follow entirely new ROW. South of Kent-Kangley Road, this will affect only large commercial forest holdings. North of the road, however, the ROW would cross an area that contains two long-established rural communities.

Option C2 — the first part of Option C2, also shared with Alternative A, is described in the first paragraph under Section 3.11.6.1**, Alternative A/Residential Areas.**

Remainder of Alternative C — at the point where it would connect with either Option C1 or C2, heads north on newly cleared ROW from the small Georgetown community through heavily forested land containing rural residences. After crossing the Cedar River, it would encounter an increasing number of homes, including those in the large Maplewood Estates subdivision located west of the proposed alignment and south of 224th Avenue. When the alignment enters the rural community of Hobart, it would cross or be adjacent to more than 25 homes. Before reaching its end point (connecting with the east-west Echo Lake-Maple Valley transmission line), it would cross or run near a small number of homes at the base of Tiger Mountain.

3.11.8.2 Recreation Areas

Option C1 — Recreational facilities along Option C1 (from east to west) include a local school's playing fields.

Option C2 — Recreational facilities along Option C2 (from east to west) include King County Shooting Sports Park along the existing BPA ROW on the east side of 292nd Avenue SE.

Remainder of Alternative C — Recreational facilities and uses along Alternative C (from south to north) include King County's Big Bend Park, which straddles the Cedar River; the regional Cedar River Trail, which would be crossed by the Alternative C ROW; and trails and viewpoints in Tiger Mountain State Forest.

3.11.8.3 Transportation Facilities

Option C1 — Locally important roadways crossed by Option C1 include Kent-Kangley Road and SE Ravensdale Way.

Option C2 — The only locally important roadway crossed by Option C2 is Landsburg Road SE.

Remainder of Alternative C — Important local roadways crossed by Alternative C (from south to north) include SE Summit-Landsburg Road; SE 216th Street; and Issaquah Hobart Road. This portion also crosses Highway 18 at a particularly scenic point featuring Tiger Mountain views and forest vistas.

3.11.9 Alternative D (Options D1 and D2)

3.11.9.1 Residential Areas

Alternative D would parallel (Option D1 on the south side; Option D2 on the north side) the existing Rocky Reach-Maple Valley line from the Stampede Pass area to Echo Lake Substation. Consequently, it would affect the same residences discussed in Section 3.11.7.1**, Alternative B/Residential Areas.** While the width of the existing line's ROW would be widened to 300 feet to accommodate Option D1 or D2's new parallel line, this does not change which residences are affected.

3.11.9.2 Recreation Areas

See Section 3.11.7.2, **Recreation Areas**.

3.11.9.3 Transportation Facilities

See Section 3.11.7.3, **Transportation Facilities**.

3.11.10 Echo Lake Substation Expansion

There are no residences or recreation sites in the Echo Lake Substation vicinity. Dispersed recreation may occur within the surrounding private forestlands. However, it is unlikely much recreation use occurs because motorized access is restricted and difficult. See Section 3.4 for a more detailed discussion. Users in the timberlands would experience a patchwork of recent (within the past 10 years) and older (within the past 40 years) clearcuts.

Echo Lake Substation is accessed from SR 18 by SE 104th Avenue, then Road #35000. The area surrounding the substation is a mixture of early-successional forest and clearcuts. The forest stands comprise evergreen and deciduous trees. The substation is in a shallow valley, with Taylor Mountain visible to the west and Brew Hill visible to the south. Views of Rattlesnake Mountain from this area are blocked by trees.

3.12 Socioeconomics

3.12.1 Existing Population

The project area is located within rural areas of King and Kittitas counties and the incorporated cities of Covington and Maple Valley. Other cities near the project area are North Bend, Snoqualmie and Black Diamond. The routes of most alternatives pass predominantly through forested areas with little population, although there are varying degrees of rural residential and/or denser residential use along each route.

Table 3-7 — Historic Population Growth, 1970 to 2000, State of Washington, Kittitas County, King County Incorporated and Unincorporated Areas, Covington, Maple Valley, Black Diamond, Snoqualmie and North Bend

					1970-2000 Difference	
	1970[1]	1980[1]	1990[1]	2000[2]	Number	Annual Avg. Change
Washington State	3,413,250	4,132,353	4,866,663	5,894,121	2,480,871	1.3%
Kittitas County	25,039	24,877	26,725	33,362	8,323	1.0%
King County	1,156,600	1,269,900	1,507,300	1,686,200	529,600	1.3%
Incorporated Area	748,600	766,500	994,100	1,322,200	573,600	1.9%
Unincorporated Area*	410,700	503,300	513,300	364,000	-46,700	-0.4%
Maple Valley	NA[3]	NA[3]	6,700[2]	12,800	6,100[4]	6.7%[4]
Black Diamond	1,200	1,200	1,400	3,800	2,600	3.9%
Snoqualmie	1,300	1,400	1,500	2,300	1,000	1.9%
North Bend	1,600	1,700	2,600	3,800	2,200	2.9%

* Encompasses the project area
[1] *Source: U.S. Census Bureau (18-21 Decennial Censuses)*
[2] *Source: King County Office of Regional Policy and Planning*
[3] No U.S. Census Bureau data is available for the City of Maple Valley which was incorporated in 1997
[4] Reflects approximate population difference and annual average change over 10-year period from 1990 to 2000

King County is the most populated county in Washington. King County and the state have both experienced substantial increases in their populations since 1960, with growth rates exceeding the national average. Although population growth experienced by King County has been rapid, the state as a whole has been growing at an even faster rate, as shown in Table 3-7.

Population and population growth is distributed unevenly throughout King County. Most King County residents are concentrated in the large Seattle metropolitan area in the western portion of the county. According to the King County Office of Regional Policy and Planning, the county's population growth can be largely attributed to in-migration from other areas (as opposed to natural increase) and most growth is in suburban areas.

Table 3-7 shows the populations of the incorporated and unincorporated areas of King County, Kittitas County, plus the population of Covington, Maple Valley, Black Diamond, Snoqualmie and North Bend. The population growth rates of all the incorporated areas of King County and Covington, Maple Valley, Black Diamond, Snoqualmie, and North Bend have exceeded that of the county as a whole and of the state of Washington. Conversely, the unincorporated portion of King County has experienced a net decrease of nearly 150,000 people in the last decade. According to the King

County Office of Regional Policy and Planning, this net reduction was due primarily to the transfer of population into cities through annexation and incorporation.

In addition to the incorporated communities listed above, several unincorporated residential communities (*e.g.,* Selleck, Kangley, Georgetown, Hobart), plus several other residential enclaves occur within the project area or in the vicinity. The development density of these residential areas is primarily rural in nature, ranging between one dwelling unit per 2.5 acres to one dwelling unit per 23 acres of land. The predominant residential parcel size is five acres. There are a few greater density housing developments within the project area's western portion, along the routes for Alternatives A and C.

The unincorporated residential communities of Selleck and Kangley are located within half mile of the project area and in the proximity of a majority of the proposed alternative routes (Alternatives 1-4, A and Option C2). Selleck, just south of the Watershed, is an historic timber company community that is predominantly comprised of small, single family dwellings laid out along a compact local street grid within a one-square-mile area. The community is directly east of Segment A and north of the existing BPA Schultz-Raver transmission lines. Kangley is contiguous to and south of Selleck. It is generally comprised of more recently constructed single family homes that are dispersed over a slightly larger area than the residences in Selleck.

In addition to the residential developments within half mile of the project area, several other areas of rural residential development occur within the project vicinity. For example, residential developments occur along both sides of Kent-Kangley Road between 276th Avenue SE and Kangley, and additional residences occur east of 276th Avenue SE along the north side of the existing Schultz-Raver lines. The unincorporated community of Hobart is served by 276th Avenue SE, approximately 4-4.5 miles west of the project area. The eastern portion of Hobart, comprised of residential development, extends east of 276th Avenue SE to the western boundary of the Cedar River Watershed. Residential development also occurs within a mile of the project area north and west of Echo Lake Substation. This development is along both sides of I-90 and west of SR 18. Along the route of Alternatives B and D, small pockets of rural residential use are primarily found south of North Bend, near the recreational development at Snoqualmie Pass and around Lake Keechelus. (See the discussion of affected residential areas in Section 3.11, **Visual Resources**.)

The two incorporated areas crossed by Alternatives A and C, the cities of Covington and Maple Valley, contain existing and proposed residential subdivisions and apartments. Within a quarter mile of Alternative A in Maple Valley, at least nine new subdivisions (about

Table 3-8 — Population Forecast, 2000 to 2020, King County and State of Washington

				2000-2020 Difference	
	2000	2010	2020	Number	Annual Avg. Change
Kittitas County	33,362[3]	36,732[3]	41,764[3]	8,402	1.3%
King County	1,686,200[1]	1,856,400[1]	2,132,700[2]	446,500	1.2%
Incorporated	1,322,200[1]	1,433,400[1]	NA	111,200[4]	0.8%[4]
Unincorporated	364,000[1]	423,000[1]	NA	59,000[4]	1.5%[4]
State of Washington	5,803,400[3]	6,566,400[3]	7,455,600[3]	1,652,200	1.3%

[1] *Source: King County Office of Regional Policy and Planning*
[2] *Source: Puget Sound Regional Council*
[3] *Source: State of Washington Office of Financial Management*
[4] *Reflects approximate population difference and annual average change over 10-year period from 2000 to 2010*

1,053 residential units) are either planned or already permitted. The exact route Alternative A will take around Covington Substation has not been decided but it will pass by or through the existing residential subdivisions at the intersection of SE Wax Road and Covington Way SE. The Covington Apartments are currently under construction along the existing ROW. Along Alternative A north of State Route (SR) 18 in Covington, a four-lot short plat called Fox Wood is proposed along the ROW. Three pending subdivisions or short plats (216 units) are located within a quarter mile of Alternative A.

Table 3-9 — Lodging in the Project Vicinity

City	No. of Hotels/Motels	Total No. of Rooms
Auburn	3	197
Enumclaw	1	40
Issaquah	2	203
Kent	7	639
North Bend	3	74
Renton	4	539
Snoqualmie	1	101
Total	21	1,793

Source: AAA Oregon/Washington TourBook, February 1999

3.12.2 Forecast Population

The population and employment forecast prepared by the State of Washington Office of Financial Management (***OFM***) anticipates that recent growth will likely continue for the state, but at a slower rate than recent decades (see Table 3-8). The OFM forecast assumes that Washington's growth rate will likely continue at a faster rate than the United States as a whole, but that the difference between the state and national rates will likely decrease over time. The OFM methodology assumes this convergence of growth rates because of the physical constraints of any area to sustain growth rates beyond the national average for long periods of time. These constraints include availability of land and infrastructure limitations.

3.12.3 Lodging

For the proposed project, BPA would use contractors to clear the ROW, create new access roads, and construct the transmission line. Contractors would also be used for site preparation work at Echo Lake Substation. BPA employees and manufacturer representatives would install electrical components at the expanded substation. Because transmission line construction is highly specialized work, a company from outside the local area would likely be hired, although a company from the Seattle/Tacoma area could also be selected to be the prime contractor on the project.

If a contractor would be retained from outside the local area, sufficient lodging and recreational vehicle (**RV**) sites are available within 20 miles. Table 3-9 lists hotel and motel rooms in the project vicinity.

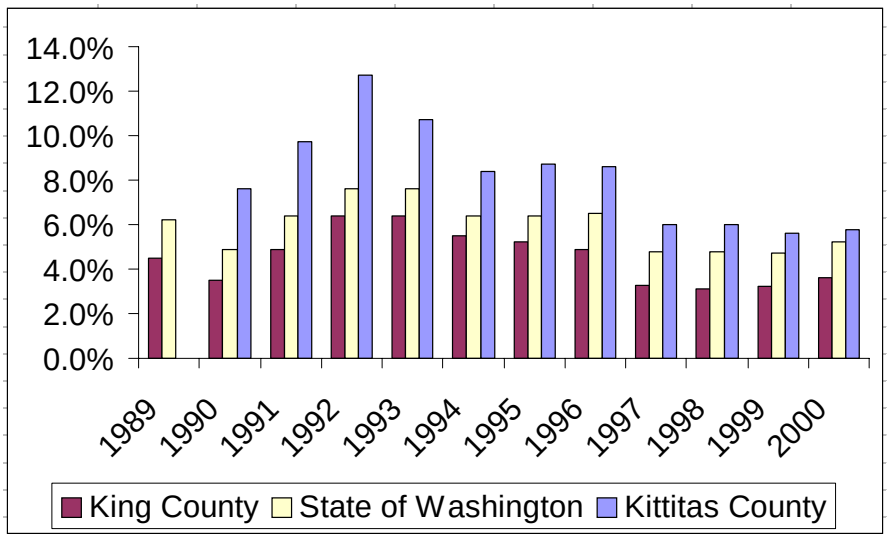
In addition to the lodging in Table 3-9, the Sunrise Resorts/Lake Sawyer RV Park in Black Diamond has 109 RV sites and the Seattle/Tacoma KOA has 116 RV sites. There is one RV park in North Bend and one in Issaquah. There are also hundreds of hotel and motel rooms in the Seattle/Tacoma metropolitan area that are within convenient driving distance of the project site.

3.12.4 Social Characteristics

In general, the age breakdown in King County parallels that of the state.

According to estimates provided by OFM, the average annual covered wage in King County of $47,000 was above the state average annual covered wage of $37,000 in 1999, the latest information available. Average annual covered wage in Kittitas County was $22,400, significantly lower than the state annual coverage wage. Household income in the incorporated communities near the project

Figure 18 — Unemployment Rate Comparison, 1989 to 2000 King and Kittitas Counties



alternatives had fewer households below the poverty level than did King and Kittitas counties as a whole. Eight percent of King County residents and almost 20 percent if Kittitas County residents fell below the poverty level in 1999, the latest information available. This compares to 6.5 percent in North Bend, 4 percent in Covington, and 1.7 percent in Maple Valley.

The ethnicity of the project vicinity is predominantly Caucasian and the remainder primarily African-American, American Indian, Pacific Islander, and Asian. King County as a whole has a higher minority population (greater than 20 percent) than does Kittitas County (11 percent). The project vicinities all have lower percentages of minorities than their respective counties.

Table 3-10 — Total Employment, 1989 to 1999 King and Kittitas Counties

Year	State of Washington		King County		Kittitas County	
	Employment	Growth Rate	Employment	Growth Rate	Employment	Growth Rate
1989	2,046,000		903,800		9,900	
1990	2,142,600	4.7%	942,900	4.3%	10,160	2.6%
1991	2,177,400	1.6%	942,700	0.0%	10,340	1.8%
1992	2,221,900	2.0%	952,200	1.0%	10,530	1.8%
1993	2,251,800	1.3%	948,700	-0.4%	10,790	2.5%
1994	2,304,300	2.3%	957,400	0.9%	11,310	4.8%
1995	2,347,000	1.9%	978,300	2.2%	11,990	6.0%
1996	2,416,000	2.9%	1,018,300	4.1%	12,060	0.6%
1997	2,514,000	4.1%	1,073,300	5.4%	12,310	2.1%
1998	2,594,700	3.2%	1,119,700	4.3%	12,280	-0.2%
1999	2,648,700	2.1%	1,151,000	2.8%	12,380	0.8%

Source: State of Washigton Employment Security Department

3.12.5 Employment

The main economic activities in King County are manufacturing, shipping and trade, agriculture, business services, shipbuilding, fishing, wood products, and tourism. Total employment in King County has grown gradually over the past six years, with unemployment rates dropping from their high rates of 6.4 percent in 1992 and 1993. Figure 18 compares the unemployment rates for King and Kittitas counties to the statewide average from 1989 through 2000. King County has consistently had lower rates of unemployment than the statewide average during the last decade.

Total employment has generally expanded over the last decade, with the economy recovering strongly from the lag at the end of the 1980s (see Table 3-10). The current economic slowdown does not show in this data set, but overall unemployment does tip up in 2000, as shown in Figure 18. Total employment reached 1.15 million for King County and 12,380 for Kittitas County in 1999.

The distribution of jobs in King and Kittitas counties is displayed in Table 3-11. Employment in King County is nearly one-third in services, slightly higher than the distribution of employment for the state of Washington as a whole, with nearly 28 percent of all jobs in the state attributable to the services sector. This sector is dominated by the business services industry, which accounts for nearly one-third of King County's services sector jobs. Government employment is the dominant sector in Kittitas County.

Another dominant industry group for King County is agriculture, forestry, and fishing. Due to the difficultly reporting employment in these industries because of its seasonal and transient nature, it is also an industry group not typically included in employment forecasts.

According to forecasts the OFM, net job growth in King County and the state of Washington will likely be primarily in the non-manufacturing industry groups, especially within the services and retail trade sectors. Although growth is expected in the state's manufacturing sector, it is expected to lag behind growth in non-manufacturing sectors. The employment forecast data provided by OFM indicates that the

Table 3-11 — Non-Agricultural Employment by Industry Group, 1999 King and Kittitas Counties

	Construction & Mining	Manufacturing	Trans., Comm., & Utilities	Trade	Finace, Insurance, Real Estate	Services	Government	Total
State of Washington	157,000	364,200	139,800	636,100	137,600	739,700	474,300	2,648,700
Kittitas County	460	700	530	2,400	270	2,110	4,900	11,370
King County	62,400	152,800	76,900	273,500	73,800	360,600	150,900	1,150,900

Source: State of Washington Employment Security Department

services industry group, the fastest-growing industry group, is expected to account for more than 40 percent of the net new jobs created between 2000 and year 2020.

Declining business opportunities in the manufacturing sector have resulted in slower growth of manufacturing jobs. Those are traditionally higher paying than jobs in the retail trade in King County and the state as a whole, and higher paying than service sector jobs in the state overall.

One indicator of the type of wage an industry provides is average annual payroll (total covered payroll divided by total number of employees in that industry group). Average wages for all industries are higher for King County than the statewide average. Wage differentials between King County and the statewide average are largest in the relatively high-paying services industry group.

More socioeconomic information can be found in Appendix T.

3.13 Cultural Resources

The project area is rich in cultural history. Portions of the project area have been and continue to be used traditionally by members of many Indian tribes. Members have used the area for camping, fishing, hunting, gathering berries, trading with other tribes and as a traveling route (SPU, 2000).

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Traditional cultural properties *— A traditional cultural property is defined generally as one that is eligible for inclusion in the National Register of Historic Places because of its association with cultural practices or beliefs (*e.g., *traditions, beliefs, practices, lifeways, arts, crafts, and social institutions) of a living community that are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community.*

BPA has asked potentially affected tribes to identify tribal concerns about potential ***traditional cultural properties*** (**TCP**s) (locations that may not contain physical remains, but hold heritage importance for their association with cultural traditions) within the project area. The corridors for Alternatives B and D, for example, contain previously identified TCPs near Rattlesnake Mountain and in the Snoqualmie River drainage. Another traditional cultural use site, Lookout Mountain, occurs within the Cedar River Watershed, but is more than one mile from any of the alternatives (SPU 1999:3.6-4).

Other existing cultural resource sites, prehistoric and historic, described in various records and literature were researched. No registered historic sites — structures or districts — are located within a quarter mile of the proposed ROW for each alternative, although three are located within one mile of one or more of the alternatives. The Selleck National Historic District, for example, is the closest cultural resource site and is separated from Alternative 2 by a road and more than 700 feet. Of the cultural resources identified through archival and map research, only the Barneston townsite (including Hemlock and the related Japanese settlement) and the Pedro Felise cabin occur on or within the 150-foot right-of-way of BPA's proposed alternative routes. Field reconnaissance conducted at the Barneston site observed a mill pond depression and a scatter of associated historic debris (Getz

1987:44). Getz did not observe cultural materials in her 1986 visit to the Hemlock/Japanese Camp, although a logger found a Japanese coin there in 1984 (Getz 1987:44). The Pedro Felise cabin, observed on the 1895 GLO map but not found by appraisers in 1909–1911, was located within the ROW granted to BPA in 1941 and is thought to have been destroyed during the construction of the Raver-Echo Lake Transmission Line (Getz 1986).

Former routes of old logging railroads can also be considered culturally sensitive. The Green River and Northern Railroad is listed on the 1893 Government Land Office map within the vicinity of the Proposed Action, although it is not listed on the SPU Geographic Information System (**GIS**) layer map. Getz lists eight other railroads that were present at one time in the Watershed, but states that few remnants of the logging railroads remain, as most have been replaced by graded roads or are now well forested (Getz 1987:45).

The probability for encountering prehistoric cultural resources along any of the alternatives varies by landform (more common in flat than steep areas) and increases along the Cedar River and other water sources (streams, lakes, wetlands). Due to the landforms crossed by the alternatives, there is a high probability of encountering these resources in the general project area. There is also a high probability of encountering many historic-period cultural resources despite the fact that few recorded resources are in the immediate vicinity of the alternatives. Many such resources have been identified in archival sources and maps, although few have been formally inventoried or even verified on the ground by cultural resource professionals.

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Culturally modified tree (CMT) *— A tree that has been altered by native people as part of their traditional use of the forest. Non-native people also have altered trees, and it is sometimes difficult to determine if an alteration (modification) is of native or non-native origin. However, the term is commonly used to refer to trees modified by native people in the course of traditional tree utilization.*

A portion of the Proposed Action outside the CRW was surveyed for ***culturally modified trees*** (**CMTs**). No CMTs were located during the survey. Most of the forested area that was surveyed has been cut, so the potential to find CMTs was low. Subsequently, during the cultural resource survey for the proposed project, a survey was also conducted for culturally modified trees in the CRW both on the proposed right-of-way as well as adjacent to the proposed right-of-way. No culturally modified trees were identified.

3.14 Noise, Public Health and Safety

Transmission facilities provide electricity for heating, lighting, and other services essential for public health and safety. These same facilities can potentially harm humans. Contact with transmission lines can injure people and damage aircraft. This section describes public health and safety concerns, such as shocks and noise related to transmission lines, as well as other electric and magnetic field (**EMF**) effects.

3.14.1 Noise

3.14.1.1 Transmission-line Noise

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Corona *— Corona occurs in regions of high electric field strength on conductors, insulators, and hardware when sufficient energy is imparted to charged particles to cause ionization (molecular breakdown) of the air.*

Audible noise (**AN**) can be produced by transmission-line ***corona***. Corona is the partial electrical breakdown of the insulating properties of air around the conductors of a transmission line. Corona-generated AN can be characterized as a hissing, crackling sound that, under certain conditions, is accompanied by a 120-***Hertz*** (Hz) hum.

AN from transmission lines is generally a foul-weather (wet-conductor) phenomenon. Wet conductors can occur during periods of rain, fog, snow, or icing. Based on meteorologic records near the route of the proposed transmission line, such conditions are expected to occur less than 9 percent of the time during the year.

Environmental noise, including transmission-line noise, is usually measured in decibels on the A-scale (**dBA**), which models the sound to correspond to human perception. Table 3-12 shows AN levels expressed in dBA for various common sources. Clearly, there is wide variation. Noise exposure depends on how much time an individual spends in different locations.

AN levels and, in particular, corona-generated AN vary in 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. Thus, L_{50} refers to the sound level exceeded 50 percent of the time and represents a median level.

Table 3-12 — 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 – 51	Edge of proposed 500-kV ROW during rain
40	Refrigerator
25	Bedroom at night
0	Hearing threshold

*Decibels (A-weighted)

Source: Lee et al., 1996

Along the alternative routes of the proposed 500-kV transmission line, existing AN levels depend on land use and on whether there is an existing transmission line. Background levels of AN in remote areas depend on ambient conditions: whether the wind is blowing, whether it is raining, whether there is traffic or other human activity nearby. For example, levels associated with rain on foliage will be up to 50 dBA. Audible noise from existing lines along the proposed corridors depends on the voltage of the line. Median (L50) levels during foul weather at the edge of existing ROWs are about 44 dBA for 230-kV lines, and 50 dBA for a short section of 500-kV line.

The BPA design criterion for corona-generated audible noise (L_{50}, foul weather) is 50 ±2 dBA at the edge of the right-of-way (Perry, 1982). The Washington Administrative Code provides noise limitations by class of property, residential, commercial or industrial (Washington State, 1975). Transmission lines are classified as industrial and may cause a maximum permissible noise level of 60 dBA to intrude into residential property. During nighttime hours (10 p.m. to 7 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 has encouraged BPA to design lines with lower audible noise levels (WDOE, 1981).

King County has noise regulations for maximum permissible sound levels that include the state levels but add an additional category for districts receiving or sending noise. In addition to industrial, commercial, and residential areas, the county defines a rural area where the maximum sound arising/affecting from an industrial area (say, a transmission line) is limited to 57 dBA, with a reduction to 47 dBA during the hours of 10 p.m. and 7 a.m. weekdays and 10 p.m. and 9 a.m. weekends and holidays (King County, 1992). Kittitas County has similar noise ordinances, however, the area affected in Kittitas County is predominantly zoned Forest with very few residences.

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 nighttime noise between the hours of 10 p.m. and 7 a.m.

3.14.1.2 Substation Noise

Noise near existing substations depends on the surrounding land use and the equipment in the substation. Audible noise produced by substation equipment (not the connecting transmission lines) is generally associated with transformers in a substation. Echo Lake Substation does not have transformers.

Echo Lake Substation is in an isolated rural area where it is relatively quiet and where existing noise levels depend on weather conditions and vehicles or equipment operating in the area.

3.14.2 Electric and Magnetic Fields (EMF)

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

EMF 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 some electrical appliances such as electric blankets.

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*A **milligauss** is one thousandth of a gauss. A **gauss** is a unit of magnetic induction.*

Average magnetic-field strength in most homes (away from electrical appliances and home wiring, etc.) is less than 2 ***milligauss*** (***mG***). Very close to appliances carrying high current, fields of tens or hundreds of milligauss can be present. Unlike electric fields, magnetic fields from outside power lines are not reduced in strength by trees and building materials. So, transmission or distribution lines can be a major source of magnetic-field exposure throughout a home located close to the line.

3.14.2.1 Transmission Lines

Magnetic fields within transmission-line corridors constantly increase and decrease for a variety of reasons. If electric loads on a line increase, magnetic fields also increase. Magnetic fields are typically greatest in winter months, when electrical demands are highest. Operational, meteorological, and line design factors also affect magnetic fields. Fields are higher when the line is physically lower (closer to the ground) either because of design or because of higher temperatures. Since the voltage on transmission lines is relatively constant, the electric-field strength is dependent primarily on height above ground, and is more constant than magnetic-field strength. Thus, predicting exact electric- and magnetic-field strengths involves uncertainty. Nevertheless, it is possible to estimate EMF for specific transmission-line conditions (maximum voltage, maximum load, and minimum height) that place upper limits on the field strengths that will actually be found under specific lines.

Information about EMF levels for the existing transmission lines in the project area are in Appendix E. Appendix E also describes how levels are determined.

3.14.2.2 Regulations and Guidelines

There are no national standards for EMF from power facilities such as transmission lines nor does the state of Washington have a standard. BPA has an electric field standard of 9kV/m maximum on the ROW and 5kV/m at the edge of the ROW. More information about standards is in Appendix E.

3.14.3 Toxic and Hazardous Substances

3.14.3.1 Operations

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

3.14.3.2 Substation Equipment

Echo Lake Substation has a single station service transformer that does not require an oil containment system. The equipment at Echo Lake Substation does not contain PCB-contaminated oil. There is an ***oil spill containment*** system at Echo Lake Substation for the oil tank that holds fuel for the emergency diesel generator. BPA does have a Spill Prevention Control and Countermeasure Plan that puts in place protocols and procedures for response in case a spill occurs.

3.14.3.3 Right-of-Way Vegetation Management

BPA manages vegetation on its rights-of-way and substation sites to ensure electricity from lines or equipment cannot arc to a too-close object and cause an outage, fire or injury to maintenance crews and the public. BPA has examined its entire vegetation management program and taken steps to determine control methods and mitigation measures appropriate for any given vegetation control project (Transmission System Vegetation Management, FEIS 2000.) Four techniques are used to control vegetation: manual (hand-cutting with chainsaws, for instance), mechanical (big brush-cutters and mowers), biological (using insects that like to eat certain noxious weeds such as gorse), and chemical (herbicides).

Herbicides are used sparingly and in combination with other techniques on ROWs. Vegetation within substations is removed with herbicides to prevent nuisance and serious shock hazards to workers.

The health and safety issues associated with herbicides relate to toxicity and potential long-term effects on those who apply them, and potentially on those others who might cross the ROW after application. BPA uses only a limited number of herbicides. All herbicides used by BPA must be approved by the EPA and must also go through a BPA environmental review process. Although all but one (picloram) of the herbicides used by BPA can be bought and used by an untrained person, only trained crew members are allowed to apply herbicides, and they are required by law to follow the directions for use and disposal that are placed on each container.

Herbicides are not used in the Cedar River Watershed.

3.14.4 Fire

The City of Seattle permits fire suppression activities in the Cedar River Watershed and requires that activities in the Watershed follow strict fire control regulations. This policy is consistent with safe and reliable operation of the existing transmission lines.

The USFS and Weyerhaeuser require that vehicles traveling and working on their land carry fire suppression tools during the fire season. All BPA vehicles used for maintenance of transmission lines are equipped with such tools.

Fires on or near the ROW can jeopardize safe and reliable operation of transmission lines. Besides physical damage from heat and flames, smoke and hot gases from a fire can cause arcing between lines, between lines and a tower, or between lines and the ground. Such occurrences can pose a threat to the safety of personnel in the vicinity, such as firefighters, and can result in line outages.

To prevent fires and other hazards, safe clearances are maintained between the tops of trees and the existing lines in the corridors. Electricity can arc from the conductor to a tree top. Generally, trees are not allowed to grow over 20 feet high on the ROW. Trees that need to be cleared from the ROW or that could cause such an arc are removed. BPA also prohibits storage of flammable materials on its ROWs.

Transmission towers are tall structures that may be struck by lightning. Because the towers are electrically grounded, the current from the lightning strike passes directly into the ground, with minimal risk of starting a fire.

3.14.5 Radio/TV Interference

Corona on transmission-line conductors can also generate electromagnetic noise in the frequency bands used for radio and

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EMI *(electromagnetic interference) is a high-frequency noise caused by corona that can cause radio and television interference.*

television signals. The noise can cause radio and television interference (**RI** and **TVI**). In certain circumstances, corona-generated electromagnetic interference (**EMI**) can also affect communications systems and other sensitive receivers. Interference with electromagnetic signals by corona-generated noise is generally associated with lines operating at voltages of 345-kV or higher. This is especially true of interference with television signals. The three-conductor bundle design of the proposed 500-kV line is intended to mitigate corona generation and 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.

No state has limits for either RI or TVI. In the United States, electromagnetic interference from power transmission systems is governed by the Federal Communications Commission (**FCC**) Rules and Regulations presently in existence (Federal Communications Commission, 1988). A power transmission system falls into the FCC category of "***incidental radiation device***," which is defined as "a device that radiates radio frequency energy during the course of its operation although the device is not intentionally designed to generate radio frequency energy." Such a device "shall be operated so that the radio frequency energy that is emitted does not cause harmful interference. In the event that harmful interference is caused, the operator of the device shall promptly take steps to eliminate the harmful interference." For purposes of these regulations, harmful interference is defined as: "any emission, radiation or induction which endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radio communication service operating in accordance with this chapter" (Federal Communications Commission, 1988: Vol. II, part 15. 47 CFR, Ch. 1).

Electric power companies have been able to work quite well under the present FCC rule because harmful interference can generally be eliminated. It has been estimated that more than 95 percent of power line sources that cause interference are due to gap-type discharges. These can be found and completely eliminated, when required to prevent interference (USDOE, 1980). Complaints related to corona-generated interference occur infrequently. This is especially true with the advent of cable television and satellite television, which are not subject to corona-generated interference. Mitigation of corona-generated interference with conventional radio and television receivers can be accomplished in several ways, such as use of a directional antenna or relocation of an existing antenna (USDOE, 1977; USDOE, 1980; Loftness et al., 1981).

3.14.5.1 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 Institute of Electrical and Electronics Engineers, Inc. (***IEEE***) Radio Noise Design Guide identifies an acceptable limit of fair-weather RI as expressed in decibels above 1 microvolt per meter (dBmV/m) of about 40 dBmV/m at 100 feet 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 dBmV/m higher than average fair-weather levels.

3.14.5.2 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 feet of a line. As is the case for RI, gap sources on distribution and low-voltage transmission lines are the principal observed sources of TVI. The use of modern hardware and construction practices for the proposed line would minimize such sources.

3.15 Air Quality

The U.S. Environmental Protection Agency (**EPA**) uses six "criteria pollutants" as indicators of air quality and has established for each of them a maximum concentration above which adverse effects on human health may occur. These threshold concentrations are called National Ambient Air Quality Standards (**NAAQS**). When an area does not meet the air quality standards for one of the criteria pollutants, it may be designated as ***non-attainment***.

King County, inclusive of the project area, is designated as a marginal ozone maintenance area, a moderate carbon monoxide maintenance area, and a moderate particulate matter maintenance area. A maintenance area designation means that King County is not currently but was previously listed as a non-attainment area for these three pollutants but had not exceeded the NAAQS for the three years prior to its designation as a maintenance area. Alternatives B and D cross over the Cascade Mountains and would be located in Kittitas County as well as King County. Kittitas County is an attainment area; the NAAQS are met for all criteria pollutants in Kittitas County.

Chapter 4 — Environmental Consequences

In this Chapter:

- Specific impacts from alternatives
- Proposed mitigation
- Cumulative impacts
- Comparison of alternatives

This chapter discusses the potential impacts of the alternatives on the environment. To analyze potential impacts from construction, operation and maintenance activities, resource specialists analyzed actions using a scale with four impact levels: **high**, **moderate**, **low** and **no** impact. Definitions of the impact levels vary with each resource. Most impact definitions are given in the first part of each resource discussion.

Specialists considered direct and indirect impacts in the short and long term. Direct impacts are caused by the action and occur at the same time and place. Indirect impacts are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Impacts can be beneficial or adverse. The impact discussion lists mitigation that could reduce impacts and ***cumulative impacts*** of the alternatives. Cumulative impacts are the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions. Foreseeable future actions can be undertaken by federal or non-federal entities. Foreseeable future actions considered in the project area include the following:

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Cumulative impact — *Cumulative impacts are created by the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions.*

- Interstate-90 widening from four lanes to six lanes between Easton and Hyak in 2005;
- commercial forest thinning projects on National Forest lands (I-90 Thin, 246 acres);
- development of lots currently impacted by transmission lines;
- expansion of the Snoqualmie Pass ski areas;
- expansion of summer use of ski areas for mountain biking, concerts, and hiking
- future logging of private timberlands;
- continued urban growth in the Puget Sound area;
- widening of State Route 18 from two lanes to four lanes between Maple Valley and I-90 in 2006–2009.

The level of detail for each affected resource depends on the

character of that resource, the importance of the issue, and the scale of analysis most relevant for the affected resource. Additional detail and maps can be found in appendices.

4.1 Land Use

4.1.1 Impact Levels

Land use impacts would be considered **high** where transmission facilities would:

- Require acquisition of new right-of-way (**ROW**) and access roads and installation of new structures outside of existing electrical transmission corridors, precluding existing or planned use of land in an area not previously directly affected by the presence of electrical transmission lines

Displace five or more residences. Impacts would be considered **moderate** where transmission facilities would:

- Require acquisition of new ROW and access roads and installation of new structures outside of but immediately adjacent to existing electrical transmission corridors, precluding existing or planned use of land in an area already affected by the presence of electrical transmission lines.
- Displace between one and four residences.

Impacts would be considered **low** where transmission facilities would:

- Occupy existing ROW and access roads and require rebuilding or replacement of existing structures or the installation of new structures requiring adjustment of established or planned use of land within the existing ROW.
- Displace no residences.

4.1.2 Transmission Alternatives

The impacts associated with the conversion of one land use to another are addressed in this section. No comprehensive plan or zone changes would be required to site any of the proposed alternatives since utility facilities are either a permitted or a conditional use in all land use zones crossed by those alternatives.

Where access to a transmission line already exists, access along any alternative would be from existing access roads serving an existing BPA line, where possible. Where this is not the case, BPA would acquire access rights and develop and maintain permanent access for travel by wheeled vehicles to each structure. Access road requirements are

described in Section 2.1.1.5. Each alternative would require construction of some new access roads (including spur roads). BPA has estimated the number of miles of new access roads that would be needed for each alternative. New access roads would generally have a minimal impact to the transportation system because they would be secured by locked gates and/or located in areas where motorized vehicle access is restricted (e.g., Cedar River Municipal Watershed, private and DNR timberlands). In more remote areas, impacts may be more substantial if gates are vandalized and road closures violated.

The presence of BPA ROW and transmission lines has varied impacts on lands accommodating or planned for different uses. Land currently managed for timber production would be converted from that use within the entire ROW. Other uses, however, would be accommodated within the cleared areas of the ROW when timber management for commercial harvest is no longer possible. The same would be true for land managed for the protection or enhancement of late-successional forests or old-growth timber stands. Some land uses, such as farming or recreation, may continue to be used in much the same way within the ROW as it would be if the ROW did not exist. Lands used for grazing of livestock could continue to be used in the same way. Concerns about livestock security due to increased access can be mitigated by active road management (i.e., using gates). Visual impacts or disturbance related to noise created by transmission lines is possible, but the actual conversion of the land would occur only in those areas occupied by tower structures or access roads.

4.1.3 Proposed Action

The Proposed Action would cross 12 tax lots comprised of forestland, a municipal watershed and rural residential land. One parcel is owned by BPA. By far the predominant use is forest (which may also be used for watershed protection), in terms of overall area that would be converted.

The Proposed Action traverses a rural-residential area west of the communities of Kangley and Selleck. Two residences and a small barn are within 75 feet of the centerline of Segment A. All three structures would be displaced. No other residences would be displaced; however, the alternative would prevent the development of one lot of a four-lot subdivision.

The Proposed Action would require about 2.9 miles of new access roads. BPA would also obliterate and abandon about 0.6 mile of existing roads.

Because the Proposed Action would convert approximately 0.02 percent of land designated for forest uses in King County and 0.1 percent of land within the Cedar River Watershed (about 90 acres),

its impact would be low if only the conversion were considered. However, because the Proposed Action would displace two residences, the overall long-term impact would be **moderate**.

4.1.4 Alternative 2

Alternative 2 would not convert any land designated for rural residential uses. It would cross eight tax lots (one owned by BPA) designated for forest uses, including land within the Cedar River Municipal Watershed.

Under Alternative 2, about 2.7 miles of new access roads would be needed. BPA would also obliterate and abandon about 0.6 mile of existing roads. No residences would be displaced. Alternative 2 would result in a **low** impact.

4.1.5 Alternative 3

Alternative 3 would only cross six tax lots (one owned by BPA) designated for forest uses and land within the Cedar River Watershed. It skirts an area of privately-owned land just north of the Watershed that contains several residences, though the area is designated for forest uses.

About 6.4 miles of new access roads would be needed. No existing access roads would be abandoned. Alternative 3 would convert about 0.02 percent of land designated for forest uses in King County and about 0.11 percent of land within the Cedar River Watershed. No residences would be displaced, although two residences are within 650 feet of the proposed ROW for Alternative 3, on the west side of the route alignment. To minimize impacts on those residences and other residences in the Halmar Gates area, the transmission line could be placed in the eastern portion of the corridor. Based on the land use conversions, Alternative 3 would have a **low** impact.

4.1.6 Alternative 4A

Similar to Alternatives 2 and 3, Alternative 4A would not convert any areas designated for rural-residential uses to transmission facilities. Alternative 4A crosses nine tax lots (one owned by BPA), converting only land designated for forest uses and including land within the Cedar River Watershed. About 2.7 miles of new access roads would be needed. BPA would also abandon about 0.6 mile of existing roads. Land-use impacts would be similar to those under Alternatives 2 and 3. About 0.02 percent of land designated for forest uses in King County and about 0.11 percent of land within the Cedar River Watershed (about 95 acres) would be converted to transmission facility uses. No residences would be displaced. Alternative 4A would have a **low** impact.

4.1.7 Alternative 4B

Alternative 4B would not convert any areas designated for rural-residential uses to transmission facilities. Like Alternative 4A, Alternative 4B crosses nine tax lots (one owned by BPA), converting only land designated for forest uses and land within the Cedar River Watershed.

About 2.2 miles of new access roads would be needed. BPA would also obliterate and abandon about 0.6 mile of existing roads. Alternative 4B would not displace any residences. It would convert about 0.02 percent of land designated for forest uses in King County and about 0.12 percent of land within the Cedar River Watershed (about 100 acres). The land use impact of Alternative 4B would be **low**.

4.1.8 Alternative A

Most of the 20-mile length of Alternative A would be accommodated within existing ROWs, requiring less ground disturbance and vegetation clearing than construction in a new ROW. Alternative A crosses a variety of land use zones, including rural and urban residential; neighborhood, regional and commercial business; and industrial.

The transmission line would need to be routed around Covington Substation. There are two possible routes around the substation: one location would be located mostly on BPA owned property (Option A1); the other located on new ROW beyond the eastern edge of BPA's substation property.

Option A1 would displace up to three homes located on private property just east of the substation. It may also occupy an area where BPA was planning to construct a new large maintenance headquarters building. The maintenance building could be constructed in another area at a much higher cost ($1,500,000 to $2,000,000 more) due to inefficiencies of communication cables, utilities, and other factors. In addition, personnel currently in an old maintenance/storage building would need to be moved to another, likely new, building, because the new line would be located right over the top of the existing maintenance/storage building. BPA would still retain the existing building for storage. If the new maintenance headquarters building is not constructed soon, then a new building for the displaced crew would have to be constructed adding to the cost of this option (another $500,000). Also an existing helicopter landing site would have to be moved to another location at the substation. There are also concerns about impacts to water mains and gas lines. Alternative A, with Option A1 would have a **moderate** land use impact.

Location of the transmission line outside existing BPA-owned land around Covington Substation would affect as many as 25 homes and

two tax lots in the subdivision located at the corner of SE Wax Road and Covington Way. For this reason alone, Alternative A would have a **high** land use impact. No other portion of this alternative would require new ROW. In all, this alternative would directly affect more than 400 tax lots along its length. As many as 240 of these tax lots are developed.

Impacts along this alternative would not be limited to displaced residents. Careful coordination would be required to maintain the circulation pattern in and out of the commercial development in Covington and the parking area at the new Covington Apartments now under construction. Though specific location of towers through the proposed ball fields and around the bus barn in Maple Valley would be planned to create the least disruption possible to existing plans and to ensure impacts to proposed land uses are minimized, concerns about build-up of static electricity under the proposed lines may cause the city to decide to relocate school bus parking to another site.

Many small buildings within the existing ROW (vacant and occupied) would have to be removed. Residents have extensively used the ROW as part of their back yards. As a general rule, no buildings are allowed within a ROW occupied by a BPA transmission line for safety purposes. This would also include a large building within the vacant ROW at Elk Run Golf Course.

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See Appendix L for information about Alternatives A–D.

4.1.9 Alternative B

Alternative B would require rebuilding the existing transmission facility within existing ROW, allowing less ground disturbance and vegetation clearing than construction in new ROW. This alternative crosses predominantly land zoned for forest use and some limited rural residential land and would not displace any dwellings. Alternative B would be considered to have **low** land use impact. The approximate 35.6-mile length of Alternative B does cross more than 110 tax lots, at least 20 of which are developed. Clearing of danger trees would impact tax lots adjacent to the existing ROW. Some access roads would need to be acquired to access the new structures. This alternative would not be consistent with the Northwest Forest Plan if aquatic conservation strategy objectives were not met in riparian reserves. This alternative is consistent with recommendations for corridor locations in the Western Regional Corridor Study (Sierra Pacific 1992).

4.1.10 Alternative C (Options C1 and C2)

Option C1 — The north-south segment of Alternative C, which is common to both Options C1 and C2, would require clearing of new ROW. It runs almost entirely through rural residential land and would displace between 23 and 28 dwellings. The impact would cause a **high** land use impact. The rest of Option C1, also requiring newly-cleared

ROW, runs across more rural residential and some forestland. This option could displace an additional seven dwellings (total of 30 to 35 homes for this option). Overall, Option C1 would have a **high** land use impact. In all, the 10.1-mile length of Option C1 could cross 128 tax lots, at least 54 of which are developed.

Option C2 — Option C2 does not displace any additional homes beyond the 23–28 displaced along the north-south portion. Along its 10.6-mile length, it would cross mainly rural residential land (including 134 tax lots, of which 56 are developed), but also some forestland zoned for mineral extraction. Option C2 would have a **high** land use impact.

4.1.11 Alternative D (Options D1 and D2)

Option D1 — Option D1 would require acquisition of additional ROW across land predominantly zoned forest, but also some rural residential areas. Clearing of these new ROWS would conflict with National Forest land management goals outlined for the area by the Northwest Forest Plan and Snoqualmie Pass Adaptive Management Area Plan. Specifically, clearing of vegetation would not meet the intent of managing for late-successional habitat and maintenance of connectivity emphasis areas on National Forest lands. Aquatic conservation strategy objectives are also not likely to be met. However, this alternative is consistent with corridor locations outlined in the Western Regional Corridor Study (Sierra Pacific 1992), which the Forest Service uses as a guidance document for new corridor locations.

Option D1 would displace between 11 and 14 homes and possibly prevent development on up to five additional unused tax lots as a result of easement expansion south of the existing line. Along its 35.6-mile length, this alternative would cross more than 134 tax lots, at least 32 of which are developed. Clearing of danger trees would impact tax lots adjacent to the new ROW.

Additional land use concerns along this option include potential impacts to existing cabins and lots at Roaring Creek, a development west of Lake Keechelus. The new line would also directly conflict with the new North Bend Gravel Mine that is proposed by Cadman on Weyerhaeuser land east of North Bend. This option would likely have a **high** land use impact.

Option D2 — Land use impacts related to Option D2 would be similar to Option D1, although less new ROW would be required since a portion of the ROW already has sufficient width to accommodate an additional transmission line near the ski areas at Snoqualmie Pass. It would cross a minimum of 121 tax lots, at least 22 of which are developed. Clearing of danger trees would impact tax lots adjacent to the new ROW. Option D2 would displace about eight homes and would have a **high** land use impact.

4.1.12 Non-Transmission Alternative

The Non-Transmission Alternative — a delay in the construction of the transmission line for up to three years — could be possible if sufficient load relief could be provided by the aluminum smelter and local industries, sufficient local generation is available, and the rate of load growth does not exceed the net gain from these two resources. If load growth is greater than anticipated, or if there is less load relief than needed, the transmission line would be needed sooner. If there is less load growth and equal or greater load relief, then the need for a new transmission line could be deferred more than three years.

Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

4.1.13 No Action Alternative

If the transmission line is not built at any time, now or in the future, land in existing or designated areas for forest management, watershed protection, or residential use would not be converted to transmission facility use for the BPA ROW and substation expansion for the foreseeable future, and **no** land use impacts would occur.

4.1.14 Short-Term (Construction) Impacts

4.1.14.1 Transmission Alternatives

For each of the transmission alternatives, short-term (construction-related) impacts could temporarily interfere with or diminish the primary use of surrounding properties. Construction-related impacts are often referred to as "nuisance impacts" and would be similar for the alternatives. They would be considered adverse but of **low** impact because of their short-term nature. Construction-related impacts typically include increased noise, dust generation and erosion. They can usually be mitigated through noise mitigation measures, erosion and dust control measures, and revegetation of disturbed areas.

Construction impacts on forest uses and within the Cedar River Municipal Watershed would primarily include increased erosion, damage to timber outside the ROW, and noise and disturbance impacts on surrounding wildlife habitat. Such impacts can be mitigated, though additional measures may be required when construction occurs in the vicinity of ***sensitive species*** or their habitats. Short-term impacts to rural residential uses would result from the dust and noise from construction

equipment and increased traffic on local roads as contractors move materials to and from the construction site.

4.1.14.2 Non-Transmission and No Action Alternatives

Under the Non-Transmission or No Action Alternatives, there would be **no** short-term construction-related impacts.

4.1.15 Mitigation Measures

Some actions BPA could take to mitigate some of the land use impacts include:

- adjusting line and tower locations to avoid impacting subdivision lots and rural residential dwellings where possible;
- building new permanent access roads along the edges of clearings, pastures or small farms as much as possible to minimize disturbance of these uses;
- closely coordinating with and notifying landowners or land managers regarding work scheduling and associated impacts;
- where cattle, horses, and other livestock are present, ensure gates and fences remain closed during construction and maintenance activities;
- considering special agreements with rural landowners to allow growing of ornamental and orchard trees or other crops that do not interfere with operation or maintenance of the facilities on the ROW;
- providing relocation services and benefits pursuant to Public Law 91-646 and other related regulations to affected owner occupants, tenants, and businesses, ensuring that the eligible parties have a good understanding of the relocation process and assist these parties in filing claims for relocation benefits;
- locating access roads on existing public and private roadways.

4.1.16 Cumulative Impacts

Cumulative land use impacts of the new transmission line and substation expansion would be additive to those associated with past, present and reasonably foreseeable future projects in the project vicinity. Table 4-1 lists the degree to which each alternative may have an additive effect with a particular action. If there is no change to land use, then no impact is displayed. Logging on private timberlands is not shown because this action would not represent a change to existing land use.

Future actions that impact land use are least likely to occur in the Cedar River Municipal Watershed and on National Forest lands because these areas are protected and any new land uses are highly regulated. The alternatives that are predominantly within the Cedar River Watershed, and within the city of Seattle's Habitat Conservation Plan, have **low** cumulative effects, except for Alternative 1 (the Proposed Action), which has a **moderate** effect because it would have a direct effect of displacing two residences. Alternatives B and D that cross National Forest land have higher cumulative effects because of cumulative effects outside of National Forest boundaries. These alternatives cross a large number of tax lots outside of National Forest land that could be developed. Therefore, Alternative B would have **moderate** cumulative effects and Alternative D **high** cumulative effects because of direct impacts associated with their construction.

There are **high** cumulative effects associated with Alternatives A and C due to direct impacts associated with these alternatives, moderate levels of existing development and future potential development, and population pressures from the Puget Sound area which are likely to result in development of vacant lots and widening and construction of streets and highways. However, BPA is not aware of any particular projects with significant impacts that are in advanced planning stages, or otherwise reasonably certain to occur along these ROWs.

The No Action Alternative would have an indirect cumulative effect on land use. If electricity demand exceeds supply in the future,

Table 4-1 — Cumulative Land Use Impacts

Past, present and future projects	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4A**	**Alt 4B**	**Alt A**	**Alt B**	**Alt C**	**Alt D**
Effect of proposed alternative on land uses	**	*	*	*	*	***	*	***	***
Existing transmission lines	*	*		*	*	0	*		*
Existing level of development	*	*	*	*	*	**	*	**	*
I-90 widening east of Hyak							*		*
I-90 thinning on NF land							0		0
Potential lot development	*	*	*	*	*	**	**	**	**
Snoqualmie Pass recreation expansion							*		*
Population growth in Puget Sound area	*	*	*	*	*	**	*	**	*
Expansion of SR-18						0		*	
Total Cumulative Effect	****	*	*	*	*	***	**	***	***

* = low adverse impact ** = moderate adverse impact *** = high adverse impact
+ = beneficial effect 0 = no effect

this would have a dampening effect on economic growth in the Puget Sound area and probably result in less demand for changes in land use overall.

4.2 Transportation Facilities

4.2.1 Impact Levels

The potential conflicts between transmission lines and transportation facilities occur where they are parallel and in proximity to each other, or where the transmission lines cross a transportation facility. A **high** impact on a roadway, bridge, or rail facility would be where the placement of a transmission tower precludes future expansion or realignment of the facility. **No** impact would occur where the towers are placed a sufficient distance from the transportation ROW so that future planned expansion within that ROW, or even future acquisition of ROW, is not affected by the line.

BPA maintains a minimum clearance of 47.5 feet over highways and county roads for 500-kV lines supported by lattice steel towers. The BPA minimum clearance over railroad ROWs is 37 feet for 500-kV lines supported by lattice steel towers. BPA's minimum clearances are sufficient to clear any objects that would be carried by rail or truck, with the possible exception of military items. Because of the mandatory minimum clearances, **no** transportation impacts would occur under any of the alternatives due to insufficient clearance. Alternative A, however, would have a **low** impact on the urbanized area of Covington as a result of converting a portion of easement (now covered by paved ingress and egress routes in the Covington Square Shopping Center area) to transmission line use.

Long-term impacts would also be related to new access roads constructed for the project. In general, the level of impact would depend on the total amount of new roads that would be built. Conversion impacts (*i.e.*, converting land from its primary use to a roadway use) are addressed in Section 4.1.3.

The alternatives would have **no** long-term impacts on area bridges, rail lines, or airports. Bridges would be used only for transporting materials, which would be within acceptable load limits. Any transmission lines crossing rail lines would provide sufficient clearance for cargo transport. Towers would also be less than 200 feet tall and would therefore not enter navigable airspace, as defined by FAA guidelines. In the short-term, if any cranes may rise above 200 feet during construction, BPA would seek FAA review and approval and comply with suggested mitigation.

Improvement or reconstruction of existing roads on the Mt. Baker-Snoqualmie National Forest that access the Rocky Reach-Maple Valley

line in Alternatives B and D could improve the safety and lessen the environmental impacts associated with the existing roads. Installing better traffic control barriers, such as gates, would lessen problems with refuse dumping that is occurring in some locations on National Forest land.

To accommodate the Echo Lake Substation expansion, the existing access road east of the site would need to be realigned further to the east on uplands. Because the road would be realigned and would continue to provide access to the substation and other land uses in the area, the realignment would not have long-term transportation impacts.

4.2.2 Non-Transmission Alternative

Because no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12), there would be **no** immediate transportation-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

4.2.3 No Action Alternative

No changes to existing transportation facilities would occur.

4.2.4 Mitigation Measures

Installing gates on access roads when requested by property owners to reduce unauthorized use would mitigate some of the transportation impacts.

4.2.5 Cumulative Impacts

Construction of the transmission line wherever there is no existing line (Alternatives 3 and C) would result in an increased number of access roads. This would result in some increase in operation and maintenance traffic and four-wheel-drive vehicle access. Where the new line is adjacent to an existing line (Alternatives 1, 2, 4, D), there would be no change to this type of use. Table 4-2 displays potential cumulative effects on traffic. An effect on transportation facilities is assumed if the action impacts safety or increases use of existing facilities. The existing level of development and potential future development of lots would increase traffic on roads near Alternatives A and C. Potential future population growth would be expected in these areas as well. These are the only alternatives that have more than a minor estimated cumulative effect.

There are beneficial cumulative effects associated with the improvement of SR 18 and I-90. Improvement of roads on National Forest land affected by Alternatives B and D would also result in beneficial effects to transportation. Cumulative effects from lot development along Alternatives B and D are likely to be spread out over a long distance and would have a low impact overall on transportation facilities. Logging trucks hauling logs from private timberlands would have some impacts on road surfaces and increase safety hazards in localized areas on narrow rural roads. Overall, cumulative impacts on transportation would be **low** for all alternatives except Alternatives A and C. Cumulative transportation impacts from future residential and commercial growth are expected to occur along the A and C alternatives, but these are expected to be **moderate**.

4.3 Recreation

4.3.1 Impact Levels

Impacts on recreational resources fall into two general categories: functional and experiential. Functional impacts are those that prevent, interfere with, or limit the use of a site or area for recreational purposes. Experiential impacts are those project elements that detract from the expectations of the user when recreating in a given area (those that would alter viewsheds or create noise in an otherwise quiet location).

A **high** functional impact would preclude the use of or access to a recreation facility or preclude a particular recreational activity. A **low** functional impact would limit the use of or access to a recreation facility

Table 4-2 — Cumulative Transportation Facility Impacts

Past, present and future projects	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4A**	**Alt 4B**	**Alt A**	**Alt B**	**Alt C**	**Alt D**
Effect of proposed alternative on transportation facilities	0	0	0	0	0	*	+	0	+
Existing transmission lines	0	0		0	0	0	0		0
Existing level of development	*	*	*	*	*	**	*	**	*
I-90 widening east of Hyak							+		+
I-90 thinning on NF land							0		0
Potential lot development	*	*	*	*	*	**	*	**	*
Logging on private timberlands	*	*	*	*	*	*	*	*	*
Snoqualmie Pass recreation expansion							0		0
Population growth in Puget Sound area	*	*	*	*	*	**	*	**	*
Expansion of SR-18						+		+	
Total Cumulative Effect	*	*	*	*	*	**	*	**	*

* = low adverse impact ** = moderate adverse impact *** = high adverse impact
+ = beneficial effect 0 = no effect

or limit a recreational activity.

A **high experiential** impact would negatively affect a substantial portion of an experience, for example, a transmission line paralleling a trail for more than half its length would be a high impact to the hiking experience. A **low experiential** impact would negatively impact a small portion of an experience, for example, a transmission line crossing a trail. (Note: The experiential impacts on recreational resources in this area are tied to the visual and aesthetic qualities of the environment in which the recreational activity takes place. Section 4.10, **Visual Resources**, qualifies and quantifies the visual/aesthetic nature of the alternatives' impacts. This section focuses primarily on functional and experiential impacts other than those reviewed in Section 4.10.

Recreation impacts apply to existing and planned recreation facilities. Additional impacts may occur where the proposed project would conflict with the general recreation plans and policies of a responsible agency or jurisdiction.

4.3.2 Transmission Alternatives 1 through 4

There are no developed recreation sites within the project areas of Alternatives 1 through 4, so there would be **no** *functional* impact on any developed recreation sites by these alternatives.

The only *potential* impact to a *planned* facility in the vicinity of these alternatives is to a proposed trail along the Cedar River Watershed's northern boundary. SPU is working with the DNR and other agencies to develop the trail. It would link the trails and interpretive center at Rattlesnake Lake to Landsburg Park and adjacent regional trails. Although the proposed trail is not officially described in a plan document, nor does it have funding, it is important because it would link recreational facilities from downtown Renton to the Mt. Baker-Snoqualmie National Forest. It would provide the final link among national, state, and local parks, trails, conservation areas, and boat ramps. All alternatives would cross the proposed trail. The *experiential* impact of these alternatives on the proposed trail would be **low** since the trail would be perpendicular to the alternatives. The proposed transmission line would affect the hiking, biking, and wildlife viewing experiences only where the line crosses, and not elsewhere along its length. Similarly, if access roads were to cross the trail, there would be low experiential impacts.

While the land within the Cedar River Watershed is not formally classified by its HCP, the setting is considered primitive. "Primitive" recreational settings are unmodified natural landscapes (including areas where timber has been removed previously) where users can expect to encounter few, if any, other people. For activities that would occur on the proposed trail such as hiking and wildlife observation, recreationists tend to desire natural settings.

For that reason, *experiential* impacts on *dispersed recreation* may occur, but are expected to be **low** because the amount of such recreation is minimal. (There would be **no** *functional* impacts to dispersed recreation, as uses would not be prevented or limited.) Recreational activities such as hiking, fishing, and hunting are permitted, although limited, in the private lands in the north and south portions of the project area. Hiking is permitted, although limited, in the CRW. None of the land in the project area is formally classified into recreational setting types by the landowners or managing agencies. The quantity and type of recreation use that occurs within the project area is unknown because the companies and agencies that own and manage the lands in the project area do not track use specifically within the project area. However, based on conversations with the managers of these lands, probably little use occurs within the project area.

Conversion of land from forest to transmission line ROW may diminish opportunities for hiking, since users tend to expect a forested setting. At the same time, land conversion may increase opportunities for hunting, as wildlife could be more visible in the areas cleared of vegetation and big game would likely use the cleared areas for forage. The only differences in *experiential* impacts to dispersed recreation among the alternatives would be in the amount of land converted from timber or conservation use to transmission line ROW along each alternative.

Motorized recreation accessibility in the project area would not be increased because none of the land is open to motorized vehicle use. Although the Weyerhaeuser Company would permit vehicles on its land, its parcel is accessible only through WRECO-owned land, which is not open to motorized vehicles. BPA would gate the access roads. Gating access roads is not expected to impact the minimal non-motorized recreation that occurs because most users simply walk around or scale gates easily.

The proposed alternatives would not conflict with any relevant recreation plans or policies.

4.3.2.1 Mitigation Measures

To reduce low *experiential* recreation impacts even further BPA could:

- Use non-reflective conductors and non-luminous insulators.
- Use darkened steel towers.

4.3.2.2 Cumulative Impacts

Since there are no recreation sites within the area of Alternatives 1 through 4, and there is likely little dispersed recreation within the

project area of these alternatives, the project would have **no** *functional* cumulative impacts on recreation. *Experiential* cumulative impacts to recreation from increased use due to population growth, increasing development, and occasional logging traffic on rural roads outside of the Cedar River Watershed would be **low**.

4.3.3 Alternative A

Option C2, shared by Alternatives A and Alternative C, crosses the City of Kent's Clark Springs property and parallels the Cedar River Watershed on its southern side. Neither of these areas is open for public recreation, so **no** impact on recreation would occur.

Alternative A continues through Maple Valley, crossing the city's planned bus barn and recreational field complex and the Elk Run Golf Course. Current plans for the city's recreation fields and bus parking take into account the existing transmission line, but do not anticipate accommodation of an additional line and support structures. There likely would be a need to redesign the proposed facilities if Alternative A is selected. While this would create a short-term complication, if BPA were able to coordinate with the city before construction of the recreational facilities, long-term conflicts with recreational use may be avoided. The golf course has developed around existing transmission structures. The open nature of a golf course is not incompatible with transmission line ROWs. However, coordination would be necessary to ensure that no long-term incompatibilities result from an additional line being located in the vacant ROW.

No public recreational resources are located along the existing BPA ROW between Maple Valley and Covington Substation. Consequently, Alternative A is considered to have **no** direct recreational impact in the Covington area. There are, however, some private play areas, including one in the Eastwood Forest Subdivision on the west side of Maple Valley and Ryan Brunner Park, south of Covington, that serves Winterwood residents. As long as the play areas are constructed in compliance with the terms of the BPA easement, construction of Alternative A would not preclude use of this type of play area. It may, however, require relocation of facilities and parents may be concerned about their children's safety if new transmission lines pass directly over structures that were once unencumbered by transmission lines.

North of Covington, Alternative A passes between Lake Youngs and Shadow Lake, then crosses Peterson Lake Natural Area and the Cedar River Trail. Visual impacts related to taller towers are discussed in Section 4.10, **Visual Resources**. Replacement of an existing line in the existing ROW as it currently crosses these areas would cause some temporary construction impacts, but would not alter the ability to use or enjoy either of these amenities long term.

Functional impacts — Overall, there would be **no** long-term *functional* impacts to recreational resources along Alternative A. There would be temporary **low** functional impact to the Elk Run Golf Course while construction of the additional line limits access to specific areas of the golf course. A building may need to be removed in the ROW on the golf course.

Experiential Impacts— There would be **no** or **low** permanent *experiential* impacts to recreation at the Elk Run Golf Course or the Maple Valley recreation site after construction is complete. Construction of an additional transmission line and replacement of the existing line would present some temporary *experiential* impacts.

4.3.3.1 Mitigation Measures

To lessen impacts from Alternative A, BPA would:

- Coordinate with Elk Run Golf Course to ensure short-term construction impacts to recreation are limited and long-term impacts are minimized.
- Coordinate with homeowners associations where possible to ensure that impacts on private community playgrounds are minimized and that any risks related to the location of new transmission lines in the existing ROW is clearly understood by users.

Mitigation suggested in Section 4.10, **Visual Resources**, on aesthetic impacts would be used to ensure impacts to recreational experiences are minimized.

General Mitigation — The following mitigation steps would be taken for any of Alternatives A through D:

- Final siting decisions would be made with recreational users and their patterns of use in mind to avoid disruption where possible. Structure locations would be selected in consultation with landowners.
- Disruption of recreation caused by installation and maintenance would be minimized and installation plans would include adequate public notice and communication.

4.3.3.2 Cumulative Impacts

Cumulative impacts would occur if an additional transmission line were to be constructed in existing ROW where transmission lines already exist. Though the ROW already exists, additional or taller structures could be more visible to recreation users. For the portion of the alternative where an additional line would be added, line noise would be increased and additional tower supports would occupy land within the ROW that was previously available for recreational use.

Experiential cumulative impacts to recreation from increased use due to population growth, increasing development, and occasional logging traffic on rural roads crossing forest lands would be low. The construction of SR 18 would have a potentially negative effect on recreation in the Tiger Mountain area during construction and would increase the flow of traffic through the area and potentially increase the number of recreational users in the long term.

4.3.4 Alternative B

Alternative B would rebuild the existing line within the existing corridor on mostly existing ROW. Converting the line to a double-circuit 500-kV line would require towers about 180 feet tall. The visual and aesthetic impacts of increased tower heights on recreation users are considered in Section 4.10**.** The primary *experiential* impacts to recreation along the I-90 corridor posed by this alternative are related to visual impacts. Non-visual impacts are primarily *functional* and are discussed below by resource.

4.3.4.1 In the National Forest

Alpine Lakes Wilderness Area — This wilderness area is located on the north side of I-90. Alternative B is located on the south side of I-90 in this area and does not cross the wilderness area. Alternative B poses **low** or **no** *functional* impact or *experiential* impacts, other than visual impacts, on the Alpine Lakes Wilderness Area.

For Your Information

See Appendix L for information about Alternatives A-D.

Snow Parks south of Lake Keechelus — Heavy snowmobile use takes place south and west of Lake Keechelus. Existing ROWs provide access to and between areas frequented by snowmobiling. Concerns have been raised regarding the increased voltage of the lines and increased hazards to snowmobilers operating their equipment under the lines. Because the lines would be a higher voltage, a higher ground clearance is required. This higher clearance ensures the same level of safety afforded by the current ground clearance required for the existing line.

Pacific Crest Trail — This trail passes under the existing line for approximately 0.5 mile near Surveyors Lake. This single trail crossing would not be functionally altered by replacement of the existing towers to upgrade the existing line. *Experiential* impacts other than visual impacts would be limited primarily to noise from the overhead lines. This line noise would not be increased substantially by implementation of Alternative B. The area surrounding the trail crossing appears to have been harvested, so *experiential* impacts related to vegetative management also would be negligible. Alternative B poses **low** or **no** *functional* impact or *experiential* impact, other than visual impacts, to the Pacific Crest Trail.

Tinkham Campground — This campground is located 0.75 mile off the ROW, on the opposite side of the existing U.S. Forest Service Road in a forested area. Alternative B poses **low** or **no** *functiona*l impact or *experiential* impact to the Tinkham Campground.

McClellen Butte Trail — This trail passes under Alternative B once between the trailhead and the Snoqualmie River. The surrounding area is predominantly wooded. In this setting, rebuilding the existing line as stated in Alternative B would not substantially alter the recreational experience beyond that of the current conditions. Alternative B poses **low** or **no** *functiona*l impact and *experiential* impact, other than visual impacts, to the McClellen Butte Trail.

Downhill ski areas at Snoqualmie Pass — The Summit at Snoqualmie East is one of three downhill ski areas located on the southwest side of the I-90 corridor at Snoqualmie Pass. One chairlift at the area does run up to and apparently under the existing transmission line. Nordic ski trails, which are also used for mountain biking and hiking trails during the summer months, use existing access roads and ROW tied to the existing transmission line. Rebuilding existing transmission facilities poses **no** *functional* or *experiential* impact on this recreational use, other than the short-term impacts of the construction itself.

4.3.4.2 Outside the National Forest Boundary

Iron Horse State Park and John Wayne Pioneer Trail — Alternative B crosses the John Wayne Pioneer Trail at four locations in a length of more than 20 miles. Alternative B also parallels the trail and park for much of its length. This trail is a Rails-to-Trails project and the area is recognized for its utility as well as recreational use. A portion of this trail in on National Forest lands as well. Primary impacts to the trail and park would be visual and are discussed in Section 4.10. Alternative B would pose **no** *functional* limitations to trail or park use. The only *experiential* impacts might be related to increased visibility because of increased tower heights, as discussed in Section 4.10.

Ollalie State Park — The Ollalie Area Mountain Bike Study is under way. This area has many abandoned logging roads that could be linked to create multiple use loop trails. Trails identified in the study thus far are primarily located uphill from the railroad grade (typically above 2,000 feet) and are not near the existing transmission line ROW (Person, 2002). **No** *functional* impacts or *experiential* impacts, other than possible visual impacts, would result.

Upper and Lower Twin Falls Trailhead, Twin Falls Natural Area, and Twin Falls Trail — Access to or activities supported by the Twin Falls recreational facilities would not be altered by implementation of Alternative B. The most noticeable *experiential* impact would result

from rebuilding the existing line along the entry road providing access to the Lower Twin Falls Trailhead. Aesthetic impacts of this action are addressed in Section 4.10. The access road appears to be frequented by vehicles rather than pedestrians; therefore, line noise or other *experiential* impacts would not be substantial. **No** *functional* impacts or *experiential* impacts, other than possible visual impacts, would result.

Camp Waskowitz — Other than construction impacts, Alternative B would pose little impact on the camp or its activities in the area of the existing line. **No** *functional* or *experiential* impacts other than possible visual impacts would result.

Snoqualmie Valley Trail — This trail crosses the existing ROW that would accommodate Alternative B in a wooded location south of I-90. The trail continues under I-90 and through North Bend, which is not a wilderness experience. **No** *functional* impacts or *experiential* impacts, other than possible visual impacts, would result.

Rattlesnake Mountain Scenic Area, Rattlesnake Mountain Trail, and Rattlesnake Lake Recreational Area — The Rattlesnake Mountain Trail follows the ridge of Rattlesnake Mountain and is crossed by the existing ROW in a single location. Rebuilding the existing line with taller tower supports would not limit access to the trail or scenic area and would pose **no** *functional* or *experiential* impacts to use and enjoyment of these resources, other than possible visual impacts.

4.3.4.3 Mitigation Measures

To reduce impacts, BPA would notify landowners and the public of construction activities.

Mitigation suggested in Sections 4.3.3.1 and 4.10, **Visual Resources**, would also be used along Alternative B.

4.3.4.4 Cumulative Impacts

Cumulative impacts resulting from rebuilding the existing line in existing ROW in Alternative B would be **low**. The proposed widening of I-90 in the same time frame as this project may hinder access to some trails and recreational facilities locally for short periods of time. The USFS thinning project may use some of the same roads that would be used for construction of the new transmission line. Increased logging traffic mixed with construction traffic would have a short-term cumulative impact on the recreational experience along this alternative. Increasing population and further development of lots would increase the number of users of recreation facilities and increase sensitivity of future impacts.

4.3.5 Alternative C (Options C1 and C2)

Option C1 of Alternative C crosses no recreational areas. Some informal recreation, such as hiking or horseback riding, likely occurs on the large parcels crossed by this alternative, but expanding the existing ROW and constructing an additional line in expanded ROW on large forest zoned parcels would not result in substantial adverse impacts. Recreational impacts related to Option C2 of Alternative C, which is common to Alternative A, were addressed in Section 4.3.3.

The north-south portion of Alternative C, common to Options C1 and C2, would not limit access to Ravensdale or Big Bend Park. The southern end of Tiger Mountain is classified as an unmodified area and is managed primarily to protect sensitive plant communities (DNR, 1997). Alternatives C (both Options C1 and C2) would pose **no** *functional* and **low** or **no** *experiential* impact, other than visual impacts, to use and enjoyment of these resources.

4.3.5.1 Mitigation Measures

Mitigation for visual impacts suggested in Section 4.10 would be used along Alternative C to ensure those impacts are minimized.

4.3.5.2 Cumulative Impacts

Other transmission lines and corridors pass through the surrounding rural residential area. Other construction and development projects, such as the proposed widening of Highway 18 and other road construction projects, as well as development of additional subdivisions and housing, increase the amount of use on surrounding recreation resources. These developments also change the character of the landscape and limit future options for recreational development. Addition of a new ROW and transmission line along Alternative C would add to the impacts of existing corridors by creating a new corridor in an area not previously affected by the presence of a transmission line. However, these alternatives would not directly affect a great number of recreational resource sites. Overall cumulative impact would be **low**.

4.3.6 Alternative D (Options D1 and D2)

Alternatives D (Options D1 and D2) would have similar impacts on recreational resources. Distinctions between Options D1 and D2 are identified in this text. Otherwise, the impacts of expansion of the existing corridor to the north or to the south should be considered equivalent.

The types of recreational areas affected would be the same as those affected by Alternative B. Impacts would be similar in nature to those discussed in Section 4.3.4, but greater in extent.

4.3.6.1 In the National Forest

Alpine Lakes Wilderness Area — Access to the wilderness area would not be affected by creation of additional ROW or addition of another transmission line. The primary experiential impacts would be related to increased visual impacts resulting from a wider transmission corridor. Options D1 and D2 would pose **low** or **no** *functional* impact or *experiential* impacts, other than visual impacts, in this area.

Snow Parks south of Lake Keechelus — Heavy snowmobile use occurs south and west of Lake Keechelus. Existing ROWs provide access to and between areas frequented by snowmobilers. Additional width of ROW in this area would not affect snowmobilers.

Pacific Crest Trail — An additional line would increase the disturbance at the trail crossing, but the trail and lines still would cross at a single location. The trail crossing is near the area where the Pacific Crest Trail passes other disturbances, including the summit area development and ski areas and I-90. Although Option D2 would be accommodated in existing ROW in this area, this factor alone does not distinguish the impacts of Options D1 and D2. Both options would pose **no** *functional* impact and **low** *experiential* impact, other than visual impacts.

Tinkham Campground — Distance and vegetation ensure that Options D1 and D2 would pose similar impacts as Alternative B **(low** or **no** *functiona*l or *experiential* impacts).

McClellen Butte Trail — An additional line would increase the disturbance at the trail crossing and the broader cleared area (150 feet expanded to 300 feet) would double a trail user's exposure to the transmission line corridor, but the trail and lines still would cross at a single location. Options D1 and D2 would pose **no** *functional* impact and a **low** *experiential* impact to the McClellen Butte Trail.

Downhill ski areas at Snoqualmie Pass — The Summit at Snoqualmie East is one of three downhill ski areas located on the southwest side of the I-90 corridor at Snoqualmie Pass. One chairlift at the area does run up to and apparently under the existing transmission line. Downhill skiing is not a wilderness activity. Access roads and ROWs available for mountain biking and hiking use would be slightly increased by these alternatives. The presence or expansion of the existing ROW and transmission facilities would not detract greatly from the surrounding recreational environment. Options D1 and D2 pose **no** *functional* and **low** *experiential* impact on this recreational use.

4.3.6.2 Outside the National Forest Boundary

Iron Horse State Park and John Wayne Pioneer Trail — Options D1 and D2 would have the same general location relative to Iron Horse State Park and the John Wayne Trail as Alternative B. The distinction among visual impacts from Options D1, D2 and Alternative B are discussed in Section 4.10. Neither Option D1 nor D2 would limit or prevent access to any portion of the trail or park. As with other trail crossings, the wider ROW and additional line would extend the trail user's exposure to the transmission corridor. Options D1 and D2 would pose **no** *functional* impact and only **low** *experiential* impact, other than visual impacts, to the park and trail.

Ollalie State Park — Options D1 and D2 would have the same general location relative to Ollalie State Park as Alternative B. Neither Option D1 nor D2 would present any barriers to access to the park or its planned uses. Therefore, this alternative would pose **no** *functional* impact and only **low** *experiential* impact, other than visual impacts.

Upper and Lower Twin Falls Trailhead, Twin Falls Natural Area, and Twin Falls Trail — Access to or activities supported by the Twin Falls recreational facilities would not be altered by implementation of Options D1 or D2. The *experiential* impact of Option D1 would be distinctly higher than that of Option D2. As mentioned in the discussion of Alternative B, the impacts of Alternatives B, and Options D1 and D2 would be most noticeable along the entry road providing access to the Lower Twin Falls Trailhead. Aesthetic impacts of this action are addressed in Section 4.10. Option D1 would place the trailhead's entry drive between the two transmission lines and pose greater impact on the experience of reaching the trailhead than Option D2, which would locate the additional line on the opposite side of the existing line. **No** *functional* impacts would result from implementation of Option D1 or D2. However, Option D1 would pose **high** *experiential* impacts and Option D2 would pose **low** *experiential* impacts, other than visual impacts, on the approach to the Lower Twin Falls Trailhead.

Camp Waskowitz — Some of the trails parallel or run directly under the existing lines. Broadening the ROW from 150 feet to 300 feet would pose a **moderate** *experiential* impact to the shorter trails used by campers and school groups. An existing Christmas tree farm and several educational sites and camp structures would also be disrupted or require relocation or reconstruction, temporarily altering the functions on this portion of the Camp's property. Long term, however, *functional* impacts would be **low**.

Snoqualmie Valley Trail — An additional line would increase the disturbance at the trail crossing and the broader cleared area (150 feet expanded to 300 feet) would double a trail user's exposure to the

transmission line corridor, but the trail and lines still would cross at a single location. Options D1 and D2 would pose **no** *functional* impact and a **low** *experiential* impact to this trail.

Rattlesnake Mountain Scenic Area, Rattlesnake Mountain Trail, and Rattlesnake Lake Recreational Area — Options D1 and D2 would pose the same functional impacts as Alternative B. The increased ROW and additional line would, however, increase a trail user's awareness of the trail crossing. Options D1 and D2 would pose **no** *functional* impact and a **low** *experiential* impact.

4.3.6.3 Mitigation Measures

To reduce impacts, BPA would:

- Communicate with area landowners and land managers about timing and duration of construction activities on the new ROW.

In addition, mitigation suggested in Section 4.3.3.1 and measures to mitigate visual and aesthetic impacts suggested in Section 4.10 would be used along Options D1 or D2 to ensure these impacts are minimized.

4.3.6.4 Cumulative Impacts

Experiential impacts on individual recreational resources related to Options D1 and D2 would, in most cases, be **low.** The sum of the impacts within the broader I-90 corridor, which comprises the Mountains-to-Sound Greenway and provides multiple recreational experiences to local users who often explore many different recreation sites, would be greater than the impact from any single project. The potential combined impacts of construction on I-90, construction for this transmission line, and logging traffic from National Forest thinning projects could create a **moderate** *experiential* impact for the recreational user in the short term. Heightened sensitivity to changes along the corridor would take place as more adjacent or directly impacted lots have houses or cabins constructed on them.

4.3.7 Non-Transmission Alternative

Because no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12), there would be no immediate recreation-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

4.3.8 No Action Alternative

Under the No Action Alternative, there would be **no** impacts to existing recreational areas and recreational uses.

4.4 Geology and Soils

4.4.1 Impact Levels

Direct impacts from the project would be caused by new access road construction, improvements to existing access roads, ROW clearing, and site preparation for construction of structures. During construction, these activities would disturb the soil surface, which could lead to an increase in soil erosion and runoff. The eroded soil could enter streams and impact fish habitat and water quality.

This section addresses potential short- and long-term geology and soil impacts resulting from construction of each alternative, focusing on erosion impacts. Appendices F and M contain more details on erosion impacts, as well as soil settlement (compaction) and landslide impacts. It is highly unlikely that any of the alternatives would exacerbate existing shallow or deep-seated landslides; most do not cross any known landslide areas. Alternatives B and D (Options D1 and D2) have the greatest potential for initiating landslides because they are located on steeper ground. Other alternatives crossing isolated steeper slopes would encounter similar landslide potential. In all cases, however, these potential impacts can be mitigated with proper construction techniques.

Appendices F and M also address seismic issues that could affect tower construction (i.e., siting, type of footings used). However, these are not "impacts" created by construction of the towers (construction cannot trigger an earthquake) and so are not discussed here.

4.4.1.1 Soil Erosion Impact Levels

➲ For Your Information

Ravel *— The downslope movement of single, granular particles, usually as a result of gravity.*

Unprotected cut and fill slopes, road surfaces, and spoil piles can cause surface erosion. It can occur as a result of wind and downslope movement, such as creep or ***ravel***; however, soil erosion is most often associated with flowing water. Soils that are most susceptible to surface erosion by water have no or minor cohesion (as a result of a low percentage of clay minerals) or have a low percentage of gravel-size particles (which would otherwise armor the soil surface). Other factors that lead to high rates of soil erosion are disturbance, absence of vegetative cover, concentrated water and steep slopes.

Impact ratings using throughout this section are summarized below. (Note: erosion hazard ratings have not yet been developed for Kittitas County soil units. Ratings for Kittitas County soils encountered

by Alternatives B and D were applied based on soil description, the erosion factor "k," and slope.)

- **High** erosion impact was assigned to those sections of the route alternatives that cross soil units identified as very severe to severe erosion hazards. These soils may require intensive management or special equipment and methods to prevent excessive loss of soil.
- **Moderate** erosion impact was assigned to those sections of the route alternatives that cross soil units identified as moderate erosion hazards. These soils may require erosion control measures during logging and road construction to prevent excessive loss of soil.
- **Low** erosion impact was assigned to those sections of the route alternatives that cross soils identified as slight erosion hazards. Loss from these soils during construction is expected to be minor.
- **No** erosion impact would occur only in soils that are not disturbed during the construction and maintenance of the proposed project (USDA, 1992).

Most impacts would likely be short term. Once the cuts and fills next to roads and the areas cleared for tower construction revegetate, the road surfaces are graveled or naturally become armored, and construction is complete, erosion rates should reduce substantially and not affect nearby streams and other water bodies if properly maintained. Long-term impacts should be minor unless efforts to revegetate and control erosion and runoff are unsuccessful and/or not maintained properly.

BPA's decision to use micropile footings for tower structures (described in Section 2.1.1.1), which require much less ground disturbance, would likely reduce the impacts discussed in this section.

4.4.2 Proposed Action

➲ For Your Information

Culvert *— A corrugated metal or concrete pipe used to carry or divert runoff water from a drainage; usually installed under roads to prevent washouts and erosion.*

The Proposed Action parallels most of the existing Raver-Echo Lake Transmission Line, so most of the road system is already in place. As a result, in most cases, only short spur roads to the actual tower sites from the existing roads would be needed. No new locations for ***culvert*** installation would be needed. Some existing culverts would be replaced to improve fish passage.

The total length of the Proposed Action is about nine miles. Of this, about 0.3 miles (3 percent) cross soil designated as a severe erosion hazard, 1.4 miles (15 percent) cross soil designated as a moderate erosion hazard, and the remaining 82 percent of the route crosses soil

designated as a slight erosion hazard. The severe erosion hazard occurs on the slopes above the Raging River.

Areas of soil erosion would be expected along steep banks of a high-energy stream that is incising, such as a section of Rock Creek. All but one of the soil units mapped along the southern and eastern flanks of Brew Hill have a slight erosion hazard. An area of moderate soil erosion hazard is in the headwaters of Rock Creek. Project construction, including access roads, would avoid steep slopes and sensitive soils adjacent to waterways.

Several inner gorges are encountered along alternatives where the alignments cross rivers or creeks (see Appendix F). These are potential shallow landslide and soil erosion areas. Roads and towers would not be placed on steep slopes within these inner gorges. Towers would be placed on flatter slopes on either side of the gorges and the transmission lines would span the drainages. The potential for project-related landslides in these areas is remote.

In most cases, only short spur roads from the existing roads to the actual tower sites would be needed. In addition, there is no need for construction of additional culverts, resulting in **no** new potential impacts to water bodies, as compared to the number of similar drainage structures required for a whole new road system.

The increased amount of surface water runoff resulting from the lengthened road prism and additional cleared slopes could potentially cause an increase in peak flows. Increased surface runoff and peak flows can cause additional erosion at road cuts and fills, along drainage ditches, below culvert outfalls, and in stream channels. However, the anticipated increase is expected to be small relative to existing conditions. Impacts would be **low**.

4.4.2.1 Mitigation Measures

Most impacts that would cause soil erosion would be from construction and improvement of roads and ROW clearing, followed by operation and maintenance of roads. The following measures could be used to reduce soil erosion and the movement of sediments:

- *Design the project to comply with local, state and federal water quality regulations and programs to prevent degradation of aquifer and surface water quality, and avoid jeopardizing their usability as a drinking water source. This could include:*

    1. Designing facilities, including substations, to meet regional seismic criteria, to prevent mass movement of soils, such as from a landslide or severe erosion areas, from entering into U.S. waters.

2. Designing logging systems that create minimal soil disturbance. Require pre-approval of the logging plan before any clearing takes place. The logging plan should identify logging equipment to be used, method of skidding, approximate skid trail locations, landings and haul routes of log trucks. The logging plan should also incorporate standard Washington State Forest Practices guidelines for erosion protection, wetlands protection, soil protection, and sediment control in logging operations.
3. Improving existing culverts and stream crossings that pose a risk to riparian, wetland, or aquatic habitat to accommodate at least a 100-year flood and associated bedload and debris.
4. Identifying specific locations and measures when road and line design are finalized.

- *BPA could use construction practices that avoid, prevent or minimize erosion, such as:*

1. Avoiding erosion hazard areas if possible.
2. When practicable, scheduling construction and maintenance during periods when precipitation and runoff potential is at a minimum to reduce the risk of erosion, sedimentation, and soil compaction, May through September.
3. Building roads to be used for logging activities in the CRW in a manner consistent with the standards and guidelines of DNR's Forest Practice Guide and other applicable guidelines.
4. Avoiding riparian areas, drainage ways, and other water bodies. Where these areas cannot be avoided, apply sediment reduction practices to prevent degradation of riparian or stream quality. Consider using riparian plantings where needed to restore streamside vegetation and insure stream bank stability.
5. Leaving vegetative buffers along stream courses to minimize erosion and bank instability.
6. Protecting low-growing vegetation and root systems as much as possible.
7. Limiting vehicle access during construction and maintenance operations to reduce the potential for erosion and to impacts to wildlife.
8. Restricting road construction to the minimum needed and abandoning non-essential existing roads and temporary construction access roads.

9. Using full-bench road construction and end hauling of excess material on slopes exceeding 60 percent, if needed to stabilize road prisms. Prior to construction, locate suitable waste areas for depositing and stabilizing excess material.
10. Wherever possible, using low-impact equipment to reduce the amount of soil disturbance.
11. Using portable/temporary construction matting to cross sections of road where access is inhibited due to the seasonal migration of wetlands.
12. If required, coordinating any culvert installation with the appropriate local, state and federal agencies.
13. If needed, designing and constructing fords and bridges to minimize bank erosion.
14. Avoiding the filling of wetlands.

- *BPA could prepare and implement a Storm Water Pollution Prevention Plan (SWPP Plan): to guide construction activities to prevent erosion and the transport of sediment and other pollutants from the site during construction. The SWPP Plan would require that an Erosion and Sediment Control Plan be prepared for each site that would have ground-disturbing activities. The ESCP includes descriptions of erosion and sediment control Best Management Practices for preventing the off-site movement of sediment-laden water or other pollutants. Some of the types of BMPs that may be used include:*

  1. Marking clearing limits.
  2. Implementing stabilization measures as soon as practicable where construction activities have temporarily or permanently ceased.
  3. Properly spacing crossdrains, water bars, rolling dips, and armoring of ditches, and drain inlets and outlets to keep road surfaces dewatered.
  4. Using vegetative buffers and sediment barriers to prevent sediment from moving off-site and into water bodies.
  5. Promptly seeding disturbed sites with an herbaceous seed mixture suited to the site.
  6. Covering actively-used roads with sound crushed rock.
  7. Establishing a construction stormwater monitoring plan.
  8. Restoring and stabilizing roads that would not be used after construction with vegetation and drainage measures (e.g., water bars, culvert removal and sidecast fill removal).

9. Controlling de-watering.
10. Reducing off-site tracking of sediment and the generation of dust.
11. Locating suitable waste areas for depositing and stabilizing excess material and excavation spoils.
12. Maintaining BMPs.
13. Managing and phasing construction of the project.

4.4.2.2 Cumulative Impacts

Some increased sediment and peak flows in streams are expected from construction and operation of the line, but could also be generated by current and future forest management activities, home and subdivision developments outside the Cedar River Municipal Watershed, and major road construction. The volume of peak flow and the amount of sediment entering streams would depend on site-specific conditions. Mitigation measures proposed for construction of the line and those required for logging-related activities and suburban development would reduce the chance of large amounts of sediment entering streams. Although minor, localized increases in erosion, runoff, and sedimentation are expected from construction and maintenance, these increases would have a **low** impact on the area's soil resources and water quality, and should not impair the current beneficial use of water bodies. (See Table 4-3.)

4.4.3 Alternative 2

About 0.3 miles (3 percent) of Alternative 2 cross soil designated as a severe erosion hazard, 1.4 miles (15 percent) cross soil designated as a moderate erosion hazard, and the remaining 82 percent crosses soil designated as a slight erosion hazard. The severe erosion hazard occurs on the slopes above the Raging River.

Because of the moderate- to low-sloped ground, and the number of existing roads adjacent to Alternative 2, new tower construction access roads would generally not require stream crossings.

Impacts of project construction and operation on soil erosion and sediment delivery would be similar to the **low** impacts described for the Proposed Action (see Section 4.4.2).

4.4.3.1 Mitigation Measures

See Section 4.4.2.1, under Proposed Action.

4.4.3.2 Cumulative Impacts

See Section 4.4.2.2, under Proposed Action.

4.4.4 Alternative 3

About 0.2 miles (2 percent) of Alternative 3 cross soil designated as a severe erosion hazard, 2.1 miles (20 percent) cross soil designated as a moderate erosion hazard, and the remaining 78 percent of the route crosses soil designated as a slight erosion hazard. The severe erosion hazard occurs on the slopes above the Raging River and Canyon Creek.

There is a mapped, deep-seated landslide hazard along this alternative in the Steele Creek Basin (see Appendix F). Evidence of recent or historical mass movement in the area was not observed.

Although impacts from project construction and operation on soil erosion and sediment delivery would be similar to those impacts described for the Proposed Action (see Section 4.4.2), the relative amount of potential impacts would be greater because Alternative 3 would require more new access roads. More stream crossings with their attendant potential erosion and sedimentation impacts would be required with this alternative. Impacts would be **moderate**.

4.4.4.1 Mitigation Measures

In general, mitigation required for this alternative would be similar to the Proposed Action (see Section 4.4.2.1). However, because the length of this alternative is greater than the Proposed Action, more mitigation may be needed. The potential excavation of hard rock might require some blasting. The timing of blasting may need to be

Table 4-3 Cumulative Geology and Soils Impacts

Past, present and future projects	Alt 1	Alt 2	Alt 3	Alt 4A	Alt 4B	Alt A	Alt B	Alt C	Alt D
Effect of proposed alternative on geology and soils	*	*	**	*	*	**	*	*	***
Existing transmission lines	*	*		*	*	*	*		*
Existing level of development	*	*	*	*	*	**	*	**	*
I-90 widening east of Hyak							**		**
I-90 thinning on NF land							*		*
Potential lot development	*	*	*	*	*	**	*	**	*
Logging on private timberlands	*	*	*	*	*	*	*	*	*
Snoqualmie Pass recreation expansion							0		0
Population growth in Puget Sound area	*	*	*	*	*	**	*	**	*
Expansion of SR-18						**		**	
Total Cumulative Effect	*	*	**	*	*	**	**	**	***

* = low adverse impact ** = moderate adverse impact *** = high adverse impact
+ = beneficial effect 0 = no effect

coordinated to avoid conflicts with residents and wildlife. Foundation engineering measures, such as piles or over-excavation, could be employed to reduce the amount of settlement of subsurface materials.

4.4.4.2 Cumulative Impacts

Cumulative effects would be similar to those described under the Proposed Action (see Section 4.4.2.2). However, direct impacts associated with this alternative are greater so the cumulative impact is **moderate**.

4.4.5 Alternative 4A

About 0.3 miles (3 percent) of Alternative 4A cross soil designated as a severe erosion hazard, 1.5 miles (15 percent) cross soil designated as a moderate erosion hazard, and the remaining 82 percent of the route crosses soil designated as a slight erosion hazard. Severe erosion hazard is present on the slopes above the Raging River.

Because of the number of existing roads adjacent to Alternative 4A, new tower construction access roads (spur roads) would generally not require additional stream crossings with their attendant potential erosion and sedimentation impacts. Impacts of project construction and operation on soil erosion and sediment delivery would be similar to the **low** impacts described for the Proposed Action (see Section 4.4.2).

4.4.5.1 Mitigation Measures

See Section 4.4.2.1, under Proposed Action.

4.4.5.2 Cumulative Impacts

See Section 4.4.2.2, under Proposed Action.

4.4.6 Alternative 4B

About 0.3 miles (3 percent) of Alternative 4B cross soil designated as a severe erosion hazard, 1.5 miles (15 percent) cross soil designated as a moderate erosion hazard, and the remaining 82 percent of the route crosses soil designated as a slight erosion hazard. Severe erosion hazard occurs on the slopes above the Raging River.

Because of the number of existing roads next to Alternative 4B, new tower construction access roads would generally not require additional stream crossings. Impacts of project construction and operation on soil erosion and sediment delivery would be similar to the **low** impacts described for the Proposed Action (see Section 4.4.2).

4.4.6.1 Mitigation Measures

See Section 4.4.2.1, under Proposed Action.

4.4.6.2 Cumulative Impacts

See Section 4.4.2.2, under Proposed Action.

4.4.7 Alternative A

Alternative A would parallel the existing Covington-Columbia No. 3 230-kV line to near Covington Substation in a vacant ROW, much of which needs to be cleared. From the substation, the existing Covington-Maple Valley line would be rebuilt to a double-circuit, 500-kV line to accommodate the new line. Clearing of undisturbed ground would not be required. Danger trees would need to be removed along most of Alternative A. Most of the road system is already in place. Only short spur roads from existing roads to actual tower sites along the Covington-Columbia line would be needed. These spur roads might cross small intermittent streams, and culverts could be required for passage of stormwater.

About 2.2 miles (11 percent) of Alternative A's 20-mile route cross soil designated as a severe erosion hazard, 13.5 miles (68 percent) cross soil designated as a moderate erosion hazard, and the remaining 4.3 miles (21 percent) cross soil designated as a slight erosion hazard.

Only short, new spur roads would be required resulting in a small potential increase in surface water runoff. Also, the need for construction of additional culverts and bridges is greatly reduced, resulting in smaller potential impacts to water bodies. Culverts could be required where the short spur roads cross small, intermittent streams. Impacts of Alternative A construction and operation on soil erosion and sediment delivery would be **low.**

4.4.7.1 Mitigation Measures

See Section 4.4.2.1, under Proposed Action.

4.4.7.2 Cumulative Impacts

Most of the long-term land use impacts of the new transmission line would be in addition to similar impacts from existing transmission and distribution lines in the project vicinity, and from other types of development. Alternative A extends across substantial areas of suburban residential and commercial development, primarily in the Kent and Maple Valley areas. Existing and new residential and

commercial development in the project vicinity would cause additional geological and soil impacts. Additional impacts could also occur from improvement or construction of new streets and highways, such as the ongoing Highway 18 expansion. Impacts could also result from improvements to the Burlington Northern and Santa Fe Railroad that extends from Kent to Georgetown across the southern portion of the route.

The most likely impacts would be increased soil erosion from construction sites and logging or as a result of increased surface water runoff from less pervious surfaces, such as rooftops, roadways and parking lots. Cumulative effects would be **moderate** (see Table 4-3).

4.4.8 Alternative B

Alternative B would rebuild approximately 36 miles of BPA's existing Rocky Reach-Maple Valley 345-kV line to a 500-kV double-circuit line, with the 500-kV line on one side and the line operating at 345-kV on the other side. The new line would be installed on 180-foot-tall towers. This route would be on existing ROW with access roads already in place. A majority of the ROW is already cleared; however, about 20 feet of the north side of the existing ROW would require clearing, along with removal of danger trees outside the existing ROW.

About 1 mile (3 percent) of Alternative B's approximate 36-mile route crosses soil designated as a severe erosion hazard, 10.5 miles (29 percent) cross soil designated as a moderate erosion hazard, and the remaining 24.5 miles (68 percent) cross soil designated as a slight erosion hazard. However, because the route crosses numerous streams that are on steeply to moderately sloped ground, delivery of construction-derived sediment could be great if appropriate BMPs are not implemented.

Overall, impacts from clearing approximately 210 acres of ROW are considered to be **low** to **moderate**. Most of the access roads in the ROW would require only slight modification. However, the segment requiring more extensive work is in steep terrain with abundant rainfall; therefore, the amount of sediment generated in that area of the project could be considered a **moderate** impact.

The existing Rocky Reach-Maple Valley ROW crosses lands in the Rattlesnake Mountain Scenic area rated both high and moderate for mass wasting and erosion sensitivity. The Rattlesnake Mountain management plan states that "future development, infrastructure, utilities, and private property along the lower slopes of the mountain will be highly susceptible to damage or destruction by repeated landslide and debris flows." Consequently, if Alternative B were selected, BPA would need to focus on preservation of the thin, erodible soils, mass-wasting areas, and many stream corridors.

4.4.8.1 Mitigation Measures

See Section 4.4.2.1, under Proposed Action. Additional mitigation measures would likely be required on National Forest lands and other sensitive areas.

4.4.8.2 Cumulative Impacts

As mentioned in Section 4.4.2.2, short-term increases in sediment and peak flows from line construction may add to impacts generated by current and future forest management practices on private timberlands and National Forest lands through road construction, increased road use, and tree clearing. Other activities along Alternative B that could cause cumulative impacts include use and maintenance of existing roads, construction of houses and cabins on lots adjacent to the corridor, and expansion of sand and gravel mining at rock quarries. Improvement and proposed expansion of I-90 would also cause cumulative impacts. Cumulative effects would be **moderate** (see Table 4-3).

4.4.9 Alternative C (Options C1 and C2)

Option C1 would originate at the Raver Substation, then proceed west approximately 2.5 miles in a vacant, though not cleared, ROW along the existing Raver-Tacoma double-circuit 500-kV line. At this point, the segment would turn north for about 7.5 miles to tie into an unused circuit of the Echo Lake-Maple Valley double circuit 500-kV line. This segment would be on new ROW. Option C2 would begin at the tap point along the Schultz-Raver line near Kangley and proceed west along vacant transmission line ROW immediately north of the Covington-Columbia line for about 4.5 miles. At this point, the C2 segment would turn north for about six miles along the same route described for Option C1.

Some clearing and construction of short spur roads from existing BPA roads would be required along the first 2.5 miles of the Option C1 alignment or along the first 4.5 miles of the Option C2 route. The actual route along the remaining north-south oriented 7.5 miles (Option C1) or six miles (Option C2), much of which would pass through rural residential areas, has not been determined. This portion could require substantial clearing of vegetation and structures and construction of access roads along the proposed ROW.

About 1 mile (10 percent) of Option C1 crosses soil designated as a severe erosion hazard, 3 miles (30 percent) cross soil designated as a moderate erosion hazard, and the remaining 6.1 miles (60 percent) cross soil designated as a slight erosion hazard. For Option C2, about 0.5 mile (5 percent) crosses soil designated as a severe erosion hazard, 3.5 miles (33 percent) cross soil designated as a moderate erosion

hazard, and the remaining 6.5 miles (62 percent) cross soil designated as a slight erosion hazard.

Impacts of project construction and operation on soil erosion and sediment delivery would be similar to the **low** impacts described for the Proposed Action (see Section 4.4.2).

4.4.9.1 Mitigation Measures

In general, erosion and sedimentation mitigation required for Options C1 and C2 would be similar to the Proposed Action (see Section 4.4.2.1). The north end of the route crosses into the Issaquah Creek drainage and the Tiger Mountain State Forest. The Issaquah Creek Watershed Management Committee Proposed Basin and Nonpoint Action Plan (King County 1994) also suggests several measures regarding timber harvesting, including education and monitoring, to reduce pollution and improve water quality.

4.4.9.2 Cumulative Impacts

Like Alternative A, most of the long-term land use impacts of Options C1 and C2 would be in addition to similar impacts from existing transmission and distribution lines in the project vicinity, as well as from other types of development and land use. Both options of Alternative C extend across substantial areas of suburban residential and commercial development, primarily in the Maple Valley area. Existing and new residential and commercial development would cause cumulative impacts. Cumulative impacts could occur from improvement or construction of new streets and highways. Impacts could also result from improvements to the Burlington Northern and Santa Fe Railroad that extends through Georgetown across the southern portion of the route. Mining operations, predominantly for aggregate, occur south of the Cedar River.

The most likely impacts would be increased soil erosion from construction sites or because of increased surface water runoff from more impervious surfaces, such as rooftops and parking lots. Cumulative effects would be **moderate** (see Table 4-3).

4.4.10 Alternative D (Options D1 and D2)

This alternative requires a much larger amount of clearing and road construction than any of the other alternatives. As such, it would have greater soil erosion impacts. The potential for sediment delivery from the disturbed ground is considered high because of the numerous streams and moderate to steep slopes along the route and evidence of past failure of roads due to debris flows. In addition, much of the lands crossed by this alternative are at elevations that accumulate some

snowpack. These areas are susceptible periodically to rain-on-snow events that, if they occur, can create debris flows and landslides that can be highly destructive. Clearing vegetation from lands in the zone of snow accumulation would increase the risk of soil erosion damage occurring should a warm weather front bring rain when snow is present on the ground. By implementing BMPs, the overall soil erosion impact would be **moderate**.

4.4.10.1 Mitigation Measures

Mitigation measures would be similar to Alternative B, but expanded due to the increased level of clearing and road construction associated with this alternative. See Section 4.4.8.1.

4.4.10.2 Cumulative Impacts

Cumulative impacts would be similar to Alternative B (see Section 4.4.8.2), except that the high level of vegetation clearing and higher level of road construction increases the risk of erosion on the steep slopes crossed by this alternative. Cumulative effects would be **high**.

4.4.11 Non-Transmission Alternative

Because no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12), there would be **no** immediate geology-or soils-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

4.4.12 No Action Alternative

Under the No Action Alternative, there would be **no** impacts.

4.5 Water Resources

This section addresses impacts of each alternative on floodplains, streams, water quality, and groundwater resources. While Alternatives 1 through 4 do not impact any floodplains, portions of Alternatives A, B and D would be sited in the floodplains of the Yakima, South Fork Snoqualmie and Cedar rivers. Alternative C spans the Cedar River, but would site no towers in its floodplain.

Surface water runoff is typically more rapid from areas that have been cleared of large vegetation and/or have disturbed soil than it is from areas with a mature forest canopy and/or undisturbed soil. The

➲ For Your Information

Evapotranspiration *— The total water loss from the soil, including that by direct evaporation and that by transpiration from the surfaces of plants.*

Permeable *— Capable of transporting liquids.*

forest canopy intercepts and temporarily stores rainfall, much of which may evaporate. The remaining stored rainfall eventually reaches surface water or groundwater, but over a longer time than rain falling on unforested ground. Forested areas typically return more moisture to the atmosphere by ***evapotranspiration***, which reduces the total amount of runoff. More runoff would occur more rapidly after an area is cleared.

Disturbed soil is generally less ***permeable*** than undisturbed soil. Rainfall is more likely to runoff directly to streams from areas of disturbed soil than from undisturbed soil where rainfall typically infiltrates. These impacts would occur along ROW clearings, access roads, and in the substation.

Ratings for floodplain and groundwater impacts are defined below. Ratings for stream water quality impacts follow the criteria for soil erosion impacts (see Section 4.4.1.1).

Appendices F and M further address impacts on Washington State 303(d) listed water bodies and potential "windthrow" hazards. No 303(d) listed water body segments are crossed by any of the alternatives and therefore none are impacted. Windthrow hazard ratings, which gauge to what extent ROW clearing would cause newly exposed trees to blow down during moderate to strong winds, are low for most alternatives. Those exposing more trees or those alternatives requiring more miles of clearing of older trees pose greater windthrow hazards. See the referenced appendices for more information.

4.5.1 Floodplain Impact Levels

Construction and development can directly impact floodplains by obstructing or changing floodwater channels, which could increase downstream flows and/or upstream flooding. Indirect impacts can occur when resources are degraded (*e.g.*, vegetation is removed and soil is compacted) enough to lessen the ability of the floodplain to store excess water, which increases the chance for flooding. Even when construction does not occur directly in a floodplain (such as for Alternatives 1 through 4), ROW clearing and access road construction above a floodplain could increase the peak runoff and total annual runoff somewhat. These impacts would likely be short term — most intense during and immediately following construction.

Floodplain impacts are defined as follows:

- **A floodplain impact** would occur when structures or permanent access roads encroach on designated floodplains and increase the potential for flooding, or might cause loss of human life, personal property, or natural resources within the floodplain.

- **No impacts** would occur where floodplains are avoided or spanned, or where standard mitigation would effectively eliminate impacts.

Because Alternatives 1 through 4 do not have any direct floodplain impacts, floodplain issues are not discussed under each of those alternatives below. Floodplain impacts are discussed only under Alternatives A through D.

4.5.2 Groundwater Impact Levels

Numerous residential wells exist in the areas of all the alternative routes. Alternatives 1 through 4 cross portions of the Cedar River Municipal Watershed, which supplies drinking water to the City of Seattle and some surrounding water districts. Alternatives A and C also cross land included in the city of Kent and city of Covington wellhead protection programs. Groundwater impact is assigned as follows:

- **High** groundwater impact is assigned to areas within a 100-foot radius of groundwater wells or within a wellhead protection area.
- **Moderate** groundwater impact is assigned to private land where groundwater wells likely exist within 0.5 mile.
- **Low** groundwater impact was assigned to the remaining areas.

4.5.3 Proposed Action

Because the Proposed Action would follow the existing Raver-Echo Lake 500-kV line, new access road construction would be limited. Consequently, most potential soil erosion and other water quality impacts would be short term.

Impacts on Streams/Water Quality — During construction, it is possible that surface water runoff containing fuel spills, herbicide runoff (herbicides would not be used in the CRW) and other contaminants could reach the main stream discharging from the drainage basin. Two major drainage basins could be affected. From south to north, the Proposed Action crosses the Cedar River, Rock Creek, and three small tributaries of Rock Creek, and the Raging River and two tributaries of the Raging River. The transmission line could also cross many small streams not shown on maps. Project construction and operation-related activities would be strictly controlled in the Cedar River Watershed to protect the drinking water supply. The state of Washington has designated this Watershed in a special category where no waste discharges are permitted.

The banks of the Cedar River and the Raging River are relatively high; low-growing vegetation close to the stream could be left in place to preserve shade and protect bank stability. Some tall-growing vegetation would be cleared. Where the Proposed Action crosses Rock Creek and its various tributaries, the ROW clearing may remove all tall-growing vegetation. This clearing would expose the creek to more direct sunlight, possibly causing some slight increase in water temperature.

The impacts from clearing would be most intense during and immediately following construction and would diminish as low-growing vegetation is re-established over the creek. However, some long-term impacts could occur because of the reduction in shade from the forest canopy. Fortunately, few streams would be affected and those that are are crossed by the proposed transmission line at an angle close to perpendicular, so that a relatively short distance (*i.e.*, 150 to 200 feet) of any one stream would be affected. Approximately 600 feet of creek channel in the Rock Creek drainage would be in newly cleared ROW, which is less than 1 percent of the more than 60,000 feet of total channel length.

The Proposed Action would cross over a pond and wetland area about one mile south of Echo Lake Substation. Most of this wet area is on the west side of the existing access road. Little disturbance should occur from construction, operation and maintenance of the proposed new line, which would be on the east side of the access road. Overall, the Proposed Action would create a **low** impact on streams. The proposed project should not result in a detectable degradation of the water quality.

Impacts on Groundwater — Construction and maintenance activities generally would not directly or indirectly introduce contaminates into groundwater aquifers. The project should not affect the chemical or biological characteristics of groundwater in the area. However, uncontrolled accidental spills from construction fuels and lubricants could infiltrate into, and contaminate, the aquifers that provide groundwater for residences, such as in the community of Selleck. Where appropriate, BPA uses herbicides during construction to prevent certain vegetation from resprouting and commonly uses herbicides during maintenance activities where appropriate. No herbicides would be used in the Cedar River Municipal Watershed. BPA's policy on herbicide use in the vicinity of domestic and public drinking water wells is to maintain a 165-foot buffer for any herbicide having a ground or surface water advisory and a 50-foot buffer for any other herbicide. Any herbicide used in construction, operation or maintenance of the proposed project, including the substation, would be EPA-approved and would be applied by licensed contractors in accordance with the label instructions. Impact on groundwater is expected to be **low**.

4.5.3.1 Mitigation

Most impacts to water quality would be from construction of roads and ROW clearing, followed by use and maintenance of roads. Most of the impacts and mitigation measures would be related to soil erosion, as discussed in Section 4.4. The following measures could be used to reduce impacts on water quality:

- *Avoidance*: Avoid construction in wetlands and avoid or mitigate degradation of water quality and fish habitat. Should access through an existing wetland be necessary, cross through wetland by the use of low-impact equipment or by laying down portable/temporary construction matting. Gate roads to restrict access with landowner/land manager's permission. (While public access is currently not allowed in the Cedar River Watershed, similar restrictions should be imposed on access roads for portions of the alignment that are in the upper Cedar River drainage basin. This would include the area south of Pole Line Road.) Restrict road construction to areas physically suitable based on watershed resource characteristics.
- *Prevention*: Preserve existing vegetation where practical, and especially next to intermittent and perennial creeks and streams. In the Cedar River Watershed, encourage low-growing vegetation. When improving roads in upland areas adjacent to wetlands, use appropriately sized rock material that will not inhibit the natural movement of water. BPA will require that, as much as possible, low impact construction equipment be used in order to reduce soil compaction and minimize disturbance to wetland soils. Design and maintain roads so that drainage from the road surface does not directly enter surface water. While no new bridges or fords are anticipated across larger streams, some new roads may cross smaller tributaries to these creeks. At these locations, design and construct stream crossings to avoid adverse impacts to stream hydraulics and deterioration of stream bank and bed characteristics.

Other elements of the SWPP Plan that would be used to management pollution to U.S. waters, other then erosion and sediments, are described as follows:

- **Spill Prevention Control and Countermeasure Plan:** *This element of the SWPP Plan helps prevent accidental spills and establishes cleanup requirements for petroleum and other hazardous materials. The emphasis of this plan element is to prevent any man-made debris from entering into nearby water bodies. Employees shall be trained on spill source and receptor recognition, spill prevention planning, spill prevention techniques, spill response measures, and spill reporting protocol. Included in this plan are requirements for:*

    1. Avoiding refueling and/or using hazardous materials where accidental spills could enter surface or groundwater.
    2. Using secondary containment to prevent fuel and hazardous materials spills and contaminated runoff from reaching streams.
    3. Inspecting and maintaining construction equipment to prevent releases of petroleum based fluids and / or solvents to the environment.
    4. Removing and disposing of materials such as caustics, grout/ concrete/cement, concrete wash water, etc.
    5. Removing and disposing of other construction waste such as plastic, paper, metal, construction debris, etc.
    6. Avoiding discharge of solid materials, including building materials, into U.S. waters unless authorized by a Clean Water Act Section 404 permit.

4.5.3.2 Cumulative Impacts

Although no waters are 303(d) listed within the project area, potential increases in sedimentation, temperature, or other 303(d) parameters could affect future listings. The potential cumulative impacts on water quality and fish and other habitat would occur mostly from soil disturbing activities, which are described in Section 4.4 and displayed in Table 4-4. The estimated cumulative effect from soil erosion is considered **low**.

Several impacts discussed in the previous section could affect fish habitat. These include changes in water temperature from clearing vegetation adjacent to stream channels, increased sedimentation, increased peak runoff resulting from reduced evapotranspiration and interception in cleared areas, and reduced permeability on road surfaces. Suburban development and logging would have minor cumulative effects on these parameters.

The Proposed Action's overall cumulative impacts on water quality are expected to be **low**.

4.5.4 Alternative 2

Most construction-related impacts would be the same as the Proposed Action. The portion of Alternative 2 that does not coincide with the Proposed Action would require some additional road building. Most soil erosion impacts would be short term.

Impact on Streams/Water Quality — Alternative 2 would cross the same streams as the Proposed Action; however, the Cedar River crossing would be at a low bank. Most trees and high brush close to the stream would have to be removed. This clearing would expose the river to more direct sunlight possibly causing some increase in water temperature. However, because the relative amount of river exposed is small, overall impact on streams would be considered **low** as in the Proposed Action.

Impact on Groundwater — Alternative 2 passes east of the community of Selleck before proceeding north into the Cedar River Watershed. The portions of Alternative 2 near this community are designated as moderate groundwater impact areas because they likely use water wells for residential domestic use. Accidental construction- and maintenance-related fuel spills or use of herbicides likely would not directly impact these wells. However, contaminants could migrate in groundwater towards the wells if an accidental spill were to occur *upgradient* from the wells. Overall impact on groundwater would be **low**.

4.5.4.1 Mitigation

See Mitigation heading under Section 4.5.3.1, Proposed Action.

4.5.4.2 Cumulative Impacts

See Cumulative Impacts heading under Section 4.5.3.2, Proposed Action.

4.5.5 Alternative 3

Most construction-related soil erosion, ROW clearing activities and maintenance along Alternative 3 would be essentially the same as along the Proposed Action. Impacts would be similar. All of Alternative 3 would be on new ROW, requiring additional access roads and increasing potential impacts on water quality. However, most potential soil erosion impacts would be short term.

Impact on Streams/Water Quality — During construction, it is possible surface water runoff containing fuel spills, herbicide runoff and other contaminants could reach the main stream discharging from the drainage basin. The Cedar River and Raging River drainage basins could be affected.

Alternative 3 would cross the Cedar River at a low bank location so that trees and high brush close to the stream would have to be removed. This clearing would expose the creek to more direct sunlight, possibly causing some increase in water temperature. Alternative 3 crosses other streams including Taylor Creek, Steele Creek, the Raging River headwater creek, Canyon Creek, and three tributary creeks of the Raging River. The moderate risk of soil erosion described in section 4.4.4 creates a **moderate** risk of turbidity in these streams. Clearing along these streams may also cause increases in temperature, although the impacts should be **low** because of the short length of channel affected.

Impact on Groundwater — Alternative 3 does not cross private land where groundwater wells may be present. The entire alignment is in a **low** groundwater impact area.

4.5.5.1 Mitigation

See Section 4.5.3.1, Proposed Action.

4.5.5.2 Cumulative Impacts

Cumulative impacts would be very similar to those described in Section 4.5.3.2 for the Proposed Action. However, the higher level of direct impacts to soils associated with this alternative would create a higher risk of sedimentation in the Raging River, Steele Creek Basin, and Canyon Creek. Cumulative effects would be **moderate**.

Table 4-4 — Cumulative Water Impacts

Past, present and future projects	Alt 1	Alt 2	Alt 3	Alt 4A	Alt 4B	Alt A	Alt B	Alt C	Alt D
Effect of proposed alternative on floodplains	*	*	*	*	*	*	*	0	**
Effect of proposed alternative on streams/water quality	*	*	**	*	*	*	**	*	**
Effect of proposed alternative on groundwater	*	*	*	*	*	***	* to **	***	**
Existing transmission lines	*	*		*	*	*	*		*
Existing level of development	*	*	*	*	*	**	*	**	*
I-90 widening east of Hyak							**		**
I-90 thinning on NF land							*		*
Potential lot development	*	*	*	*	*	**	*	**	*
Logging on private timberlands	*	*	*	*	*	*	*	*	*
Snoqualmie Pass recreation expansion							0		0
Population growth in Puget Sound area	*	*	*	*	*	**	*	**	*
Expansion of SR-18						**		**	
Total Cumulative Effect	*	*	**	*	*	***	**	***	***

* = low adverse impact ** = moderate adverse impact *** = high adverse impact
+ = beneficial effect 0 = no effect

4.5.6 Alternative 4A

Most construction-related, soil erosion, ROW clearing activities and maintenance along Alternative 4A would be essentially the same as along the Proposed Action. Impacts would be similar. Additional spur road building and maintenance would be required along the portions of Alternative 4A that do not parallel the existing line. Most potential soil erosion impacts would be short term.

Impact on Streams/Water Quality — Alternative 4A would cross the same streams as the Proposed Action, with the Cedar River crossing at the same high bank location. Therefore, the impacts at the stream crossings would be the same (**low**) as along the Proposed Action.

Impact on Groundwater — See Section 4.5.2.2, **Alternative 2**. The remainder of Alternative 4A crosses **low** groundwater impact areas that probably do not currently have active groundwater use, including the Cedar River Watershed and private timberland.

4.5.6.1 Mitigation

See Section 4.5.3.1, Proposed Action.

4.5.6.2 Cumulative Impacts

See Section 4.5.3.2, Proposed Action.

4.5.7 Alternative 4B

The impacts, mitigation, and cumulative impacts would be essentially the same as along Alternative 4A: **low**. The primary differences are the total length of the alignment is longer, more area in the Cedar River Watershed would be disturbed by ROW clearing, and Pole Line Road would serve as the trunk road where Alternative 4B does not coincide with the Proposed Action or Alternative 2. In addition, Alternative 4B would create a separate Cedar River crossing including clearing near the river (removal and topping of trees). Approximately six miles of the new line would be within the watershed boundaries. About 6.4 miles of the new line would be in the upper Cedar River drainage basin, while the remainder would be in the Raging River drainage basin.

4.5.8 Alternative A

Impact on Floodplains and Flooding — Alternative A could affect the Cedar River floodplain. Roads and towers in the floodplain could alter the floodways. Debris could be trapped against the tower structures during floods and divert flows or cause the structure to fail. If additional ROW clearing and access road construction is needed, the

peak runoff and total annual runoff could increase. These impacts would be most intense during and following construction. As vegetation again becomes well established in the ROW clearing, the impacts would decrease. However, because few new roads and little additional clearing of the ROW is proposed, major project-related changes in the peak and total amount of runoff would be unlikely, and overall floodplain impacts are **low**.

Impact on Streams/Water Quality — Two major drainage basins could be affected by Alternative A. Approximately 5.6 miles of the route would be within the Cedar River watershed (not the Cedar River Municipal Watershed), and the remaining 14.4 miles would be in the Big Soos Creek drainage basin. Surface water runoff containing fuel spills, herbicide runoff, and other contaminants could reach these main streams. Construction-related soil erosion from clearing activities along the ROW could affect water quality, as discussed in Section 4.4.

However, because Alternative A would mostly follow existing transmission line ROWs, new access road construction would be limited to improving the existing trunk access and spur roads, and construction of some new, short spur roads to the new tower locations. Because the ROW would cross gently to moderately sloping ground, the potential for erosion and landslides would be generally **low**. Impacts on streams would also be **low**.

Impact on Groundwater — From the tap point of the Schultz-Raver line west to Covington, Alternative A would cross private land with numerous residences. Many of the residences likely have groundwater wells for domestic use. This portion of the route also extends through an area designated for the city of Kent's and the city of Covington's wellhead protection programs. These programs are intended to protect the groundwater quality for the Clark Springs, Kent Springs, and Armstrong Springs source areas. These source areas represent approximately 95 percent of the city of Kent's water supply (City of Kent, 1996). Alternative A would cross directly through the Clark Springs area. Much of the wellhead protection area that Alternative A traverses has been rated as highly susceptible to groundwater contamination. Construction and maintenance-related accidental fuel spills or use of herbicides could affect groundwater quality. This portion of the route has been designated as a **high** groundwater impact area.

The remainder of Alternative A north of Covington would also cross private land with numerous residences. Many of these residences likely have groundwater wells for domestic use. This portion of the route is designated as a **moderate** groundwater impact area,

4.5.8.1 Mitigation

Besides mitigation measures suggested under Section 4.5.3.1, **Proposed Action**, the following floodplain-oriented measures could be taken:

- Locate towers and associated roads outside of the floodplain whenever possible.
- If construction must occur within a floodplain, locate towers as far as practical from active channels and out of the channel migration zone.
- Keep access road lengths to a minimum to reduce hydrologic and erosion impacts.

4.5.8.2 Cumulative Impacts

Because Alternative A has potential direct effects to many private groundwater wells and the city of Kent and the city of Covington wellhead protection area, any other additional projects or activities within the area that could affect the water quality would exacerbate these effects. The potential impacts of further development and road projects would cause additional clearing of vegetation and soil erosion. The cumulative effect on water from Alternative A is **high**. See Table 4-4.

4.5.9 Alternative B

Impact on Floodplains and Flooding — Construction of Alternative B would involve tearing down the existing transmission structures, extending existing short spur roads to new tower locations, excavating new foundations in different locations from the existing towers, and erecting new towers along the existing route. Construction activity would include removing ROW trees and danger trees outside the ROW and reconstructing and upgrading existing roads. Alternative B crosses the Yakima River and South Fork Snoqualmie River floodplains. These floodplains are wide and may require tower structures within the floodplain to cross them. Because some additional ROW clearing and reconstruction of roads may be required, some impacts to peak flows could occur. Impacts would be **low** if mitigation measures are properly installed and monitored, but there is a risk of higher impacts.

Impact on Streams/Water Quality — Two major drainage basins could be affected by Alternative B. Approximately 12 miles of the route would be within the Yakima River watershed, and the remaining 24 miles would be in the South Fork Snoqualmie River drainage basin. Surface water runoff containing fuel spills, herbicide runoff and other contaminants could reach these main streams. Construction-related soil

erosion and ROW clearing activities could affect water quality, as discussed in Section 4.4.

Because Alternative B would follow an existing transmission line ROW, new access road construction would be limited to improving the existing trunk access and spur roads, reconstructing some spur roads to improve drainage, and construction of some new, short spur roads to any new tower locations. However, because of the amount of earth-disturbing activities associated with footing excavation and road construction and improvement, the many streams crossed, and the moderate to steep topography, the potential for erosion and landslides is considered to be moderate, at least in the short term and low after the area has stabilized. Overall impacts to streams would be **low** to **moderate.**

Impact on Groundwater — Alternative B would cross the Yakima River Valley floor where substantial groundwater probably occurs. However, few residences that may be dependent on water supply wells are located in this area. The route would continue west across the lower portion of steep to moderate slopes, where there is also minor development. Between the most western crossing of the South Fork Snoqualmie River and Rattlesnake Mountain, southeast of North Bend, residential development increases. Many of these residences may depend on wells for water supply. No groundwater supply users exist along Rattlesnake Mountain to Echo Lake Substation. The entire route is considered to be a **low** groundwater impact area except the area of denser residential development southeast of North Bend, which is considered a **moderate** impact area.

4.5.9.1 Mitigation

See Section 4.5.8.1, **Alternative A**. In addition, the following applies on National Forest land:

- Full bench road construction and end hauling may be required on slopes <60% in some areas.

4.5.9.2 Cumulative Impacts

The potential impacts to the upper Yakima River due to widening of I-90 and construction of this alternative during the same timeframe could be substantial. The sensitivity of potential impacts may be heightened in the near future with Washington Department of Ecology plans to monitor water quality in the upper Yakima Watershed during the next few years.

Further development of lots and road projects would cause additional clearing of vegetation and soil erosion, particularly on the South Fork Snoqualmie River near North Bend. Logging on private

timberlands also has the potential to affect stream quality in the South Fork Watershed. The cumulative effect to water of Alternative B is **moderate**. See Table 4-4.

4.5.10 Alternative C (Options C1 and C2)

Impact on Floodplains and Flooding — This route would be located in a new ROW near Ravensdale. The Cedar River floodplain is narrow in the vicinity of the proposed crossing so that the floodplain would be spanned. Smaller streams along the route would also be spanned so that their floodplains would not be impacted. Therefore, Alternative C has **no** floodplain impacts. The required ROW clearing and access road construction could increase the peak and total annual runoff volumes. These impacts would be short term — most intense during and following construction. As vegetation again becomes more established in the ROW, the runoff impacts would decrease.

Impact on Streams/Water Quality — Three major drainage basins could be affected by Alternative C. From south to north, approximately 3.6 miles of the Option C1 route or four miles of the Option C2 route would be within the Cedar River Watershed. About four miles of the Alternative C route would be in the Big Soos Creek Watershed. The remaining 2.6 miles of the route would be in the Issaquah Creek drainage basin. Surface water runoff containing fuel spills, herbicide runoff, and other contaminants could reach these main streams. Because much of Alternative C would be in a new ROW, erosion and sedimentation from additional cleared ground and new roads could impact surface water sources, although most impacts would be short-term. Removal of streamside vegetation would be minimized to reduce impacts on water quality, such as stream temperatures. Overall impacts would be **low**.

Impact on Groundwater — Alternative C would cross the east end of the city of Kent's wellhead protection area. This section of the route is rated as a **high** groundwater impact area. To the north, the route traverses rural residential development. Some of these residences may be dependent upon groundwater supplies for domestic use. This area is designated a **moderate** groundwater impact.

4.5.10.1 Mitigation

See Section 4.5.8.1**, Alternative A**.

4.5.10.2 Cumulative Impacts

Alternative C could potentially directly impact groundwater wells. As further development near the new line takes place, potential impacts to additional wells from operation and maintenance of the line may

occur. The potential impacts of further development and road projects would cause additional clearing of vegetation and soil erosion. Widening of SR 18 during the same timeframe would increase overall effects within the Issaquah Creek Basin. The cumulative effect to water of Alternative C is **high**. See Table 4-4.

4.5.11 Alternative D (Options D1 and D2)

Impact on Floodplains and Flooding — Alternative D (both Options D1 and D2) would require new ROW clearing and access roads. New ROW would be adjacent to existing ROW, limiting new road construction to short spur-road extensions from existing roads to the new tower sites. Options D1 and D2 would cross the Yakima River and South Fork Snoqualmie River floodplains. These floodplains are wide and may require tower structures and roads within the floodplain to cross them. Because additional ROW clearing and roads are required, peak and total flow volumes would likely increase. However, because the total area of cleared and roaded ground in the floodplain would be small, such impacts would be **low** if mitigation measures are properly installed and monitored. The new route would span floodplains of smaller streams so that they would not be impacted.

Impact on Streams/Water Quality — This alternative has the highest potential to impact streams. Options D1 and D2 could affect two major drainage basins. Approximately 12 miles of either route would be within the Yakima River Watershed, and the remaining 245 miles would be in the South Fork Snoqualmie River drainage basin. Surface water runoff containing fuel spills, herbicide runoff, and other contaminants could reach these main streams. Because of the large number of acres that would be cleared, and increased amount of earth-disturbing activities for roads and tower construction, the potential for erosion and landslides would be greater. This potential would be greatest during and following construction, but would diminish with time as the areas revegetate and stabilize.

Alternative D (either Option D1 or D2) could also impact the numerous streams it crosses by requiring removal of some streamside vegetation. The amount removed would depend on tower siting and clearing requirements. Either route would cross the South Fork Snoqualmie River twice in a new ROW. Any vegetation removal could result in impacts to water quality, such as increased temperature resulting from reduced shade.

Overall, Alternative (Option D1 or D2) would have a **moderate** to **high** impact on streams.

Impact on Groundwater — Impacts to groundwater resources from Options D1 and D2 would be similar to those for Alternative B:

low to **moderate** (see Section 4.5.9). However, because this alternative would require new ROW clearing, the impacts could be greater.

4.5.11.1 Mitigation

See Section 4.5.8.1, **Alternative A**.

4.5.11.2 Cumulative Impacts

The potential cumulative impacts of this alternative are similar to Alternative B, except that this alternative results in substantially increased amounts of vegetation clearing and new road construction compared to Alternative B. The sensitivity of potential impacts may be heightened in the near future with Washington Department of Ecology plans to monitor water quality in the upper Yakima Watershed during the next few years. The cumulative effect to water of Alternative D is **high**. See Table 4-4.

4.5.12 Non-Transmission Alternative

Because no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12), there would be no immediate water resource impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

4.5.13 No Action Alternative

Under the No Action Alternative, there would be **no** impacts.

4.6 Fisheries

All transmission alternatives would have similar impacts to fish and their habitat. All transmission alternatives would require removal of riparian forest vegetation in areas that could cause adverse effects to fish species listed as threatened under the ESA. Although measures could be taken to minimize vegetation clearing in riparian areas, the residual impacts would persist throughout the life of the project. All alternatives would also require the construction and maintenance of roads, some more than others, which could contribute to erosion and sedimentation in streams. Mitigation methods are available that would reduce road-related impacts. The alternatives that pass through USFS-managed lands would likely impact riparian reserves under the protection of the Northwest Forest Plan.

Specifically, construction, operation, and maintenance of transmission facilities could impact fish and their habitat as a result of:

- reduced in-stream large woody debris (**LWD**), reduced LWD recruitment potential, and changes in stream thermal regime associated with vegetation and tree clearing within designated riparian buffers for the transmission line ROW and access roads;
- disturbance of fish habitat or passage from placement of culverts, fords, or other crossing structures in streams;
- degradation of water or spawning gravel quality from ground surface disturbance associated with ROW clearing or road construction that contributes sediment to streams;
- catastrophic loss of habitat and fish populations if a debris torrent affects a stream channel as a result of ROW clearing, road construction, or road maintenance;
- acoustic shock from the use of explosives in or close to fish-bearing streams; or
- toxicity or deterioration of water quality from accidental chemical spills.

These are recognized as common impacts to fish populations and habitat resulting from timber harvest and associated activities in mountainous terrain in the Pacific Northwest (WFPB 1998, City of Seattle 2000). The physical transmission line structure itself would not impact fish or their habitat. All impacts would be associated with ROW clearing for construction and maintenance of the transmission facilities and access roads.

See Appendices A and N for more detailed information and maps.

4.6.1 Impact Levels

An impact would be **high** if an action causes:

- an adverse effect on a federally-listed threatened fish species, as determined through interagency consultation with the USFWS and NMFS under Section 7 of the Endangered Species Act; or
- substantial adverse effects to essential fish habitat; or
- non-attainment of USFS Aquatic Conservation Strategy objectives (**ACSOs**) and/or direct impacts to USFS-managed riparian reserves; or
- a regional adverse effect on the populations, habitat, or viability of fish species of concern, which would tend toward endangerment and the need for federal listing of the species.

An impact would be **moderate** if an action causes:

- an effect on threatened or endangered species that could be mitigated through interagency consultation with the USFWS and NMFS under Section 7 of the ESA; or
- minimal adverse effect or less than substantial adverse effect to essential fish habitat; or
- temporary impediments to attaining USFS ACSOs and/or temporary impacts to USFS-managed riparian reserves; or
- a localized and/or short-term (up to three years) reduction in the quality or quantity of aquatic resources or habitats that does not result in the take of a federally-listed species, or have a major effect on a fish species of concern.

An impact would be **low** if an action causes:

- an effect on fish species not listed under the ESA, that would be largely mitigated; or
- no adverse effect to essential fish habitat; or
- attainment of USFS ACSOs with temporary impacts to USFS-managed riparian reserves that would largely be mitigated; or
- a temporary (less than three years) reduction in the quantity or quality of aquatic resources or habitats confined to the site of the action.

No impacts would occur if the action would result in no temporary or permanent loss of quantity or quality of aquatic resources.

To compare the alternatives' impacts on fisheries, a number of factors that could affect fish were evaluated (see Table 4-5), including the number and location of potential fish-bearing streams crossed by the ROW, the number and location of stream-crossing structures (culverts or bridges) associated with new roads, and the sensitivity of fish resources (whether accessible to anadromous fish). The estimates of clearing in Table 4-5 reflect the assumption that all trees in the ROW would be cleared. In practice, clearing requirements may be reduced in some areas due to local topography and use of micropile tower footings. Conversely, clearing requirements, including vegetation both on and off the ROW, may be greater in other areas due to a number of factors including tree heights, tree species, tree health, tree stability, and topography. Thus, the cleared areas shown in Table 4-5 could vary from final actual clearing by as much as +/- 20 percent.

4.6.2 Impacts Common to All Transmission Alternatives

4.6.2.1 Removal of Riparian Vegetation

Removal of riparian trees during construction could affect fish habitat. Such effects would be permanent because the ROW would be kept clear during operation and maintenance. Riparian trees protect fish habitat by filtering runoff before it reaches the stream, shading the stream and reducing mid-summer temperatures, providing LWD to streams that increases habitat complexity, stabilizing streambanks, and providing organic matter to the stream that increases productivity in the aquatic food chain. Removal of riparian trees and disturbance of the streambank could result in increased erosion, sediment loading, and turbidity; increased temperature; changes in habitat complexity; and lower productivity.

There has been a great deal of debate about how the ecological role of riparian vegetation varies with distance from the stream. The principal ecological variables of concern include LWD delivery to streams, root reinforcement of streambanks, litter fall, and shading (FEMAT 1993). These variables are generally agreed to vary approximately in proportion to the distance from the channel, relative to ***site potential tree height (SPTH)***. The SPTH is the height that trees in the riparian forest may reasonably be expected to achieve within an appropriate time period, often established as 50 or 100 years. Most analysts also agree that the size of the affected stream should be considered in assessing riparian zone effects on the stream.

Land management agencies in the Pacific Northwest have had to manage for riparian ecological functions in response to development pressures that generally entail removal of forest cover. The most widespread removal activity is logging, but loss of riparian vegetation is also a major concern in areas subject to agricultural, residential, industrial, and other land uses. The usual response by management agencies has been to require preservation of a "riparian buffer" or "riparian management zone" (***RMZ***), within which tree removal is restricted or prohibited and impacts to riparian vegetation must be minimized. Within the entire project area (including all alternative routes), several regulatory standards have been approved by the USFWS and NMFS as being sufficiently protective of riparian and fisheries resources to ensure compliance with the ESA. These regulatory standards are the Cedar River Watershed HCP (City of Seattle 1998, 2000), Washington Department of Natural Resources HCP (WDNR 1997), the Northwest Forest Plan (USFS & BLM 1994a), and Washington Forest Practices Rules, as amended in March 2000 (WAC 222). These regulatory standards are summarized in Table 4-6. Local municipal codes also set minimum limits for stream buffers and affect all alternatives.

Each of these regulatory standards has received Section 7 concurrence from NMFS as having low potential to adversely affect listed salmonid species. Vegetation clearing, if performed under the applicable regulatory standard, is assumed to have **no** (or **low**) impact to fish and their habitat. Conversely, vegetation clearing that exceeds the criteria specified in Table 4-6 is assumed to have a **moderate** or **high** impact to fish resources.

Clearing the transmission line ROW and danger trees outside the ROW would involve removal of trees and other tall-growing vegetation for construction. However, there may be places where this is sufficient clearance between the existing vegetation and the conductor so some trees could be retained within the ROW. Transmission towers are typically sited on higher ground, and they generally span drainages and associated riparian areas. This siting requirement may reduce potential impacts from riparian clearing because topography facilitates placement of structures that span drainages and increases the likelihood that conductors would be above some riparian areas and require only limited removal of vegetation.

Construction of the transmission line, particularly clearing riparian vegetation, has the potential for **high** impacts on *protected fish* and **moderate** impacts on *non-listed fish*. However, BPA would prepare a clearing advisory as part of the design of the project. This advisory would evaluate areas to be cleared and the permissible height of existing vegetation that could remain. BPA would site facilities to reduce clearing of riparian areas.

BPA would also minimize potential effects to fish habitat from vegetation clearing during road construction. Roads would be constructed outside of riparian zones except at stream crossings, steep and erodible areas would be avoided where possible, and water bars and drainage features would be installed where needed in accordance with the Washington Forest Practices Rules, the Northwest Forest Plan (USFS & BLM 1994b), and the Memorandum of Understanding (**MOU**) between the Forest Service and WDFW (WDFW & USFS 1997).

4.6.2.2 Culvert Installation

Some alternatives require the installation of culverts to provide or upgrade stream crossings for access roads. BPA recognizes that improper culvert installation may cause drainage network extension, increasing peak flows in affected streams. It may also result in increased delivery of fine sediment to affected streams, either by exposing erodible surfaces during stream crossing placement, by channeling ditch runoff to the streams, or by increasing stream power due to the changes in peak flows as discussed in Section 4.6.2.3. Peak flow increases may cause stream channel instability, altering fish habitat and increasing scour in spawning gravels. Fine sediment effects are detailed below.

Table 4-5 — Impact on Fish-Bearing Streams by Each Transmission Alternative

Affected Area	Alternative										
	Proposed Action	2	3	4A	4B	A	B	C (Option C1)	C (Option C2)	D (OptionD1)	D (Option D2)
Number of Fish-Bearing Streams Crossed by Conductors	9*	11	25	11	11	8	31	4	4	31	31
Number of Fish-Bearing Streams Crossed by New Roads	0	2	7	2	2	1	1	0	0	2	1
Number of Fish-Bearing Streams within 100 ft. of Clearing	11	14	28	13	13	8	34	4	4	34	34
Area Cleared within 100 ft. of Fish-Bearing Stream (ac.)**	12	14	34	14	14	8	7	4	4	40	31
Number of Fish-Bearing Streams within 300 ft. of Clearing	15	16	28	15	15	8	34	4	4	34	34
Area Cleared within 300 ft. of Fish-Bearing Stream (ac.)[a]	33	40	77	37	37	24	28	14	14	120	95
Number of Towers within 300 ft. of Fish-Bearing Streams	NONE	NONE	NONE	NONE	NONE	4	13	5	5	18	6
Length of Fish-Bearing Stream within Cleared Area (ft.)	2,869	3,060	6,200	3,180	3,180	1,708	1,427	963	964	9,199	6,866
Length of Non-Fish-Bearing Stream within Cleared Area (ft.)	NONE	NONE	NONE	NONE	NONE	473	3,380	727	367	13,705	14,119
Number of Fish-Bearing Streams on USFS-Managed Lands Crossed by Conductors	NONE	NONE	NONE	NONE	NONE	NONE	19	NONE	NONE	19	20
Length of Fish-Bearing Stream on USFS-Managed Lands within Cleared Area (ft.)	NONE	NONE	NONE	NONE	NONE	NONE	999	NONE	NONE	5,114	3,667
Length of Non-Fish-Bearing Stream on USFS-Managed Lands within Cleared Area (ft.)	NONE	NONE	NONE	NONE	NONE	NONE	2,044	NONE	NONE	8,778	8,892
Area Cleared within Riparian Reserves (ac.)[a]	NONE	NONE	NONE	NONE	NONE	NONE	24	NONE	NONE	110	89

*Span across Cedar River will be double circuit with existing line for one span only requiring no clearing for over 1,000 feet on each side of the river.

**The cleared areas shown could vary from final actual clearing by as much as +/- 20%.

Improperly installed stream crossings may block or impede fish passage by increasing the velocity or decreasing the depth of water flowing through the structure, or because the culvert poses a physical barrier (as with a hung culvert). Blocking a stream to fish passage could result in a loss of access to spawning and rearing habitat. Some fish in the streams along the proposed transmission line ROW — including sensitive species such as bull trout, steelhead, and salmon — migrate upstream to spawn. Although spawning fish could tolerate short delays in migration, blocking or prolonged delays in migration to spawning grounds could locally reduce the productivity of these species.

BPA would comply with guidelines for fish passage in the design of all culverts as specified in the WDFW guidelines and criteria for stream crossings (WDFW 1999) and would comply with WDFW guidelines for in-water work, as specified in the Hydraulic Project Approval (***HPA***) for each stream-crossing structure. In addition, BPA would design roads to minimize the number of new stream crossings. BPA would also meet all of the requirements of the Northwest Forest Plan related to culvert design (USFS & BLM 1994b) and the measures included in the MOU between the USFS and WDFW (USFS & WDFW 1997). Some existing culverts that currently block fish passage may be replaced with culverts designed to allow fish passage if BPA can obtain the necessary permits. Because of these measures, culvert installations for any alternative requiring them would result in **low** impacts to fish and their habitat.

4.6.2.3 Fine Sediment Delivery to Streams

Excessive delivery of fine sediment to streams would degrade water quality and fish habitat. Increased ***turbidity***, the fine suspended sediment load carried by a stream, could affect fish and other aquatic organisms directly by abrasion, clogging of gills, decreasing feeding success due to reduced visibility, and by affecting other organisms that fish eat. As sediment settled, it could enter spawning gravels, reducing spawning gravel permeability and causing increased egg and fry mortality and reduced fry growth rates. Fine sediment could also reduce plant or phytoplankton productivity, reduce flows within gravels that are important to maintaining low stream temperatures, and smother or displace aquatic invertebrates. In very large quantities, fine sediment could fill pools, which are important habitat for fish.

Construction of the transmission line would generally cause **low** impacts to fish and their habitat as a result of erosion and sedimentation, although the potential for greater impacts varies considerably among the alternatives. BPA has constructed transmission lines using a number of standard construction practices and BMPs that would minimize potential impacts to fish from turbidity and sedimentation (see Section 4.6.2.10, **Mitigation**).

4.6.2.4 Catastrophic Channel Disturbance

Clearing of the transmission line ROW and for new access road construction on steep slopes (generally slopes steeper than 70 percent), may reduce soil strength as tree roots decay that formerly stabilized the soil. This mechanism has been shown to be a principal cause of landslides in logged areas (WFPB 1998). Such landslides typically occur during exceptional winter storms, which occur about once every 10 years in the mountains of western Washington. If such a landslide enters a stream, it becomes a debris torrent or ***debris flow*** — a water-rich landslide that descends a stream channel. A debris torrent may cause greatly increased erosion rates, loss of most in-stream LWD, reduction of riparian vegetation, deposition of fine sediment that is redistributed downstream, and mortality of all fish in the directly affected channel (WFPB 1998, Coho and Burges 1994). Impacts from alternatives would vary depending on the number of road stream crossings needed for construction and maintenance of the lines.

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Debris flow *— Rapid movement of water-charged mixtures of soil, rock, and organic debris down steep stream channels.*

4.6.2.5 Blasting Tower Footings

Although specific sites have not yet been identified, it is likely that BPA would need to blast bedrock to install some tower footings. Detonation of explosives in or adjacent to fish habitat could cause disturbance, injury, or death to fish and destruction or alteration of their habitat.

Some towers would be located within 400 feet of streams. If blasting was required for those footings, and streams near the blast site were fish bearing, BPA would avoid blasting during periods when eggs or ***alevins*** are present in gravels. If blasting were required in or adjacent to streams supporting federally-listed or proposed species, BPA would follow consultation recommendations agreed to with the USFWS and/or NMFS. Construction, including blasting near streams, may be performed during authorized in-water work windows based on WDFW procedures for protection of salmon and their eggs. (See Section 4.6.2.10, **Mitigation**.)

Alevins *— The developmental life stage of young salmonids and trout that are between the egg and fry stage. The alevin has not absorbed its yolk sac and has not emerged from the spawning gravels.*

4.6.2.6 Accidental Spills of Hazardous Materials

Construction of any of the alternatives and access roads would require several fairly common construction materials (*e.g.*, concrete, paint, and wood preservatives), herbicides, and petroleum products (*e.g.,* fuels, lubricants, and hydraulic fluids) that could be toxic to fish and other aquatic organisms. BPA might store small quantities of these materials either along the ROWs or in staging areas. An accidental spill of these materials that reached streams, lakes, ponds, or wetlands could impact fish.

Table 4-6 Regulatory Standards for RMZs and Riparian Buffers in the Project Area

Standard	Jurisdiction	Stream Type	Provisions
United States Forest Service Northwest Forest Plan Standards and Guidelines (USFS & BLM 1994a and b)	USFS Region 6 managed forest lands	Class 1-Fish-Bearing Streams	Stream plus the greater distance of top of inner gorge, outer edges of 100-year floodplain, outer edges of riparian vegetation, two times the site potential tree height (SPTH), or 300-ft. slope distance on each side.
		Class 2-Perennial, Non-Fish-Bearing Streams	Stream plus the greater distance of top of inner gorge, outer edges of 100-year floodplain, outer edges of riparian vegetation, one times the SPTH, or 150-ft. slope distance on each side.
		Class 3-Intermittent Streams	Stream plus the greater distance of top of inner gorge, outer edges of riparian vegetation, one times the SPTH, or 100-ft. slope distance on each side.
Cedar River Watershed Habitat Conservation Plan (City of Seattle 2000)	Cedar River Municipal Watershed	Not applicable	No commercial forest harvest within the Cedar River Watershed. Manage all forests to provide certain enumerated ecological functions.
Department of Natural Resources Habitat Conservation Plan (WDNR 1997)	State-owned timberlands	Type 1, 2, or 3	No trees to be cut in a buffer width corresponding to the 100-year SPTH, with a minimum 100-ft. width.
		Type 4	No trees to be cut in a 100-ft.-wide buffer.
		Type 5	Buffer width to be determined on a case-by-case basis pending further studies.
Washington Forest Practices Rules (WAC 222)	Privately owned commercial timberlands	Type 1, 2, or 3	For Site Class 2 lands (50-year SPTH, 119 to 136 ft.): No trees to be cut in a 50-ft.-wide core buffer; very limited tree removal in an additional buffer 63-ft.-wide on streams with a bankfull width of less than 10 ft., or 78 ft. wide on streams with a bankfull width of more than 10 ft.; leave 20 trees per ac. larger than 12 in. dbh in an additional buffer 57 ft. wide on streams with a bankfull width of less than 10 ft., or 78 ft. wide on streams with a bankfull width of more than 10 ft.
		Type 4	No trees to be cut in a 50-ft.-wide buffer within 300 ft. of a junction with a WDNR Type 1, 2 or 3 stream. On longer streams, buffer at least 50% of stream length with a 50-ft.-wide buffer. No trees to be cut near certain sensitive sites. Numerous additional restrictions.

BPA would prepare a Spill Prevention and Contingency Plan to minimize the potential for spills of hazardous materials to streams and other water bodies (see Section 4.6.2.10, **Mitigation**). The plan would include restrictions on storage or transfer of fuels or other hazardous materials within riparian areas, and plans for clean-up in the unlikely event of a spill.

4.6.2.7 Species Listed and Proposed for Listing under the Endangered Species Act

Any of the transmission alternatives could potentially impact listed chinook salmon and bull trout and a listing candidate species of coho salmon. Alternatives A through D could potentially impact listed steelhead as well. Reduced LWD recruitment potential and impacts to stream thermal regime are the two primary issues of concern. The level of these *potential* impacts would be high for the following reasons. First, the loss of LWD recruitment would be permanent and would affect streams that, by and large, already contain insufficient LWD. Second, in view of the low project area elevation of some alternatives, potential thermal effects could harm fish by causing thermal stress during low flows.

The Lower Cedar River provides most of the current spawning habitat for chinook in the Cedar-Sammamish Watershed and is also used by bull trout upstream of Landsburg Dam. The Upper Cedar River also contains suitable chinook salmon spawning habitat, and such use is expected to occur after the Landsburg Diversion Dam fish ladder is completed (scheduled for August 2003). In the Soos Creek Basin, chinook are known to be present in Jenkins and Little Soos Creek at the locations crossed by Alternative A. In the Issaquah Creek Basin, the presence of chinook has been document in Carey Creek and as far as 11 miles upstream in Holder Creek. Chinook salmon have been recorded in the Raging River less than one mile downstream of the Proposed Action crossing and are known to spawn in the upper Yakima River as well.

In addition, listed Middle Columbia steelhead and bull trout are known to be present in the mainstem of the Yakima River. The USFWS and NMFS Fisheries regard all streams accessible to anadromous fish east of the Cascade Crest as having the potential to support steelhead and bull trout.

Other streams in the project area are generally too narrow and steep to support chinook or coho salmon spawning habitat. Snoqualmie Falls precludes accessibility of the South Fork Snoqualmie Basin by any anadromous species.

4.6.2.8 Echo Lake Substation Expansion

One fish-bearing stream crosses the substation property. This fish-bearing tributary to Lake Creek has no documented anadromous fish presence, but is used by resident salmonids. The stream channel has been historically modified and now runs through a detention pond facility on the site. Impacts of the substation expansion would be **low**.

4.6.2.9 Operation and Maintenance

Once the project is constructed, BPA would conduct routine monitoring of the transmission line. BPA generally inspects transmission lines and access roads every three to four months by air or on the ground. Routine inspection activities would have **no** effect on fish.

Management of vegetation within the ROW is necessary to control tall vegetation that may grow into conductors or create the likelihood of a flashover, which could jeopardize reliable continued service of the transmission line and endanger lives and property. BPA has prepared a programmatic EIS for its vegetation management program associated with transmission lines, roads, and related facilities. The EIS identifies appropriate measures to protect the environment while minimizing hazard tree risks and maintaining the ROW within safe, reliable limits. The program seeks to manage vegetation in ROWs by:

- promoting the establishment of low-growing plant communities on the ROWs to "out compete" trees and tall-growing brush; and
- having all possible vegetation control methods available for use to maintain ROWs (manual, mechanical, chemical and biological) (BPA 2000).

These guidelines additionally provide for protecting water resources by using herbicide buffer zones. As requested by SPU, BPA would use no herbicides anywhere within the CRW. These standards and guidelines are expected to provide sufficient mitigation to avoid disturbance of listed, sensitive, or other fish species. Site-specific mitigation measures would be developed for each alternative as they are designed and surveyed. Vegetation management activities would therefore have a **low** impact on fish.

Access Roads — During routine maintenance, BPA would also inspect roads, identify potential erosion problems, and correct any erosion problems identified. Some road wear and erosion could occur in association with increased vehicle usage during project maintenance, and some of those vehicles might leak or spill petrochemicals. These impacts would be **low**.

Substation — It is possible, but unlikely, during storms that fine sediment could be eroded from exposed ground surfaces during operations and then be conveyed by surface flow to the one fish-

bearing stream that crosses through the Echo Lake Substation property. This impact would be **low**.

4.6.2.10 Mitigation

To minimize potential impacts to fisheries habitat from clearing of vegetation:

- BPA would site the transmission facilities and access roads to minimize clearing of riparian vegetation. In some cases, the topography would allow BPA to site towers so that the conductor would span drainages and associated riparian areas. Some of the hazardous trees within the riparian zone could be made into snags or left where they lay as downed woody debris. This would limit disturbance to ground cover;
- where streams are devoid of LWD, trees would be felled into streams;
- no equipment would be allowed within 50 feet of any fish-bearing stream and none would be allowed to cross any non-fish-bearing stream;
- where necessary, BPA could replant impacted riparian areas with appropriate low-growing species.

To avoid impacts to fish from vegetation maintenance:

- BPA would prepare a clearing advisory that allows as much vegetation to remain on the ROW as possible, yet assures that the reliability of service is not jeopardized. The advisory, along with other tools, aids in the selection of danger trees and retention of vegetation within the ROW. Areas of "no cutting" would be marked in the field to delineate areas for contractors where vegetation would be retained. During the clearing of the ROW, contractors would be required to use equipment that minimizes damage to root systems of low-growing vegetation, thus providing more rapid recovery of this vegetation and greater protection against runoff in the ROW;
- roads would be constructed outside of the riparian corridors of streams, so that vegetation provides a protective buffer between streams and construction areas.

To ensure adequate fish passage at stream crossings:

- BPA would design stream crossings following WDFW guidelines. Where practical, the culvert would be set to grade and provide direct entrance and exit for water flow. Where necessary, BPA would armor the culvert entrance and exit to prevent erosion and development of physical barriers.

To minimize the potential for increases in fine sediment delivery to streams:

- prepare and implement a Storm Water Pollution Prevention Plan. BPA would prepare and implement an SWPP Plan that will include many pollution control elements (see Section 4.4.2.1);
- ROW clearing would use methods that minimize erosion. BPA would prepare a clearing advisory that would aid in the selection of danger trees and retention of vegetation within the ROW. Areas of "no cutting" would be marked in the field to let contractors know where vegetation would be retained. Prior to ROW clearing, BPA would review and approve the logging plan. During the clearing of the ROW, contractors would be required to use low ground pressure equipment that minimizes damage to root systems of low-growing vegetation;
- access roads would be designed to minimize the potential for erosion. Construction of steep, straight road sections, which could result in channelization and concentration of runoff, would be avoided. Waterbars and drainage would be installed where appropriate;
- stream crossings would be designed to minimize impacts to the bed and banks by orienting crossings perpendicular to streams, minimizing the removal of riparian vegetation, preventing the disruption of normal flow patterns, and choosing the appropriate culverts. Stream crossings would be sited to minimize the potential for erosion and avoid sensitive fisheries habitat;
- construction activities near streams would be scheduled to avoid sensitive fish spawning, incubation, and migration periods (following WDFW in-water work timing guidelines);
- new culverts would be sized to convey 100-year flows and installed using standard construction techniques that minimize the potential for erosion during or after installation. Methods may include isolating the working area from the streamflow (using temporary diversions or dams), providing sediment containment devices during construction, 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. In areas that provide fish habitat or migration corridors, culverts would be sized and sloped to allow appropriate depth and flow velocities for fish passage, and culvert design would follow WDFW fish passage guidelines.

To minimize any impacts due to construction activities:

- construction activities near streams would be scheduled to avoid sensitive fish spawning, incubation, and migration periods (following WDFW in-water work timing guidelines);
- to avoid potential impacts to fish from acoustic shock, BPA would attempt to avoid blasting during periods when eggs or alevins are present in gravels.

To minimize the potential for impacts from accidental spills:

- BPA will include in its SWPP Plan a Spill Prevention Control and Countermeasures Plan. See Section 4.5.2.

To avoid impacts to fish from vegetation maintenance:

- BPA would comply with the standards and guidelines established in the Record of Decision (ROD) for vegetation management (BPA 2000). (See Appendix K.)

4.6.2.11 Cumulative Impacts

Cumulative impacts to fisheries are summarized in Table 4-7. Current and anticipated land uses in the project area include management to preserve and restore a wide range of ecological functions (in the Cedar River Municipal Watershed and National Forests) and management for commercial timber production (in the Raging River Watershed, for example). Both management regimes call for full protection of fish habitat. Increased residential land use and other associated development could impact fish habitat.

Fine Sediment Load — Fine sediment that could harm fish and degrade fish habitat is transported downstream through a river system. The effect of an increase in sediment load is not just a local concern, but becomes additive with sediment increases throughout the watershed. Timber harvesting, agriculture, road building, and other development resulting in clearing of vegetation, and construction of impervious surfaces such as access roads, parking lots and roof tops, could all contribute to increased sediment load in a watershed. Use and maintenance of existing access roads contribute some sediment as well. The sensitivity of a watershed to the cumulative effects of additional sediment load depends on the distribution of resources sensitive to fine sediment inputs, such as spawning beds, as well as the quantity and location of fine sediment sources, soils, slopes, vegetation cover, and flow regime.

LWD Recruitment — Most streams in parts of the Northwest that have experienced timber harvest are currently depleted in LWD relative to historic conditions, and recovery of in-stream LWD concentrations is

a principal goal of land management agencies in the region. BPA's proposed vegetation clearing would not comply in some areas with riparian shade protections called for by either the Washington Forest Practices Rules or the CRW HCP, possibly resulting in reduced LWD recruitment and adverse impacts to in-stream fish habitat. Most timber harvesting that would occur in the project area must meet guidelines in the Washington Forest Practices Rules or Northwest Forest Plan Aquatic Conservation Strategy, so impacts to fish from these activities would be **low**. No harvesting is expected in the CRW. Cumulative impact to LWD is expected to be **low**.

Stream Temperature — Although reduction of shading along a small length of stream may have a small influence on stream temperature, this effect could produce a moderate or high impact if there were many such reductions in shading throughout any one watershed. Protections in place for Federal lands, the CRW, and most other lands in the project area would limit further reductions in riparian vegetation. Fine sediment can also impact stream temperature. Cumulative impact on stream temperature for all the alternatives is expected to be **low**.

Other Effects — In the future, the transmission line ROW could be a logical choice for construction of other linear projects, such as additional transmission lines or fiber optic cables. The decision to create new ROW in this area could increase the likelihood of such proposals. Cumulative impacts from such potential, but not yet planned, uses is unknown at this time.

4.6.3 Proposed Action

Overall, impacts to fisheries under the Proposed Action would be **low** to **moderate**. Impacts due to vegetation removal, culvert installation and the other activities previously discussed are listed individually below.

The Alternative 1 ROW would be nine miles long and cross 10 fish-bearing (Type 1, 2, or 3) streams and an unknown number of non-fish-bearing (Type 4 or 5) streams. The ROW would cross three watersheds: Green River, Cedar River, and Raging River. One of these streams, the Raging River, is currently accessible to anadromous fish. Two of these streams, Rock Creek and the Cedar River, are expected to be accessible to anadromous fish by the time the project would be constructed, due to completion of the fish ladder at Landsburg Diversion Dam. Beginning in August 2003, adult and juvenile anadromous salmonids may be present in the study area. No fish-bearing streams would be crossed in the Green River Watershed.

Near station 326 + 00 there is an existing culvert on Rock Creek that prevents any fish passage. Currently fish are unable to migrate up

Rock Creek. BPA would apply for permits to replace this culvert to allow for fish passage. This culvert does not need to be replaced for construction or maintenance activities.

Vegetation removal impacts — Construction of the Proposed Action would result in the clearing of 12 acres within 100 feet of potentially fish-bearing streams and 33 acres within 300 feet of potentially fish-bearing streams (see Table 4-5). About 2,900 feet of stream would be within the cleared ROW. Clearing within 100 feet of the stream could reduce riparian shading and bank reinforcement by roots, and increase fine litter contributions to the stream. Depending on topography, clearing within 300 feet of the stream could affect LWD recruitment to the stream and stream microclimate. For the Cedar River crossing, the line would be located on double-circuit structures along with the existing Raver — Echo Lake line on the existing ROW for one span, thereby alleviating the need to clear vegetation for over 1,000 feet on each side of the river. This would create no new impacts to the Cedar River water quality or its habitat. Given offsetting measures to be taken when clearing riparian vegetation (see Section 4.6.2.1), riparian zone clearing for the Proposed Action is expected to have a **moderate** impact on fish habitat.

Culvert installation impacts — BPA would design roads to avoid stream crossings and wetlands where possible. Some existing culverts may be replaced to allow fish passage if permits are obtained. This would create a positive impact since fish to migrate to new areas. Because of these measures, there would be **no** negative impacts to fish and their habitat.

Fine sediment delivery impacts — Construction of the Proposed Action would cause **low** impacts to fish and their habitat as a result of erosion and sedimentation.

Catastrophic channel disturbance impacts — The proposed project is expected to cause **low** impacts to fish and their habitat as a result of catastrophic events. Very few portions of the proposed ROWs are on slopes steeper than 70 percent, so the likelihood of landslides due to timber harvest is very low. No stream crossing structures are expected to be installed on stream channels with a gradient of more than 20 percent, so the likelihood of causing a dam-break flood is also very low.

Blasting impacts — Although it is unlikely that BPA would undertake any blasting due to the new footing design proposed, BPA may be required to blast at one tower site near the tap point at the southern end of the project. Because of mitigation measures to be taken, and use of new footing designs, blasting activity impacts are expected to be **low.**

Table 4-7 — Cumulative Fisheries Impacts

Past, present and future projects	Alt 1	Alt 2	Alt 3	Alt 4A	Alt 4B	Alt A	Alt B	Alt C	Alt D
Effect of proposed alternative on riparian vegetation	**	**	**	**	**	0	*	*	***
Effect of proposed alternative on fine sediment production	*	*	**	*	*	*	*	*	**
Effect of proposed alternative on T & E species	**	**	**	**	**	**	**	**	**
Existing transmission lines	*	*		*	*	*	*		*
Existing level of development	*	*	*	*	*	**	*	**	*
I-90 widening east of Hyak							**		**
I-90 thinning on NF land							*		*
Potential lot development	*	*	*	*	*	**	*	**	*
Logging on private timberlands	*	*	*	*	*	*	*	*	*
Snoqualmie Pass recreation expansion							0		0
Population growth in Puget Sound area	*	*	*	*	*	**	*	**	*
Expansion of SR-18						**		**	
Total Cumulative Effect	*** to ****	*** to ****	******	*** to ****	*** to ****	*** to ****	*** to ****	*** to ****	**** to *****

* = low adverse impact ** = moderate adverse impact *** = high adverse impact
\+ = beneficial effect 0 = no effect

Hazardous material spill impacts — The potential for impacts to fish from accidental spills of hazardous materials involved in construction would be **low**. (See Section 4.6.2.6.)

Endangered species impacts — Due to permanent loss of LWD recruitment potential and impacts to stream temperatures, potential impact is **moderate**.

Access road impacts — The Proposed Action requires no new stream crossings, creating **no** impact.

4.6.3.1 Mitigation

See Section 4.6.2.10, **Mitigation**.

4.6.3.2 Cumulative Impacts

See Section 4.6.2.11, **Cumulative Impacts**. Since most of this proposed location is in the Cedar River Watershed, the amount of future development and use will be limited. Some impacts would occur from maintenance of existing transmission lines and logging activities on lands outside of the watershed. Overall cumulative effect on fisheries is **low** to **moderate**.

4.6.4 Alternative 2

Overall potential impacts to fish would be similar to those described for the Proposed Action: **low** to **moderate**. Table 4-5 shows the various factors evaluated in comparing Alternative 2 with the other transmission alternatives.

Alternative 2 would be nine miles long and cross 11 fish-bearing (Type 1, 2, or 3) streams and an unknown number of non-fish-bearing (Type 4 or 5) streams. Construction would require clearing 40 acres within 300 feet of potentially fish-bearing streams, and 14 acres within 100 feet of such streams. About 3,100 feet of stream would be within the cleared ROW. Impacts from clearing of vegetation would be as described for the Proposed Action. New access roads would cross two fish-bearing streams, requiring culverts to be installed.

All of the 11 streams crossed by Alternative 2 potentially support resident salmonids, including cutthroat and rainbow trout. One of these streams, the Raging River, is currently accessible to anadromous fish. Two of these streams, Rock Creek and the Cedar River, are expected to be accessible to anadromous fish — possibly including chinook salmon and bull trout — by the time the project would be constructed, due to completion of the fish ladder at Landsburg Diversion Dam.

4.6.4.1 Mitigation

See Section 4.6.2.10, **Mitigation**.

4.6.4.2 Cumulative Impacts

See Sections 4.6.2.11 and 4.6.3.2, **Cumulative Impacts**, for descriptions of relevant impacts. Alternative 2 would require a new Cedar River crossing, which could impact LWD recruitment to a greater extent than the Proposed Action. Cumulative impacts would still be considered **low** to **moderate**.

4.6.5 Alternative 3

Overall, potential impacts to fish would be similar to those described for the Proposed Action: **low** to **moderate**. (See Table 4-5.)

Alternative 3 would be 10.2 miles long and cross 25 fish-bearing (Type 1, 2, or 3) streams and an unknown number of non-fish-bearing (Type 4 or 5) streams. Construction would result in the clearing of 77 acres within 300 feet of potentially fish-bearing streams, and 34 acres within 100 feet of such streams. About 6,200 feet of stream would be within the cleared ROW. Impacts from clearing of vegetation would be as described for the Proposed Action. New access roads would cross seven streams, although none would be fish bearing.

All of the 25 streams crossed by Alternative 3 potentially support resident salmonids including cutthroat and rainbow trout. None of these streams are currently known to support anadromous fish, due to the presence of natural passage barriers on most streams, as well as the artificial barrier of the Landsburg Diversion Dam on the Cedar River. However, the fish ladder scheduled to be completed at this dam in August 2003 would be operational in time for the fall salmon run that year (Bachen pers. comm.). Beginning in mid-September 2003, adult and juvenile anadromous salmonids may be present in the project area as shown in Table 4-8. Bull trout are not expected to occur in the project area.

Because there is some uncertainty regarding the precise route of Alternative 3, its potential impacts were reviewed under two alternative scenarios. In one scenario, the ROW would be located in a 175-foot wide area west of the centerline. In this scenario, 84 acres would be cleared within 300 feet of streams, and 38 acres would be cleared within 100 feet of streams. In a second scenario, the ROW would be sited in a 175-foot wide area east of the centerline. In this scenario, 87 acres would be cleared within 300 feet of streams, and 36 acres would be cleared within 100 feet of streams. Both scenarios would produce a greater impact to riparian habitat compared with the Alternative 3 centerline ROW.

4.6.5.1 Mitigation

See Section 4.6.2.10 **Mitigation**, under Proposed Action.

4.6.5.2 Cumulative Impacts

See Sections 4.6.2.11 and 4.6.3.2, **Cumulative Impacts**, for descriptions of relevant impacts. Alternative 3 would have a higher direct impact on sediment production due to the amount of new access roads. Overall cumulative impact would be **moderate**.

4.6.6 Alternative 4A

Overall, potential impacts to fish would be similar to those described for the Proposed Action: **low** to **moderate**. (See Table 4-5.)

Construction would result in clearing of 37 acres within 300 feet of potentially fish-bearing streams, and 14 acres within 100 feet of such streams. About 3,200 feet of stream would be within the cleared ROW. New access roads would cross seven fish-bearing streams, requiring that culverts be installed.

Alternative 4A would be 9.5 miles long and cross 11 fish-bearing (Type 1, 2, or 3) streams and an unknown number of non-fish-bearing (Type 4 or 5) streams. All of these streams potentially support resident salmonids including cutthroat and rainbow trout. One of these streams, the Raging River, is currently accessible to anadromous fish. Two other streams, Rock Creek and the Cedar River, are expected to be accessible to anadromous fish by the time the proposed project would be constructed, due to completion of the fish ladder at Landsburg Diversion Dam. These three streams could be used by chinook salmon by the time the proposed project would be constructed.

4.6.6.1 Mitigation

See Section 4.6.2.10, **Mitigation.**

4.6.6.2 Cumulative Impacts

See Sections 4.6.2.11 and 4.6.4.2, **Cumulative Impacts**, for descriptions of relevant impacts. Impacts related to stream temperature and LWD recruitment would be the same as for Alternative 2 because Alternative 4A shares some of the same ROW and stream crossings as Alternative 2. Overall cumulative effect on fisheries is **low** to **moderate**.

4.6.7 Alternative 4B

Impacts are the same as Alternative 4A. See Section 4.6.6.

4.6.8 Alternative A

Overall, potential impacts to fish would be similar to those described for the Proposed Action: **low** to **moderate**. (See Table 4-5.)

Alternative A would be about 20 miles long and cross two basins: Lower Cedar River and Soos Creek. These basins are currently accessible to anadromous fish.

Construction would require clearing 24 acres within 300 feet of potentially fish-bearing streams, and eight acres within 100 feet of such streams. About 1,708 feet of stream would be within the cleared ROW. Impacts from clearing of vegetation would be as described for the Proposed Action. Alternative A would require building one new road, which would cross a known anadromous fish-bearing tributary of Little Soos Creek.

Alternative A crosses eight fish-bearing streams, including Jenkins Creek, Little Soos Creek, a tributary of Little Soos Creek, Peterson Creek, Rock Creek, and the Cedar River. All potentially support resident salmonids, including cutthroat and rainbow trout, and are accessible to and known to support anadromous fish.

4.6.8.1 Mitigation

See Section 4.6.2.10, **Mitigation**.

4.6.8.2 Cumulative Impacts

See Section 4.6.2.11, **Cumulative Impacts**, for discussion of impacts Alternative A shares with other alternatives. Some sediment movement would occur from maintenance of existing transmission lines and logging activities on lands outside of the watershed. The higher level of existing development and potential future development along this route poses a moderate level of impact on fisheries. Continued population pressures and the widening of SR 18 will have moderate impacts as well through sediment production, construction activities, and creation of additional impervious surfaces and rooftops. Overall cumulative effect on fisheries is still **low** to **moderate** because of the lower level of direct impacts.

4.6.9 Alternative B

Overall, potential impacts to fish would be the same as those described for the Proposed Action: **low** to **moderate**. (See Table 4-5.)

Alternative B would be 36 miles long and cross three watersheds: Upper Yakima River (including Lake Keechelus), South Fork

Table 4-8 — Potential Anadromous Salmonid Presence in Project Area within the Cedar River Municipal Watershed, Following Completion of Landsburg Dam Fish Ladder

Species	Utilization	Months											
		1	2	3	4	5	6	7	8	9	10	11	12
Chinook Salmon	Upstream migration								■	■	■	■	
	Spawning									■	■	■	
	Intragravel development	■	■	■						■	■	■	■
	Rearing	■	■	■	■	■	■	■					■
	Outmigration			■	■	■	■	■	■				
Coho Salmon	Upstream migration	■	■						■	■	■	■	■
	Spawning	■	■	■							■	■	■
	Intragravel development	■	■	■	■	■				■	■	■	■
	Rearing	■	■	■	■	■	■	■	■	■	■	■	■
	Outmigration			■	■	■	■	■					
Steelhead	Upstream migration	■	■	■	■	■	■					■	■
	Spawning		■	■	■	■	■	■	■				
	Intragravel development		■	■	■	■	■	■	■	■			
	Rearing	■	■	■	■	■	■	■	■	■	■	■	■
	Outmigration				■	■	■	■					

Snoqualmie River, and Raging River. Both the Upper Yakima River and Raging River basins are currently accessible to anadromous fish. Lake Keechelus has resident kokanee, a state species of concern.

Construction would require clearing 28 acres within 300 feet of potentially fish-bearing streams, and seven acres within 100 feet of such streams. About 1,430 feet of fish-bearing stream would be within the cleared ROW. Impacts from clearing of vegetation would be as described for the Proposed Action, although only the northern 20 feet of the existing corridor would need to be cleared.

All of the 31 fish-bearing streams crossed by Alternative B potentially support resident salmonids, including cutthroat and rainbow trout. Two of these streams, the Yakima River and an unnamed tributary, are accessible and known to support anadromous fish. All of the 11 fish-bearing streams in the Upper Yakima Watershed are accessible to anadromous fish, including Middle Columbia steelhead. One new road would cross a known fish-bearing stream, Rock Creek, which is upstream of Snoqualmie Falls and inaccessible to anadromous fish.

A total of 19 fish-bearing streams and their associated Riparian Reserves are crossed on USFS-managed lands. Five of these fish-bearing streams drain into Lake Keechelus, seven are tributary to the upper Yakima River, and the remaining seven are in the South Fork Snoqualmie River basin. Construction of Alternative B would require clearing of 24 acres of Riparian Reserves on National Forest lands. About 1000 linear feet of fish-bearing stream and another 2,044 linear feet of non-fish-bearing stream would occur within the cleared ROW on these lands. Direct loss of Riparian Reserves would contribute to non-attainment of all nine ACSOs and therefore constitute a **high** impact where Alternative B crosses National Forest land. If site-specific analysis substantiates this conclusion, a Forest Plan amendment would be required.

4.6.9.1 Mitigation

See Section 4.6.2.10, **Mitigation** Additional mitigation is likely to be required within riparian reserves on National Forest lands.

4.6.9.2 Cumulative Impacts

The widening of I-90 has the potential to have a moderate impact on fisheries. Minor impacts can be expected from logging on private and National Forest lands (see Section 4.6.2.11, **Cumulative Impacts**), lot development, and operation and maintenance of access roads. Cumulative impact is **low** to **moderate.**

4.6.10 Alternative C (Options C1 and C2)

Overall, potential impacts to fish would be the same as those described for the Proposed Action**: low** to **moderate**. (See Table 4-5.)

Option C1 would be 10.1 miles long and cross four basins: Green River, Rock Creek, Lower Cedar River, and Issaquah Creek. Option C2 would be 10.6 miles long and cross three of those basins, excluding Green River. These basins are currently accessible to anadromous fish.

Construction of either Option C1 or C2 would require clearing 14 acres within 300 feet of potentially fish-bearing streams and four acres within 100 feet of such streams. About 963 feet (Option C1) or 964 feet (Option C2) of stream would be within the cleared ROW. Clearing impacts would be as described for the Proposed Action. New roads would not cross any fish-bearing streams, so no new culverts would be installed.

Both Options C1 and C2 would cross four fish-bearing streams. All of these streams potentially support resident salmonids, including cutthroat and rainbow trout. All of these streams, which include Holder Creek, Carey Creek, the Lake Walsh Diversion Channel, and the Cedar River, are accessible and known to support anadromous fish.

4.6.10.1 Mitigation

See Section 4.6.2.10, **Mitigation**.

4.6.10.2 Cumulative Impacts

See Sections 4.6.2.11 and 4.6.8.2, **Cumulative Impacts**, for a description of relevant impacts. Cumulative effects from Alternative C would be very similar to Alternative A, although C has a higher level of direct impact from sediment production and vegetation clearing because it requires clearing a new ROW in a new location. Cumulative impact is **low** to **moderate**.

4.6.11 Alternative D (Options D1 and D2)

Overall, potential impacts to fish would be the same as those described for the Proposed Action: **low** to **moderate**. (See Table 4-5.)

Like Alternative B, Alternative D (both Options D1 and D2) would be 36 miles long and cross three basins: Upper Yakima River (including Lake Keechelus), South Fork Snoqualmie River, and Raging River. Both the Upper Yakima River and Raging River basins are currently accessible to anadromous fish.

Construction of Option D1 would require clearing of 120 acres within 300 feet of potentially fish-bearing streams and 40 acres within 100 feet of such streams. About 9,200 feet of stream would be within

the cleared ROW. Construction of Option D2 would require clearing of 95 acres within 300 feet of potentially fish-bearing streams and 31 acres within 100 feet of such streams. About 6,866 feet of stream would be within the cleared ROW. Vegetation clearing impacts would be as described for the Proposed Action.

Two new roads required for Option D1 would cross known fish-bearing streams, including Rock Creek and Olallie Creek, which are upstream of Snoqualmie Falls and inaccessible to anadromous fish. Option D2 would require building one new road, which would cross Rock Creek.

Both Alternative D options would cross the same 31 fish-bearing streams crossed by Alternative B but, because they require clearing of extensive new ROW, would have potentially greater impacts on these streams. All of these streams potentially support resident salmonids, including cutthroat and rainbow trout. Two of these streams, the Yakima River and an unnamed tributary of the Yakima River, are accessible and known to support anadromous fish. All of the 11 fish-bearing streams in the Upper Yakima Watershed are accessible to anadromous fish, including Middle Columbia steelhead. Seven of the fish-bearing streams impacted drain into Lake Keechelus, which supports kokanee salmon, a state species of concern.

Also similar to Alternative B, Options D1 and D2 cross 19 streams and their associated Riparian Reserves on USFS lands. Construction of Option D1 would require clearing 110 acres of Riparian Reserves on National Forest lands. About 5,114 linear feet of fish-bearing stream and another 8,778 linear feet of non-fish-bearing stream would occur within the cleared ROW on USFS lands. Construction of Option D2 would require clearing 89 acres of Riparian Reserves, with about 3,667 linear feet of fish-bearing stream and another 8,892 linear feet of non-fish-bearing stream occurring within its cleared ROW on National Forest lands. Direct loss of Riparian Reserves would contribute to non-attainment of all nine ACSOs and therefore constitutes a **high** impact. If site-specific analysis substantiates this conclusion, a Forest Plan amendment would be required.

4.6.11.1 Mitigation

See Section 4.6.2.10, **Mitigation**. Additional mitigation is likely to be required within riparian reserves on National Forest lands.

4.6.11.2 Cumulative Impacts

See Section 4.6.2.11, **Cumulative Impacts**, for discussion of impacts Options D1 and D2 share with the other alternatives. Since Options D1 and D2 would be on entirely new cleared ROW, the magnitude of impact on fine sediment load from these options could be

substantially more than Alternative B, and is the highest of any alternative. The combined effects of I-90 widening in the Yakima River Watershed and placement of additional towers within the floodplain makes the cumulative impact **moderate** to **high.**

4.6.12 Non-Transmission Alternative

Because no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12), there would be no immediate fish-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

4.6.13 No Action Alternative

No project-related impacts to fish or their habitat would occur under the No Action Alternative because no vegetation clearing or new access road construction would occur. No mitigation would be required and no cumulative impacts would be expected.

4.7 Wildlife

Each of the alternatives would impact wildlife during construction of the transmission line and later, as a result of ongoing operation and maintenance activities. These impacts could be temporary or permanent. Impacts may involve the physical loss of habitat, or disturbance of wildlife from the construction activities or ongoing facility use and maintenance.

Temporary construction impacts would be associated with noise and human presence. Examples include tower installation activities involving the use of heavy equipment, helicopters, and blasting, and intense levels of human activity around the construction site; construction of the substation addition and roads; clearing the ROW; and pulling conductors. These activities would occur only during the construction phase and would not be long term.

Permanent construction impacts would occur when an area is modified (*e.g.*, vegetation removed) and maintained in the modified state. Examples include clearing for transmission lines, building sites, and roads, which could result in permanent loss of wildlife habitat.

Overall, impacts from all transmission alternatives on potential habitat for threatened, endangered, and sensitive species occurring in the project area would be **low** to **moderate**. Impacts to different species groups would vary. For example, construction impacts to

forested community species is expected to be **low**; impacts to riparian and aquatic community species are expected to be **low** to **moderate**; and impacts to early regeneration communities are expected to be minimal — either **no** or **low** impact, or a **beneficial** impact. Operations and maintenance impacts would be greatest (considered **moderate**) on those species that avoid openings presented by the newly-cleared ROWs. These and other wildlife impacts are discussed in more detail in this section.

Detailed information and maps are in Appendices B and O.

4.7.1 Impact Levels

High impacts on wildlife would occur when an action creates an adverse change in wildlife populations or habitats. Adverse changes include impacts that would:

- create an unavoidable adverse effect on a species federally-listed as threatened or endangered;
- reduce the quantity or quality of a regionally or nationally important wildlife population or habitat associated with the USFS-managed "Survey and Manage" species;
- reduce the quantity or quality of habitat critical for local animal populations, such as big-game winter range; or
- adversely affect rare or declining species or other species with high public profiles, values or appeal, such as elk and bald eagles.

Moderate impacts on wildlife occur if the actions would:

- create an effect on a threatened or endangered species that could be partially mitigated through an interagency consultation with the USFWS under Section 7 of the ESA;
- cause a local reduction or a temporary impact in the quality or quantity of wildlife habitats associated with USFS-managed "Survey and Manage" species; or
- marginally reduce the productivity of adjacent wildlife habitats or resources (such as nest sites).

Low impacts occur when an action would:

- create an effect that could be largely mitigated;
- reduce the quality or quantity of wildlife habitat or species confined to the site of the action;
- cause no major effect on productivity of adjacent wildlife habitat;

- temporarily disturb common wildlife species;
- reduce habitat that is very common in the project vicinity;
- adversely affect relatively common species at a local level; or
- cause temporary effects that can be minimized by site planning or by placing seasonal restrictions on activities.

A project may also have **no** impact.

4.7.2 Impacts Common to All Transmission Alternatives

To assess potential impacts to wildlife habitat, the vegetation cover developed for the proposed project area (see Map 12 and Table 3-5) was used, with the assumption that the entire width and length of the 150 feet ROW centered on the proposed transmission line would be cleared, as well as areas for new or upgraded access roads and clearing for "angle points" (a 370-foot radius to the line). Actual cleared acreage would likely be less than shown due to topography, the ability to span trees in low areas, and the use of micropile tower footings. The changes in habitat discussed below are calculated from converting vegetation within the cleared ROW to a managed grass/forb/shrub condition. Table 4-10 shows the habitat changes that would occur.

All the transmission alternatives would have the same types of impacts, with differences only in magnitude. The following types of impacts would occur under all transmission alternatives.

4.7.2.1 Threatened, Endangered, and other Sensitive Species

Potential impacts to threatened, endangered, and other sensitive species could occur as a result of habitat loss or alteration, disturbance, or collision with transmission lines. These impacts are included in discussion of habitat loss and fragmentation, bird collision, and disturbance to wildlife sections that follow.

4.7.2.2 Habitat Loss

Impacts would occur to all wildlife habitat types. Habitat for species dependent upon forested communities, riparian communities, aquatic communities, and unique habitats would be reduced while habitat for early regeneration dependent or edge species would be increased. For all alternatives, this would be a **moderate** impact.

Within the CRW and USFS lands, there would also be a loss of recruitment habitat for late successional forest dependent species. The CRW has a Habitat Conservation Plan in place that prescribes

management of forested stands in the watershed so that they develop late successional characteristics. Similarly, USFS has set aside land within three of the proposed ROWs as late successional regeneration areas. Permanent conversion of these stands from a forested condition to either being maintained in an early-regeneration condition (within the ROW) or developed conditions (new access roads) would cause a permanent loss of recruitment habitat. The amount of forested habitat lost is described under each alternative.

4.7.2.3 Habitat Fragmentation

Under all the transmission alternatives, the amount of habitat fragmentation within the project vicinity would increase, resulting in a **moderate** impact. Fragmentation can affect wildlife habitat in several ways. It can increase the amount of edge habitat, which simultaneously decreases the amount of interior habitat, and it can create barriers to travel and/or dispersal for species that use forested habitats. This would benefit edge species such as elk and bats, but reduce the quantity and quality of interior habitat for such species as spotted owls and goshawks. Edge effect (the distance into the stand that an edge impacts such features as microclimate) varies by the types of vegetation structure that abut one another, with early regeneration or developed types abutting late regeneration habitat being the most extreme. Changes in microclimate can be expected to occur 200–260 feet into the stand adjacent to roads and 300–790 feet into the stand adjacent to regeneration harvest, depending on site conditions (Jones 1990). For all alternatives, new edge habitat would be created in association with both clearing the transmission line ROW and construction of new access roads.

Habitat fragmentation can also impact the suitability of the landscape for migratory or wide-ranging animals. This can take the form of limiting the amount of habitat available to species that avoid crossing large openings, such as fisher, or an increase in the potential for predation for species that may cross openings but are more susceptible to predation while doing so, such as spotted owl. If an opening creates a *dispersal* barrier for a given species, it can lead to otherwise suitable habitat being unoccupied, or can lead to isolation of segments of a population and possible local extinctions. It could also limit the amount of habitat available for establishment of home ranges, limiting the ability of a species to populate an area.

If an opening creates a *travel* barrier for a given species, it would limit the available habitat within a home range and could lead to creating home ranges that are too small to support individuals. If the potential increase in predation on individuals crossing an opening were to occur, it could also limit the potential for a species to repopulate an area. Since one of the goals of the Cedar River Watershed's HCP and

the National Forest Plan is to manage forested habitat so that it develops into habitat suitable for late successional species, creating an opening that could limit the potential for these species to use the habitat could affect the probability of these goals being reached.

For some species, allowing brush to revegetate the site and providing large downed wood within the cleared ROW may provide enough cover to allow individuals to cross the ROW. This would be most effective for small-bodied animals, such as small mammals.

In addition, all alternatives would cross wildlife linkage corridors identified in the King County Comprehensive Plan (King County 2000), creating openings that may reduce the effectiveness of these corridors for species dependent on cover for travel. The Proposed Action and Alternatives 2, 4A and 4B would cross two corridors. One would be bisected by the new ROW where it parallels the existing Raver-Echo Lake ROW, and so would double the size of an existing opening in the network corridor. This gap would result in a **moderate** impact to *low-mobility species* for which such an opening may be a barrier. The second corridor, also crossed by Alternative 3, follows the Cedar River. However, because the riparian vegetation in this area is expected to remain intact (with the transmission line spanning much of the riparian zone), impacts to this corridor would be **low**. Similarly, Alternative A crosses two corridors, Alternatives B and D (both Options D1 and D2) cross one, and Alternative C (both Options C1 and C2) cross three. Because these Alternative A through D crossings involve permanent removal of habitat, a **moderate** impact will result to low-mobility species for which such an opening may be a barrier.

4.7.2.4 Bird Collision

The risk of bird mortality from collision with transmission lines is primarily a concern for migratory waterfowl, which have the highest incidence of mortality associated with transmission lines. Historically, raptors were known to have a high incidence of mortality associated with power lines, primarily from electrocution; however current design standards have greatly reduced the probability of this occurring. Raptor collisions with power lines are relatively rare. Keen eyesight and a tendency to avoid flying in inclement weather are believed to reduce the risk of power line collisions by raptors (Olendorff and Lehman 1986). If raptor mortality were to occur, particularly to a bald eagle, this would be a **high** impact.

Species that are at greatest risk of collision with power lines are waterfowl, particularly near wetlands or open water and during conditions of low visibility (Stout 1976, Arend 1970, Anderson 1978). Within the project vicinity, small wetlands occur that may be used by waterfowl, and collisions may occur when these birds are traveling between areas.

Other species may also collide with transmission lines, including marbled murrelets potentially flying up the Cedar River enroute to suitable nesting habitat in the upper CRW or Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. The risk of this occurring is unknown, however the risk would be related to the height at which murrelets fly above the canopy while traveling to nest sites, which is not well documented. Peregrine falcons and bald eagles foraging in the vicinity of the transmission lines may also be at risk for collision. If mortality of any of these species were to occur to it would be a **high** impact.

According to the Avian Powerline Interaction Committee (APLIC 1994), four factors contribute to the level of risk of collision with powerlines: the current level of risk; the type of power line; the amount of avian use in the area; and the inherent tendency of a species to collide with overhead wires. Because the proposed transmission line would have a ground wire, which is located at the top of the lines and is usually a smaller diameter than the transmission lines, the level of risk is higher. However, BPA would install bird flight diverters in designated fly zones on the overhead ground wire to make the wires more visible to flying birds. These diverters would be installed in areas where migratory birds are likely to be flying across the line, such as at the Cedar River crossing. Design factors, such as placing new lines adjacent to existing lines (Alternatives 1, 2, 4, and D) or utilizing existing corridors (Alternative A and B), are methods of reducing impacts to migratory birds. Even if these and other measures are taken, it is likely that some level of mortality due to power line collision would occur. Given the study area is not known to be a high use area for listed species, the overall expected impact is **low**.

Habitats for migratory birds in the project area are primarily upland forest habitats, although lakes, ponds, and wetlands are also found. The transmission line alternatives will increase diversity of habitats by opening the understory and regenerating shrub species. This will increase suitable habitat for some key species such as rufous hummingbird and olive-sided flycatcher. Habitat will still remain for those species that depend on dense, young to mid-aged stands. The amount of dead and dying standing trees would be sufficient in providing habitat for primary and secondary nesters. The alternatives would be consistent with the U.S. Forest Service policy regarding migratory bird conservation on National Forest lands and compliance with the Migratory Bird Treaty Act.

4.7.2.5 Disturbance of Wildlife

Noise associated with construction of the proposed transmission line could disturb wildlife potentially occurring within the project area. Construction activities with the potential to cause noise disturbance

include use of chainsaws, heavy equipment, helicopters, and explosives. Because potential disturbance would be confined to the site of the action, would be temporary, and could be limited by seasonal restrictions if a high-priority resource such as a bald eagle or spotted owl nest were discovered in the area, this would be a **low** impact. Noise from blasting would be audible over a larger area than the other potential disturbance mechanisms; however, blasting would be infrequent and of short duration and so would result in a **low** impact, if it occurs at all. An exception to this would be blasting that occurred during the nesting season of species sensitive to noise, such as raptors, which could cause disturbance impacts up to a mile from the blasting site.

Construction of Alternatives 3, B, and D (Options D1 and D2) have the highest potentials for causing disturbance because these alternatives would be built through habitats currently receiving little human use. Construction of Alternatives A and C (Options C1 and C2) would have the least potential impacts because they would occur primarily in rural residential/managed areas, (i.e., within an area of ongoing regular human activity in which wildlife is adapted to these types of activities). Disturbance impacts from the Proposed Action and Alternatives 2, 4A and 4B fall somewhere in between. Construction of segments not parallel to existing transmission lines would pose relatively greater disturbance.

4.7.2.6 Impacts on Wildlife Species Types

Impacts on each wildlife species type are discussed under each alternative, beginning with Section 4.7.3, **Proposed Action.**

4.7.2.7 Access Roads

Habitat loss and fragmentation and wildlife disturbance would occur due to access road construction under any of the transmission alternatives. However, because the amount of land converted to roads is small relative to the much larger area cleared for ROW, access roads would pose little additional impact over that already discussed above. Those alternatives that parallel existing transmission lines or use existing ROW generally require less clearing for access road construction. Alternatives requiring the least acreage for this purpose are the Proposed Action and Alternatives 2, 4A and 4B. Even for the other alternatives, which may require more clearing for access roads, the impact is not sufficiently large enough to change overall habitat and disturbance impact levels.

4.7.2.8 Substation Impacts

The proposed expansion of Echo Lake Substation would occur east of the existing substation. Habitat types in the area are early regeneration, coniferous forest and early regeneration, mixed forest, types that are most likely to provide habitat for early regeneration community dependent species or forest community dependent species that use early regeneration forest. Given the large amount of this habitat type available in the surrounding area and the existing disturbed nature of the site, impacts associated with expansion of the substation are expected to be **low.**

4.7.2.9 Operation and Maintenance

Operational impacts tend to be disturbance impacts, potentially leading to avoidance of areas by wildlife even if habitat in the area has not been altered in a way that would make it otherwise unsuitable. Unlike short-term, more intense construction impacts, operational impacts tend to be longer term and may influence wildlife use of an area to a greater extent. Such impacts could result from activities such as road maintenance, repair of towers or conductors, and vegetation removal within or adjacent to the ROW.

Under the transmission alternatives, vegetation within the cleared transmission line ROW would be maintained in the managed early regeneration grass/forb/shrub habitat type. Taller vegetation may be maintained to minimum safe clearing distances in spanned areas. Associated impacts include the potential for noise disturbance to wildlife in adjacent forest habitats during maintenance activities, and the long-term maintenance of a cleared ROW with associated edge habitat and potential barriers to wildlife travel.

As the stands adjacent to the cleared ROW continue to develop, the potential for use by forest community dependent species would increase. As this occurs, the presence of a cleared ROW and associated edge habitat would have an increasing impact on the quality of forested habitat in the project area. For species that use interior habitat, the maintenance of edge habitat may preclude the use of otherwise suitable habitat in the future. This would mean a **moderate** impact on these species.

Maintaining a cleared ROW through stands that are developing late successional characteristics may also maintain a barrier between patches of suitable habitat for both *low-mobility species*, such as mollusks, and species that avoid openings, such as fisher. This would reduce the quality of the habitat in the project area. Because of the long, linear nature of the proposed project, this would be a **moderate** impact on these species.

Noise associated with the operation of the line, including constant humming and crackling during rain showers, has the potential to cause noise disturbance in the immediate vicinity of the line. Since this noise would be relatively constant, wildlife in the vicinity would be expected to acclimate to it. Also, only the area immediately adjacent to the line would be impacted. For these reasons, *noise* impacts during project operation would be **low**.

4.7.2.10 Mitigation

Habitat loss and fragmentation — Potential mitigation measures for habitat alteration, isolation or removal include:

- minimizing the amount of forest vegetation clearing by clearing only tall-growing vegetation. Outside ROW edges, retain trees that are of insufficient height to pose a hazard to the transmission line;
- landowners could improve forest habitat conditions outside of the ROW through stand manipulations such as pre-commercial thinning;
- where trees must be felled outside the ROW edges, make some into snags while leaving some trees in the adjacent stand to provide coarse woody debris. Larger trees are most valuable for this purpose;
- creating snags within the ROW by topping and/or girdling coniferous species;
- leaving or placing large downed woody debris or pulled stumps within the ROW;
- manipulating the low-growing vegetation and control noxious weeds to benefit forage for species such as deer and elk;
- purchasing replacement habitat;
- leaving all vegetation cut in forested wetlands if unable to be removed by helicopter/sky crane;
- spanning riparian corridors to the extent possible, maximizing the amount of riparian vegetation left across the ROW for use as travel corridors;
- leaving a minimum of two logs (a minimum of 20 inches in diameter each) per acre within the ROW.

Bird Collision — To minimize the risk of mortality from collision:

- install bird flight diverters where the transmission line crosses riparian corridors or other likely areas of migration to make the transmission line more visible to birds;

- Base design and construction of the new transmission line on guidelines described in the publication, Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996 (APLIC 1996).

Disturbance of Wildlife — To minimize or avoid this risk:

- before construction, verify that no new bald eagle or spotted owl nests, or marbled murrelet occupied sites, have been found within one mile of the proposed ROW. If any are found, avoid blasting within one mile and construction within half mile of bald eagle nests and a quarter mile of spotted owl and marbled murrelet sites during nesting periods (January 1 through August 15, March 1 through September 30, and April 1 through September 15, respectively). Survey techniques would follow available protocols or would be determined and would be included in the mitigation action plan prepared for the project;
- before construction, verify that no other special status raptor nests occur within one mile of the proposed ROW. If any are found, avoid construction within a quarter mile of the nest during nesting season (varies by species), or within one mile for blasting. Survey techniques are to be determined and would be included in the mitigation action plan to be prepared for this project;
- plan flight paths for helicopters or sky cranes used during construction so that they do not fly over potential nesting habitat for northern spotted owls, marbled murrelets or peregrine falcons during their nesting seasons, or maintain a minimum altitude of 500 feet over these stands (1,500 feet for falcon habitat) if they are unavoidable. Nesting seasons are noted above.

4.7.2.11 Cumulative Impacts

Construction impacts resulting from any of the transmission line routes, access roads, and the substation expansion would occur in conjunction with the current land management activities on the properties that the proposed new ROW would cross. Within rural residential and developed areas, development can be expected to continue, following the trend in the greater Puget Sound region. Vegetation removal and habitat alteration associated with development would be additive to changes related to any alternative. Alternatives A and C have the highest potential for further development due to the number of tax lots crossed, existing level of development, and proximity to the Puget Sound area (population pressure).

Within the CRW, vegetation removal and habitat alteration is expected to be minimal, as described in the HCP (City of Seattle, 2000). For this reason, clearing associated with any alternatives crossing the CRW would be the greatest foreseeable impact in this portion of the project area. The HCP also outlines plans to close certain roads within the CRW.

Industrial forestlands crossed by portions of several alternatives would continue to be managed for timber production, and so impacts to vegetation described earlier would be additive to impacts caused by timber management activities. The exception would be within forested riparian areas, which would be maintained as riparian buffers on industrial forestlands.

Bird collisions associated with transmission lines and fragmentation of habitat would have similar cumulative effects. If new lines are placed adjacent to existing lines, the effect is lessened compared to having two lines in separate locations. Alternatives 3 and C are located in new ROW locations not adjacent to existing lines and have the highest potential for increased bird collisions and habitat fragmentation. Alternatives A and B would have the least impact since they are predominantly replacing existing lines within existing ROW. Table 4-9 summarizes cumulative impacts for all the transmission alternatives.

4.7.3 Proposed Action

As noted in Section 4.7.2, **Impacts Common to All Transmission Alternatives**, the Proposed Action would have **moderate** potential impacts on habitat loss, **moderate** impacts on habitat fragmentation (**low** impact along the Cedar River); **low** potential impact on bird mortality resulting from line collisions; **low** wildlife disturbance impacts; and **low** to **moderate** longer term operations and maintenance impacts.

The Proposed Action would be among the alternatives causing the least habitat fragmentation since clearing would be less than many other alternatives. Most new access road construction would occur within the area of already cleared ROW and so would not, in itself, contribute to an increase in edge habitat. Road construction outside of the cleared transmission line ROW would lead to an approximate 13-acre increase in edge habitat, all within the mid-regeneration, closed canopy coniferous habitat type. However, the Proposed Action would widen the existing ROW by 150 feet and so create more of a barrier to animals moving through the area. This is why its overall habitat loss and fragmentation impact would be considered **moderate**.

The Proposed Action's impact on each species type follows. Specific species members affected are discussed in greater detail in Appendix B.

4.7.3.1 Forest Community Dependent Species

Construction of the Proposed Action would require clearing 118 acres of forested community habitat. A total of 85 acres of mature coniferous regeneration forest would be cleared. Because this habitat type is common in the project area and the amount of reduction is relatively small, construction of the Proposed Action would have a **low** impact on this species type. In addition, BPA has purchased 352 acres for potential mitigation to replace habitat removed for the Proposed Action. There are 80 acres of large trees within this parcel. The remaining acreage could eventually become forested habitat.

BPA believes the proposed transmission line would leave the CRW HCP wholly intact. The Proposed Action is undergoing a separate and distinct Section 7 consultation to comply with the Endangered Species Act. In addition, BPA Is exploring with the city of Seattle, the USFWS, and NMFS possible ways to provide sufficient compensatory mitigation to SPU to ensure that the functionality and viability of the HCP is left intact.

4.7.3.2 Riparian Community Dependent Species

Construction of the Proposed Action would require clearing 15 acres of riparian vegetation — 5 percent of that present in the Proposed Action immediate project area. Ten acres of forested riparian and five acres of mature coniferous regeneration riparian forest habitat would be removed, representing 4 and 3 percent, respectively, of that habitat type present. Because this vegetation removal could result in a loss of productivity in adjacent aquatic habitat and would cause a local reduction in the quantity of wildlife habitat, but could also be largely mitigated by spanning riparian corridors, this would represent a **low** to **moderate** impact. No clearing would take place within 1,000 feet of the Cedar River. Individual trees may be topped as part of normal maintenance for the existing line.

4.7.3.3 Aquatic Community Dependent Species

Because construction of the Proposed Action could reduce the quantity of wetland habitat and the quality of both wetland and stream habitat, it would have a **moderate** impact on aquatic community dependent species. Construction of the Proposed Action would potentially impact 11 acres of wetlands, or 8 percent of total wetland habitat within the Proposed Action project area (141 acres).

4.7.3.4 Species Dependent upon Unique Habitats

Only one species was identified that is primarily associated with unique habitat and may occur within the project area, the Larch Mountain salamander. This species is associated with talus habitat,

a type that has not been mapped in the project area. While talus habitat may occur in small, localized areas within the project area, it is not expected to be an abundant habitat type given the relatively gentle terrain and well developed soil layer. Potential impacts to this habitat type within the project area are **unknown**.

4.7.3.5 Early Regeneration Community Dependent Species

Construction would increase early regeneration habitat (managed grass/forb/shrub) by 128 acres. This would benefit species dependent upon this habitat type, particularly elk and deer; therefore it will have **no** negative impact.

4.7.3.6 Mitigation

Mitigation measures common to all alternatives are included in Section 4.7.2.10. The **Proposed Action** includes these additional measures.

Forested Community Dependent Species and **Species Dependent on Unique Habitats** — Mitigation measures to minimize or reduce potential impacts on these species include:

- Providing coarse woody debris within the cleared ROW for cover for small mammals and for connectivity of habitat for invertebrates. This can be accomplished by leaving some logs or pulled stumps in the ROW with permission from the landowner. Large logs have the highest value for this purpose.

Riparian Community Dependent Species — Mitigation measures to minimize or reduce potential impacts to these species include:

- Leaving downed logs in riparian communities to provide LWD and felling logs into streams to create LWD.

Aquatic Community Dependent Species — Mitigation measures to minimize or reduce potential impacts to these species include:

- Avoiding placing tower footings within or adjacent to wetlands whenever possible.
- Avoiding building new roads within or adjacent to wetlands.
- Minimizing soil disturbance within or adjacent to wetlands and stream banks.

Species Dependent upon Early Regeneration Habitats — Mitigation measures to minimize or reduce potential impacts to these species include:

Table 4-9 — Cumulative Wildlife Impacts

Past, present and future projects	Alt 1	Alt 2	Alt 3	Alt 4A	Alt 4B	Alt A	Alt B	Alt C	Alt D
Effect of proposed alternative on habitat loss	* to **	* to **	* to **	* to **	* to **	* to **	**	* to **	***
Effect of proposed alternative on fragmentation	**	**	** to ***	**	**	*	*	** to ***	**
Effect of proposed alternative on T & E species	**	**	**	**	**	*	**	*	***
Effect of proposed alternative on disturbance to wildlife	*	*	*	*	*	*	*	*	**
Existing transmission lines (bird collisions)	*	*	**	*	*	0	0	**	*
Existing level of development	*	*	*	*	*	**	*	**	*
I-90 widening east of Hyak							**		**
I-90 thinning on NF land							*		*
Potential lot development	*	*	*	*	*	**	*	**	*
Logging on private timberlands	*	*	*	*	*	*	*	*	*
Snoqualmie Pass recreation expansion							*		*
Population growth in Puget Sound area	*	*	*	*	*	**	*	**	*
Expansion of SR-18						**		**	
Total Cumulative Effect	*** to ****	*** to ****	******	*** to ****	*** to ****	******	******	******	*******

* = low adverse impact ** = moderate adverse impact *** = high adverse impact
\+ = beneficial effect 0 = no effect

- Creating snags within the ROW and outside the edges of the cleared ROW to create potential nesting habitat for western bluebirds.
- Manipulating low-growing vegetation and control noxious weeds to benefit forage for species such as deer and elk.

4.7.3.7 Cumulative Impacts

See Section 4.7.2.11, **Cumulative** Impacts. Alternatives 1, 2, 4A and 4B are similar in relative cumulative impacts.

4.7.4 Alternative 2

Overall, potential impacts to wildlife would be similar to those described for the Proposed Action: **low** to **moderate**. Disturbance from

construction activities would be greatest along segments not parallel to the existing transmission line.

Alternative 2 impacts to each species type follows. Specific species members affected are discussed in greater detail in Appendix B:

4.7.4.1 Forest Community Dependent Species

Construction of Alternative 2 would result in clearing 127 acres of forested community habitat, representing 5 percent of the forest community habitat in the Alternative 2 project area. A total of 85 acres of mature coniferous regeneration forest would be cleared, representing 6 percent of the amount present in the project area. This also represents a reduction in the amount of recruitment habitat available for late successional forest dependent species in the CRW. Alternative 2 impacts to forest community dependent species are expected to be comparable to those described under the Proposed Action, which are **low**.

4.7.4.2 Riparian Community Dependent Species

Construction of Alternative 2 would result in the clearing of 15 acres of riparian vegetation (4.5 percent of that present in the project area). Of this total, 10 acres would be forested riparian habitat (4 percent of the amount present in the project area). Alternative 2 impacts to riparian community dependent species are expected to be comparable to those described under the Proposed Action: **moderate** to **low**.

4.7.4.3 Aquatic Community Dependent Species

Construction of Alternative 2 would potentially impact 11 acres of wetlands and one mile of stream, representing 8 percent and 7 percent of the amount present in the project area, respectively. Alternative 2 impacts to aquatic community dependent species are expected to be comparable to those described under the Proposed Action: **moderate**.

4.7.4.4 Species Dependent upon Unique Habitats

Alternative 2 impacts to species dependent on unique habitat types would be similar to those described under the Proposed Action (potential disturbance of unmapped talus habitat and clearing of mature coniferous regeneration forest habitat). The amount of mature coniferous regeneration forest habitat cleared under Alternative 2 would be 85 acres, or 6 percent of the amount in the project area. As described under forest communities, this removal of mature coniferous regeneration forest habitat would result in a **low** impact.

Table 4-10 — Habitat Impacts within the Transmission Alternatives

	Change in Acreage for Each Habitat Type due to Vegetation Clearing Associated with each Alternative										
Habitat Type	Proposed Action	2	3	4A	4B	A	B	C (Option C1)	C (Option C2)	D (OptionD1)	D (Option D2)
Forested Communities											
Mid-regeneration deciduous	-9	-9	-<1	-9	-9	-3	-2	-16	-16	-11	-9
Mature deciduous	-3	-3	0	-3	-3	-5	-11	-28	-27	-28	-30
Early regeneration conifer	0	-8	-3	-4	-4	-6	-17	-2	-8	-67	-44
Mid-regeneration conifer	-1	-1	-27	-1	-1	-9	-35	-40	-3	-135	-144
Mature regeneration conifer	-85	-85	-113	-96	-107	-8	-60	-4	-<1	-158	-186
Mature conifer	0	0	0	0	0	0	-29	0	0	-108	-97
Managed early regeneration conifer	0	0	0	0	0	0	-23	0	0	-3	-4
Early regeneration mixed	-4	-4	-20	-4	-4	-5	-12	-7	0	-43	-50
Mid-regeneration mixed	-16	-17	-14	-17	-17	-45	-11	-24	-47	-40	-73
Mature mixed regeneration	0	0	0	0	0	-37	-10	-9	-13	-39	-57
Totals	**-118**	**-127**	**-178**	**-134**	**-145**	**-118**	**-210**	**-130**	**-115**	**-632**	**-694**
Riparian Communities [a]											
Mid-regeneration deciduous	-<1	-<1	0	-<1	-<1	0	-<1	-1	-1	-<1	-2
Mature deciduous	0	0	0	0	0	0	-1	-1	-1	-3	-3
Early regeneration conifer	0	-1	-1	-1	-1	0	0	0	0	-11	-<
Mid-regeneration conifer	-<1	-<1	-4	-<1	-<1	-<1	-<1	-1	-1	-3	-3
Managed early Regeneration conifer	0	0	0	0	0	0	-1	0	0	-<1	0
Mature regeneration conifer	-5	-5	-12	-5	-5	0	-1	0	0	-6	-7
Mature conifer	0	0	0	0	0	0	-<1	0	0	-5	-3
Early regeneration mixed	-<1	-<1	-4	-<1	-<1	0	-<1	0	0	-2	-2
Mid-regeneration mixed	-2	-<1	-4	-2	-2	-2	-<1	-1	-1	-<1	-2
Mature mixed regeneration	0	0	0	0	0	-1	-<1	-<1	-<1	-2	-5
Rural residential/ managed landscape	0	0	0	0	0	-1	-<1	0	0	-2	-1
Developed	0	0	0	0	0	-<1	0	0	0	-<1	0
Lakes/rivers/stream	0	0	0	0	0	-1	-<1	0	0	-1	-1

Natural non-vegetated	0	0	0	0	0	0	-<1	0	0	-<1	-<1
Managed grass/forb/shrub	-5, +10[b]	0	0	0	0	-2, +7[b]	-<1 +12[b]	0, +5[b]	0, +5[b]	-3, +31[b]	-<1, +31[b]
Natural non-forest shrubland	0	0	0	0	0	0	0	0	0	-<1	0
Natural non-forest grassland	0	0	0	0	0	0	0	0	0	0	0
Totals	**-15**	**-15**	**-28**	**-16**	**-16**	**-9**	**-13**	**-5**	**-5**	**-34**	**-32**
Aquatic Communities [a]											
Streams	0	0	0	0	0	-3	-<1	-<1	-<1	-2	-2
Wetlands	-14	-16	-6	-16	-17	-17	-27	-10	-8	-18	-16
Totals	**-14**	**-16**	**-6**	**-16**	**-17**	**-20**	**-28**	**-11**	**-19**	**-20**	**-18**
Unique Habitats											
Rural residential/ managed landscape	0	0	0	0	0	-105	-4	-25	-41	-18	-18
Developed	-10	-4	-3	-4	-4	-54	-2	-10	-5	-10	-7
Natural non-vegetated	0	0	0	0	0	0	-<1	0	0	-1	-2
Total	**-10**	**-4**	**-3**	**-4**	**-4**	**-159**	**-7**	**-35**	**-46**	**-29**	**-27**
Early Regeneration Communities											
Managed grass/forbs/shrubs	-23, +128[a]	-25, +142[a]	-7, +182[a]	-26, +149[a]	-26, +160[a]	-113, +284[a]	-30, +215[a]	-26, +169[a]	-41, +165[a]	-97, +672[a]	-43, +733[a]
Natural non-forest shrubland	0	0	0	0	0	-4	-3	-3	-3	-9	-10
Natural non-forested grassland	0	0	0	0	0	0	0	0	0	0	0
Totals	**-23**	**-25**	**-7**	**-26**	**-26**	**-117**	**-33**	**-29**	**-44**	**-106**	**-53**

[a] Riparian and aquatic communities, which are comprised of a variety of forested, unique, and early regeneration community habitat types, are included in the acreage count of the other community habitat types.

b The total impacted acreage for each community habitat type does not reflect the increase in managed grass/forb/shrub (MGFS) acreage resulting from conversion of other habitat types (excluding aquatic communities) in the study area. The positive acreage in the MGFS category is the increase that will occur as part of this conversion. Impacts to existing MGFS habitat will be temporary because these areas will continue to be managed in their current state.

4.7.4.5 Early Regeneration Community Dependent Species

Construction of Alternative 2 would result in an increase in early regeneration habitat (managed grass/forb/shrub) of 142 acres. This would benefit species dependent upon this habitat type, particularly elk and deer, and therefore have **no** negative impact.

4.7.4.6 Mitigation

See Section 4.7.3.6**, Mitigation**, under Proposed Action.

4.7.4.7 Cumulative Impacts

See Section 4.7.2.11, **Cumulative Impacts.** Alternatives 1, 2, 4A and 4B are similar in relative cumulative impacts.

4.7.5 Alternative 3

Generally, potential impacts to wildlife would be similar to those described for the Proposed Action: **low** to **moderate**. Construction impact analysis for Alternative 3 assumes that the transmission line would be constructed in the currently mapped location. It is possible that this alternative, if chosen, could be shifted up to 250 feet to the east or west of the currently mapped location, depending upon site-specific conditions and construction constraints. If this were to occur, the impacts to wildlife habitat types may differ to some extent from those described below but, given the overall uniformity of the vegetation within the project area, the level of impact to the vegetation types is not expected to change.

Alternative 3 would create a second corridor through the project vicinity, creating a second barrier for animals that avoid openings. Because habitat fragmentation reduces habitat quantity and quality for some species and also reduces productivity of adjacent habitat for interior forest species, this would be a **moderate** impact. Among the alternatives, construction of Alternative 3 has one of the highest potentials for causing disturbance because it would be built through habitats used minimally by humans.

Alternative 3 impacts on each species type follow. Specific species members affected are discussed in greater detail in Appendix B.

4.7.5.1 Forest Community Dependent Species

Construction of Alternative 3 would result in clearing 178 acres of forested community habitat, with 113 acres of this total in the mature coniferous regeneration forest type. This represents 6 percent of the total forest community habitat and 6 percent of mature coniferous regeneration forest present within the project area. This also represents a reduction in the amount of recruitment habitat available for late successional forest dependent species in the CRW.

Alternative 3 impacts to forest community dependent species would be comparable to those described under the Proposed Action: **low**.

4.7.5.2 Riparian Community Dependent Species

Construction of Alternative 3 would require clearing 28 acres of riparian vegetation, 25 acres of which is forested riparian habitat. This represents 6.5 percent of total riparian vegetation present and 6.5 percent of the forested riparian vegetation present in the project area. Alternative 3 impacts to riparian community dependent species would be comparable to those described under the Proposed Action. Impacts would be **moderate** to **low**.

4.7.5.3 Aquatic Community Dependent Species

Construction of Alternative 3 would potentially impact 2 acres of wetlands and one mile of stream, representing 7 percent and 5 percent of these habit types present in the project area, respectively. Alternative 3 impacts to aquatic community dependent species would be comparable to those described under the Proposed Action: **moderate**.

4.7.5.4 Species Dependent upon Unique Habitats

Under Alternative 3, impacts to species dependent on unique habitat types would be similar to those described under the Proposed Action (that is, potential disturbance of unmapped talus habitat and clearing of mature coniferous regeneration forest habitat). The amount of mature coniferous regeneration forest habitat cleared under Alternative 3 would be 113 acres, or 6 percent of the amount present in the project area. As described under forest communities, this removal of mature coniferous regeneration forest habitat would result in a **low** impact.

4.7.5.5 Early Regeneration Community Dependent Species

Construction of Alternative 3 would result in an increase in early regeneration habitat (managed grass/forb/shrub) of 182 acres. This would benefit species that depend upon this habitat type, particularly elk and deer, and so would have **no** negative impact.

4.7.5.6 Mitigation

See Section 4.7.3.6**, Mitigation**, under Proposed Action.

4.7.5.7 Cumulative Impacts

See Section 4.7.2.11, **Cumulative Impacts**. This alternative would have **moderate** cumulative impact due to its location in a new ROW increasing fragmentation and risk of bird collisions.

4.7.6 Alternative 4A

Overall, potential impacts to wildlife would be similar to those described for the Proposed Action**: low** to **moderate**. Disturbance from construction activities would be greatest in the segments not parallel to the existing transmission line.

Alternative 4A impacts to each species type follow. Specific species members affected are discussed in greater detail in Appendix B.

4.7.6.1 Forest Community Dependent Species

Construction of Alternative 4A would result in clearing 134 acres of forested community habitat (5 percent of the amount present in the project area), of which 96 acres is the mature coniferous regeneration forest type (6 percent of the amount present in the project area). This also represents a reduction in the amount of recruitment habitat available for late successional forest dependent species in the CRW. Alternative 4A' impacts to forest community dependent species would be comparable to those described under the Proposed Action: **low**.

4.7.6.2 Riparian Community Dependent Species

Construction of Alternative 4A would result in the clearing of 16 acres of riparian vegetation (5 percent of the amount present in the project area), of which 11 acres is forested riparian habitat (4 percent of the amount present in the project area). Alternative 4A impacts to riparian community dependent species would be comparable to those described under the Proposed Action: **moderate** to **low**.

4.7.6.3 Aquatic Community Dependent Species

Construction of Alternative 4A would potentially impact 16 acres of wetlands and one mile of stream, representing 8 percent and 6 percent of the amount present in the project area, respectively. This also represents a reduction in the amount of recruitment habitat available for late successional forest dependent species in the CRW. Alternative 4A impacts to aquatic community dependent species would be comparable to those described under the Proposed Action: **moderate**.

4.7.6.4 Species Dependent upon Unique Habitats

Alternative 4A impacts to species dependent on unique habitat types would be similar to those described under the Proposed Action (that is, potential disturbance to unmapped talus habitat and clearing of mature coniferous regeneration forest habitat). The amount of mature coniferous regeneration forest habitat cleared under Alternative 4A would be 96 acres, or 6 percent of the amount present in the project

area. As described under forest communities, this removal of mature coniferous regeneration forest habitat would result in a **low** impact.

4.7.6.5 Early Regeneration Community Dependent Species

Construction of Alternative 4A would result in an increase in early regeneration habitat (managed grass/forb/shrub) of 149 acres. This would benefit species dependent upon this habitat type, particularly elk and deer, and so would have **no** negative impact on them.

4.7.6.6 Mitigation

See Section 4.7.3.6, **Mitigation,** under Proposed Action.

4.7.6.7 Cumulative Impacts

See Section 4.7.2.11, **Cumulative Impacts**. Alternatives 1, 2, 4A and 4B are similar in relative cumulative impacts.

4.7.7 Alternative 4B

Overall, potential impacts to wildlife would be similar to those described for the Proposed Action**: low** to **moderate**. Disturbance from construction activities would be greatest in the segments not parallel to the existing transmission line.

Alternative 4B impacts to each species type follow. Specific species members affected are discussed in greater detail in Appendix B.

4.7.7.1 Forest Community Dependent Species

Construction of Alternative 4B would result in clearing 145 acres of forested community habitat (5 percent of the amount present in the project area), of which 107 acres is the mature coniferous regeneration forest type (6 percent of the amount present in the project area). This also represents a reduction in the amount of recruitment habitat available for late successional forest dependent species in the CRW. Alternative 4B impacts to forest community dependent species would be **low**.

4.7.7.2 Riparian Community Dependent Species

Construction of Alternative 4B would result in the clearing of 16 acres of riparian vegetation (5 percent of the amount present in the project area), of which 11 acres is forested riparian habitat (4 percent of the amount present). Alternative 4B impacts to riparian community dependent species are expected to be comparable to those described under the Proposed Action: **moderate** to **low**.

4.7.7.3 Aquatic Community Dependent Species

Construction of Alternative 4B would potentially impact 17 acres of wetlands and 0.5 mi. of streams, representing 8 percent and 3 percent of the amount present in the project area, respectively. Alternative 4B impacts to aquatic community dependent species would be comparably **moderate** to those described under the Proposed Action.

4.7.7.4 Species Dependent upon Unique Habitats

Alternative 4B impacts to this species would be similar to those described under the Proposed Action (that is, potential disturbance of unmapped talus habitat and clearing of mature coniferous regeneration forest habitat). The amount of mature coniferous regeneration forest habitat cleared under Alternative 4A would be 107 acres, or 6 percent of the amount present in the project area. As described under forest communities, this removal of mature coniferous regeneration forest habitat would result in a **low** impact.

4.7.7.5 Early Regeneration Community Dependent Species

Construction of Alternative 4B would result in an increase in early regeneration habitat (managed grass/forb/shrub) of 160 acres. This would benefit species dependent upon this habitat type, particularly elk and deer, and so have **no** negative impact on them.

4.7.7.6 Mitigation

See Section 4.7.3.6, **Mitigation,** under Proposed Action.

4.7.7.7 Cumulative Impacts

See Section 4.7.2.11, **Cumulative Impacts**. Alternatives 1, 2, 4A and 4B are similar in relative cumulative impacts.

4.7.8 Alternative A

Overall, potential impacts to wildlife would be similar to those described for the Proposed Action**: low** to **moderate**.

Alternative A impacts on each species type follows. Specific species members affected are discussed in greater detail in Appendix O.

4.7.8.1 Forest Community Dependent Species

Construction of Alternative A would require clearing 118 acres of forested community habitat (4 percent of the amount present in the project area), of which eight acres is mature coniferous regeneration

forest (3 percent of the amount present in the project area). This also represents a reduction in the amount of recruitment habitat available for late successional forest dependent species in the CRW. Alternative A impacts to forest community dependent species would be comparably **low** to those described under the Proposed Action.

4.7.8.2 Riparian Community Dependent Species

Construction of Alternative A would result in the clearing of nine acres of riparian community habitat (8 percent of the amount present in the project area), of which four acres is forested riparian habitat (9 percent of the amount present). Alternative A impacts to riparian community dependent species are expected to be comparable to those described under the Proposed Action: **low** to **moderate**.

4.7.8.3 Aquatic Community Dependent Species

Construction of Alternative A would potentially impact 17 acres of wetlands and three acres of lakes/rivers/streams, representing 43 percent and 11 percent of the amount present in the project area, respectively. Alternative A impacts to aquatic community dependent species would be comparably **moderate** to those described under the Proposed Action.

4.7.8.4 Species Dependent upon Unique Habitats

Alternative A impacts to this species would be similar to those described under the Proposed Action for potential disturbance of unmapped talus habitat and clearing of mature coniferous regeneration forest habitat. The amount of mature coniferous regeneration forest habitat cleared under Alternative A would be eight acres, or 3 percent of the amount present in the project area. As described under forest communities, this removal of mature coniferous regeneration forest habitat would result in a **low** impact.

4.7.8.5 Early Regeneration Community Dependent Species

Construction of Alternative A would result in an increase in early regeneration habitat (managed grass/forb/shrub) of 284 acres. This would benefit species dependent upon this habitat type, particularly elk and deer, and so have **no** negative impact on them.

4.7.8.6 Mitigation

See Section 4.7.3.6, **Mitigation,** under Proposed Action.

4.7.8.7 Cumulative Impacts

See Section 4.7.2.11, **Cumulative Impacts**. Compared to the alternatives that cross the CRW, Alternative A would have less effect on habitat fragmentation, threatened and endangered species, and bird collisions because of its location in an existing ROW. Cumulative impacts are increased, however, by the semi-urban location, potential future development, habitat loss and wildlife disturbance as a result of the widening of SR 18. Overall, the cumulative impact would be **moderate**.

4.7.9 Alternative B

Generally, potential impacts to wildlife would be similar to those described for the Proposed Action**: low** to **moderate**. Alternative B would have some higher impacts on some wildlife species, as noted below. Specific species members affected are discussed in greater detail in Appendix O.

4.7.9.1 Forest Community Dependent Species

Construction of Alternative B would require clearing 210 acres of forested community habitat (2 percent of the amount present in the project area), of which 60 acres is mature coniferous regeneration forest and 29 acres is mature coniferous forest (3 percent and 1 percent, respectively, of these habitat types present in the project area). This alternative would impact National Forest land designated as Connectivity Emphasis Area for late-successional species and poses potential impacts to late-successional habitat.

Clearing of mature coniferous forest would cause a **high** impact, because this habitat type is potential nesting habitat for a USFS "Survey and Manage" species (great gray owl) and for two federally-listed species (northern spotted owl and marbled murrelet). (Surveys would be required for such species at tower locations within the existing ROW and in any areas where trees and vegetation would be removed.) Additionally, Alternative B passes through designated critical habitat for both the northern spotted owl and the marbled murrelet, requiring clearing of 37 acres within spotted owl critical habitat and 11 acres within marbled murrelet critical habitat. Of this, six acres are currently suitable nesting habitat for the northern spotted owl and three acres are currently suitable nesting habitat for the marbled murrelet. Clearing of forested habitat that is not currently suitable nesting habitat for these species also represents a reduction in the amount of recruitment habitat available for them and for other late-successional forest dependent species.

Additionally, clearing 128 acres of forested habitat on National Forest lands would reduce potential habitat for USFS "Survey and Manage" mollusks and salamanders. Table 4-11 lists the acreages of

clearing for each plant community that would be impacted on National Forest lands. Because this impact has regional importance, it would be **high**. However, Alternative B impacts to forest community dependent species that are not dependent on mature coniferous forest types are expected to be **low** because this is a common habitat type in the project area.

4.7.9.2 Riparian Community Dependent Species

Construction of Alternative B would require clearing of 13 acres of riparian community habitat (2 percent of the amount present in the project area), of which nine acres is forested riparian habitat (2 percent of the amount present). Alternative B impacts to riparian community dependent species are expected to be comparable to those described under the Proposed Action: **moderate** to **low**. However, 12 acres occur on National Forest lands and removal of these habitat types would create a **high** impact by causing a reduction in a regionally important USFS "Survey and Manage" species habitat — specifically unsurveyed potential habitat for Van Dyke's salamander and Pressley Hesperian (snail).

4.7.9.3 Aquatic Community Dependent Species

Construction of Alternative B would potentially impact 27 acres of wetlands and one acre of lakes/rivers/streams, representing 40 percent and 1 percent of the amount present in the project area, respectively. Alternative B impacts to this species would be comparably **moderate** to those described under the Proposed Action.

4.7.9.4 Species Dependent upon Unique Habitats

Given the topography of this alternative, and based on field observations, talus is likely to occur within the Alternative B alignment. Removal of this habitat type on National Forest lands would create a **high** impact by reducing regionally important habitat — specifically unsurveyed potential habitat for Larch Mountain salamander, a Forest Service "Survey and Manage" species. This salamander species is also known to occur in association with LWD, which is most likely to occur in mature coniferous regeneration and mature coniferous forest habitat types within the Alternative B project area.

Alternative B would clear 60 acres of mature coniferous regeneration and 29 acres of mature coniferous forest habitat containing LWD — 2 percent and 1 percent, respectively, of the amount present in the project area. As described under forest communities, removal of mature coniferous forest habitat would result in a **high** impact.

4.7.9.5 Early Regeneration Community Dependent Species

Construction of Alternative B would result in an increase in early regeneration habitat (managed grass/forb/shrub) of 210 acres. This would benefit species dependent upon this habitat type, particularly elk and deer, and so have **no** negative impact on them.

4.7.9.6 Mitigation

See Section 4.7.3.6, **Mitigation,** under Proposed Action. In addition, if Alternative B is chosen as the new BPA transmission alignment, BPA would need to conduct protocol-level surveys for USFS "Survey and Manage" to evaluate whether the proposed project would affect any of those species. If those species were found, BPA would provide the appropriate mitigation to reduce the amount of impacts.

4.7.9.7 Cumulative Impacts

See Section 4.7.2.11, **Cumulative Impacts**. In addition, there would be impacts from clearing vegetation related to the I-90 expansion and the potential resulting increase in number of visitors passing through the area. The potential expansion of the ski area at Snoqualmie Pass would also remove vegetation and increase human disturbance to wildlife. Logging plans on National Forest lands would remove some vegetation, but have an overall goal of improving late-successional forest habitat. These logging plans would provide a beneficial effect to wildlife in the long-term. The Habitat Conservation Plan in the Cedar River Watershed and forest conservation efforts on other private and state lands will also improve habitat for late-successional species such as the spotted owl and marbled murrelet. There is potential as well for expansion of the Alpine Lakes Wilderness Area. Cumulative impacts associated with this alternative would be **moderate.**

4.7.10 Alternative C (Options C1 and C2)

Overall, potential impacts to wildlife would be similar to those described for the Proposed Action**: low** to **moderate**.

Discussion of impacts on each species type resulting from Alternative C (Options C1 and C2) follows. Specific species members affected are discussed in greater detail in Appendix O.

4.7.10.1 Forest Community Dependent Species

Construction of Option C1 would require clearing 130 acres of forested community habitat (6 percent of the amount present in the project area), of which four acres is mature coniferous regeneration forest (4 percent of the amount present in the project area). Option C2 would require slightly less clearing, 115 acres of forested community

habitat (5 percent of the amount present in the project area), of which less than one acre is mature coniferous regeneration forest (1 percent of the amount present in the project area). This also represents a reduction in the amount of recruitment habitat available for late successional forest dependent species. Options C1 and C2 impacts to this species would be comparably **low** to those described under the Proposed Action.

4.7.10.2 Riparian Community Dependent Species

Construction of either Option C1 or C2 would require clearing of five acres of riparian community habitat (7 percent of the amount present in the project area), all of which is forested riparian habitat (about 8 percent of the amount present). Options C1 and C2 impacts to riparian community dependent species are expected to be comparable to those described under the Proposed Action: **moderate** to **low**.

4.7.10.3 Aquatic Community Dependent Species

Construction of Option C1 would potentially impact 10 acres of wetlands and less than one acre of lakes/rivers/streams, representing 27 percent and 10 percent of the amount present in the project area, respectively. Construction of Option C2 would potentially impact eight acres of wetlands and less than one acre of lakes/rivers/streams, representing 27 percent and 13 percent of those habitat types present in the project area, respectively. Options C1 and C2 impacts to this species would be comparably **moderate** to those described under the Proposed Action.

4.7.10.4 Species Dependent upon Unique Habitats

Option C1 impacts to this species would be similar to those described under the Proposed Action regarding potential disturbance of unmapped talus habitat and clearing of mature coniferous regeneration forest habitat. The amount of mature coniferous regeneration forest habitat cleared under Option C1 would be four acres, or 4 percent of the amount present in the project area. Under Option C2, the amount cleared would be less than one acre, or 1 percent of the amount present in the project area. As described under forest communities, this removal of mature coniferous regeneration forest habitat would result in a **low** impact. Additionally, talus habitat is unlikely to occur in this proposed alignment, given the topography of the route, and is not expected to be impacted.

4.7.10.5 Early Regeneration Community Dependent Species

Construction of Option C1 would result in an increase in early regeneration habitat (managed grass/forb/shrub) of 169 acres (the

Table 4-11 — Wildlife Habitat Impacts within Transmission Alternatives on USFS-Managed Lands

Acres of Habitat Impacted by Alternative within USFS Lands			
Habitat Type	**B**	**D1**	**D2**
Forested Communities			
Mid-regeneration deciduous	<1	0	2
Mature deciduous	3	6	6
Early regeneration conifer	13	30	25
Mid-regeneration conifer	25	94	112
Mature regeneration conifer	42	107	141
Mature conifer	18	74	68
Managed early regeneration conifer	18	2	5
Early regeneration mixed	6	30	18
Mid-regeneration mixed	<1	7	7
Mature mixed regeneration	<1	0	5
Totals	**128**	**350**	**389**
Riparian Communities			
Mid-regeneration deciduous	<1	0	<1
Mature deciduous	1	2	2
Early regeneration conifer	0	<1	<1
Mid-regeneration conifer	<1	8	2
Managed early regeneration conifer	1	0	0
Mature regeneration conifer	1	2	4
Mature conifer	<1	7	3
Early regeneration mixed	<1	0	<1
Mid-regeneration mixed	<1	<1	<1
Mature mixed regeneration	<1	0	1
Rural residential/managed landscape	0	0	0
Developed	0	0	0
Lakes/rivers/stream	<1	1	<1
Natural nonvegetated	<1	<1	<1
Managed grass/forb/shrub	<1	2	<1
Natural nonforest shrubland	0	<1	0
Natural nonforest grassland	0	0	0
Totals	**12**	**18**	**19**
Aquatic Communities			
Lakes/rivers/stream	<1	-<1	1
Totals	**1**	**1**	**1**
Unique Habitats			
Rural residential/managed landscape	0	0	0
Developed	<1	2	0
Natural nonvegetated	0	2	1
Total	**1**	**4**	**1**
Early Regeneration Communities			
Managed grass/forbs/shrubs	14	34	64
Natural nonforest shrubland	<1	10	8
Natural nonforested grassland	0	0	0
Totals	**15**	**44**	**72**

increase would be 165 acres under Option C2). This would benefit species dependent upon this habitat type, particularly elk and deer, and so have **no** negative impact on them.

4.7.10.6 Mitigation

See Section 4.7.3.6, **Mitigation,** under Proposed Action.

4.7.10.7 Cumulative Impacts

See Section 4.7.2.11, **Cumulative Impacts**. Cumulative effects associated with Alternative C are similar to Alternative A because of its location. Alternative C would have slightly higher cumulative impacts because of the increased amount of vegetation clearance associated with the alternative. Overall, the cumulative effect would still be **moderate**.

4.7.11 Alternative D (Options D1 and D2)

Generally, potential impacts to wildlife would be more substantial than those described for the Proposed Action and would be **moderate** overall. Alternative D (Options D1 and D2) would have high impacts on some wildlife species. Specific species members affected are discussed in greater detail in Appendix O.

4.7.11.1 Forest Community Dependent Species

Construction of Option D1 would require clearing 632 acres of forested community habitat (6 percent of the amount present in the project area), of which 158 acres is mature coniferous regeneration forest and 108 acres is mature coniferous forest (7 percent and 5 percent, respectively, of these habitat types present in the project area). Table 4-11 lists the acreages of clearing for each plant community that would be impacted on National Forest lands. Option D2 would require even greater amounts of clearing: 694 acres of forested community habitat (6 percent of the amount present in the project area), of which 186 acres is mature coniferous regeneration forest and 97 acres is mature coniferous forest (8 percent and 4 percent, respectively, of these habitat types present in the project area).

This alternative (either option) would require the greatest amount of mature coniferous vegetation clearing of all transmission alternatives and would have a **high** impact on forest species. Specifically, it would:

- impact National Forest land designated as Connectivity Emphasis Area for late-successional species and poses potential impacts to late-successional habitat;

- impact potential habitat for three USFS "Survey and Manage" species, the great gray owl (nesting habitat), mollusks and salamanders. It would also impact nesting habitat for two federally-listed species — northern spotted owl and marbled murrelet. Surveys would be required of the entire expanded corridor (Shrenk 2002), areas where new roads would be needed outside the ROW, and existing roads outside of the ROW where improvements would take place. These surveys could take as much as a full calendar year to complete;
- impact designated critical habitat for both the northern spotted owl and the marbled murrelet. Option D1 would require clearing of 101 acres within spotted owl critical habitat and 32 acres within marbled murrelet critical habitat. Of this, 23 acres are currently suitable nesting habitat for the northern spotted owl and eight acres are currently suitable nesting habitat for the marbled murrelet. Option D2 would require clearing of only slightly fewer critical habitat areas: 92 acres within spotted owl critical habitat and 19 acres within marbled murrelet critical habitat. Of this, 19 acres are currently suitable nesting habitat for the northern spotted owl and four acres are currently suitable nesting habitat for the marbled murrelet. Clearing of forested habitat that is not currently suitable nesting habitat for these species also represents a reduction in the amount of recruitment habitat available for them and for other late-successional forest dependent species;
- not likely be deemed consistent with the Snoqualmie Pass Adaptive Management Area (**AMA**) Plan unless it was determined to be the only viable alternative that would "address public needs or provide significant public benefits." Alternative D (Options D1 and D2) is not likely to be found in compliance with applicable Standards and Guidelines in the Snoqualmie Pass AMA Plan (Rogalski, 2002).

Forest community dependent species that are not dependent on mature coniferous forest would experience a **low** impact because other forest habitat types are common in the project area.

4.7.11.2 Riparian Community Dependent Species

Construction of Option D1 would require clearing of 34 acres of riparian community habitat (5 percent of the amount present in the project area), of which 25 acres is forested riparian habitat (5 percent of the amount present). Option D2 would require clearing of 32 acres of riparian community habitat (5 percent of the amount present in the project area), of which 28 acres is forested riparian habitat (5 percent of

the amount present). This alternative would result in the greatest amount of riparian community habitat clearing of all transmission alternatives. Still, Option D1 and D2 impacts to riparian community dependent species are mostly comparable to those described under the Proposed Action: **moderate** to **low**. The exception relates to removal of this habitat type on 12 acres (Option D1) or 19 acres (Option D2) on National Forest lands, which would create a **high** impact by causing a reduction in a regionally important USFS "Survey and Manage" species habitat — specifically potential habitat for Van Dyke's salamander and Pressley Hesperian (snail).

4.7.11.3 Aquatic Community Dependent Species

Construction of Option D1 would potentially impact 18 acres of wetlands and two acres of lakes/rivers/streams, representing 26 percent and 1 percent of the amount present in the project area, respectively. Option D2 would potentially impact 16 acres of wetlands and two acres of lakes/rivers/streams, also representing 26 percent and 1 percent of the amount present in the project area, respectively. Option D1 and D2 impacts to this species would be comparably **moderate** to those described under the Proposed Action.

4.7.11.4 Species Dependent upon Unique Habitats

Given the topography of this alternative, and based on field observations, talus is likely to occur within the Option D1 and D2 alignment. Removal of this habitat type on National Forest land would create a **high** impact by reducing regionally important habitat — specifically potential habitat for Larch Mountain salamander, a USFS "Survey and Manage" species. This salamander species is also known to occur in association with LWD, which is most likely to occur in mature coniferous regeneration and mature coniferous forest habitat types within the Option D1 project area.

Option D1 would clear 158 acres of mature coniferous regeneration and 108 acres of mature coniferous forest habitat containing LWD — 7 percent and 5 percent, respectively of the amount present in the project area. Option D2 would clear 186 acres of mature coniferous regeneration and 97 acres of mature coniferous forest habitat containing LWD — 8 percent and 4 percent, respectively, of the amount present in the project area. As described under forest communities, removal of mature coniferous forest habitat would result in a **high** impact.

4.7.11.5 Early Regeneration Community Dependent Species

Construction of Option D1 would result in an increase in early regeneration habitat (managed grass/forb/shrub) of 672 acres, while

Option D2 would create an increase of 733 acres of this habitat, the highest of any alternative. This would benefit species dependent upon this habitat type, particularly elk and deer, and so have **no** negative impact on them.

4.7.11.6 Mitigation

See Section 4.7.3.6, **Mitigation,** under Proposed Action. In addition, if Alternative D is chosen as the new BPA transmission alignment, BPA would need to conduct protocol-level surveys for USFS "Survey and Manage" to evaluate whether the proposed project would affect any of those species. If those species were found, BPA would provide appropriate mitigation to reduce the amount of impacts.

4.7.11.7 Cumulative Impacts

See Sections 4.7.2.11 and 4.7.9.7, **Cumulative Impacts**, for descriptions of relevant impacts. The direct impacts of vegetation clearing, riparian vegetation removal, increased access roads, and long-term habitat loss are greater with this alternative than Alternative B or any of the other alternatives. Cumulative impacts associated with this alternative would be **high**.

4.7.12 Non-Transmission Alternative

Because no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12), there would be no immediate wildlife-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

4.7.13 No Action Alternative

Under the No Action Alternative, wildlife and wildlife habitats within the CRW would be managed as described in the HCP (City of Seattle 2000). Forest stands would be retained and allowed to develop as wildlife habitat. Industrial forestlands within the project area would continue to be managed for timber production under the provisions of the Washington Forest Practices Act. Rural residential areas would continue to be occupied, and development in these areas is likely to increase, given the population trend in the greater Puget Sound area.

4.7.13.1 Cumulative Impacts

Maintenance activities under the No Action Alternative would consist primarily of vegetation maintenance under existing transmission lines, resulting in potential disturbance of wildlife in adjacent habitats. Within the rural residential areas, this would occur simultaneously with a high level of human activity and so would not be appreciably different from the existing condition. The same is true for industrial forestlands.

Within the CRW, maintenance of existing lines would have a greater potential to cause noise disturbance to wildlife because human activity is limited in this area. Activities that occur include some road use, road maintenance, and vegetation management along roads. Thinning may also occur in the future, as described in the HCP (City of Seattle 2000), which could compound potential impacts from ROW maintenance if they are in the same general vicinity.

4.8 Vegetation

Impacts on vegetation could occur through direct clearing for the transmission line and for construction of roads, transmission line footings, substation and other facilities. Additional impacts could occur from the effects of heavy equipment use on local soils, including compaction and physical movement of soils. Compaction of soils could inhibit precipitation from infiltrating over plant root zones. Compaction could also inhibit germination of seeds residing in the upper soil horizon, and it could favor the development of bare-soil areas. Physical movement of soils could disrupt the seed bank in the upper soil horizon, inhibiting regeneration of desirable species. Physical movement of soils at greater depths could damage the fine root zones of shrubs and trees. Additionally, the temporary storage of soils and cleared vegetation could compact soils beneath the storage piles. Decomposition of vegetation within the storage piles could generate sufficient heat to inhibit germination of desirable species in the seed bank of the upper soil horizon beneath the piles.

Forested areas are the most affected by placement of a transmission line, because these areas must be cut to keep trees from interfering with the line. For Alternatives 1 through 4, B, and D (Options D1 and D2), at least 57 percent of the total project impacts would occur in coniferous forest types (76 percent for Alternative 3), and an average of 80 percent of their total project impacts would occur within some type of forested cover type. Alternatives A and C (Options C1 and C2) cross higher proportions of developed areas: 70 percent and 40 percent, respectively. Project impacts for Alternatives A and C would occur in developed, rural residential or other managed cover types.

Consequently, this section focuses on each alternative's impact on coniferous forested communities, as well as impacts on any single vegetation community. See Appendices C and P for more information and maps.

Construction of the transmission line would involve clearing a 150-foot wide ROW and removing danger trees outside of the ROW. Throughout the project, BPA would use the "stable tree" criteria for selecting danger trees. To aid in this determination, a clearing advisory is being developed which reports safe heights at various distances from the centerline. This advisory is generated from data gained in the field and through design. This data includes:

- topography at various distances from centerline (ground modeling);
- structure design which includes phase spacing and elevation of the conductor;
- conductor design which includes sag and swing;
- minimum clearance between the conductor and the trees;
- growth factor of five years (which is enough time for the new trees to adapt to their new environment and become more "wind firm").

However, the clearing advisory is only one of the tools that would be used to select danger trees. Data was gathered at the site to determine past tree failures and wind direction. Aided by this information, personnel familiar with tree failures will select danger trees. Only those trees deemed to have a high risk of failure within the first five years will be marked for removal or made into snags. Any tree deemed stable will remain even though, if it fell, it could fall into the transmission line. By using the stable tree criteria, BPA would assume more risk that falling trees could cause the loss of BPA facilities.

4.8.1 Impact Levels

High impacts on vegetation occur when an action would:

- create an unavoidable adverse effect on a federally-listed threatened or endangered plant species (see sidebar);
- significantly reduce the quantity or quality of a regionally or nationally important botanical reserve, plant population, or similar botanical habitat area;
- spread noxious weeds due to construction or maintenance; or
- adversely affect rare or declining species at the regional level. For this project, the regional levels are considered the

Washington Western Cascade Province, Puget Trough Province, and Northern Cascade Province.

Moderate-level impacts on vegetation occur if the impacts:

- create an effect on threatened or endangered plant species that could be mitigated partially through interagency consultation with the USFWS under Section 7 of the ESA;
- temporarily disturb sensitive plants during construction but do not affect the viability of local populations;
- cause a local reduction in the quantity or quality of vegetation communities (as opposed to regional reductions); or
- marginally reduce the productivity of adjacent vegetation communities or resources (such as wetland plant communities or botanical reserves).

Low-level impacts occur when an action would:

- create an effect that could be largely mitigated;
- reduce the quantity or quality of vegetation communities confined to the site of the action;
- cause no major effect on productivity of adjacent vegetation communities;
- temporarily disturb common plant species;
- reduce plant communities that are very common in the project vicinity;
- adversely affect relatively common species at a local level (i.e., occurring within the immediate vicinity of the project and not affecting regional populations); or
- cause temporary effects or those that can be minimized by site planning or by placing seasonal restrictions on construction activities.

For Your Information

The USFWS has been consulted about the presence of federally-listed plant species within the project area. Based on Washington Natural Heritage Program (NHP) listings of known occurrences of rare plants in King and Kittitas counties, it is unlikely that any federally-listed plant species occur within the project areas of any of the alternatives.

Minimal or **no** impacts occur when an action creates no impacts or fewer impacts than the low impact level. Vegetation clearing impacts were estimated on an assumption that the entire length of the 150-foot-wide transmission line corridor would be completely cleared of existing vegetation. This represents a worst-case scenario for clearing. Actual cleared acreage within the proposed transmission line corridors would likely be less than described due to topography and the ability to span trees in low areas.

4.8.2 Proposed Action

The Proposed Action parallels a portion of the existing Raver-Echo Lake transmission line and would be constructed to the east of the existing ROW. No impacts to forested communities west of the existing transmission line ROW would occur.

The Proposed Action would impact about 152 acres within the ROW. Over half (56 percent) of this impact would occur in mature coniferous regeneration and mid-regeneration, closed canopy coniferous cover types. These stands are dominated by Douglas fir and average 100 to 130 feet high. BPA would also selectively remove danger trees in adjacent areas to ensure the reliable operation of the transmission line. Reduction in quantity of *any one vegetation community*, confined to the site of the action, would be a **low** impact.

The Proposed Action would have **moderate** impacts to coniferous forested communities, and potentially **high** impacts from noxious weed colonization in disturbed areas. Table 4-12 shows the acreage of vegetation that would be impacted for each alternative from each vegetative cover type within the 150-foot ROW. (See also Map 12.) Impacts to non-forested areas should be considered temporary, since they would not be converted to a different cover type. (See Table 4-14.)

Additional cutting outside the 150-foot ROW would vary, based on the type and height of vegetation and terrain crossing. Some danger tree removal would be required whenever the height and stability of trees, in combination with the topography and maximum swing of the conductors during heavy winds, could represent a danger to electrical transmission line reliability. Outside the ROW, the taller trees would be cut or made into snags, and most shrubs and lower vegetation would be left in place. Subsequently, trees would be allowed to grow back outside the 150-foot ROW. In some cases, forested stands even within the maintained ROW would not require clearing. This is because the transmission line could span some narrow, deep draws and stream channels.

Trees that grow within the protection of a group of trees (with relatively little exposure to wind) would be exposed when the trees around them were removed, making them vulnerable to wind throw and sunscald. However, trees that were already growing in the open would have become “wind-hardened” and much less likely to fall or be damaged by excessive sun exposure. So, trees that grow back within the initial cleared area, but outside of the 150-feet maintained ROW, would not be as likely to fall because they would have grown adjacent to the maintained ROW and become wind-hardened and acclimated to the site.

Soil disturbance from construction of the line, towers, roads, and related facilities could change the ability of some plant communities to reestablish. Additionally, trees next to the cleared areas could be injured or killed if large portions of the plant roots or aboveground shoots were cut or damaged, or if soils were excessively compacted by equipment.

As noted, the project has a potentially high impact for spreading noxious weeds, as designated by federal or state law. The identification, control, or eradication of noxious weeds is delegated to the local county weed boards throughout the state. Disturbed areas such as transmission line ROWs have a higher probability for becoming infested with undesirable or non-native plant species. These species take advantage of disturbed soils and the lack of competing vegetation in areas recently cleared. Construction would disrupt vegetation and disturb soils, increasing the potential for noxious weeds invading new areas. Vehicles and equipment could inadvertently transport seeds from infested areas to locations along the ROW and access roads. Without proper mitigation measures in place, the spread of noxious weeds would likely increase.

4.8.2.1 Access Roads

New access roads would be built for the construction, operation, and maintenance of the transmission line. Table 4-13 lists the acreages of clearing for new access roads for each alternative. The Proposed Action would follow the existing transmission line ROW and, therefore, is one of the alternatives with the least impact from new access roads. Almost all the new roads would be located within the new and existing ROW, which would require little additional clearing. This impact would be **low**.

4.8.2.2 Substation Impacts

Clearing of 13 acres would be required to accommodate the three-acre Echo Lake Substation expansion. This clearing would take place in an early regeneration, closed canopy mixed cover type, with trees about 10 to 30 years old. Reduction in quantity of a vegetation community, confined to the site of the action, would be a **low** impact.

A young (10- to-25 year) Douglas fir-dominated stand located immediately east of the proposed expansion could also be temporarily impacted by construction activities. Movement of the disturbed area edge eastward to the young Douglas fir stand would encourage colonization of the stand's edge by non-native species and/or noxious weeds. This is a **low** impact because it could be mitigated.

4.8.2.3 Operation and Maintenance Impacts

Impacts associated with operation and maintenance of the transmission line would include continued clearing and trimming of vegetation beneath and next to the transmission line, and continued disturbance of vegetation and soils during maintenance activities.

Vegetation beneath the transmission line would be converted to a managed grass/forb/shrub type. However, trees would regrow or resprout in this area, and they would either be removed immediately, or cleared as they attain heights that could interfere with the operation of the transmission line. The continued removal and/or suppression of tree growth would be a **low** impact.

Routine and emergency maintenance activities would require visits to tower sites and movement of personnel and vehicles along the transmission line ROW. These activities could cause additional soil disturbance. Vehicles could also transport seed and/or vegetative parts of unwanted plants to the site. This in turn would favor colonization by non-native and/or noxious plant species. This is a **low** impact because it could be mitigated.

Access Roads — Impacts associated with the operation and maintenance of access roads would include periodic clearing of vegetation; disturbance of soils; and potential spills of fuels, oils, or other compounds toxic to vegetation. Impacts are as follows:

- trees and shrubs within and next to access roads would be cleared periodically to allow vehicle passage. This would be a low impact.
- driving on access roads would disturb soils. Vehicles could transport weed seed. These activities would favor colonization by non-native and/or noxious plant species. In extreme cases, soil disturbance would preclude growth of vegetation entirely. This would be a low impact.
- while driving and parking maintenance vehicles along access roads, occasional small fuel and oil leaks could occur. In addition, petroleum-based compounds or herbicides being transported by vehicles could spill or leak, especially on rough or uneven terrain. Any such spills or leaks could kill or injure vegetation in the immediate vicinity of the spill. This would be a low impact.

Echo Lake Substation — Impacts associated with the operation and maintenance of the expanded Echo Lake Substation would include periodic clearing of vegetation and potential spills of fuels, oils, or other compounds toxic to vegetation, similar to that discussed under **Access Roads**, above.

Table 4-12 — Acreage of Vegetative Cover Types Impacted by Transmission Alternative

Cover Type	Impacted Acreage by Alternative										
	1	**2**	**3**	**4A**	**4B**	**A**	**B**	**C1**	**C2**	**D1**	**D2**
Early regeneration coniferous	0	8	3	4	4	6	17	2	8	67	44
Managed early regeneration coniferous	0	0	0	0	0	0	23	0	0	3	4
Mid-regeneration coniferous	1	1	27	1	1	9	35	40	3	135	144
Mature coniferous regeneration	85	85	113	96	107	8	60	4	<1	158	186
Mature coniferous	0	0	0	0	0	0	29	0	0	108	97
Old forest	0	0	0	0	0	0	0	0	0	0	0
Mid-regeneration deciduous	9	9	0	9	9	3	2	16	16	11	9
Mature deciduous	3	3	0	3	3	5	11	28	27	28	30
Early regeneration mixed	4	4	20	4	4	5	12	7	0	43	50
Mid-regeneration mixed	16	16	14	17	17	45	11	24	47	40	73
Mature mixed regeneration	0	0	0	0	0	37	10	9	13	39	57
Managed grass/forb/shrub	23	25	7	26	26	113	31	26	41	97	43
Natural nonforested grassland	0	0	0	0	0	0	0	0	0	0	0
Natural nonforested shrubland	0	0	0	0	0	4	3	3	3	9	10
Lake/river/stream	0	0	0	0	0	3	0	<1	<1	2	2
Developed	11	4	3	4	4	54	2	10	5	10	7
Natural nonvegetated	0	0	0	0	0	0	0	0	0	1	2
Rural residential/managed landscape	0	0	0	0	0	105	4	25	41	18	18
Total	**152**	**155**	**187**	**164**	**175**	**397**	**250**	**195**	**206**	**769**	**776**

4.8.2.4 Mitigation

Standard mitigation measures to minimize impacts to vegetation would include the following:

- locate the proposed project adjacent to existing ROWs as much as possible to keep clearing to a minimum.
- keep vegetation clearing to the minimum needed to maintain safety and operational standards, leaving low-growing vegetation where possible. Flag and/or clearly mark clearing limits and additional danger trees, and include clear descriptions of clearing limits as part of construction contracts.
- promptly reseed or revegetate disturbed areas with native seed mix as soon as construction is completed in an area. However, in many cases, locally adapted native plant materials are not available. Many native species available for restoration are actually from other areas, representing different genetics than existing vegetation. BPA would consult with counties, Washington DNR, SPU, U.S. Forest, Service, and other agencies about the appropriate seed mixtures to use.
- develop and implement aggressive vegetation management programs (if also being carried out by adjoining landowners) to limit colonization by non-native species and control noxious weeds within the transmission line ROW and expanded substation and access roads. Management practices regarding noxious weed control, and general

Table 4-13 — Summary of Access Roads by Transmission Alternative

Alternative	Access Rd. Acreage w/in 150-ft. Corridor	Access Rd. Acreage outside 150-ft. Corridor
1	2	2
2	7	[a]
3	16	[a]
4A	6	[a]
4B	6	[a]
A	20	13
B	7	22
C1	18	5[b]
C2	21	8
D1	20	20
D2	19	22

[a] not available [b] represents acreage within existing 150-ft. ROW

vegetation management practices, have been defined in the BPA Transmission System Vegetation Management Program (see Appendix K). Areas would be maintained using Integrated Vegetation Management. BPA has not used herbicides in the CRW for 16 years.

- use only certified weed-free straw where straw is used as mulch or for erosion control;
- locate all construction staging, soil stockpiles, and cleared vegetation piles within the existing cleared transmission line ROW. This would minimize impacts caused by these activities in forested areas outside the existing ROW;
- where possible, BPA would replant impacted areas outside the ROW with conifers or with appropriate low-growing wetland species;
- require cleaning of off-road equipment before entering the project area to assure equipment is free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds. Inspect equipment thoroughly (opening hoods, panels, etc.) prior to off-loading from a transportation vehicle;
- provide maps of known infested sites to contractors performing project work;
- clean equipment after operations in infested areas. Do not allow run-off to enter streams; contain run-off with methods specified to minimize movement of water from the cleaning site;
- dispose of soil contaminated with invasive plants and seedpods at an approved area;
- stockpiles of rock and other road construction materials that contain invasive plants will have the top six inches scraped off, set aside, and treated. The pile will be monitored and treated again if invasive plants reappear.

BPA would also use the following mitigation measures suggested by the Muckleshoot Tribe. (The Muckleshoot Tribe would like the opportunity to salvage or relocate plants before construction.)

- create wildlife habitat through seeding of various grasses favored by game and allow the opportunity for browse to emerge in disturbed areas within the ROW;
- minimize disturbance to riparian areas;
- leave LWD in the riparian areas after clearing.

Table 4-14 — Area and Percentage of Converted and Non-Converted Vegetative Cover by Transmission Alternative

General Vegetative Cover Type	Alternative										
	1	**2**	**3**	**4A**	**4B**	**A**	**B**	**C1**	**C2**	**D1**	**D2**
Converted Cover Types											
Early regeneration coniferous	0	8	3	4	4	6	17	2	8	67	44
Managed early regeneration coniferous	0	0	0	0	0	0	23	0	0	3	4
Mid-regeneration coniferous	1	1	27	1	1	9	35	40	3	135	144
Mature coniferous regeneration	85	85	113	96	107	8	60	4	<1	158	186
Mature coniferous	0	0	0	0	0	0	29	0	0	108	97
Mid-regeneration deciduous	9	9	0	9	9	3	2	16	16	11	9
Mature deciduous	3	3	0	3	3	5	11	28	27	28	30
Early regeneration mixed	4	4	20	4	4	5	12	7	0	43	50
Mid-regeneration mixed	16	16	14	17	17	45	11	24	47	40	73
Mature mixed regeneration	0	0	0	0	0	37	10	9	13	39	57
Total converted impact area (ac.)	**118**	**126**	**177**	**134**	**145**	**118**	**210**	**130**	**115**	**632**	**694**
Total project impact area (ac.)	152	155	187	164	175	397	250	195	206	769	776
Percent of project impact	**78**	**81**	**95**	**82**	**83**	**30**	**84**	**67**	**56**	**82**	**89**
Non-converted Cover Types											
Managed grass/forb/shrub	23	25	7	26	26	113	31	26	41	97	43
Lake/river/stream	0	0	0	0	0	3	0	<1	<1	2	2
Developed	11	4	3	4	4	54	2	10	5	10	7
Natural non-forested shrubland	0	0	0	0	0	4	3	3	3	9	10
Natural non-vegetated	0	0	0	0	0	0	0	0	0	1	2
Rural residential/managed landscape	0	0	0	0	0	105	4	25	41	18	18
Total nonconverted impact area (ac.)	**34**	**29**	**10**	**30**	**30**	**279**	**40**	**65**	**91**	**137**	**82**
Total project impact area (ac.)	152	155	187	164	175	397	250	195	206	769	776
Percent of project impact	**22**	**19**	**5**	**18**	**17**	**70**	**16**	**33**	**44**	**18**	**11**

4.8.2.5 Cumulative Impacts

Impacts associated with construction of the transmission line include long-term loss of forested area within the CRW or the USFS Mt. Baker-Snoqualmie and Wenatchee National Forests, additional road construction, and increased colonization by non-native species. However, because the CRW is now an HCP, and commercial timber harvesting is prohibited, cumulative impacts to vegetation within the CRW are expected to be small. However, temporary alterations of vegetation communities would include timber harvesting on private lands outside the watershed boundary.

Forested stands growing in the areas that BPA would maintain as low-growing vegetation zones would not be allowed to grow beyond a height that would endanger the reliable and safe operation of the transmission line. Periodic clearing in these areas would be unavoidable.

Additional access road construction would generally increase risk of colonization by non-native species within a watershed. Alternatives with more road construction (3, A, C and D) would have a higher risk, although Alternatives 3 and D would have the highest risk because they cross areas with less human disturbance than A and C. Construction of housing or businesses on vacant lots would remove additional vegetation and create additional paved roads and parking lots, which would permanently remove native vegetation.

For all alternatives except Alternative B and a portion of Alternative A, fragmentation of forested stands would increase, as would the number of trees prone to windfall along forest edges. Alternatives adjacent to existing transmission lines (Alternatives 1, D, and most of 2, 4A, and 4B) would lessen the amount of windfall edge by 50 percent.

Overall, the Proposed Action's cumulative impact on vegetation would be **low** (see Table 4-15).

4.8.3 Alternative 2

Impacts would be similar to the Proposed Action: **low** impacts on any one vegetation community confined to the site of the project; **moderate** impacts on coniferous forested communities, and potentially **high i**mpacts from noxious weed colonization in disturbed areas. It is expected, however, that the latter high impact could be extensively mitigated through weed control measures. (See Section 4.8.2, Proposed Action.)

Alternative 2 would result in impacts to 155 acres. Over half (55 percent) of this impact would occur in mature coniferous regeneration and mid-regeneration, closed canopy coniferous cover types. These

stands are dominated by Douglas fir, and average 100 to 130 feet tall. Along Alternative 2, construction of Segments E, F, and G would require danger tree clearing outside the ROW on both sides of the proposed centerline. Segment D would parallel a portion of the existing cleared ROW, however, so new danger tree clearing outside the ROW along this segment would occur only to the east of the proposed centerline.

4.8.3.1 Mitigation

See Section 4.8.2.4, **Mitigation,** under Proposed Action.

4.8.3.2 Cumulative Impacts

See Section 4.8.2.5, **Cumulative Impacts,** under Proposed Action. There would be increased fragmentation of forested stands and an increase in the number of trees prone to windfall along forest edges compared to the Proposed Action. However, cumulative impacts would still be **low**.

4.8.4 Alternative 3

Impacts would be similar to the Proposed Action: **low** impacts on any one vegetation community confined to the site of the project; **moderate** impacts on coniferous forested communities, and potentially **high i**mpacts from noxious weed colonization in disturbed areas. The latter high impact could be extensively mitigated through weed control measures. (See Section 4.8.2, **Proposed Action**.)

Alternative 3 would require an entirely new cleared ROW — affecting 187 acres — and have greater impacts on forested areas. Although its exact siting is not yet determined, adjustments to the ROW would have a low effect on its overall impacts because the area that Alternative 3 passes through contains relatively uniform vegetation. Regardless of its ultimate placement, over half (60 percent) of this impact would occur in mature coniferous regeneration and mid-regeneration, closed coniferous canopy cover types. These stands are dominated by Douglas fir, and average 100 to 130 feet tall. Alternative 3 would result in greater impacts to early regeneration, open canopy coniferous and early regeneration, open canopy mixed cover types as well.

Certain stands within Alternative 3 are somewhat taller than the average tree height in the project area, ranging from 140 to 170 feet high. These stands may be close enough to the Alternative 3 ROW to pose a threat to the line, once constructed. In these areas, additional selective cutting would be expanded beyond what has been proposed to ensure reliable operation of the transmission line.

4.8.4.1 Mitigation

See Section 4.8.2.4, **Mitigation,** under Proposed Action.

4.8.4.2 Cumulative Impacts

See Section 4.8.2.5, **Cumulative Impacts,** under Proposed Action. There would be increased fragmentation of forested stands and an increase in the number of trees prone to windfall along forest edges. Cumulative impacts would still be **low**.

4.8.5 Alternative 4A

Impacts would be similar to the Proposed Action: **low** impacts on any one vegetation community confined to the site of the project; **moderate** impacts on coniferous forested communities, and potentially **high i**mpacts from noxious weed colonization in disturbed areas. The latter high impact could be extensively mitigated through weed control measures. (See Section 4.8.2, **Proposed Action**.)

Table 4-15 — Cumulative Vegetation Impacts

Past, present and future projects	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4A**	**Alt 4B**	**Alt A**	**Alt B**	**Alt C**	**Alt D**
Effect of proposed alternative on vegetation change	*	*	*	*	*	*	*	*	**
Effect of proposed alternative on risk of non-native introduction	*	*	**	*	*	*	*	*	**
Existing transmission lines (effect on tree blowdown)	*	*	**	*	*	0	0	*	*
I-90 widening east of Hyak							*		*
I-90 thinning on NF land							0		0
Potential lot development	*	*	*	*	*	**	*	**	*
Logging on private timberlands	*	*	*	*	*	*	*	*	*
Snoqualmie Pass recreation expansion							*		*
Population growth in Puget Sound area	*	*	*	*	*	**	*	**	*
Expansion of SR-18						*		*	
Total Cumulative Effect	*	*	*	*	*	*	*	*	**

* = low adverse impact ** = moderate adverse impact *** = high adverse impact
+ = beneficial effect 0 = no effect

Alternative 4A would impact 164 acres. Over half (59 percent) of this impact would occur in mature coniferous regeneration and mid-regeneration, closed coniferous canopy cover types. These stands are dominated by Douglas fir and average 100 to 130 feet tall. Along Alternative 4A, construction of Segments E, F, and H would require danger tree clearing outside the ROW on both sides of the proposed centerline. Segment D would parallel the existing cleared ROW, however, and so new danger tree clearing along this segment would occur only to the east of the proposed centerline.

4.8.5.1 Mitigation

See Section 4.8.2.4, **Mitigation,** under Proposed Action.

4.8.5.2 Cumulative Impacts

See Section 4.8.2.5 **Cumulative Impacts,** under Proposed Action. There would be increased fragmentation of forested stands and an increase in the number of trees prone to windfall along forest edges compared to the Proposed Action. However, cumulative impacts would still be **low**.

4.8.6 Alternative 4B

Impacts would be similar to the Proposed Action: **low** impacts on any one vegetation community confined to the site of the project; **moderate** impacts on coniferous forested communities, and potentially **high i**mpacts from noxious weed colonization in disturbed areas. The latter high impact could be extensively mitigated through weed control measures. (See Section 4.8.2, **Proposed Action**.)

Alternative 4B would impact 175 acres, over half (61 percent) of which would occur in mature coniferous regeneration and mid-regeneration, closed coniferous canopy cover types. These stands are dominated by Douglas fir and average 100-130 feet tall. Along Alternative 4B, construction of Segment I would require danger tree clearing outside the ROW on both sides of the proposed centerline. Segment D would parallel the existing cleared ROW, however, and so new danger tree clearing along this segment would occur only to the east of the proposed centerline.

4.8.6.1 Mitigation

See Section 4.8.2.4, **Mitigation**, under Proposed Action.

4.8.6.2 Cumulative Impacts

See Section 4.8.2.5, **Cumulative Impacts,** under Proposed Action. There would be increased fragmentation of forested stands and an increase in the number of trees prone to windfall along forest edges compared to the Proposed Action. However, cumulative impacts would still be **low.**

4.8.7 Alternative A

Impacts would be similar to the Proposed Action with one exception. Alternative A's impact on coniferous forested communities would be **low** because it runs through a greater proportion of developed or managed areas. Otherwise, it would have **low** impacts on any one vegetation community confined to the site of the project and potentially **high** impacts from noxious weed colonization in disturbed areas, like the Proposed Action. The latter **high** impact could be extensively mitigated through weed control measures. (See Section 4.8.2, **Proposed Action**.)

Alternative A would impact 397 acres, 39 percent of which would occur in developed and rural residential/managed landscape cover types. An additional 29 percent of the impact area would occur in managed grass/forb/shrub cover under the existing BPA transmission line corridor. Forested stands impacted by Alternative A are primarily mixed hardwood-conifer communities under 30 years old. This cover type accounts for 11 percent of the total impact area. Coniferous forested areas impacted by Alternative A account for only 6 percent of the total impacted area.

4.8.7.1 Mitigation

See Section 4.8.2.4, **Mitigation,** under Proposed Action.

4.8.7.2 Cumulative Impacts

See Section 4.8.2.5, **Cumulative Impacts,** under Proposed Action. Additional causes of long-term or permanent forest loss in the area include the highway widening project between Maple Valley and I-90 near Tiger Mountain and an increased number of potential lots for development compared to other alternatives. The lessened amount of vegetation change by constructing within an existing ROW maintains a cumulative impact level of **low.**

4.8.8 Alternative B

Impacts would be similar to the Proposed Action: **low** impacts on any one vegetation community confined to the site of the project; **moderate** impacts on coniferous forested communities, and potentially **high i**mpacts from noxious weed colonization in disturbed areas. The latter **high** impact could be extensively mitigated through weed control measures. (See Section 4.8.2, **Proposed Action**.)

Alternative B would impact 250 acres, of which about two-thirds (66 percent) would occur in coniferous forested cover types. Of this total, 60 acres (24 percent) would occur in mature coniferous regeneration stands dominated by Douglas fir and averaging 100 to 130 feet high. About 12 percent of Alternative B's impacts would occur in the existing managed grass/forb/shrub cover type typical of BPA transmission line corridors.

4.8.8.1 Mitigation

See Section 4.8.2.4, **Mitigation**, under Proposed Action.

In addition, the following measures would be taken on National Forest lands:

- Require cleaning of off-road equipment before entering National Forest lands to assure equipment is free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds. Inspect equipment thoroughly (opening hoods, panels, etc.) prior to off-loading from a transportation vehicle. Move off National Forest lands if cleaning is needed before start of operations, unless otherwise agreed. If cleaning is to occur on National Forest lands, it will be with compressed air, high-pressure water, or other specified methods (use of solvents, detergents, etc., is prohibited on National Forest lands).
- Provide maps of known infested sites to contractors performing project work.
- Clean equipment after operations in infested units in areas specified by the USFS. Do not allow run-off to enter streams; contain run-off with methods specified to minimize movement of water from the cleaning site.
- Dispose of soil contaminated with invasive plants and seed off National Forest land.
- Stockpiles of rock and other road construction materials that contain invasive plants will have the top six inches scraped off, set aside, and treated. The pile will be monitored and treated again if invasive plants reappear.

4.8.8.2 Cumulative Impacts

See Section 4.8.2.5, **Cumulative Impacts**, under Proposed Action. Impacts of the alternative would include long-term loss of forest cover on private lands and the USFS Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests, some additional road construction, and risk of non-native species introduction. This would add to several other causes of long-term or permanent forest loss in the area such as the widening of I-90 east of Snoqualmie Pass. Temporary alterations of vegetation communities would include stand thinning and timber harvesting on private and National Forest lands. Timber harvesting would retain the land in a forested condition in the long-term. The lessened amount of vegetation change by constructing within an existing ROW maintains a cumulative impact level of **low**.

4.8.9 Alternative C (Options C1 and C2)

Impacts incurred by Alternative C (Option C1) would be similar to the Proposed Action: **low** impacts on any one vegetation community confined to the site of the project; **moderate** impacts on coniferous forested communities, and potentially **high i**mpacts from noxious weed colonization in disturbed areas. (See Section 4.8.2, Proposed Action.) Alternative C (Option C2) differs only in its impact on coniferous forested communities which, because of its different route on the south end, would be considered **low.**

Option C1 would impact 195 acres, of which about one quarter (24 percent) would occur in coniferous forested cover types and approximately 43 percent in deciduous or mixed deciduous-conifer forested areas. Of the impacted coniferous forest areas, 42 acres (21 percent) would be in early or mid-regeneration coniferous forest stands dominated by Douglas fir and averaging 40 to 80 feet high.

Option C2 would impact 206 acres, of which only 6 percent would occur in coniferous forested cover types. A total of 46 acres (22 percent) of the impacted area would occur in developed or rural-residential/managed landscape cover types. An additional 41 acres (20 percent) would occur in the existing managed grass/forb/shrub cover type typical of BPA transmission line corridors.

4.8.9.1 Mitigation

See Section 4.8.2.4, **Mitigation**, under Proposed Action.

4.8.9.2 Cumulative Impacts

See Section 4.8.2.5, **Cumulative Impacts**, under Proposed Action. Additional causes of long-term or permanent forest loss in the area include the highway widening project between Maple Valley and I-

90 near Tiger Mountain and an increased number of potential lots for development compared to other alternatives. There is an increased chance of windfall along this new ROW location, but much of it is in a rural landscape setting that has many openings for houses and pastures already. This lessens the chance of potential windfall. Cumulative impacts would be **low**.

4.8.10 Alternative D (Options D1 and D2)

Impacts would be similar to the Proposed Action: **low** impacts on any one vegetation community confined to the site of the project; **moderate** impacts on coniferous forested communities, and potentially **high i**mpacts from noxious weed colonization in disturbed areas. The latter high impact could be extensively mitigated through weed control measures. (See Section 4.8.2, **Proposed Action**.)

Alternative D (Option D1) would impact 769 acres, of which over three quarters (82 percent) would occur in coniferous forested cover types. This includes the removal of 108 acres of mature coniferous forest stands, dominated by 75- to 250-year-old Douglas fir, western hemlock and Pacific silver fir at higher elevations. Alternative D (Option D2) would impact 776 acres, of which nearly two thirds (64 percent) would occur in coniferous forested cover types. This includes the removal of 100 acres of mature coniferous forest stands, slightly less than Option D1. Alternative D (either option) is the only alternative that results in the loss of mature coniferous forest. However, due to the amount of this cover type in the project area, impacts are considered **moderate.**

An additional 158 acres (20 percent) of Option D1's total impact area (186 acres, or 24 percent, under Option D2) would be in mature coniferous regeneration stands, consisting of 36- to 75-year-old stands dominated by Douglas fir averaging 100 — 130 feet tall. Less than 20 percent and 9 percent, respectively, of Option D1 and D2 impacts would occur in developed or managed cover types.

Construction of Options D1 or D2 would result in a **high** probability of impacts to USFS "Survey and Manage" vascular and nonvascular plant and fungal species. The locations and extent of populations of these species have not been identified within the project area. However, due to the relatively high percentage of mature coniferous stands in the Option D1 project area, the likelihood of impacting these populations is notably higher than for the other alternatives. Plant species designated as sensitive by the USFS Mt. Baker-Snoqualmie and Wenatchee National Forests would also have a **high** probability of sustaining impact by construction of Option D1.

4.8.10.1 Mitigation

See Section 4.8.2.4, **Mitigation**, under Proposed Action and Section 4.8.2.5 **Mitigation** under Alternative B.

4.8.10.2 Cumulative Impacts

See Section 4.8.2.5, **Cumulative Impacts**, under Proposed Action. Cumulative effects of this alternative are similar to Alternative B except for the increased amount of vegetation removal and increased chance for windfall by locating adjacent to the existing ROW. The risk of introduction of non-natives is highest with this alternative due to the highest amount of road construction and sensitivity of habitat on National Forest lands. Cumulative impacts would be **moderate**.

4.8.11 Non-Transmission Alternative

Because no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12), there would be no immediate vegetation impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

4.8.12 No Action Alternative

Under the No Action Alternative, there would be no loss of vegetation and no conversion from forested to non-forested types. There would be no additional potential for the spread of noxious weeds. Expansion of low-growing vegetation zones for the reliable operation of the transmission line would not occur. Areas next to Echo Lake Substation would remain in their existing conditions. New access roads would not be constructed. There would be **no** impacts.

4.8.12.1 Mitigation

No additional mitigation measures would be required. Existing vegetation management practices, especially those associated with noxious weed control, would be maintained in the existing transmission line ROW.

4.8.12.2 Cumulative Impacts

The No Action Alternative would not contribute additional impacts to the project area. There would be no additional clearing of forested areas or conversion of forested land to non-forested use related to the proposed transmission line project.

4.9 Wetlands

For transmission alternatives, impacts to wetlands could occur during construction, operation and maintenance. Construction impacts could result from building new roads or widening existing access roads (most existing access roads are 10 feet wide and may require widening to 16 feet for use by construction equipment), installing culverts, clearing vegetation within the 150-foot wide ROW and danger tree areas, and clearing vegetation for staging and materials storage areas, work areas, and installation of tower footings. Operational impacts could include periodic removal of vegetation within or next to wetlands to ensure proper clearance to conductors.

➲ For Your Information

Maps of wetlands are in Appendices D and Q.

4.9.1 Impact Levels

A **high** impact to wetlands would occur if the project:

- Permanently altered wetland hydrology, vegetation, and/or soils by excavation or fill, and the ecological integrity of a wetland was impaired; or
- Caused non-attainment of USFS Aquatic Conservation Strategy objectives and/or direct impacts to USFS-managed wetlands; or
- Completely filled a wetland or destroyed a wetland function.

A **moderate** impact would occur if the project:

- Partially filled a wetland or degraded a wetland function. Recovery generally would require restoration and monitoring; or
- Created temporary impediments to attainment of USFS ACSOs and/or temporary impacts to USFS-managed wetlands.

A **low** impact would occur if the project:

- Changed vegetation or soils for the short term but did not change hydrology; or
- Enabled attainment of USFS ACSOs with temporary impacts to USFS-managed wetlands that would be largely mitigated; or
- Caused a short-term disruption of a wetland function.

No impact would occur if the project avoids wetlands and their buffers; if new or widened access roads do not affect wetlands and buffers; if construction, operation, and maintenance of facilities do not affect wetlands and buffers; or if the size, quality, and functions of existing wetlands are not reduced.

4.9.2 Proposed Action

The proposed transmission line ROW would cross stream channels, valleys, and other landforms supporting wetlands. Wherever possible, the conductor (wire) would span wetlands, and new towers and roads would be sited to avoid wetlands. BPA would avoid crossing wetlands altogether where possible, and where impacts are unavoidable, BPA would use BMPs to minimize destruction or denigration of the wetland to the maximum extent practicable.

Because of the need to maintain low-growing vegetation for safety (conductor clearance), the impacts to vegetative cover in forested wetlands would be more dramatic than the impacts to other wetland areas. A 150-foot wide ROW generally would be cleared of all tall-growing vegetation, except when crossing steep, deep drainages or other locations where conductor clearance would be sufficient. Existing low-growing wetland vegetation areas would generally not require clearing and would be protected and maintained where possible.

Maps in Appendices D and Q illustrate the relationship between identified wetland locations and the Proposed Action's 150-foot transmission line ROW. The 150-foot cleared ROW would impact a total of 14 acres of wetlands (see Table 4-16). Wetlands surveyed within the ROW consisted primarily of palustrine scrub-shrub and palustrine forested types that would be cleared of deciduous and coniferous trees. No wetland areas would be filled for this alternative. Most wetlands were low-gradient, depressional wetlands. Major streams and rivers associated with wetlands within the ROW include the Raging River, Rock Creek, and Cedar River.

Clearing would cause a **high** impact to *forested wetlands* and their buffers. Wetland vegetation, flood flow and flood storage capabilities, water quality improvement functions, and wildlife habitat would be degraded; these impacts are described individually below. *Scrub-shrub* and *open water wetlands* would experience **moderate**, **low**, or **no** impact assuming the wetlands could be avoided or spanned and that soils, hydrology, and vegetation were maintained.

Direct construction impacts within wetlands would occur from hand-clearing the ROW. These activities would also result in the loss of vegetation, but other habitat features such as stumps, downed logs, and snags would be maintained where possible. Soil disturbance from these activities could injure or kill plants if large portions of the plant roots or aboveground shoots were cut or damaged. Indirect impacts could occur within or outside of the cleared ROW from water quality degradation, sedimentation, introduction of invasive species, and changes in wetland hydrology.

Wetland Vegetation Impacts — Construction would include cutting tall-growing vegetation from wetlands and wetland buffers. Trees cut within and next to forested wetlands would create a permanent modification of that wetland type to either an emergent or shrub-scrub condition. Forested wetlands where vegetation would be permanently altered to shrub-scrub and emergent communities would experience greater impacts than other wetland areas. (Low-growing vegetation within herbaceous and scrub-shrub wetlands is already generally compatible with the vegetation height requirements for conductor clearance.) Overall impact on wetland vegetation would be **moderate**.

Hydrology Impacts — Construction-related activities could impact the hydrology of wetlands within and next to the cleared ROW and substation facilities. Construction could affect wetland hydrology by:

- Altering the subbasin that drains to a particular wetland by diverting surface and subsurface flows from grading and road construction;
- Altering evapotranspiration by modifying vegetation; and
- Increasing soil and water temperatures as a result of less shading.

Construction within or next to wetlands associated with streams or other surface water could also adversely affect those surface water resources. Factors that determine the risk of altering wetland hydrology include the source of water for the wetland (*e.g.,* groundwater, surface runoff, or streamflow), landscape position, size, surface geology, and soils.

➲ For Your Information

Hydroperiod *— Seasonal occurrence of flooding and/or soil saturation.*

Tower and road construction would avoid wetland areas, which would allow hydric soils within forested wetlands in ROWs to be maintained. However, wetland ***hydroperiod*** (seasonal occurrence of flooding and/or soil saturation) would change with the removal of trees, likely resulting in reduced evapotranspiration and forest litter and increased storm runoff volumes and delivery rates to adjacent waters (Reinelt and Taylor 1997). Overall impact on wetland hydrology would be **moderate**.

Water Quality Impacts — The reduction in forested cover within wetlands and construction of new roads could result in degradation of water quality (Horner et al. 1997). Construction activities could introduce sediments into wetlands and degrade the water quality of the wetlands if preventive measures are not taken. The most likely source of sediment would be construction of roads, staging areas, and excavation for tower footings. However, all tower sites would be located outside of wetlands. Overall wetland water quality impacts would be **low**.

Table 4-16 — Acreage of Wetland Impact from Vegetation Clearing by Transmission Alternatives

	Acres of Wetland Impact			
Alternative	**Total Wetland Acreage Impacted**	**Vegetation Clearing**	**Access Road Construction Fill**	**Tower Fill**
Proposed Action	14	14	0	0
2	14	14	0	0
3	6	6	0	0
4A	14	14	0	0
4B	15	15	0	0
A	17	2.35	0.44	0.01
B	27	2.69	0.12	0.02
C1	10	1.28	0.34	<0.01
C2	8	1.23	0.31	<0.01
D1	18	4.28	0.30	<0.01
D2	16.5	11.94	0.19	0.01
Substation	0	0	0	0

Wildlife Impacts — Removal of vegetation within and next to wetlands could affect wildlife habitat and use in those wetlands. The change in vegetative cover from trees and snags to low-growing scrub-shrub or emergent vegetation would impact wildlife species. Wildlife that depend on forested wetlands (*e.g.,* cavity-dwelling birds and mammals) would be most impacted by construction due to loss of habitat (Richter and Azous 1997). However, the Proposed Action's impact on wetland wildlife would be **low**.

4.9.2.1 Access Roads

New access roads would be required. All new access roads for this alternative would avoid filling in wetlands. BPA would use temporary road matting wherever an existing access road has become a wetland. Low impact equipment and/or matting would be used to cross wetlands when soils are wet.

New road construction could carry sediment into wetlands, affecting water quality and biological productivity. However, use of erosion and sediment control devices would minimize these impacts. Wetlands within the ROW and next to access roads would be subject to soil compaction and vegetation damage from vehicles carrying heavy construction machinery and transmission line structures. BPA proposes using helicopter construction techniques and a new footing design to reduce the potential impacts to vegetation and soil. The overall impact of new access road construction on wetlands would be **low**.

4.9.2.2 Substation Impacts

Expansion of the substation would have **no** impact on wetlands or streams. The expansion has been designed to avoid all impacts to wetlands surveyed adjacent to the existing substation site.

4.9.2.3 Operation and Maintenance Impacts

Maintenance of the 150-foot transmission ROW would require the periodic removal of trees to ensure a safe distance to the conductors. Tree cutting would occur in forested wetlands and their buffers where trees may grow to a height that conflicts with the operation of the transmission line. Wetland impacts would also occur where forest cover was removed and permanently maintained as scrub-shrub or emergent vegetation. This would be a **moderate** impact.

Access roads used for maintenance of towers and the vegetation within the transmission line could carry sediment into wetlands, affecting water quality and biological productivity. Truck travel, exposed soil, and malfunctioning drainage control devices could result in **low** to **moderate** impacts.

4.9.2.4 Mitigation

Standard mitigation measures to minimize wetland impacts include the following:

- Locate structures and new roads to avoid wetlands and buffers.
- Do not perform mechanized (other than chain saw) clearing within wetlands.
- Use helicopters to erect towers and string conductor during construction to minimize the need for use of roads and avoid impacts to wetlands.
- Use low impact vehicles where possible.
- Limit disturbance to the minimum necessary when working in and next to wetlands.
- Locate construction staging areas outside of wetlands and associated buffers.
- Delineate wetlands before final design and flag for avoidance during construction.
- Use erosion control measures when conducting any earth disturbance upslope of wetlands to ensure soil is not washed downhill during storms.

- Ensure that the hydrology of wetlands and associated streams is maintained wherever the ROW crosses these resources. This can be accomplished by ensuring that landforms are regraded to pre-existing conditions, and that connectivity is maintained between streams and wetlands.
- Stockpile wetland topsoil when excavating in wetlands and redeposit soil in place for restoration following construction.
- Return temporary construction roads to their original contours following construction to reestablish pre-project surface water flow patterns.
- Ensure noxious weed infestations do not become a problem in wetlands by washing all construction vehicles and conducting a weed inventory one year after construction to verify that weeds have not been introduced.
- Use vehicle-crossing mats within wetlands to support equipment used during construction to minimize wetland soil compaction.
- Use existing road systems to access tower locations and for the clearing of the transmission line ROW.
- Maintain properly functioning drainage control devices.
- Avoid construction on steep slopes and geologically unstable areas.
- Avoid building steep road grades.
- Construct roads consistent with the DNR Forest Practices Rules (WAC 222).
- Repair degraded road surfaces.
- Decommission unused roads.
- Where possible, replant impacted areas outside the ROW with conifers or appropriate low-growing wetland species.

Mitigation measures specific to the wetland resources along the Proposed Action would include:

- Minimizing disturbance within designated King County wetland buffers (Ordinance #9614).
- Siting towers to span the sinkhole associated with wetland 1-9.
- Minimizing road construction and strategically siting towers to avoid wetlands 1-3 and 1-4 to minimize impacts to wetlands within the headwaters of Rock Creek.
- Avoiding Wetland E-1 near the substation.

4.9.2.5 Cumulative Impacts

Filling or adverse modification of wetlands would result in the incremental reduction of wetland acreage and function within the watersheds of the project area. Other projects and activities that could affect wetlands would include I-90 widening east of Snoqualmie Pass, SR 18 widening between Maple Valley and I-90 near Tiger Mountain, and lot development. All of these activities would require mitigation through avoidance or offset through purchase and protection of existing wetlands or restoration of degraded wetlands within the affected watersheds.

Past actions point towards the increasing importance of wetland protection and mitigation. During the period of 1991–2002, the Seattle Corps of Engineers (the Corps) has permitted the disturbance or destruction of approximately 284 acres of wetland and required mitigation, either restoration or replacement of wetlands, on 406 acres in King County (Seattle Corps of Engineers, 2002). Mitigation requirements have become increasingly more commonplace in the period since 1997. In Kittitas County during the same time period, the Corps has permitted the disturbance or destruction of approximately 40 acres of wetland, and required mitigation on about 51 acres of wetlands.

Wetlands within the Cedar River Watershed and within National Forest boundaries are currently well protected by the Habitat Conservation Plan and the Northwest Forest Plan standards and guidelines respectively. These areas would likely see the quality and quantity of wetland habitat improve through time.

With these protection measures in place, documented unmitigated impacts to wetlands have been low. There is some loss of wetlands from illegal filling, but it is difficult to estimate the amount of impact that occurs in this manner. Cumulative impacts that are reasonably certain to occur in either county within the foreseeable future would be **low**.

4.9.3 Alternative 2

The 150-foot cleared ROW would impact a total of 14 acres of wetlands (see Table 4-16). BPA would avoid wetlands where possible. Wetland impacts associated with this alternative would include all of the wetland impacts described for the shared portion of the Proposed Action. Additional impacts would occur in the area not common to the Proposed Action.

Clearing would cause a **high** impact to forested wetlands. Wetland vegetation, flood flow and flood storage capabilities, water quality improvement functions, and wildlife habitat would be degraded.

Scrub-shrub and open water wetlands would experience **moderate**, **low**, or **no** impact assuming the wetlands could be avoided or spanned and that soils, hydrology, and vegetation were maintained. See Appendix D for more information.

4.9.3.1 Mitigation

See Section 4.9.2.4, **Mitigation**, under Proposed Action.

4.9.3.2 Cumulative Impacts

See Section 4.9.2.5, **Cumulative Impacts**, under Proposed Action.

4.9.4 Alternative 3

For comparison purposes, wetland impacts along Alternative 3 were calculated for the 150-foot ROW centerline and also for the remaining 350 feet within a 500-foot corridor (including 175 feet west and 175 feet east of Alternative 3). The 150-foot centerline for Alternative 3 would impact a total of six acres of wetlands (see Table 4-16).

In comparison to the Alternative 3 centerline, if the transmission line were located in the corridor west of the centerline, a total of 10 acres of wetlands would be impacted, four acres more than the centerline. If the transmission line were located in the corridor east of the centerline, a total of six acres of wetlands would also be impacted. BPA would avoid wetlands where possible.

Clearing would cause a **high** impact to *forested wetlands*. Wetland vegetation, flood flow and flood storage capabilities, water quality improvement functions, and wildlife habitat would be degraded. *Scrub-shrub* and *open water wetlands* would experience **moderate**, **low**, or **no** impact assuming the wetlands could be avoided or spanned and that soils, hydrology, and vegetation were maintained. (See Appendix D for more information.)

4.9.4.1 Mitigation

See Section 4.9.2.4, **Mitigation**, under Proposed Action. Mitigation measures specific to the wetland resources along Alternative 3 would include:

- Siting towers to span wetland 3-9 at the crossing of Canyon Creek and avoiding vegetation clearing within the wetland.
- Constructing the line in the 150-foot ROW centerline to minimize clearing in wetlands, instead of placing the line in the western or eastern portions of the 500-foot corridor.

- Using the existing cleared ROW paralleling Pole Line Road to reduce the amount of tree removal and associated impacts.

4.9.4.2 Cumulative Impacts

See Section 4.9.2.5, **Cumulative Impacts**, under Proposed Action.

4.9.5 Alternative 4A

The 150-foot wide ROW would impact a total of 14 acres of wetlands (see Table 4-16). Wetland impacts would include those described with the shared portions of the Proposed Action and the southern portion of Alternative 2. BPA would avoid wetlands where possible. Additional impacts would occur for the additional one mile of ROW located between the Proposed Action and Alternative 2.

Clearing would cause a **high** impact to forested wetlands. Wetland vegetation, flood flow and flood storage capabilities, water quality improvement functions, and wildlife habitat would be degraded. Scrub-shrub and open water wetlands would experience **moderate**, **low**, or **no** impact assuming the wetlands could be avoided or spanned and that soils, hydrology, and vegetation were maintained. (See Appendix D for more information.)

4.9.5.1 Mitigation

See Section 4.9.2.4**, Mitigation**, under Proposed Action.

4.9.5.2 Cumulative Impacts

See Section 4.9.2.5, **Cumulative Impacts**, under Proposed Action.

4.9.6 Alternative 4B

The 150-foot wide ROW would impact a total of 15 acres of wetlands (see Table 4-16). Wetland impacts would include all of the wetland impacts described with the shared portions of the Proposed Action and the southern portion of Alternative 2. BPA would avoid wetlands where possible. Additional impacts would occur along the portion of the ROW running between the Proposed Action and Alternative 2 by paralleling Pole Line Road, before continuing north along the Proposed Action.

Clearing would cause a **high** impact to *forested wetlands*. Wetland vegetation, flood flow and flood storage capabilities, water quality improvement functions, and wildlife habitat would be degraded.

Scrub-shrub and *open water wetlands* would experience **moderate**, **low**, or **no** impact assuming the wetlands could be avoided or spanned and that soils, hydrology, and vegetation were maintained. (See Appendix D for more information.)

4.9.6.1 Mitigation

See Section 4.9.2.4, **Mitigation**, under Proposed Action. Mitigation measures specific to the wetland resources along Alternative 4B would include:

- Using the existing cleared ROW paralleling Pole Line Road, to reduce the amount of tree removal and associated impacts.

4.9.6.2 Cumulative Impacts

See Section 4.9.2.5, **Cumulative Impacts,** under Proposed Action.

4.9.7 Alternative A

The 150-foot wide ROW would impact a total of 17 acres of wetlands (see Table 4-16). Clearing and filling would cause a **moderate** impact on *palustrine scrub-shrub* and *open water* wetlands. Clearing of 2.35 acres would largely be temporary for the construction of angle tower string and pull areas and new and improved access roads; vegetation would generally be allowed to reestablish following construction. Permanent filling and clearing impacts on an additional 0.45 acre would be associated with new and improved access roads and tower footings. Mitigation, including restoration of wetland functions would compensate for these wetland impacts. There would be no impact on forested wetlands because none would be cleared for the construction of this alternative. (See Appendix Q for more information.)

4.9.7.1 Mitigation

See Section 4.9.2.4, **Mitigation**, under Proposed Action. Mitigation measures specific to the wetland resources along Alternative A would include:

- Avoiding any activities within designated King County, City of Covington, and City of Maple Valley wetland buffers, where possible.
- Siting towers to span Patterson Creek and associated wetland A-W-20, resulting in no clearing impact.

4.9.7.2 Cumulative Impacts

See Section 4.9.2.5, **Cumulative Impacts**, under Proposed Action.

4.9.8 Alternative B

The existing 150-foot wide cleared ROW crosses 27 acres of wetlands (see Table 4-16). Alternative B would require additional clearing on only a 20-foot width along this ROW. Clearing and filling would cause a **moderate** impact on *palustrine scrub-shrub* and *open water* wetlands. Clearing of 2.7 acres would largely be temporary for the construction of angle tower string and pull areas and new and improved access roads; vegetation would generally be allowed to reestablish following construction. Permanent filling and clearing impacts on an additional 0.14 acre would be associated with new and improved access roads and tower footings. Mitigation, including restoration of wetland functions would compensate for these wetland impacts. There would be **no** impact on forested wetlands because none would be cleared for the construction of this alternative. (See Appendix Q for more information.)

Included in the impacts described above are impacts specific to USFS-managed lands and wetlands protected under the standards and guidelines of the Northwest Forest Plan and an integral component in attainment of ACSOs. Direct loss of wetlands associated with wetland filling and clearing would contribute to non-attainment of all nine ACSOs and therefore constitute a **high** impact on National Forest lands.

4.9.8.1 Mitigation

See Section 4.9.2.4, **Mitigation**, under Proposed Action. Mitigation measures specific to the wetland resources along Alternative B would include:

- Avoiding any activities within designated King County, Kittitas County, and City of Kent wetland buffers, where possible.
- Siting towers to span the South Fork Snoqualmie River and its associated wetland BD-W-23, and Boxley Creek and associated wetlands BD-W-30 and -31.

4.9.8.2 Cumulative Impacts

See Section 4.9.2.5, **Cumulative Impacts**, under Proposed Action.

4.9.9 Alternative C (Options C1 and C2)

The 150-foot wide ROW of Alternative C (Option C1) would impact a total of 10 acres of wetlands (see Table 4-16). The ROW for

Alternative C (Option C2) would impact a total of 8 acres of wetlands. For both options, clearing and filling would cause a **moderate** impact on *palustrine scrub-shrub* and *open water* wetlands. Clearing of about 1.25 acres would largely be temporary for the construction of angle tower string and pull areas and new and improved access roads; vegetation would generally be allowed to reestablish following construction. Permanent filling and clearing impacts on an additional one-third acre would be associated with new and improved access roads and tower footings. Mitigation, including restoration of wetland functions would compensate for these wetland impacts. There would be **no** impact on forested wetlands because none would be cleared for the construction of this alternative. (See Appendix Q for more information.)

4.9.9.1 Mitigation

See Section 4.9.2.4, **Mitigation**, under Proposed Action. Mitigation measures specific to the wetland resources along Alternative C would include:

- Avoiding any activities within designated King County and City of Maple Valley wetland buffers, where possible.

4.9.9.2 Cumulative Impacts

See Section 4.9.2.5 **Cumulative Impacts,** under Proposed Action.

4.9.10 Alternative D (Options D1 and D2)

The 150-foot ROW for Alternative D (Option D1) would impact a total of 18 acres of wetlands (see Table 4-16). The ROW for Alternative D (Option D2) would impact a total of 16.5 acres of wetlands. Of these, 4.28 acres (Option D1) or 11.94 acres (Option D2) would have palustrine forested components that would need to be cleared of deciduous and coniferous trees. The remainder of the wetland acreage is primarily palustrine scrub-shrub type along the Option D1 route, with the addition of some palustrine emergent and palustrine open water types along the Option D2 route.

Construction of new and improved access roads and angle tower string and pull areas would clear an additional one-third acre of wetland vegetation under both Alternative D options. Fill for road and tower construction would affect another 0.30 acre of wetlands under Option D1 (0.20 acre for Option D2).

Clearing would cause a **high** impact to *forested wetlands* and their buffers. The permanent alteration of forested wetland community to scrub-shrub wetland community would degrade wildlife habitat, lower flood flow and flood storage capability, alter hydrology through

changes in evapotranspiration rates, and lower water quality improvement functions. *Scrub-shrub* and *open water wetlands* would experience **low** to **no** impact because these areas could be spanned by conductors and soils, hydrology, and vegetation would be minimally affected by road and tower construction. (See Appendix Q for more information.)

Included in the impacts described above are impacts specific to USFS-managed lands and wetlands protected under the standards and guidelines of the Northwest Forest Plan and an integral component in attainment of ACSOs. Direct loss of wetlands associated with wetland filling and clearing would contribute to non-attainment of all nine ACSOs and therefore constitute a **high** impact on National Forest lands.

4.9.10.1 Mitigation

See Section 4.9.2.4 **Mitigation,** under Proposed Action. Mitigation measures specific to the wetland resources along Alternative D would include:

- Avoiding any activities within designated King County, Kittitas County, and City of Kent wetland buffers, where possible.
- Siting towers to span the South Fork Snoqualmie River and its associated wetland BD-W-23, Boxley Creek and associated wetlands BD-W-30 and — 31, and wetland W-BD-05.

4.9.10.2 Cumulative Impacts

See Section 4.9.2.5, **Cumulative Impacts**, under Proposed Action.

4.9.11 Non-Transmission Alternative

Because no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12), there would be no immediate wetlands-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

4.9.12 No Action Alternative

Current levels of impacts to wetlands along the existing Raver-Echo Lake transmission line ROW would continue under the No Action Alternative. **No** impacts related to the proposed transmission line project would occur.

4.10 Visual Resources

4.10.1 Short-term Aesthetic Impacts during Construction

During construction, impacts on visual resources would be due to construction or extension of access roads; clearing of vegetation in a 150-foot ROW; construction of towers; and stringing of transmission conductors. Expansion of Echo Lake Substation would include clearing, grading, relocation of a roadway, and construction of the new bay.

Visual impacts during construction would include views of:

- Construction equipment in the ROW and at the substation site.
- Road cuts in some areas prior to restoration.
- Construction staging areas.
- Cranes over tree tops during structure assembly.
- Helicopters/sky crane during structure assembly and conductor stringing operations, and during tree removal.

Construction impacts would be temporary and would occur along the ROW during construction. Impacts would be most apparent near concentrations of residences and for people traveling on local roads. For Alternatives 1 through 4, employees of Seattle Public Utilities and visitors to the Cedar River Watershed would see construction activities if they travel in the construction area. For Alternatives B and D, visitors to Snoqualmie Pass ski areas would see construction activities. For Alternatives A and C, residents living close to the line would see construction activities.

After a line is built, operation and maintenance of the ROW would create the following potential impacts depending on the viewpoint, proximity and viewer sensitivity:

- Views of the transmission towers in the background, middleground or foreground.
- Views of the conductors in the foreground or middleground.
- Views of the 150-foot-wide cleared buffer in the background, middleground or foreground.
- Views of access roads in the background, middleground or foreground.
- Views of transmission line maintenance activities.
- Light reflecting off the conductors, insulators, and towers.

See Appendices R and S for visual simulations of the Proposed Action and Alternatives A–D.

4.10.2 Long-Term Visual Impacts

Longer term aesthetic impacts by any of the transmission alternatives depends on several factors, including population living in the immediate areas of the transmission towers, transportation and recreational uses in the near vicinity, and whether there are already existing towers in the area. Methods used in the aesthetics study for Alternatives A through D differed somewhat from those used for the original study for Alternatives 1 through 4. This is because two of the alternatives more recently considered (B and D) are considerably longer than those originally evaluated, and also cross lands administered by the USFS, which has its own special analysis system for addressing aesthetic issues. Analysis of the more recent alternatives (A through D) also needed to address the fact that some of these routes pass close to many more residences and, in general, have the potential to be seen by many more people. See Appendix S for study methodology and more information.

4.10.2.1 Impact Level Criteria for Alternatives 1 through 4

A **high** level of impact to views would occur if:

- The transmission line ROW would become the dominant feature or focal point of the view.
- A large number of sensitive viewers would see the ROW in predominantly the foreground and middle ground of the view.
- The transmission line ROW would pass adjacent to a recreational area or a school.

A **moderate** impact would occur if:

- The ROW would be clearly visible in the view but not the dominant feature of the view.
- A large number of sensitive viewers would see the ROW mostly in the middleground of the view.

A **low** impact would occur if:

- The ROW would be somewhat visible but not evident in the view.
- Few sensitive viewers would see the ROW because it is screened, or predominantly viewed in the middleground and background of the view.

No impact would occur if:

- The ROW would be isolated, screened, not noticed in the view, or seen from a distance greater than 2 miles.
- No visually sensitive resources would be affected.

4.10.2.2 Impact Level Criteria for Alternatives A through D

A **high** visual impact would occur where transmission facilities would create a substantial adverse visual change in:

- The scenic quality of immediate (within 300 feet) foreground views from residences, including but not restricted to an increased contrast in scale between residential features and close-by power line structures.
- The quality of views from residences located from 300 feet to one-quarter mile from the transmission line.
- The quality of views from schools located within one-quarter mile of the transmission line.
- The existing character and quality of views from parks, recreation facilities, public trails, and public lands and waters used for dispersed recreation where the appreciation of natural and scenic resources is a valued part of the use.
- The character and quality of views visible from major travel corridors along which existing scenic quality is high and/or policies been applied to preserve and enhance aesthetic values.

A **moderate** impact would occur where transmission facilities would create a moderate adverse visual change in:

- The quality of views from residences located within one-quarter mile of the transmission line.
- The quality of views from schools located within one-quarter mile of the transmission line.
- The existing character and quality of views from parks, recreation facilities, public trails, and public lands and waters used for dispersed recreation where the appreciation of natural and scenic resources is a valued part of the use.
- The quality of views visible from major travel corridors along which existing scenic quality is high and/or policies been applied to preserve and enhance aesthetic values.
- The quality of views visible from locally important roads along which visual quality is not high and which have not been designated for scenic protection.

Impacts would be considered **low** in all other situations.

4.10.3 Proposed Action

4.10.3.1 Residential Areas

The proposed transmission line and towers (Segment A) would be clearly visible by residents in the Kangley area, particularly the residents along Kangley-Selleck Road running north toward Selleck. The existing Schultz-Raver and Raver-Echo Lake transmission lines are the dominant visual feature in the landscape. Based on the impact level criteria, the impact would be **high** because the addition of another transmission line with an additional 150 feet of cleared ROW would further contribute to the transmission lines and towers being the dominant visual features in the area and because residents are considered highly-sensitive viewers.

There would be a **moderate** impact to some residences that would remain along the private road near Segment A. The existing and proposed transmission lines and towers would be clearly visible from many parts of the properties, but would not be the dominant feature viewed from all portions of the properties. However, for one residence, on the west side of the existing 500-kV transmission line, the line and towers are dominant visual features, and the proposed line would also be a dominant visual feature. For this residence, the Proposed Action would have a **high** impact.

4.10.3.2 Recreation Areas

Some dispersed recreation along the Proposed Action may occur in the private and public timberlands north of the Cedar River Watershed, as well as in the Weyerhaeuser Real Estate Company and Fruit Growers Supply timberlands surrounding the substation expansion. The proposed project would have a **low** impact in these areas because the transmission lines, towers, and ROW would be visible only where a user would cross the ROW or where there is a clearcut, and the substation expansion would only be visible from hills to the south and west. Although recreation users are considered highly-sensitive viewers, there are likely very few people recreating in the project area, according to respective land managers. In addition, the timberlands in the northern portion of the Proposed Action have been harvested within the last 20 to 40 years, and are subject to future cutting. Viewers expect a disturbed visual setting.

There is no dispersed recreation in the portion of the Cedar River Watershed crossed by the Proposed Action, nor are there any recreation sites in the project area.

4.10.3.3 Transportation

The Proposed Action would not be visible from I-90 or SR 18. The line and ROW would be visible from Kerriston Road (SE 208th Street) where it would cross the line, but likely would not be visible

otherwise because of the densely-forested surrounding area. The impact to Kerriston Road would be **low**. The proposed line and towers would be, along with the existing transmission lines and towers, the dominant visual features in the foreground from the portions of Kent-Kangley Road (SR 516) and Kangley-Selleck Road near the community of Selleck. However, the proposed project would be visible along less than one mile of these roadways. The impact to the roadways in the southern portion of the Proposed Action would be **moderate**.

The Echo Lake Substation expansion would not be visible from I-90 or SR 18. The access road to the substation is gated, so the few users are primarily timber company personnel, BPA maintenance staff, and utility workers. Such users are not considered sensitive in that their purpose for travel is work-related and they do not expect an undisturbed view. The substation expansion's impact would be considered **low** or negligible because it is away from public view.

The new transmission line towers and ROW may be visible from aircraft approaching or departing from SeaTac airport. The impact would be considered **low** because the ROW would be in the background of the view.

4.10.3.4 Mitigation

Modifications can be made to a project to improve its visual compatibility. The following general mitigation measures would reduce impacts.

- Use of darkened towers to reduce light reflectivity and overall tower visibility.
- Use non-reflective conductors and non-luminous, non-reflective insulators.
- Place towers so that they would not be visible from nearby communities when possible.
- Site new structures near existing structures and use a similar structure type, where possible. This would lessen visual clutter that can result when different types of structures are visible in a vast open landscape.
- Where feasible, site new structures to take advantage of existing screening offered by topography and/or vegetation.
- Set towers back from road crossings to minimize intrusion on views along road corridors. Preserve existing vegetation along the roadway if possible to screen the transmission lines and towers. Allow the growth of dense masses of medium shrubs parallel to the roadway where the transmission line ROW crosses.

- Minimize ground-disturbing activities and dispose of all waste soil off-site.
- If wetlands would be disturbed, preserve the existing topsoil in wetland areas near disturbed structure sites by stockpiling it during construction and spreading it after construction so native plant communities would regenerate and blend with the surroundings. Phase and integrate these activities with the project construction schedule to ensure the quickest rehabilitation of sites.
- Leave low-growing vegetation where possible.
- Use techniques to re-vegetate cut and fill slopes on access roads and near structure locations.
- Minimize access road placement in highly sensitive areas.

4.10.3.5 Cumulative Impacts

The cumulative visual impact of the existing Schultz-Raver and Raver-Echo Lake transmission lines and the proposed line on the community of Kangley is that the lines would continue to dominate the view. This is considered a **high** impact. Elsewhere, cumulative impacts of existing lines added to new transmission lines range from **low** to **moderate**, depending on numbers of sensitive users, existing and future screening, and other factors. Additional visual impacts can be created by activities associated with housing and commercial building construction and road construction on vacant lots. These activities can have moderate short-term impacts, but tend to blend into the surroundings when completed. These activities would be most evident in Alternatives A and C and the private land portion of Alternatives B

Table 4-17 — Cumulative Visual Resource Impacts

Past, present and future projects	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4A**	**Alt 4B**	**Alt A**	**Alt B**	**Alt C**	**Alt D**
Effect of proposed alternative on aesthetics (depending on location)	* to ***	* to ***	* to ***	* to ***	* to ***	* to ***	* to **	* to ***	* to ***
I-90 widening east of Hyak							**		**
I-90 thinning on NF land							0		0
Potential lot development	*	*	*	*	*	**	*	**	*
Logging on private timberlands	*	*	*	*	*	*	*	*	*
Snoqualmie Pass recreation expansion							*		*
Population growth in Puget Sound area	*	*	*	*	*	**	*	**	*
Expansion of SR-18						*		*	
Total Cumulative Effect	*****	*****	*****	*****	*****	*** to ****	*****	*****	******

* = low adverse impact ** = moderate adverse impact *** = high adverse impact
\+ = beneficial effect 0 = no effect

and D. Table 4-17 summarizes cumulative impacts for all the transmission alternatives.

Widening of I-90 east of Snoqualmie Pass and SR 18 northeast of Maple Valley would create visual linear scars during construction of these projects until new vegetation gets established on the disturbed sites. The widening of I-90 would be visible in the same area as Alternatives B and D, and SR 18 would be visible near Alternatives A and C.

4.10.4 Alternative 2

4.10.4.1 Residential Areas

For Alternative 2 the line and/or towers potentially would be visible from particular points within the unincorporated community of Selleck. Although trees surround the community, there are some spaces between trees where the line and/or towers may be visible. The alternatives are sufficiently far away so that the transmission line would blend in with the sky in most weather conditions. However, towers would likely be visible if they are placed within the line of sight of Selleck residences, and could result in a **moderate** impact.

4.10.4.2 Recreation Areas

Project impacts would be similar to those of the Proposed Action. See Section 4.10.3.2.

4.10.4.3 Transportation

A proposed transmission line and towers along the Alternative 2 alignment would not be visible from I-90 or SR 18. The line and ROW would be visible from Kerriston Road (SE 208th Street) and Pole Line Road where it would cross the line, but likely would not be visible otherwise because of the densely forested surrounding area. The impact to Kerriston Road would be **low**. Pole Line Road is not used to access any residences or recreation areas, only the Cedar River Watershed. The visual impacts along Pole Line Road would be **no** to **low**. The proposed line and towers would be, along with the existing Schultz-Raver transmission lines and towers, the dominant visual features in the foreground from the portion of SE 268th Street south of the community of Selleck where Alternative 2 would tap into the Schultz-Raver No. 2 Transmission Line. Because SE 268th Street primarily provides access to area timberlands, the impact would be **low**.

The new transmission line towers and ROW may be visible from aircraft approaching or departing from SeaTac airport. The impact would be considered **low** because the ROW would be in the background of the view.

4.10.4.4 Mitigation and Cumulative Impacts

See Sections 4.10.3.4 and 4.10.3.5 under Proposed Action.

4.10.5 Alternative 3

4.10.5.1 Residential Areas

Alternative 3 may be visible from residences at the east of the end of Kerriston Road. While the homes are surrounded by heavily forested areas interspersed with recently harvested timberland units, the towers may be visible, resulting in a **moderate** or **low** impact. Alternative 3 would not be visible from most of the Halmar Gates area because the dense trees and other vegetation would screen the homes from the line, towers, and ROW.

4.10.5.2 Recreation Areas

It is not expected that Alternative 3 would be visible from the majority of the Rattlesnake Mountain Scenic Area. The trail and overlooks are mainly oriented toward the Snoqualmie River Valley, and Mount Si and the Cascades in the Mount Baker-Snoqualmie National Forest. The ROW may be visible from small portions of the scenic area west of the Rattlesnake Mountain Trail. However, the impact is considered to be **no** to **low** because the transmission line would be 1.5 miles to the west, a distance at which the cleared ROW would be nearly indistinguishable from the surrounding area, particularly in the spring and early summer. In addition, the ROW would be viewed from an oblique angle, which would also limit its visibility. The towers may be visible to a limited extent depending on the distance from the viewer.

4.10.5.3 Transportation Facilities

A proposed transmission line and towers along the Alternative 3 alignment would not be visible from I-90 or SR 18. The line and ROW would not likely be visible from Kerriston Road (SE 208th Street) where it terminates west of the alternative, because of the densely-forested surrounding area. Therefore the visual impacts along Kerriston Road would be **low**. Alternative 3 would parallel Pole Line Road for approximately 2 miles. Pole Line Road is not used to access any residences or recreation areas, only the Cedar River Watershed. Therefore the impacts along Pole Line Road would be **no** to **low**.

At the southern end of Alternative 3, the proposed line and towers and existing transmission lines would be the dominant visual features in the foreground from the portion of SE 268th Street south of the community of Selleck. Because SE 268th Street primarily provides access to area timberlands, the impact would be **low**.

The new transmission line towers and ROW may be visible from aircraft approaching or departing from SeaTac airport. The impact would be considered **low** because the ROW would be in the background of the view.

4.10.5.4 Mitigation and Cumulative Impacts

See Sections 4.10.3.4 and 4.10.3.5 under Proposed Action.

4.10.6 Alternative 4A

4.10.6.1 Residential Areas

The impacts are the same as Alternative 2 (see Section 4.10.4.1).

4.10.6.2 Recreation Areas

The impacts are the same as the Proposed Action (see Section 4.10.3.2).

4.10.6.3 Transportation Facilities

The impacts are the same as Alternative 2 (see Section 4.10.4.3).

4.10.6.4 Mitigation and Cumulative Impacts

See Sections 4.10.3.4 and 4.10.3.5 under Proposed Action.

4.10.7 Alternative 4B

4.10.7.1 Residential Areas

The impacts are the same as Alternative 2 (see Section 4.10.4.1).

4.10.7.2 Recreation Areas

The impacts are the same as the Proposed Action (see Section 4.10.3.2).

4.10.7.3 Transportation Facilities

A proposed transmission line and towers along the Alternative 4B alignment would not be visible from I-90 or SR 18. The line and ROW would be visible from Kerriston Road (SE 208th Street) where it would cross the line, but likely would not be visible otherwise because of the densely forested surrounding area. The impacts along Kerriston Road would be **low**. Alternative 4B would parallel Pole Line Road for approximately one mile. Pole Line Road is not used to access any residences or recreation areas, only the Cedar River Watershed. The impacts along Pole Line Road would be **no** to **low**. The proposed line

Table 4-18 — Summary of Aesthetic Impacts for Alternatives 1-4 and A-D

Alternative	Total Miles	Aesthetic Impacts in miles		
		High	Moderate	Low
1	9	0.7	0	8.3
2	9	0.7	0	8.3
3	10.2	2.2	0	8.0
4A	9.5	0.7	0	8.8
4B	10.2	0.7	0	9.5
A	20	5.3	8.5	6.2
C with C1	10.1	5	2	3.1
C with C2	10.6	4.2	421	2.2
B	35.6	0	468	31
D (D1 & D2)	35.6	5.2	28.6	1.8

and towers would be, along with the existing Schultz-Raver transmission lines and towers, the dominant visual features in the foreground from the portion of SE 268th Street south of the community of Selleck where Alternative 4B would tap into the Schultz-Raver No. 2 Transmission Line. Because SE 268th Street primarily provides access to area timberlands, the impact would be **low**. (See also Section 4.10.4.3.)

4.10.7.4 Mitigation and Cumulative Impacts

See Sections 4.10.3.4 and 4.10.3.5 under Proposed Action.

4.10.8 Alternative A

4.10.8.1 Residential Areas

Removal of vegetation in the ROW, the addition of new towers (east-west segment), and doubling of tower height (south-north segment) would make transmission lines under this alternative readily visible from some residences adjacent to and near the transmission corridor (some very close), resulting in a **high** impact on residents in the more populated areas such as Maple Valley, Covington, and areas north of and along Covington-Sawyer Road. Screening provided by outbuildings and/or trees, and greater setbacks from the ROW, would reduce impacts to a **moderate** level for residences in other areas, particularly for farms and rural residences north of the Covington Rural District and in the Cedar River Valley.

4.10.8.2 Recreation Areas

Addition of a third transmission tower in the existing corridor would reduce the visual quality of views experienced by viewers using the Elk Run Golf Course and other recreational facilities located in the

ROW, resulting in a **moderate** impact. In the Cedar River Valley, the doubled tower heights on the ridgelines would increase visibility of the towers from the Cedar River Trail, also a **moderate** impact.

4.10.8.3 Transportation Facilities

Vegetation clearing and installation of new towers would have a **moderate** impact on views from Landsburg Road SE. In the area north of Covington-Sawyer Road, further clearing and addition of a third transmission line to the existing corridor would have a **moderate** impact on views from the many roads that cross the ROW. North of the Covington Rural District, doubling of the tower height would increase transmission line visibility from local roads, also a **moderate** impact.

4.10.8.4 Mitigation

See Section 4.10.3.4 under Proposed Action. In addition, BPA would consider using tubular poles for visual mitigation in areas very near homes.

4.10.8.5 Cumulative Impacts

Alternative A lies at the eastern edge of the Seattle metropolitan region, which is growing and expanding outward, creating strong pressures for land use alteration and concomitant visual change. During the short- and mid-term, it is inevitable these pressures will result in more residential, and in some cases commercial and infrastructure, development in the areas along this alternative. Those portions of the project area already suburban in character (primarily Covington and Maple Valley) will gradually become more intensively developed. This could, if not properly managed, compound the impact from the transmission line to degrade the visual quality of these communities.

In areas that are now rural and rural residential, primarily north of the Covington Rural District, the growth pressures are likely to lead to continued development of rural residences and, eventually, road widening to accommodate increased traffic. Over time, these changes would have the effect of degrading the rural qualities of these areas. If the proposed transmission line were to be built on this alignment, it would contribute to the overall pattern of visual change that is now underway.

4.10.9 Alternative B

4.10.9.1 Residential Areas

At its eastern end, along the Upper Yakima River, Alternative B would have **moderate** impacts on nearby residences clustered around Forest Arterial Road due to the modest change in tower height and little

or no change in the ROW. Farther west, in the Edgewick area, it would similarly have **moderate** impacts on views from rural residences.

4.10.9.2 Recreation Areas

Along the eastern third of its route, where Alternative B crosses the John Wayne/Iron Horse Trail (several times), travels along the southwest side of Lake Keechelus, and crosses through popular ski/wilderness areas and the Pacific Crest Trail near Snoqualmie Pass, it would have a **moderate** impact due to slightly taller towers. In this area on National Forest lands, this alternative in the short term may not meet retention visual quality objective where the new line and towers are close to I-90 and recreational areas. However, since this line is replacing an existing line, in the long term there would be very little change from the current condition.

Similarly, higher towers would have a **moderate** impact on views from Twin Falls State Park and the Rattlesnake Mountain Trail on the western end.

4.10.9.3 Transportation Facilities

Alternative B parallels I-90 for much of its length, crossing it twice. Taller towers would likely have **moderate** impacts on views from the highway. This is the Mountains to Sound Greenway, where any impacts are likely to be highly sensitive.

4.10.9.4 Mitigation

See Section 4.10.3.4 under Proposed Action.

4.10.9.5 Cumulative Impacts

The western end of Alternative B lies at the eastern edge of the Seattle metropolitan region. Cumulative impacts in that area are similar to Alternative A. Most of the line passes through National Forest lands, which are managed to allow few visual changes. The location of this alternative along the Mountains-to-Sound Greenway would create pressure to limit the amount of visual change that takes place along the corridor. See Sections 4.10.8.5 and 4.10.3.5 for other cumulative effect discussions that are relevant to this alternative. Overall cumulative impact would be **low**.

4.10.10 Alternative C (Options C1 and C2)

4.10.10.1 Residential Areas

Option C1 — Along the east-west segment, the community of Ravensdale would experience a **high** impact from the cleared ROW and new towers.

Option C2 — Along its east-west segment, shared with Alternative A, Option C2 would have a **moderate** impact on residences due to removal of vegetation in the ROW and the addition of new towers. Visibility would be somewhat offset by screening from outbuildings and/or trees.

Remainder of Alternative C (shared by both options) — In the Landsburg/South Hobart area, clearing and new towers have the potential to adversely affect foreground views from residences located in adjacent forested rural residential areas; distance and screening by trees would make this a **moderat**e impact. In the Hobart community, however, the introduction of 150-foot towers close to residential dwellings would have a **high** impact.

4.10.10.2 Recreation Areas

Option C1 — A school recreation area in Ravensdale crossed by the Option C1 ROW would experience a **high** impact.

Option C2 — **No** impact on recreation areas along this option.

Remainder of Alternative C (shared by both options) — The cleared ROW and 150-foot towers would have **high** impacts on the visual qualities of the forested area along the Cedar River adjacent to Big Bend Park and crossed by the Cedar River Trail, and on visual experiences from trails in the Tiger Mountain Natural Resource Conservation Area lying within or in the immediate vicinity of the project.

4.10.10.3 Transportation Facilities

Option C1 — Vegetation clearing and installation of new towers would have **high** impacts on views from 268th Street SE and Kent-Kangley Road, SE Landsburg-Summit Road.

Option C2 — Clearing and new towers would have a **moderate** impact on views from Landsburg Road SE.

Remainder of Alternative C (shared by both options) — Clearing and new towers would have **high** impacts on views from SE Landsburg-Summit Road, from roads in the community of Hobart, and from Highway 18 in the vicinity of Tiger Mountain.

4.10.10.4 Mitigation

See Section 4.10.3.4 under Proposed Action. In addition, BPA would consider using tubular poles for visual mitigation in areas very near homes.

4.10.10.5 Cumulative Impacts

See Section 4.10.8.5 under Alternative A.

4.10.11 Alternative D (Options D1 and D2)

4.10.11.1 Residential Areas

At its eastern end, along the Upper Yakima River, Alternative D (both Options D1 and D2) would have **moderate** impacts on a cluster of nearby residences due to the doubled width of cleared ROW and addition of a second set of towers. Farther west, in the Edgewick area, Options D1 and D2 would similarly have **moderate** impacts on views from rural residences. Either option would have a **high** impact on rural residences east of Cedar Falls Road near Twin Falls State Park, although Option D2's alignment would have slightly more adverse impact by removing screening trees.

4.10.11.2 Recreation Areas

Along the eastern third of its route, where Options D1 and D2 first cross the John Wayne/Iron Horse Trail, travel along the southwest side of Lake Keechelus, and cross through popular ski and wilderness areas near Snoqualmie Pass, they would have a **moderate** impact due to increased clearing for an additional ROW corridor and additional towers. The widened area of clearing would have a **high** impact where it later crosses the Pacific Crest Trail and John Wayne/Iron Horse Trail, however. The additional cleared area would not meet retention visual quality objective wherever it is visible in the foreground. It may not meet partial retention in many areas dependent upon the angle of view and distance from the cleared areas. Farther west, additional cleared ROW and towers would have **high** impacts on views from Twin Falls State Park, and where the corridor crosses the Snoqualmie Valley Trail and Rattlesnake Mountain Trail.

4.10.11.3 Transportation Facilities

Options D1 and D2 parallel I-90 for much of their length, crossing it twice. The additional set of towers and newly cleared ROW would primarily have **moderate** impacts on views from the highway, with **high** impacts where the new towers and newly cleared right-of-way cross the highway and are in the immediate foreground. Widening the right-of-way is likely to make entire towers and the line more visible from the highway instead of just the tops of existing towers. This is the Mountains to Sound Greenway and any impacts are likely to be highly sensitive. Farther west, either option would have **high** impacts on views from SE 159th Street, which provides access into Twin Falls State Park and serves

rural residential areas east of Cedar Falls Road. South-facing views from local roads in North Bend would experience **moderate** impacts from the additional cleared corridor.

4.10.11.4 Mitigation

See Section 4.10.3.4 under Proposed Action.

4.10.11.5 Cumulative Impacts

Cumulative impacts are similar to Alternative B (see Section 4.10.9.5). The higher level of visual change associated with this alternative would cause the cumulative impact to be **moderate**.

4.10.12 Non-Transmission Alternative

Because no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12), there would be no immediate impacts on visual resources under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

4.10.13 No Action Alternative

No project-related impacts to visual resources would occur under the No Action Alternative because no construction would occur.

4.11 Socioeconomics

Construction of any of the alternatives could create several short-term socioeconomic impacts, including:

- Increases in jobs and local spending.
- Increases in demand for local lodging by construction workers.
- Impaired access to local businesses during business hours. (Impaired access means obstacles placed in the way of reaching the business in the customary way, e.g., street closures, substantial traffic delays, or construction equipment blocking customer access).

Long-term impacts could include:

- Increases in population that can negatively affect the local housing market by creating housing shortages or driving up housing prices, or that can negatively affect the provision of local services until new facilities (e.g., schools, fire and police substations, water treatment plants, etc.) can be funded and built.
- Adverse social impacts, such as the perception by residents of affected communities that the project has an undesirable effect on their community and/or their way of life.
- Continuing operation and maintenance of the transmission line. This is generally positive, however, because it may involve permanent increases in jobs and local spending associated with operating and maintaining a project during its life.

- Loss of timberland removed from production within the transmission line ROW and cleared for access roads. None of the alternatives would result in major loss of marketable timberland; impact would be minimal.

4.11.1 Impact Levels

An impact would be **high** if an action:

- Increases (or decreases) jobs or spending in a county by more than 1 percent.
- Impairs access to a particular business for up to one week of regular business days.
- Creates demand for hotel/motel rooms and RV sites in a county that is more than 5 percent of the available supply.
- Produces changes in population totaling more than 5 percent of any local community's population (where the population increase is projected to occur).
- Permanently removes from production more than 2 percent of the land designated for forest uses in King County (not including forestland inside the Cedar River Watershed).

An impact would be **moderate** if an action:

- Increases (or decreases) jobs or spending in a county by between 0.5 and 1 percent.
- Impairs access to a particular business for more than one business day but less than one week.

- Creates demand for hotel/motel rooms and RV sites in a county that is between 1 and 5 percent of the available supply.
- Produces changes in population totaling between 1 and 5 percent of any local community's population (where the population increase is projected to occur).
- Permanently removes from production between 1 and 2 percent of the land designated for forest uses in King County (not including forestland inside the Cedar River Watershed).

An impact would be **low** if an action:

- Increases (or decreases) jobs or spending in a county by less than 0.5 percent.
- Impairs access to a particular business for less than one regular business day.
- Creates demand for hotel/motel rooms and RV sites in a county that is less than 1 percent of the available supply.
- Produces changes in population totaling less than 1 percent of any local community's population (where the population change is projected to occur).
- Permanently removes from production less than 1 percent of the land designated for forest uses in King County (not including forestland inside the Cedar River Watershed).

4.11.2 Impacts of Transmission Alternatives

4.11.2.1 Lodging

BPA would use a specialized company, likely drawn from a large metropolitan area, to construct the project. Such a regional or national construction company may employ local contractors for ROW clearing and road building activities.

BPA anticipates that existing BPA employees would be used for Echo Lake Substation upgrade. It is assumed that these workers would not need temporary housing.

Adequate lodging is available within a convenient 20-mile distance from potential construction staging areas. There would be **no** lodging impact from construction activities associated with any of the alternatives.

4.11.2.2 Local Spending and Employment

The contractors who would be responsible for clearing the ROW and constructing the access roads and transmission line would be paid rates determined by BPA for this work. Estimated cost of this work ranges from about $24 million to $80 million, depending on the alternative selected. This cost covers labor, equipment, management/ supervision, materials, overhead and profit.

In addition, BPA has budgeted about $6.5 million for upgrading Echo Lake Substation. It can be assumed that most of the substation work force construction dollars for equipment would be spent locally, resulting in a short-term economic benefit to the communities along the proposed transmission line route and near Echo Lake Substation. The electrical equipment used for the substation expansion would likely be brought in from outside the region.

The economic impact from this construction activity would be **low** because no new jobs are expected to be created by this project. Although construction workers, whether drawn from the Seattle metropolitan area or other regions, would use some temporary lodging and would purchase meals and other incidentals from local businesses, the impact to the local economy would be expected to be negligible relative to the economic base of King and Kittitas counties. Any minor increased economic impact would be limited to the construction period and be considered a beneficial impact.

BPA would be responsible for ongoing maintenance, which involves such tasks as maintaining access roads and vegetation management. This work would be accomplished using existing BPA personnel and contractors, and BPA does not anticipate that additional workers would be hired for the operation and maintenance of the proposed transmission line and facilities.

BPA anticipates that ROW maintenance would be required about every three years and that the maintenance schedule for the proposed transmission line would coincide with that of the existing BPA Raver-Echo Lake 500-kV Transmission Line. This work is primarily brush-clearing and is normally performed by contractors. The contractors would be paid rates per acre, and the work could be accomplished by a crew of five to seven people. BPA estimates that they could clear approximately 1.5 acres per day per person, or roughly nine acres per day. Since there would be approximately 180 acres in the ROW, the clearing activities would be estimated to take just less than one month every three years. There is **low** employment impact from ROW maintenance because no new workers would be hired.

4.11.2.3 Population

The proposed project under any of the transmission alternatives would have **no** long-term impacts on population because it would not cause population in-migration. The project would serve the King County area and parts of Canada rather than the project area specifically. It would be a transmission facility, would not serve specific developments, and would not directly lead to increased development in the project vicinity.

4.11.2.4 Economic Factors

The alternatives would have **no** long-term impacts on local business access, either because of their location within rural areas that support limited development or because they are located within existing ROW, or both. Only Alternative A, which runs through more developed areas, could have short-term **low** impacts on access to businesses in Maple Valley and Covington.

Each of the proposed transmission alternatives would have a minimal impact on timber resources in King and Kittitas counties. Alternative A would have **no** impact because no merchantable timber would be removed within the existing ROW. Under Alternatives 1 through 4, B and C (Options C1 and C2), there would be limited amounts of merchantable timber removed within the ROW and beyond, such as to clear danger trees and for construction of access roads. This would produce a **low** impact. Alternative D (Options D1 and D2) would require the greatest amount of clearing — a total of about 410 acres of merchantable timber within the ROW alone. This is still less than 0.05 percent of the merchantable timber stock in either King or Kittitas county and so would have a **low** impact.

4.11.2.5 Community Values and Concerns

Residents and business people in King County potentially affected by the project have expressed a range of concerns. These can be grouped into four broad categories: 1) avoidance of population centers and, when avoidance is not possible, 2) compensation for loss; 3) impacts on property values, and 4) health effects, including potential impacts on the Cedar River Watershed, an important source of drinking water. The impacts on population centers, including displacement of homes, and issues of compensation and property values are addressed in this section. Potential health effects of the project are discussed in **Sections 4.5 Water Resources** and **4.13 Noise, Public Health & Safety**.

Impacts on population centers — The impact of the Proposed Action and Alternatives 2, 3, 4A and 4B, with routes through the relatively sparsely populated areas in and near the unincorporated

communities of Selleck and Kangley, are considered to be **low** because they could be mitigated by choosing the alignment that affects the least number of residential properties. Of these alternatives, only the Proposed Action would require removal and relocation of two residences located near Selleck.

The primary reason for this low impact, and sparse population, is the alternatives' alignments through the Cedar River Watershed, over which Seattle officials and residents have subsequently raised concerns about potential drinking water impacts. Although the water quality impacts of Alternatives 1 through 4 are likely to be low, Alternatives A through D were explored as routes to avoid the watershed. The new alternatives create impacts in other areas, however, such as crossing protected habitat in forestlands (Alternatives B and D) and greater impacts on population centers (Alternatives A and C). For example:

- Alternative A would require displacement of between 2 and 25 homes and an additional two housing lots to enable bypassing existing electrical infrastructure in one portion of the route. While land use impacts due to forced relocation of residents is rated high, the socioeconomic impact of the localized displacement is **low** to **moderate**.
- Similarly, acquisition of new ROW under Alternative C would require displacement of 30 to 35 homes, considered a **low** to **moderate** soecioeconomic impact**.**
- Alternative D1 would require displacement of 11–14 homes. While land use impacts due to forced relocation of residents is rated high, the socioeconomic impact of the localized displacement is **low** to **moderate**.
- Alternative D2 would require the displacement of 8 homes. While land use impacts due to forced relocation of residents is rated high, the socioeconomic impact of the localized displacement is **low** to **moderate**.
- Displacement of homes can be stressful to the individuals living there. Impacts to individuals and their families could be **high**.

Compensation for loss — The project acquisition process differs somewhat between different uses. For forestland, fair market value is paid for all timber to be cut on new ROW, as well as for any trees off the ROW that need to be cut for construction purposes or that pose a danger of falling into the line or across access roads. A transmission line crossing forestland generally leaves little value to the property for its intended use; therefore, fair market compensation for a transmission line ROW easement across forestland would be close to full-fee value.

New land rights needed across private landowners' property are acquired as easements. Landowners are offered a fair market value for the easements, established through a standard appraisal process. Taking into consideration all factors affecting value, the appraisal is an individual analysis of the property, using neighborhood/area-specific market data to determine market value. The owner is compensated up to 100 percent of market value for the easement. This compensation recognizes that future use of the easement is limited, because the ROW eliminates the ability to build structures and plant certain vegetation due to height limitations. A transmission line may also diminish the use and value of a portion of the property if the line effectively severs this area from the remaining property (severance damage) and alters its utility. In this case, BPA would pay the market value for the diminished utility impacting the property.

As with easements, when entire properties must be purchased (such as when a home must be displaced), it is BPA policy to purchase the property and home at fair market value.

Property Value Impacts — Under any of the transmission alternatives, the proposed transmission line is not expected to have long-term impacts on area property values. Whenever land uses change, concern is often raised about the effect the change may have on property values nearby. Zoning is the primary means that most local governments use to protect property values. By allowing some uses and disallowing others, or permitting them only as conditional uses, conflicting uses are avoided. Some residents consider transmission lines to be an incompatible use adjacent to residential areas. However, this feeling is not universal. Transmission lines are an allowed use in the zoning districts in which the line would be located.

The question of whether nearby transmission lines can affect residential property values has been studied numerous times in the United States and Canada over the last 20 years or so, with mixed results. In 1995, BPA contributed to the research when it looked at the sale of 296 pairs of residential properties in the Portland, Oregon metropolitan area (including Vancouver, Washington) and in King County, Washington. The study evaluated properties adjoining 16 BPA high voltage transmission lines (subjects) and compared them with similar property sales located away from transmission lines (comps). All of the sales were in 1990 and 1991 and adjustments were made for time and other factors. The results of the study showed that the subjects in King County were worth approximately 1 percent less than their matched comps, while the Portland/Vancouver area subjects were worth almost 1.5 percent more (Cowger et al. 1996).

BPA recently updated this earlier study using 1994/95 sales data. The sales of 260 pairs of residential properties in King County and Portland/Vancouver metropolitan areas were reviewed. The

information confirmed the results of the earlier study, *i.e.*, the presence of high-voltage transmission lines does not greatly affect the sale price of residential properties. This time the residential sales identified a small, negative impact from 0 to 2 percent for properties in both areas that were adjacent to the transmission lines as opposed to those where no transmission lines were present. (Cowger et al., no date, in draft).

Studies of impacts during periods of physical change, such as new transmission line construction or structural rebuilds, generally have revealed greater short-term impacts than long-term effects. However, most studies have concluded that other factors, such as general location, size of property, improvements, condition, amenities, and supply and demand factors in a specific market area are far more important criteria than the presence or absence of transmission lines in determining the value of residential real estate. As a result of the proposed project, some short-term isolate negative property value and salability impacts might occur. However, these impacts would be highly variable, individualized, and may vary with the location and other characteristics of the property.

Constructing the transmission line is not expected to cause long-term adverse effects to property values along the ROW or in the general vicinity. Non-project impacts, along with other general market factors, are already reflected in the market value of properties in the area. These conditions are not expected to change appreciably. Therefore, **no** long-term impacts to property values are expected as a result of the proposed project. However, there may be isolated negative property value impacts and such impacts may be expected to vary with the location and other characteristics of the property.

4.11.2.6 Mitigation Measures

- BPA would compensate private landowners for the fair market value of the easement area, and any severed property, together with market value for any timber off the ROW and future rights to remove danger trees.
- In cases of home dislocations, BPA would pay the fair market price for the home and associated acreage. BPA would also provide relocation services and benefits pursuant to Public Law 91-646 and other related regulations to affected displaced owner occupants, tenants, and businesses, ensuring that the eligible parties have a good understanding of the relocation process and assistance with filing claims for relocation benefits.
- BPA would avoid populated areas if possible.

4.11.2.7 Cumulative Impacts

Cumulative socioeconomics impacts are summarized in Table 4-19. In general, alternatives closest to the Puget Sound population center (A and C) would experience a higher level of economic development and pressure for expansion of services and business. Alternatives A–D have a higher number of lots available for development than Alternatives 1–4. Potential improvement of access to these transmission lines may aid in development of some of these lots. Provision of infrastructure for electricity provided by these alternatives, added to improved access through widening of SR 18 and I-90, will help ensure population growth and expansion in the Puget Sound area which improves the overall economic condition of the area. Because of their proximity to existing development, Alternatives A and C have a **moderate** cumulative effect, while the rest of the alternatives would have a **low** impact.

Under some of the alternatives, the removal of timberland within portions of the proposed transmission line ROW that support timber production would contribute to a relatively minor cumulative adverse effect on timber harvests, which have declined due to a number of factors, including the need to protect habitat for endangered species. However, this cumulative effect on timber harvests would have a **minimal** adverse economic impact on rural communities in King and Kittitas counties that have suffered employment and income losses due to declining harvest levels.

4.11.3 Non-Transmission Alternative

Under this alternative, no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12). This would impact local socioeconomics. With a 50 percent reduction in production at an aluminum smelter (required to delay construction of the line), many workers would be temporarily out of work. Other affected industries would likely lay off workers as well. It is difficult to predetermine the net amount of workers that would be affected.

Also, if the transmission line's capacity is suddenly needed, such as if loads suddenly increase or local generation is taken out of service due to equipment failure (requiring energy be imported across long-distance transmission lines), it is unlikely the line could be built and in service in time to avoid outages. This would pose socioeconomic impacts similar to the No Action Alternative (see below).

Once it is determined there is a need for the new transmission line and it is built, socioeconomic impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

4.11.4 No Action Alternative

Under the No Action Alternative, local communities would not receive the short-term economic benefits associated with construction, *i.e.,* local spending by construction workers. There are **no** short-term adverse impacts associated with the No Action Alternative.

Longer term, timberland would not be removed from production for the transmission line ROW and the tax revenues of King and Kittitas counties would not be reduced as a result. There would be **no** long-term socioeconomic impacts on population, housing, or employment from the No Action Alternative.

The No Action Alternative could, however, lead to brownouts or blackouts if a critical line is lost on the system. When a loss of electricity occurs, all services provided by electrical energy cease. Lighting used by residential, commercial, industrial and municipal customers for safe locomotion and security is affected. Electricity for cooking and refrigeration is lost. Roadways experience gridlock where traffic signals fail to operate. Commercial and industrial machinery stops, causing impacts as elevators, heating and ventilation equipment, office equipment, heavy equipment, fuel pumps, and other appliances stop functioning. Sewage transportation and treatment can be disrupted. Electricity loss also affects alarm systems, communication systems, cash registers, and equipment for fire and police departments.

The chance that service would be disrupted increases with time as load grows. Commerce and industry would be adversely affected as the quality and reliability of power decreased. Some businesses and their employees could decide to relocate to an area where the power supply is more reliable. Loss of businesses and an unstable power supply could influence whether some people move to the area.

The No Action Alternative has **high** negative socioeconomic impacts.

4.12 Cultural Resources

Existing prehistoric and historic-period archaeological sites, historical buildings and structures, and traditional cultural properties were researched. As noted in Section 3.13, **Cultural Resources**, no registered historic sites are located within a quarter mile of the proposed ROW for any alternative. Also, no previously recorded cultural resource sites occur on or near (within 700 feet) of any alternative's corridor, although there is the potential for encountering unrecorded prehistoric and historic cultural resources in the project area. In addition, portions of the project area have been and continue to be used traditionally by members of many Indian groups. Project alternatives lie within the traditional territories of the Sauk-Suiattle, Snoqualmie, Tulalip, Duwamish, Muckleshoot (Hicks et al. 1994; Suttles and Lane 1990),

Kittitas/Upper Yakima (Hollenbeck and Carter 1986), and Wenatchi Tribes (Hollenbeck, personal communication).

In addition, the Sauk-Suiattle Tribe raised concerns that a new transmission line would have the potential to affect culturally modified trees. No culturally modified trees were identified during the surveys undertaken for the project.

In general, the potential for encountering any type of cultural resource along any of the alternatives varies by landform and increases along the Cedar River.

4.12.1 Impacts

Areas with **high** cultural resource sensitivity include those with level or nearly flat ground and one or more of the following features:

- Near natural travel corridors.
- Near water sources (rivers, streams, lakes), especially those with historically known anadromous fish runs.
- Near wetlands.
- Near historic roads, trails, and logging railroad beds.
- Near rock overhangs, outcrops, or cliff faces.
- Near previously recorded or identified cultural resources.

Areas with **moderate** cultural resource sensitivity include:

- Locations near water sources without historically-known anadromous fish runs.
- Moderately sloped areas with nearby water sources.

Areas with **low** cultural resource sensitivity include:

- Locations away from water sources.
- Steeply sloped areas.

4.12.2 Proposed Action

In general, the Proposed Action contains the least number of culturally sensitive areas of all alternatives, with much of the route situated on moderate to steep slopes and with no cultural resource sites (formally inventoried or identified by archival research) occurring on or within its proposed ROW. The portions of the Proposed Action along the Cedar River have the highest sensitivity for cultural resources, as the landforms are predominantly flat and adjacent to a water source with a historically known anadromous fish run. These areas are also near a natural travel corridor, and historic-period logging activities have

Table 4-19 — Cumulative Socioeconomic Impacts

Past, present and future projects	Alt 1	Alt 2	Alt 3	Alt 4A	Alt 4B	Alt A	Alt B	Alt C	Alt D
Effect of proposed alternative on socioeconomics	*	*	*	*	*	* to **	*	* to **	*
Existing level of development	*	*	*	*	*	**	*	**	*
I-90 widening east of Hyak							*		*
Potential lot development	*	*	*	*	*	**	**	**	**
Snoqualmie Pass recreation expansion							*		*
Population growth in Puget Sound area	*	*	*	*	*	**	*	**	*
Expansion of SR-18						**		**	
Total Cumulative Effect	*	*	*	*	*	**	*	**	*

* = low adverse impact ** = moderate adverse impact *** = high adverse impact
+ = beneficial effect 0 = no effect

occurred within a mile of the route. In addition, six historical Indian places names were noted in the vicinity of the route.

However, the northern two-thirds of the Proposed Action crosses moderate to steep slopes, away from major water sources. A few cultural resources have been identified within a mile of the route in this northern portion, but none of the sites have been formally inventoried or identified on the ground by trained cultural resource staff.

No culturally modified trees were identified during the surveys undertaken for the project, nor were any resources identified that would be eligible for listing on the National Register of Historic Places. Impacts on cultural resources are therefore expected to be **low**.

4.12.2.1 Mitigation

BPA will arrange for archaeological monitoring of sensitive areas during construction. These areas consist of construction locations near waterbodies or on terraces above them. Monitoring of initial soil-disturbing activities will be conducted by a professional archaeologist and by a representative of the Muckleshoot and/or Snoqualmie tribes, if the tribes wish to participate.

Should BPA discover any archaeological remains during the construction phase of the project, mitigation would include compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, and other appropriate laws and regulations protecting historic and archaeological resources. The following is the unanticipated discovery plan for human remains or cultural resources that has been developed for this project.

Any human remains that are discovered during construction will at all times be treated with dignity and respect.

If any member of the construction work force believes he or she has made an unanticipated discovery of human skeletal remains, any Construction Inspector or Supervisor present will be responsible for stopping all construction work adjacent to the discovery. The area of work stoppage will be adequate to provide for the security, protection, and integrity of the remains.

1. The Inspector or Supervisor will be responsible for taking appropriate steps to protect the discovery by installing a physical barrier such as exclusionary fencing and prohibiting vehicles and equipment from traversing the discovery site.
2. The Inspector or Supervisor will immediately call the King County Sheriff's office, a cultural resource consultant who can identify human bones, and BPA's project environmental lead. The Sheriff's Office may arrange for a representative of the King County Medical Examiner's office to examine the discovery and will determine whether it should be treated as a crime scene or as a human burial. A discovery located on Seattle Public Utilities property should be reported to the SPU archaeologist at this time. If the find could be an Indian burial, BPA will also call the Muckleshoot and Snoqualmie Indian tribes and the State Office of Archaeology and Historic Preservation (OAHP). BPA, OAHP, and the Indian tribes will consult about the treatment of the remains.

If any member of the construction work force believes that he or she has found a cultural resource discovery, any BPA Inspector or Supervisor will be responsible for stopping all work adjacent to the discovery. The area of work stoppage will be adequate to provide for the security, protection, and integrity of the remains. A cultural resource discovery could consist of (but is not limited to), for example:

- An area of charcoal or charcoal-stained soil
- An arrowhead, stone tool, or stone chips
- A cluster of bones or burned rocks in association with stone tools or chips
- A cluster of tin cans or bottles older than 50 years

1. If the Inspector or Supervisor believes that the discovery is a cultural resource, they will take appropriate steps to protect the discovery site by installing a physical barrier such as exclusionary fencing and prohibiting vehicles and equipment from traversing the discovery site, and contact BPA's project environmental lead. A discovery located on Seattle Public Utilities (SPU) property should be reported to the SPU archaeologist at this time.

2. BPA will arrange for the discovery to be evaluated by a professional archeologist. The archeologist will recommend whether the discovery is potentially eligible for listing in the National Register of Historic Places. If the find is Native American, BPA will also call the Muckleshoot and Snoqualmie Indian tribes and the State Office of Archaeology and Historic Preservation (**OAHP**). BPA, OAHP, and the Indian tribes will consult about the treatment of the remains.

4.12.3 Alternative 2

Alternative 2 is more culturally sensitive than the Proposed Action because it crosses the western proposed site boundary of the Japanese Camp at the Barneston townsite. Although the Japanese Camp and Barneston have never been formally inventoried, cultural resource professionals have visited both sites and observed cultural materials. Alternative 2 is also located within one-half mile of the Selleck National Historic District, which increases the probability of encountering additional historic-period cultural resources in the vicinity. Finally, most of Alternative 2 crosses nearly flat ground along the Cedar River and in the vicinity of known historic-period logging activities. Impacts on cultural resources could be **moderate**.

4.12.4 Alternative 3

The southern one-third of Alternative 3 is situated along the nearly flat land south of the Cedar River. Several historic-period cultural resources identified through archival map research occur in the proximity of the route, although none fall within the alternative's ROW. Cultural resource professionals have not verified most of the potential cultural resource sites on the ground, but their presence in the archival records increases the sensitivity of the area. The portion of Alternative 3 located north of the Cedar River is less sensitive, as the land consists of moderate to steep slopes away from the Cedar River. Impacts on cultural resources could be **moderate**.

4.12.5 Alternatives 4A and 4B

Alternatives 4A and 4B are both located on the nearly flat ground south of the Cedar River and north of the Selleck National Historic District. Although no previously inventoried cultural resource sites occur within the immediate vicinity of either alternative, the routes cross a highly sensitive landform, close to the National Historic District, indicating that the area has a high sensitivity for cultural resources. Impacts on cultural resources could be **low** to **moderate**.

4.12.6 Alternative A

Two-thirds of Alternative A's route is considered to have high sensitivity for containing archaeological (prehistoric) sites, although ground disturbance from construction and development along the west half of this alternative has already inhibited preservation and identification of such sites. That high degree of development, however, creates a high sensitivity for encountering historic-period buildings and structures. Most of the ROW, particularly between Highway 18 and the Cedar River, is settled with historical farmsteads and residences. Further research is required to determine any buildings meet criteria for National Register eligibility. In addition, portions of Alternative A lie within one mile of three identified historic districts: Selleck Historic District, Cedar River Watershed Cultural Landscape, and Landsburg Headworks.

The southwest portion of Alternative A is highly sensitive for encountering historical structures because the route crosses nearly flat ground along the Cedar River Valley and in the vicinity of known historical logging activities. As researchers in the Cedar River Watershed have noted, historical logging activities were very important in the drainage (Getz 1987; Lewarch 1979; Seattle Public Utilities 1999). Numerous historical structures have been identified in archival sources and maps, specifically in Meridian Heights and near Kangley, although few have been formally inventoried or even verified on the ground by cultural resource professionals. In addition, three historical Indian places names were noted in the vicinity of the route. Overall impact on cultural resources could be **moderate.**

4.12.7 Alternative B

Nearly half of Alternative B has a relatively low sensitivity for archaeological resources because the route traverses steep slopes. The steep areas of Alternative B also are less sensitive for containing historical buildings and structures. The field study revealed very few settled or developed areas along the routes and most appeared to have been built during the modern (post 1952) period. A preliminary literature search identified seven historical Indian sites or places names along the route. Additional research is required to verify the extent of historical resources associated with these alternatives. Based on current knowledge, Alternative B's impact on cultural resources is considered to be **low** to **moderate**.

4.12.8 Alternative C (Options C1 and C2)

Among all the transmission alternatives, Alternative C is considered to have the greatest potential impact on cultural resources because its corridor has the least amount of disturbance and the largest percentage

of land with high sensitivity for containing cultural resources. The portion of Alternative C located north of the Cedar River has high sensitivity for archaeological resources because the landforms are predominantly flat or moderately sloped and lie near anadromous fish steams, lakes, marshes, or other water bodies. Although no Indian places names were noted, consultation with Indian tribes would be needed to identify TCPs.

Alternative C also is sensitive for containing historical buildings and structures. Many sections of this alternative pass through established residential settlements. Although the majority of these developments appear to date to the modern period, some historical buildings and structures were identified along the ROW, particularly near the communities of Covington and Summit. Additional research is required to determine if these buildings and structures meet criteria for National Register eligibility. There is very little development north of the Cedar River or east of Summit. Two of the three identified historic districts, the Cedar River Watershed Cultural Landscape and Landsburg Headworks, fall within one mile of portions of Alternative C. Overall, Alternative C's impact on cultural resources could be **moderate** to **high**.

4.12.9 Alternative D (Options D1 and D2)

See Section 4.12.7**, Alternative B**. Potential impact would be higher than Alternative B due to the amount of ground disturbance and vegetation clearing associated with this alternative. Overall impact would be **moderate**.

4.12.10 Mitigation

See Section 4.12.2.1 under Proposed Action.

4.12.11 Cumulative Impacts

Cumulative effects can occur to cultural resources through impacts to culturally sensitive areas from other projects and activities that disturb soil or remove vegetation. Widening of I-90 and SR 18 would disturb the ground and that would increase the risk of unearthing native artifacts. Vegetation removal could disturb cultural trees or disturb cultural sites. The relative risk of impact from other projects would be similar to what is described in Section 4.12.1. Cumulative impacts associated with Alternatives A and C could be **high** due to their location and potential development of vacant lots and roads. Cumulative impacts associated with Alternatives 1–4 would be similar to their described direct impact because of limited other activities in the CRW. Alternatives B and D are expected to have **low** cumulative impacts.

4.12.12 Non-Transmission Alternative

Because no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12), there would be no immediate impacts on cultural resources under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

4.12.13 No Action Alternative

No impacts on cultural resources are expected from this alternative.

4.13 Noise, Public Health and Safety

4.13.1 Predicted Audible Noise Levels

The predicted levels of corona-generated audible noise for the transmission alternatives operated at a voltage of 540-kV are given in Appendix E. For comparison, audible noise from existing parallel lines is also given. Audible noise levels are calculated for average voltage and average conductor heights for fair- and foul-weather conditions.

Alternatives 1 through 4 — The calculated median level (L_{50}) during foul weather at the edge of the proposed ROW is about 50 dBA, which is comparable with levels at the edges of existing 500-kV lines in Washington and lower than the levels from the existing Raver-Echo Lake line in the same corridor. The proposed line would increase the level at the edge of the existing lines by about 1 dB for the 500-kV line and by about 23 dBA for the 115-kV line. This increase at the edge of 500-kV line would not be discernible. During fair-weather conditions, which occur about 81 percent of the time, audible noise levels would be about 20 dBA lower (if corona were present). These lower levels could be masked by ambient noise on and off the ROW.

Alternatives A through D — If no existing 345-kV or 500-kV lines are present in the corridor, then the proposed line will meet the BPA 50-dBA criterion for L_{50} foul weather AN. This would be the case for configurations A-1, A-3, B-1, B-2, C-2, and C-3. (Configurations are described in Appendix E.) For Configuration C-3, the proposed line would be a new source along the corridor and would increase the AN level during foul weather at the edge of the ROW from ambient to 48 dBA. For configurations A-1, A-3, and C-2, the AN level would increase by about 10 dBA, which would be perceived as a doubling of the sound level. For the configurations of Alternative B, the AN levels at the edge of the ROW would be reduced from existing levels by 4 to 10 dBA.

The predicted L_{50} AN level exceeds the BPA 50-dBA limit at the edge of the ROW for corridors with existing 345-kV and 500-kV lines (A-2, A-4, C-1, C-4, D-1, and D-2). (The existing lines were constructed before the 50-dBA limit was adopted by the state of Washington) In these cases, AN with the proposed line present would still be dominated by that from the existing lines, and there would be no perceivable change in AN levels with the addition of the proposed line.

All Transmission Alternatives — Off the ROW, the levels of audible noise from the proposed line would be well below the 55 dBA level that can produce interference with speech outdoors. Since residential buildings provide considerable sound attenuation (-12 dBA with windows open; -24 dBA with windows closed), the noise levels off the ROW would be well below the 45 dBA level required for interference with speech indoors. It is also highly unlikely that indoor noise levels from the line would exceed the 35 dBA level where sleep interference can occur (EPA, 1973; EPA, 1978). Since corona is a foul-weather phenomenon, people tend to be inside with windows possibly closed, providing additional attenuation when corona noise is present. In addition, ambient noise levels can be high during such periods (due to rain hitting foliage or buildings), and can mask corona noise.

The audible noise from the transmission line would be below EPA guideline levels and would meet the BPA design criterion that complies with Washington state noise regulations. However, noise levels from the proposed line would not comply with King County noise regulations in rural areas.

4.13.2 Electric and Magnetic Field Effects

Power lines, like electrical wiring, can cause serious electric shocks if certain precautions are not taken. These precautions include building the lines to minimize shock hazard. All BPA lines are designed and constructed in accordance with the National Electrical Safety Code (***NESC***). NESC specifies the minimum allowable distances between the lines and the ground or other objects. These requirements basically determine the edge of the ROW 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 or irrigation pipe, too close to the lines. The Department of Energy (DOE) provides a free booklet that describes safety precautions for people who live or work near transmission lines (*Questions and Answers about EMF Electric and Magnetic Fields Associated with the Use of Electric Power).*

Possible effects associated with the interaction of EMF from transmission lines with people on and near a ROW fall into two

categories: short-term effects that can be perceived and may represent a nuisance, and possible long-term health effects. Short and long-term effects of the Proposed Action and alternatives are discussed in detail in Appendix E.

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 Appendix G.

There are no national standards for electric or magnetic fields. The state of Washington has not set a standard for electric or magnetic fields. BPA has an electric field standard of 9 kilovolts per meter (kV/m) maximum on the ROW and 5 kV/m at the edge of the ROW. The proposed alternatives would meet this electric field standard.

Predicted levels for electric and magnetic fields were calculated based on possible line configurations for the different alternatives. Appendix E describes the possible corridor configurations, how the calculations were done and the predicted values in more detail.

4.13.2.1 Calculated Values for Electric Fields

The peak electric field value on the ROW and the value at the edge of the ROW, at both minimum and average conductor clearance, were calculated for each alternative's configuration. The calculated peak electric field expected on the ROW of any alternative is 8.9 kV/m or less, below the BPA limit. 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 actual line height is generally above the minimum value and actual voltage below the maximum value used in the model, and because vegetation within and near the edge of the ROW tends to shield the field at ground level.

For any alternative, actual changes in fields from current conditions would depend on the voltage and location of existing lines on the ROW. Where no line currently exists, the increase in electric fields by a new 500 kV line will be greater relative to alternatives that replace or parallel existing lines already producing electric fields.

4.13.2.2 Calculated Values for Magnetic Fields

The values of magnetic fields were calculated at 3.28 feet height for the proposed 500-kV transmission-line corridors. Field values on the ROW and at the edge of the ROW are given for projected maximum currents during winter peak load in 2006, for minimum and

average conductor clearances. The actual magnetic-field levels would vary, as currents on the lines change daily and seasonally and as ambient temperature changes. Average currents over the year would be about 45 percent of the maximum values. The levels shown represent the highest magnetic fields expected for the proposed project. 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.

The maximum calculated 60-Hertz (***Hz***) magnetic field expected for any alternative is 472 mG, but ranges to as low as 227 mG. Existing lines along these corridors already produce up to 516 mG at maximum current and minimum clearance (the existing Raver-Echo Lake 500 kV line). This field is calculated with the conductors at a minimum height of 33 feet. The maximum field would decrease for increased conductor clearance. For an average conductor height over a span of 47 feet, the maximum field under any of the new alternatives would be 326 mG. This compares to a maximum of 287 mG for average clearance under the existing Raver-Echo Lake line.

At the edge of the ROW, calculated magnetic fields for maximum current load conditions can range from 19 to 191 mG depending on the alternative and whether it parallels an existing line. The magnetic field falls off rapidly as distance from the line increases. However, for those alternatives traversing more densely populated areas (Alternatives A, C1 and C2) in existing corridors, peak magnetic fields could exceed 10 mG up to 245 feet from the centerline of the ROW. This has the potential for causing interference with sensitive computer monitors (cathode-ray tube based) in the vicinity.

4.13.3 Toxic and Hazardous Substances

Several common construction materials (*e.g.*, concrete, paint, and wood preservatives) and petroleum products (*e.g.,* fuels, lubricants, and hydraulic fluids) would be used during construction. BPA would follow strict procedures for disposal of these or any other hazardous materials. **No** impacts would occur.

4.13.4 Fire

Construction of the new transmission line would take place primarily during spring, summer, and fall. During a portion of this time, the weather could be hot and dry, with increased danger of fire. At such times the potential for fire is high; the potential would increase even more with the increased use of vehicles, chainsaws, and other motorized equipment. The addition of construction workers in the area also would elevate the potential for fire. Restrictions on operations during fire season may limit timing of some construction activities.

Operation and maintenance of the line, including vegetation management, would involve increased activity along the line by BPA employees and contractors, slightly increasing the potential for fire. Cleared ROWs could increase access to some areas by the public, again increasing the potential for fire. On the other hand, cleared ROWs in heavily forested areas could serve as fire breaks and improve access for firefighters to remote areas. Fire suppression is a permitted activity in the Cedar River Municipal Watershed and all other forestlands in the project area.

4.13.4.1 Mitigation

Before construction BPA would prepare a Project Plan, if required. Such a plan would include a Fire Plan to ensure that fire hazards are kept low. The Fire Plan would address the needs and requirements of the City of Seattle, USFS, and BPA. Otherwise BPA would take all appropriate precautions to prevent fires and follow the fire control regulations established by the landowners, including carrying the requisite fire suppression equipment in equipment.

BPA would establish and maintain safe clearance between the tops of trees and the proposed power lines to prevent fires and other hazards. Electricity can arc from the conductor to a treetop. Generally, trees are not allowed to grow over 20 feet high on the ROW. Trees that need to be cleared from the ROW, and any trees that could fall into the line (danger trees) would be marked and removed. BPA prohibits the storage of flammable materials on the ROW. Operation and maintenance of the proposed line would follow prescribed policies that minimize the potential for fire.

4.13.5 Radio Interference (RI)

Radio reception in the AM broadcast band (535 to 1605 kilohertz (kHz)) is most often affected by corona-generated electromagnetic interference (***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 (dBmV/m) of about 40 dBmV/m at 100 feet 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 dBmV/m higher than average fair-weather levels.

The predicted fair-RI levels at 100 feet from the outside conductor for the proposed 500-kV line under all the transmission alternatives is shown in Appendix E. Median foul-weather levels would be about 17 dB higher than fair-weather levels. Predicted fair-weather L_{50} levels are comparable with those for other existing 500-kV lines and would meet

the IEEE 40 dBmV/m criterion in most cases. Exceptions are a few segments of some alternatives, which already experience levels of 42 dBmV/m due to an existing line.

The project's overall RI impact is expected to be **minimal**.

4.13.6 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 feet of a line. As is the case for RI, gap sources on distribution and low-voltage transmission lines are the principal observed sources of TVI. The use of modern hardware and construction practices for the proposed line would minimize such sources.

TVI levels predicted at 100 feet from the outside conductor of the proposed line operating at 540 kV and from existing lines are discussed in detail in Appendix E. At this distance, foul-weather TVI levels predicted for any of the alternatives range from 12 to 33 dBmV/m. This is comparable with TVI levels from other existing BPA 500-kV lines.

There is a potential for interference with television signals at locations very near the proposed line in fringe reception areas. However, several factors reduce the likelihood of occurrence. Corona-generated TVI occurs only in foul weather; consequently, signals will not be interfered with some of the time. Because television antennas are directional, the impact of TVI is related to the location and orientation of the antenna relative to the transmission line. If the antenna were pointed away from the line, then TVI from the line would affect reception much less than if the antenna were pointed towards the line. Since the level of TVI falls off with distance, the potential for interference becomes minimal at distances greater than several hundred feet from the centerline.

Other forms of TVI from transmission lines are signal reflection (ghosting) and signal blocking caused by the relative locations of the transmission structure and the receiving antenna with respect to the incoming television signal. Television systems that operate at higher frequencies, such as satellite receivers, are not affected by corona-generated TVI. Cable television systems are similarly unaffected.

Interference with television reception can be corrected by any of several approaches: improving the receiving antenna system; installing a remote antenna; installing an antenna for TV stations less vulnerable to interference; connecting to an existing cable system; or installing a translator (cf. USDOE, 1977). BPA has an active program to identify, investigate, and mitigate legitimate RI and TVI complaints. It is anticipated that any instances of TVI caused by the proposed line could be effectively mitigated and therefore would be **minimal.**

4.13.7 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.

Predicted EMI levels for the proposed 500-kV transmission line are comparable to those from existing 500-kV lines. If interference should occur, there are various methods for correcting it; BPA has a program to respond to legitimate complaints. Therefore, the anticipated impacts of corona-generated interference by any of the transmission alternatives on other reception would be **minimal**.

4.13.8 Other Corona Effects

Corona is visible as a bluish glow or as bluish plumes. On the proposed 500-kV line, corona levels would be low, so that corona on the conductors would be observable only under the darkest conditions and probably only with the aid of binoculars. Without a period of adaptation for the eyes and without intentional looking for the corona, it probably would not be noticeable.

When corona is present, the air surrounding the conductors is ionized and many chemical reactions take place, producing small amounts of ***ozone*** and other ***oxidants***. Ozone is approximately 90 percent of the oxidants, while the remaining 10 percent is composed principally of nitrogen oxides. The national primary ambient air quality standard for photochemical oxidants, of which ozone is the principal component, is 235 micrograms/cubic meter or 120 parts per billion. The maximum incremental ozone levels at ground level produced by corona activity on the proposed transmission line during foul weather would be much less than 1 part per billion. Consequently, the level produced by any of the transmission alternatives is minor when compared with natural levels and fluctuations in natural levels.

4.13.9 Security and Public Safety

The transmission alternatives would create some new access to transmission line rights-of-way. There would be no difference between the alternatives in amount of security risk for potential damage to the line because it is difficult to predict when and where actual vandalism or terrorism is likely to take place. All alternatives have some risk of vandalism.

Lines that create new rights-of-way (Alternatives 3 and C) in new locations perhaps introduce risk of unwanted access to properties. Individual landowners that are concerned about potential impacts of increased access on their lands can work with BPA to gate access roads and would have a contact number to report illegal activities within the right-of-way.

4.13.10 Non-Transmission Alternative

Under this alternative, no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12). This could have considerable impact on public health and safety. If the transmission line's capacity is suddenly needed, such as if loads suddenly increase or local generation is taken out of service due to equipment failure (requiring energy be imported across long-distance transmission lines), it is unlikely the line could be built and in service in time to avoid brownouts or blackouts. Lack of electricity poses great concerns for public health and safety due to impacts on heating, medical and transportation facilities.

Once it is determined there is a need for the new transmission line and it is built, noise and public health/safety impacts would be equivalent to those described earlier in this section.

4.13.11 No Action Alternative

While none of the transmission alternatives' impacts described in this section would occur, failure to build the new transmission line could have considerable impacts on public health and safety if the transmission line's capacity is suddenly needed but unavailable. See Section 4.13.9, above.

4.14 Air Quality

Air quality can be affected during the construction, operation, and maintenance of transmission facilities. However, actions affecting air quality primarily occur during construction. Clearing of trees and vegetation can produce debris that would need to be disposed of by "lop and scatter," chipping or burning. The burning of woody debris releases carbon monoxide, methane, and particulate matter, among other solid fuel emissions. Burning would not occur at the proposed project site because the project is in the King County carbon monoxide maintenance area as well as the King County urban growth boundary where burning is prohibited. Washington State forbids burning in any other area of the state when a reasonable alternative to burning is found to exist (WAC 173-425-040). According to the state, reasonable alternatives include chipping, woodwaste recycling, and landfilling.

Rather than burn, BPA would pursue these alternatives. BPA has not burned slash for years and tries to avoid such practices not only for air quality reasons, but because soot from fires can cause flashovers from one transmission line to another, resulting in outages.

4.14.1 Impact Definitions

A **high** impact would create one or more of these outcomes:

- An effect that could not be mitigated.
- A widespread reduction in air quality.
- A probable risk to human health or safety.

A **moderate** impact would create one or more of these outcomes:

- An effect that could be partially mitigated.
- A localized reduction in air quality.
- A possible, but unlikely risk to human health or safety.

A **low** impact would create one or more of these results:

- An effect that could be largely mitigated.
- Reduced air quality would be confined to the site of the action.
- Insignificant or very unlikely health and safety risks.

The Proposed Action would build 47 steel transmission towers, all but one would be built using a new footing design, the micropile system, which would disturb little more than 40 square feet at each tower site (see Section 2.1.1.1, **Transmission Structures**). Traditional construction of BPA towers disturbs about 30,000 square feet. All towers would be flown into the CRW through the use of a skycrane. The reduced area of disturbance as well as the reduced number of ground construction vehicles, diesel or otherwise, moving to and from the tower construction sites would facilitate the minimization of air emissions.

For the Proposed Action, there would be 9 miles of right-of-way cleared. About 2.7 miles of new access roads are proposed; within the Cedar River Watershed, access roads would be constructed to a width of 12–14 feet and outside the watershed roads would be built 14–16 feet. The substation expansion would amount to approximately three acres. Construction along this corridor, including the substation expansion, is expected to take four months time, starting in August and concluding in December. Transmission line construction activities would be low impact and affect air quality on a short-term basis. Depending upon how construction is sequenced, construction activities

in any given area would take place over a month's duration or less. Dust from construction activities, particularly access road construction, and from traffic on unpaved roads would be emitted into the atmosphere.

Heavy equipment and vehicles, including those with diesel internal combustion engines, would emit pollutants such as carbon monoxide, carbon dioxide, sulfur oxides, particulate matter less than 2.5 microns in diameter (PM2.5), oxides of nitrogen, volatile organic hydrocarbons, ***aldehydes*** and polycyclic aromatic hydrocarbons. Typical construction equipment would consist of about twenty vehicles (pickups and vans), three bucket trucks, one conductor reel machine, three large excavators, one line tensioner, and one helicopter. Vehicle and equipment emissions would be relatively small and comparable to current conditions in surrounding agricultural and urban areas. Impacts are expected to be short term, with a low level of impact on air quality. Short-term emissions from construction operations are exempt from air quality permitting requirements.

➲ For Your Information

Aldehydes *— Colorless, volatile fluids with a strong, unpleasant odor, obtained from alcohol by oxidation.*

The transmission lines themselves cause limited air emissions. The high electric field strength of 500-kV transmission lines causes a breakdown of air at the surface of the conductors called corona. Corona has a popping sound that is most easily heard during rainstorms. When corona occurs, small amounts of ozone and nitrogen oxides are released. These substances are released in such small quantities that they are generally too small to be measured or to have any significant effect on humans, animals or plants. Corona is low impact and no mitigation action or permitting is needed.

As a rough approximation for purposes of estimating emissions during construction, it is assumed the following items would be constructed in the attainment, maintenance area:

- 47 transmission towers each (about 0.75 acres) disturbing about .08 acres (about 4 acres)
- 2.7 miles of new access roads (about 4.5 acres)
- Addition to the existing Echo Lake Substation (about 3 acres).

Only if the project area fell into a non-attainment area would the transmission line construction be subject to the federal General Conformity regulation. A full conformity analysis would be required only if particulate matter less than 10 micrometers (PM10) generated inside the project area exceeded 70 tons per year. A total of about 176 acres of land would be required in the proposed project area, including the ROW corridor. As a rough approximation it is assumed that construction at each site would require 2 months to complete. A PM10 factor of 0.11 tons/acre-month is appropriate for general construction activities, assuming routine dust control measures, such as roadway watering, are conducted at the site (California EPA 1997). Based on the

estimated construction acreage and the assumed emission factor, the maximum annual PM 10 emissions during construction would be about 26 tons (12 9 acres x 0.11 tons/acre-month x 2 months). If the ROW acreage is included in the figure of project construction, PM10 emissions are still well below the 70 tons threshold at 38.7 tons.

The estimated annual PM 10 emissions are much lower than the 70 tons per year applicability threshold for the most stringent emission controls for a non-attainment area. Neither King nor Kittitas counties are non-attainment areas. No further action or permitting is needed for the criteria pollutants, namely PM2.5, PM10, ozone, and carbon monoxide.

4.14.2 Mitigation

BPA would mitigate for dust during construction and follow all necessary local or federal requirements. The following mitigation measures would be used:

- A new footing design, the micropile system, would be used to reduce the amount of disturbed acreage.
- Water trucks would be used on an as-needed basis to minimize dust.
- Chipping or "lop and scatter" would be used to dispose of small limbs and branches. No burning would be allowed.
- All on-road vehicles would comply with Washington State tailpipe emission standards.
- Off-road vehicles would be in good running condition, minimizing their emissions.
- On-road diesel vehicles will use low sulfur fuel.

4.14.3 Cumulative Impacts

The transmission line construction of the Proposed Action would have minimal impacts on air quality; line operation would have negligible impacts to air quality. Thus, cumulative impacts to air quality are not expected. An air quality cumulative impact assessment would not be commensurate with the project's impacts. Generally cumulative impact analysis is only pursued for affected areas of the environment, and air quality would not be significantly affected by this project.

Global Warming — Timber harvesting, combined with fossil fuel consumption, has altered the carbon balance on earth since the start of the industrial revolution and is believed to contribute to what is called "global warming." The transmission line project would clear between 118 and 769 acres of conifers and deciduous trees, depending on

which alternative is implemented. These trees would move from being collectors of carbon dioxide to emitters of carbon dioxide as they degrade rather than grow. Most of the wood from these trees would be sold and likely used as building material that is a form of long-term carbon storage. The amount of carbon going into long-term storage (rather than the atmosphere) represents approximately 40 percent of the trees' total carbon (Harmon et al.). The remaining non-marketable fraction would be scattered on the ROW to degrade or be chipped and left to degrade, and no burning would occur.

The project's contribution to global warming is relatively insignificant because the amount of tree clearing would be minimal. But when combined with other activities that increase greenhouse gases, the overall impact is **unknown**.

4.14.4 Transmission Alternatives

Table 4-20 compares the disturbance of the Proposed Action to the other transmission alternatives. Consistent with construction activities, the more acreage of land that is disturbed and the longer the duration of construction, the higher the potential for air quality issues resulting from dust, particulate matter and emissions from construction vehicles. The mitigation measure of using the new micropile footing design system, which decreases the acreage of land disturbed at each tower site, and collectively for the whole project, would not be used for these alternatives.

Alternatives 1, 2, 3, 4A, 4B, C and D would require clearing of new ROW, which would increase air emissions.

Air quality impact would be low for Alternatives A, B, C, and D, but higher than the Proposed Action, because the amount of disturbed acreage would range from 10 to 36 miles of ROW. Alternatives A and B would involve the decommissioning and tearing down of old lines and

Table 4-20 — Expected Disturbance from Transmission Alternatives

	ROW	Access Roads	Micropile Footing System	Burning
Proposed Action	9 miles (new)	2 acres	Yes	No
Alternative 2	9 miles (new)	7 acres	No	No
Alternative 3	10.2 miles (new)	16 acres	No	Yes
Alternative 4A	9.5 miles (new)	6 acres	No	No
Alternative 4B	9.2 miles (new)	6 acres	No	No
Alternative A	20 miles (on existing)	5 acres	No	No
Alternative B	36 miles (on existing)	4 acres	No	No
Alternative C	10 miles (new)	17 acres	No	No
Alternative D	36 miles (new)	26 acres	No	Possible

the rebuild of new lines. Alternatives C and D would involve clearing new ROWs and building new lines.

The Proposed Action would have 47 steel transmission towers and subsequent tower construction sites. Alternatives 2, 3, 4A, 4B, and C would have a comparable number of towers due to the similarities in line length. The air quality impacts would be increased for Alternatives A, B, and D due to the increased construction activities resulting from the increased length of line and towers needed. Alternative A would have about 100 towers; Alternatives B and D would have about 160 towers.

All of the transmission alternatives are in an attainment zone and would not have caused the air quality to exceed the NAAQS. Air quality impacts would be low for these alternatives. The Proposed Action poses a scope of work with the lowest negative impacts to air quality because: a) the micropile footing design system would be used b) an already existing ROW would be used c) it proposes the fewest acres of access road construction and d) no burning would occur.

4.14.5 Non-Transmission Alternative

Under this alternative, no construction of the transmission line or related access roads would occur until a future date, presuming the transmission line can be delayed (see Section 4.1.12). With the slowing/shutting down of an aluminum factory (required to delay construction of the new line), air quality could temporarily slightly improve. It is difficult to precisely determine the amount of air quality change as a result of the Non-Transmission Alternative.

Once it is determined there is a need for the new transmission line and it is built, air quality impacts would be equivalent to those described earlier in this section.

4.14.6 No Action Alternative

The air quality impacts described for the transmission alternatives would not occur under the No Action Alternative.

4.15 Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

None of the alternatives under consideration, including the Transmission alternatives and the Non-Transmission and No Action alternatives, pose any impacts that would alter the long-term productivity of the affected environment. A good example of this is the existing Raver-Echo Lake line, built in 1960s. 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 altered.

4.16 Irreversible and Irretrievable Commitment of Resources

The transmission alternatives would use aluminum, steel, wood, gravel, sand, and other ***nonrenewable*** material to construct steel towers, conductors, insulators, access roads and other facilities. Materials may come either from on-site borrow pits or from outside sources. These alternatives would also require some petroleum-based fuels for vehicles and equipment and steel for structures.

Development of the alternatives would cause commitments that result in the loss of wildlife habitat for certain species and lost production or use of renewable resources such as timber and rangeland. These alternatives would permanently convert wildlife habitat, forested land, and rangeland to utility and transportation uses for the foreseeable future.

Both the Non-Transmission and No Action Alternatives have no immediate resource commitment impacts. When, under the Non-Transmission Alternative, the transmission line is built at a future date, impacts would be as described above.

4.17 Adverse Effects that Cannot be Avoided

Adverse effects on some resources cannot be avoided by actions proposed under the alternatives. Actions to benefit one resource may have temporary or permanent effects on another. Alternatives include recommended mitigation to avoid or reduce adverse environmental effects. Many adverse effects would be temporary, occurring during site-specific activity.

Some of the adverse effects that cannot be avoided in the alternatives include the following:

- Intermittent and localized decreases in air quality from dust from road construction, road maintenance and use.
- Long-term, localized increases in visual impacts from the addition of elements of the construction alternatives: new access roads and spur roads, new structures, clearing, and new equipment at substations.
- Short-term, localized increases in visual impacts from construction equipment and ground disturbing activities, and maintenance activities.

- Short-term, localized increases in soil compaction, soil erosion, vegetation degradation and stream sedimentation from construction and maintenance.
- Elimination of small areas of vegetation, including some wetland vegetation, due to construction of permanent physical developments such as transmission line structures and bridge abutments.
- Temporary disturbances of wildlife and their habitat in localized areas from increased human activity during construction.
- Increased volume growth that could have been achieved through silvicultural prescriptions would be foregone during the life of the constructed facilities.
- Long term loss of late-successional wildlife habitat.
- Small amounts of land lost to grazing, crop production, and in some cases, recreational use if access roads are gated.

Both the Non-Transmission and No Action Alternatives have no immediate unavoidable adverse impacts. When, under the Non-Transmission Alternative, the transmission line is built at a future date, impacts would be as described above.

Chapter 5 — Consultation, Permit and Review Requirements

In this Chapter:

- Laws and procedures to be met
- Actions taken
- Consultations

Several federal laws and administrative procedures must be met by the alternatives. This chapter lists and briefly describes requirements that will apply to elements of this project, actions taken to assure compliance with these requirements, and the status of consultations or permit applications.

5.1 National Environmental Policy Act (NEPA)

This EIS was prepared according to ***NEPA*** (42 USC 4321 et seq.). NEPA is a federal law requiring federal agencies to undergo certain procedures to insure that the decision-maker and the public are informed about environmental consequences of agency actions, and to allow public participation and input on federal projects and decisions. NEPA applies to federal projects or projects that require federal funding, federal property, or federal approval, or other discretionary federal involvement.

BPA will take into account potential environmental consequences and will take action to protect, restore, and enhance the environment, should BPA decide to build the project.

5.2 Threatened and Endangered Species

The Endangered Species Act (16 USC 1536) provides for conserving endangered and threatened species of fish, wildlife and plants. Federal agencies must ensure proposed actions do not jeopardize the continued existence of any federally-listed endangered or threatened species, or cause the destruction or adverse modification of designated critical habitat. When conducting an environmental impact analysis for specific projects, agencies must identify practicable alternatives to conserve or enhance such species.

BPA asked the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) to identify the threatened and endangered species occurring within the vicinity of the proposed project and alternatives. Federally-listed threatened and endangered species potentially occurring within the vicinity of the proposed

project are chinook salmon, bull trout, bald eagle, northern spotted owl and the marbled murrelet. Other species identified as potentially within the project area by the USFWS but which, after further analysis, are not expected to be affected by the project include: Canada lynx; grizzly bear; and gray wolf. No threatened or endangered plant species were identified. Two other species, Middle Columbia steelhead and Puget Sound coho salmon, could be affected if one of the other alternatives is implemented.

USFWS and NMFS require that a Biological Assessment be prepared if threatened or endangered species might be impacted by a major federal action. A Biological Opinion from these agencies is required if the federal action is determined to have an adverse impact on a threatened or endangered species or their habitat.

BPA prepared a BA for the Proposed Action and submitted it to both agencies in July 2001. After reviewing the BA, the USFWS concluded that they did not concur with the determination that the Proposed Action "may affect, but is not likely to adversely affect" the northern spotted owl. They also indicated to BPA that they did not concur with the "no effect" determination for marbled murrelet contained in the BA, and indicated this effect determination should be changed from "no effect" to "may effect, but not likely to adversely affect." BPA submitted supplemental information to the USFWS on the northern spotted owl, requesting initiation of formal section 7 consultation, and changed its determination on the marbled murrelet to "may affect, but not likely to adversely affect." USFWS has since sent BPA a letter in which they concurred with all of the "no adverse effect" determinations on the marbled murrelet, bull trout, bald eagle, gray wolf, grizzly bear, and Canada lynx. BPA conducted six surveys for the northern spotted owl in the CRW, according to USFWS protocol, during the nesting period for 2002 (March 15 through June 15) to determine if they were present. None were found.

In January 2002, NMFS sent a letter to BPA concurring with its effect determination of "may affect, but not likely to adversely affect" for Puget Sound chinook and their designated critical habitat. This letter notified BPA that NMFS was concluding section 7 consultation with BPA in accordance with 50 CFR 402.14 (b)(1). In November 2002, NMFS sent BPA a letter as a follow-up to the completed consultations that reconfirmed their determination. (See Appendix U.) Possible impacts of the alternatives to federal threatened or endangered species are discussed in this section and in Chapter 4. Detailed discussions of federal candidate species, and other special status species are included in Appendices A, B, N and O.

Essential Fish Habitat — The letter from NMFS also notified BPA that it was concluding consultation under the Magnuson-Stevens Fishery Conservation and Management Act as well. The letter stated NMFS recognizes that the City of Seattle and other stakeholders have asked BPA to do more NEPA review of the Proposed Action, and that BPA has agreed to prepare a SDEIS. NMFS further concluded that the Proposed Action would have a negligible effect to the HCP (Cedar River Municipal Watershed Habitat Conservation Plan, April, 2000), for NMFS-covered species.

5.3 Fish and Wildlife Conservation

5.3.1 Fish and Wildlife Conservation Act

The Fish and Wildlife Conservation Act of 1980 (16 USC 2901 et seq.) encourages federal agencies to conserve and promote conservation of non-game fish and wildlife species and their habitats. In addition, the Fish and Wildlife Coordination Act (16 USC 661 et seq.) requires federal agencies undertaking projects affecting water resources to coordinate with the USFWS and the state agency responsible (Washington Department of Fish and Wildlife) for fish and wildlife resources.

Mitigation measures designed to conserve fish, wildlife and their habitat are listed in Chapter 4 (see **Mitigation** subsections in Sections 4.6 and 4.7). Standard erosion control measures would be used during construction to control sediment movement into streams, protecting water quality and fish habitat.

5.3.2 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) to establish new requirements for "Essential Fish Habitat" descriptions in federal fishery management plans and to require federal agencies to consult with NMFS on activities that may adversely affect EFH. The Magnuson-Stevens Act requires all fishery management councils to amend their fishery management plans to describe and identify EFH 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 EFH for all fisheries under NMFS' jurisdiction that would potentially be affected in the project area. EFH includes all streams, lakes, ponds, wetlands, and other currently viable water bodies and most of the habitat historically accessible to salmon. Activities occurring above impassable barriers that are likely to adversely affect EFH below impassable barriers are subject to the consultation provisions of the Magnuson-Stevens Act.

Under the Magnuson-Stevens Act, NMFS must be consulted by any federal agency undertaking, permitting, or funding activities that may adversely affect EFH, regardless of its location. Under section 305(b)(4) of the act, NMFS is required to provide EFH conservation and enhancement recommendations to federal and state agencies for actions that adversely affect EFH. Wherever possible, NMFS uses existing interagency coordination processes to fulfill EFH consultations with federal agencies. This goal would be met by incorporating EFH consultation into the Endangered Species Act Section 7 consultation.

NMFS notified BPA in a letter in early February 2002 that it was concluding consultation under the Magnuson-Stevens Fishery Conservation and Management Act. The letter stated NMFS recognition that the City of Seattle and other stakeholders, including the Pacific Crest Biodiversity Project, had asked BPA to do more NEPA review of the Proposed Action, and that BPA has agreed to prepare a SDEIS. And, in keeping with with NMFS' support of the City's HCP, which is expected to contribute substantially to conservation of Cedar River salmonids, NMFS further concluded that the Proposed Action would have a negligible effect to the HCP for NMFS-covered species.

5.3.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 U.S.C. §§ 703–712, July 3, 1918, as amended 1936, 1960, 1968, 1969, 1974, 1978, 1986 and 1989) 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. 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 birds such as pheasant, chukar, and gray partridge.

The act contains several exemptions, such as waterfowl hunting. Many types of development result in the taking of migratory birds: collision with windows, for example, is a leading cause of death among songbirds. Taking may be allowed under a scientific permit if research is deemed beneficial to migratory birds.

Construction, operation and maintenance of the proposed project would result in some impacts to migratory birds. Some of the potentially impacted bird species are protected under the Migratory Bird Treaty Act. Mortality of birds listed under the Migratory Bird Treaty Act could be viewed as a violation of this federal act, although there are presently no permits available to federal agencies for "incidental take" such as would result from the proposed transmission line project. Moreover, there is a split in the federal circuit courts as

to whether the MBTA applies to the federal government. Potential impacts to migratory birds include loss of habitat for species that nest in second growth coniferous, deciduous, or mixed forest types and that use edge habitat. Impacts would be limited to individuals potentially nesting in the area and would be incidental to the action. Potential impacts to migratory birds of special concern are discussed in Appendices B and O.

5.3.4 Bald Eagle and Golden Eagle Protection Act

The Bald Eagle Protection Act (16 U.S.C. 668–668d, June 8, 1940, as amended 1959, 1962, 1972, and 1978) prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions. Because a small number of bald eagles may reside within foraging distance of the proposed project, there is a remote possibility some mortality could result to bald eagles. However, because the Act only covers intentional acts, or acts in "wanton disregard" of the safety of golden or bald eagles, this project is not viewed as subject to its compliance.

5.3.5 Management Plans for the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests

Two alternatives (B and D) would impact lands managed by the Okanogan-Wenatchee and Mt. Baker-Snoqualmie National Forests. Both forests are managed in compliance with their applicable Land and Resource Management Plans (**LRMP**) (USDA Forest Service, 1990a; USDA Forest Service, 1990b) developed in accordance with the Forest and Rangeland Renewable Resource Planning Act and the National Forest Management Act of 1976. In addition to the two LRMPs, the Record of Decision for the Northwest Forest Plan was adopted in April 1994. This plan amended U.S. Forest Service and U.S. Bureau of Land Management (**BLM**) planning documents within the range of the northern spotted owl.

The Northwest Forest Plan specifies standards and guidelines for the management allocations in this area, including late-successional reserves, riparian reserves, matrix, and adaptive management areas (AMAs) (USDA Forest Service, 1994). The Snoqualmie Pass AMA is one of the designated adaptive management areas and is now covered by the Snoqualmie Pass AMA Plan. The majority of the AMA is designated a connectivity emphasis area (CEA) and is managed to protect and enhance late-successional forest conditions and connectivity (USDA Forest Service, 1997). The Snoqualmie Pass AMA exists primarily within the Okanogan-Wenatchee National Forest.

All of these plans must be considered collectively. For lands subject to both the Snoqualmie Pass AMA Plan and both National Forest LRMPs, the more restrictive standards and policies take precedence (USDA Forest Service, 1997). Portions of the two National Forests not covered by the Snoqualmie Pass AMA Plan are managed in accordance with the Standards and Guidelines from the Northwest Forest Plan and the standards and guidelines from the applicable LRMPs. The standards and guidelines that are the most restrictive take precedence in land management decisions made for these lands (USDA Forest Service, 1994).

The Northwest Forest Plan also outlines an Aquatic Conservation Strategy (**ACS**) to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. Under the Northwest Forest Plan ROD, all actions on USFS land must maintain or restore aquatic habitat in accordance with the Aquatic Conservation Strategy Objectives (**ACSOs**) to qualify for approval. Management actions that do not maintain the existing condition or lead to improved conditions in the long term would not meet the intent of the ACS and should not be implemented (USFS and BLM 1994).

Watershed analysis documents are used in making decisions on implementation of the Aquatic Conservation Strategy. Watershed Analyses have been completed for the Yakima River (USFS 1997) and the South Fork Snoqualmie River (USFS 1995). The Keechelus Lake-Mosquito Creek sub-watershed occurs within the greater Yakima River Watershed and also has a completed Watershed Analysis (Plum Creek 1997).

5.3.5.1 Snoqualmie Pass Adaptive Management Area Plan

The AMA acknowledges the eventual need to upgrade BPA's service levels over the lines that transect the AMA. The anticipated need to upgrade is listed as one of the proposed special uses for which an application has been submitted or for which an impact has been projected (Final EIS Snoqualmie Pass Adaptive Management Plan, p. 3-119).

The AMA Plan also spells out standards guidelines, and mitigation measures for development areas as follows:

> *In CEAs, development of new facilities that may adversely affect late-successional habitat and connectivity should not be permitted. New development proposals that address public needs or provide significant public benefits, such as power lines, pipelines, reservoirs, recreation sites, or other public works projects, will be reviewed on a case-by case basis and may be approved when adverse effects can be minimized and mitigated.*

Proposals for new facilities and the expansion of existing facilities will be encouraged in non-CEAs rather than CEAs. New facilities and the expansion of existing facilities do not need to be neutral or beneficial to late-successional forest conditions; however, all activities in non-CEAs will provide for the conservation of Threatened and Endangered species (Final EIS Snoqualmie Pass Adaptive Management Plan, p. 2-47.

5.3.5.2 Record of Decision for the Northwest Forest Plan

Portions of Alternatives B and D (both Options D1 and D2) are located outside the AMA and would be covered by other Standards and Guidelines present in the Northwest Forest Plan. Two key Standards and Guidelines from the Northwest Forest Plan state that:

. . .new access proposals may require mitigation measures to reduce adverse effects on Late-Successional Reserves. In these cases, alternate routes that avoid late-successional habitat should be considered. If roads must be routed through a reserve, they will be designed and located to have the least impact on late-successional habitat.

Development of new facilities that may adversely affect Late-Successional Reserves should not be permitted. New development proposals that address public needs or provide significant public benefits, such as power lines, pipelines, reservoirs recreation sites, or other public works projects, will be reviewed on a case-by case basis and may be approved when adverse effects can be minimized and mitigated. These will be planned to have the least possible adverse impacts on Late-Successional Reserves.

Additional requirements for survey of a number of amphibians, mammals, bryophytes, mollusks, vascular plants, fungi, and lichens are listed in the Record of Decision on page C-4, and was updated in the January 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and Other Mitigation Measures Standards and Guidelines (Hansen-Murray, 2002). BPA would comply with the protocol for required surveys should Alternatives B or D (Options D1 or D2) become the preferred alternative.

5.4 Heritage Conservation

Congress has passed many federal laws to protect the nation's cultural resources. These include, among others, the National Historic Preservation Act, the Archeological Resources Protections Act, the American Indian Religious Freedom Act, the National Landmarks Program, and the World Heritage List. Preserving cultural resources allows Americans to have an understanding and appreciation of their origins and history. A cultural resource is an object, structure, building, site or district that provides irreplaceable

evidence of natural or human history of national, state or local significance. A cultural resource can also include traditions, beliefs, practices, lifeways, arts, crafts, and social institutions of any community, often referred to as traditional cultural property. Cultural resources include traditional cultural property, National Landmarks, archeological sites, and properties listed (or eligible for listing) on the National Register of Historic Places.

A literature review of the project area was done to determine the prehistory and history of the area and the probability of finding cultural resources that may be affected by the project. A cultural survey of the Proposed Action ROW and access road system, and proposed substation expansion was undertaken in summer 2001 to determine if any cultural resources were present and would be impacted. Over 1,100 shovel tests were dug, resulting in only two artifact discoveries (an historic area logging feature which was a spike, measuring 5 and 3/8 inches long was found driven into a tall spring-board notched stump, and an undated trench, measuring 30 meters long and 3 meters wide, by 2 meters deep). BPA believes neither site is potentially eligible for listing on the National Register. BPA is coordinating this issue with the State Historic Preservation Officer.

None of the previously recorded cultural resource sites occur on or near (within 700 feet) of the proposed BPA project area.

The Muckleshoot Tribe identified a concern that a new transmission line would have the potential to affect traditional cultural property in the CRW. Consultation with the Tribe continues. BPA will continue to work with the Tribe to avoid any sensitive areas if a decision is made to build the transmission line.

The Sauk-Suiattle Tribe identified a concern that a new transmission line would have the potential to affect culturally modified trees. A survey for culturally modified trees was completed along the Proposed Action north of the Cedar River Watershed in advance of centerline surveying being conducted. No culturally modified trees were found. Subsequently, during the cultural resource survey for the proposed project, a survey was also conducted for culturally modified trees in the CRW both on the proposed right-of-way as well as adjacent to the proposed right-of-way. No culturally modified trees were identified. If, during construction, previously unidentified cultural resources that would be affected by the proposed project are found, BPA would follow all required procedures set forth in applicable cultural resources laws. This information is also contained in the unanticipated discovery of human remains or cultural resources plan that has been prepared for the project.

5.5 State, Area-wide, and Local Plan and Program Consistency

BPA, as a federal agency, is not required to comply with the requirements associated with obtaining state and local land-use approvals or permits because Congress has not waived federal supremacy over these areas. Furthermore, as a federal agency, BPA only obtains those state and local permits for which Congress has clearly and unambiguously waived sovereign immunity. However, federal regulations, promulgated by the Council on Environmental Quality, require federal agencies to discuss possible conflicts and inconsistencies of a proposed action with approved state and local plans and laws in their EIS. BPA would, to the maximum extent practical, strive to meet or exceed the substantive standards and policies of the following environmental regulations.

5.5.1 State Environmental Policy Act

The state of Washington has adopted a State Environmental Policy Act (***SEPA***), which is intended to ensure that environmental values are considered during decision-making by state and local agencies. The objectives and requirements of SEPA are similar to those of NEPA.

Some of the transmission alternatives would cross land owned by the Washington Department of Natural Resources. To grant BPA an easement or sell the right-of-way across state property, DNR would have to document compliance with SEPA. The sale or easement grant would constitute an "action" under SEPA (Washington Administrative Code [***WAC***] 197-11-704(2)(ii)). SEPA allows the use of NEPA documents to meet SEPA requirements (WAC 197-11-610). DNR may adopt the NEPA EIS prepared for the project or prepare separate documents in accordance with their SEPA regulations.

Some of the transmission alternatives would also cross land in the Cedar River Municipal Watershed owned by the City of Seattle. To grant BPA an easement across the Watershed, the City would also have to document compliance with SEPA.

5.5.2 Growth Management Act

The Washington State Legislature passed the Growth Management Act (***GMA***) in 1990. The GMA requires all urban counties and their cities to develop and adopt comprehensive plans and regulations to implement those plans. To ensure comparable planning efforts, the GMA requires comprehensive plans to address specific issues including, but not limited to, land use, transportation, housing, facilities and services, utilities, the natural environment,

and economic development. To achieve coordinated planning efforts, the GMA further requires counties and cities to develop a set of framework policies to guide development of each jurisdiction's comprehensive plan. Jurisdictions are required to designate critical areas, agricultural lands, forestlands, and mineral resource lands; to adopt development regulations to conserve resource lands and protect critical areas; and to designate urban growth areas.

King and Kittitas counties have adopted countywide planning policies, comprehensive plans, and development regulations in accordance with the GMA. These countywide planning policies, comprehensive plans, and zoning ordinances, and the project's consistency with those local plans and policies, are addressed in Sections 5.5.5, 5.5.6, 5.5.7, and 5.5.8.

5.5.3 Washington Forest Practices Act

The Washington Forest Practices Act and Forest Practices Rules and Regulations are the state's principal means of regulating activities on non-federal forestlands. While not applicable to federal agencies, state and local agencies generally must demonstrate compliance in the management of their land, including decisions to sell or lease that land. However, in this instance, because BPA would purchase an easement from the landowner, and the Forest Practices Act does not apply to federal agencies, no permit needs to be obtained from the state. BPA is, however, incorporating many of the best management practices described in the Forest Practices Act into its proposed maintenance plan. A second consideration, which lessens the conflict with the Forest Practices Act, is that Chapter 222-20 of the Washington Administrative Code states that the development of utility rights-of-way shall not be considered to be conversions under the Act.

The Forest Practices Rules and Regulations are administered by DNR. The rules and regulations set standards for, among other things, road design, riparian area buffers, wetland protection, and protection of threatened and endangered species. Consultation with the Washington Department of Fish and Wildlife is required prior to a planned disturbance to protect critical habitats, preserve wildlife reserve trees, and to avoid disturbance to both spotted owls and marbled murrelets during their nesting seasons. Conversion of forestland is a Class IV forest practice (RCW 79.09.050). Forest practices under Class IV are not exempt from SEPA requirements. Applications for Class IV forest practices must be submitted to and approved by DNR prior to conducting the activity. (RCW 79.09.050.) Failure to state that any land covered by the application will be converted to another use would result in a six-year moratorium on development of the land (RCW 76.09.060).

The Forest Practices Act also sets forth rules for road construction and maintenance (WAC 222-24), and the Washington Forest Practices Board (**WFPB**) Manual contains guidelines for forest roads, including BMPs, road maintenance and abandonment plans, and recommended tools.

5.5.4 Washington Department of Natural Resources Managed Lands

DNR owns many parcels of land within the study area. These lands are categorized as "Managed Lands" (McDonald, pers. comm., 2000). DNR manages the properties for timber production and in accordance with the DNR's Final Habitat Conservation Plan (September 1997), which provides mitigation for incidental take permits for two federally-listed species, the northern spotted owl and the marbled murrelet. All DNR-managed forest lands in western Washington are covered by the HCP, which is considered the major element for DNR compliance with the Forest Resource Plan policy on endangered, threatened, and sensitive species.

Activities applicable to the proposed project that may occur on DNR-managed forestlands covered by the HCP include, but are not limited to forest health activities (*e.g.,* wildfire suppression), timber harvesting, vegetation management, and non-timber resource activities, such as granting rights-of-way. DNR grants easements and rights-of-way for powerlines, roads, and pipelines.

The HCP allows new road construction in conjunction with timber sale activity and other land management needs. Construction decisions must be consistent with mitigation and conservation strategies in the HCP.

BPA would coordinate with DNR to secure right-of-way across DNR property and ensure consistency with the HCP for DNR lands and SEPA if a decision is made to build the new transmission line.

5.5.4.1 Washington State Department of Natural Resources Management Plans

Department of Natural Resources owned or managed lands impacted by some of the proposed alternatives include Rattlesnake Mountain Scenic Area, Tiger Mountain State Forest and non-trust lands such as the Mount Si Natural Resources Conservation Area (**NRCA**), and the West Tiger Mountain NRCA.

Rattlesnake Mountain Scenic Area — Alternatives B and D (Options D1 and D2) cross the Rattlesnake Scenic Area. In addition to the scenic values of the Rattlesnake Mountain Scenic Area (**RMSA**), the area is recognized as providing an important "habitat and

recreation connection between the Cascade Mountains to the east and the Puget Sound lowlands to the west" (DNR, 1998). However, no management recommendation explicitly dealing with utility corridors or easements is stated.

Mount Si Natural Resources Conservation Area — The Mount Si NRCA is located just north of a portion of Alternatives B and D (Options D1 and D2). Provisions of the NRCA management plan that relate to potential impacts from these alternatives is the goal to work with the King County and its cities to minimize the impact of development on views from the Mount Si NRCA.

West Tiger Mountain Natural Resources Conservation Area — Alternative C extends north into the Tiger Mountain State Forest but stops short of the West Tiger Mountain NRCA designated by WSDNR. The remainder of Tiger Mountain State Forest (not included in the NRCA) is managed in accordance with DNR's Habitat Conservation Plan. (Heintz, 2002).

Forest Legacy Program Land Acquisitions — Three parcels along Alternatives B and D (Options D1 and D2) have been purchased through the Forest Legacy Program. These three parcels are subject to Forest Legacy Conservation Easements. The three parcels include the following parcels as named and described by DNR as follows:

- Kimbal Creek Parcel in Section 8 of Township 2 North, Range 8 East;
- Plum Creek/WRECO Parcel in Section 1 of Township 23 North, Range 7 east and Sections 6 and 7 of Township 23 North, Range 8 East; and
- Grouse Ridge Parcel in Sections 29 and 30 of Township 23 North, Range 9 East.

Kimbal Creek and Plum Creek/ WRECO are both located at the northern end of the Rattlesnake Mountain Scenic Area. Grouse Ridge Parcel is located just west of the Weyerhaeuser parcel on which Cadman has proposed the North Bend Gravel Mine (Pruitt, 2002). Easement language pertaining to all parcels are not supportive of above ground utility corridors. BPA would explore the impact these conservation easements may have on the feasibility of implementing any alternative through these parcels.

5.5.5 King County Countywide Planning Policies

The King County Countywide Planning Policies (King County, 1994) define the countywide vision and establish the parameters of the King County Comprehensive Plan. By providing a framework of policies, they ensure that plans developed by King County and cities

within the county are coordinated, but adapted by each local jurisdiction. The Countywide Planning Policies are implemented through adopted local comprehensive plans and development regulations (*e.g.,* zoning ordinances). Typically, the Countywide Planning Policies do not apply directly to development proposals; the local jurisdictions' implementing plans and regulations do. Chapter VIII of the Countywide Planning Policies addresses siting of "public capital facilities of a countywide or statewide nature." The Policies recognize that King County and the cities need a process to site large facilities, such as utility corridors. The NEPA process being followed by BPA addresses project requirements identified in Countywide Planning, such as supporting the Countywide land use pattern, supporting economic activities, mitigating environmental impacts, providing amenities or incentives, and minimizing public costs.

5.5.6 King County Comprehensive Plan

The King County Comprehensive Plan responds to and implements the planning goals of the GMA, and guides land-use decisions throughout the county. The current comprehensive plan was adopted on February 12, 2001.

Rural Area Designations — As required by the GMA, King County has designated an Urban Growth Area and a Rural Area. The project is within designated Rural Area and natural resource lands.

The policy for Rural Areas is not relevant to the proposed project. A new transmission line would serve the Pacific Northwest region, including portions of Canada, rather than only the rural area of King County. The line would be designed and scaled appropriately.

Forestland Designations — The GMA requires King County to designate and conserve resource areas, including forest, agricultural and mining lands. Forestlands in the project area are designated as a Forest Production District on the Forestland map in the comprehensive plan (King County 2001). The mining area (a quarry) near the southern terminus of Segment A is not identified on the Mineral Resources map in the comprehensive plan and, therefore, is not a designated resource. However, it is zoned for mineral use.

Forest Production Districts are considered by King County to be forestlands of long-term commercial significance. Utilities and transportation facilities adjacent to these areas should be sited to ensure compatibility with resource management and protect long-term integrity of the natural environment.

The Comprehensive Plan also addresses forestland conversions. Forestland converted to non-forest uses "*must be managed to control*

the manner and extent of alteration and to minimize environmental impacts." For example, higher land clearing and grading standards than those that apply under the Forest Practices Act must be used to protect surface and groundwater quality and quantity, control stormwater runoff, and minimize harmful effects to fish and wildlife habitat.

The Kangley-Echo Lake Transmission Line Project would be compatible with forest resource management because it would not preclude or inhibit forest practices on land adjacent to the BPA property and right-of-way. Although the project would convert some resource land to a utility right-of-way and transmission facility, utilities are a permitted use in the Forest zone and are, therefore, consistent with King County policies.

Critical Area/Wildlife Network Designations — As required by the GMA, King County has also designated critical areas, which include wetlands, areas with critical recharging effect on aquifers used for potable water, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas. Wetlands, frequently flooded areas, and geologically hazardous areas are designated in the King County Sensitive Areas Ordinance, Ordinance 9614, as amended. The GMA requires protection of designated critical areas. County provisions to protect critical areas are contained in the King County zoning code, described below.

The Cedar River Watershed is crossed by corridors designated as Wildlife Network in the Comprehensive Plan (King County, 1994). The Wildlife Network identifies potential linkages between critical wildlife habitats and refuges. Three Wildlife Network corridors are crossed by project alternatives.

BPA compliance with the ESA and coordination with state and federal fish and wildlife agencies would indicate consistency with this component of the comprehensive plan.

Watershed Designations — The King County Comprehensive Plan requires public facilities to be coordinated with growth and coordinated planning for regional water supplies. Land use policy in a watershed such as the Cedar River Watershed, emphasizes management for the protection of drinking water and downstream fish.

Through NEPA coordination, consultation requirements implementation of BMPs, and mitigation measures to ensure protection of water quality, the proposed project would be consistent with this policy.

Energy Facilities — Chapter 12 of the Comprehensive Plan addresses energy and telecommunications. The plan states that electrical transmission facilities in the county need to be improved to

meet existing demand and forecast growth. Policies encourage the facilitation of corridor sharing among different utility types and owners, planning on a system-wide basis, and identification of roads as utility corridors.

Plan 2000 Potential Changes — The King County Office of Regional Policy and Planning recently completed a major update of the County Comprehensive Plan, although it has not yet been adopted and revisions to the plan are still being made. Changes to policies within the Plan may affect requirements for the project.

The proposed project would be consistent with maintenance of site productivity by not precluding forest practices on land adjacent to BPA right-of-way and by converting only approximately 0.02 percent of forestland in King County to another land use. The proposed project would limit impervious surfaces, provide for fire control, and incorporate measures to protect water supply.

Through the NEPA process and compliance with the ESA, BPA would comply with King County regulations, to the extent practicable.

5.5.7 Kittitas County Comprehensive Plan

The eastern most lengths of Alternatives B and D run through Kittitas County and the Snoqualmie Pass Sub Area. General comprehensive plan provisions and applicable provisions from the Sub Area Comprehensive Plan-Master Plan as they appear in the December 2001 Kittitas County Comprehensive Plan, Volumes I and II, are described here. Chapter 6, Utilities, includes 33 Goals Policies and Objectives (GPO) related to utilities. Chapter 7 Snoqualmie Pass Sub Area Plan includes provisions applying to Energy and Telecommunication Utilities, including minimizing health risk to residents of neighboring properties, visual impact, no adverse impact on aviation traffic patterns, convenient access, encourage use of cold weather engineering practices to cope with power outages, and ensure that new developments are designed with facilities to withstand a minimum 48-hour power outage.

Coordination with the County through the process will ensure compliance with the Comprehensive Plan.

5.5.8 Maple Valley Comprehensive Plan

The City of Maple Valley Comprehensive Plan, adopted November 22, 1999, lists the city's utility policies related to electricity. Basically, these policies urge minimizing public health risk, collocations of utilities, planting of appropriate tree and shrub species in right of way corridors, and use of corridors for recreation. These comprehensive plan provisions are similar to some policies of the city of

Covington. BPA would coordinate with the city to explore opportunities for collocation with other facilities or recreational uses as appropriate.

5.5.9 Covington Comprehensive Plan

The City of Covington Comprehensive Plan was last updated September 25, 2001. The Comprehensive Plan outlines policies for transmission lines similar to the city of Maple Valley and overall King County guidelines, emphasizing the minimization of environmental and social impacts from siting of the line.

The City intends to adopt its own sensitive areas and shoreline protection plan but currently has adopted the County's standards. The plan supports the use of utility corridors for creating open space as well as the potential for connecting open space resources for wildlife and for trail corridors.

5.5.10 Local Zoning and Sensitive Area Ordinances

Multiple local governments have jurisdiction within the various alternatives. The majority of all alternatives run through King County. The eastern end of Alternatives B and D are within the jurisdiction of Kittitas County. Alternative A runs through Covington, Maple Valley, and a parcel annexed into the City of Kent for municipal purposes. The Comprehensive Plan provisions discussed above provide good guidance for determining consistency with the goals and policies of each of these jurisdictions. The discussion below will highlight some important considerations related to zoning and sensitive area regulations.

5.5.10.1 King County Zoning Code

Title 21A — **Zoning** — of the King County Code (King County, 2001) implements the King County Comprehensive Plan policies and objectives through land-use regulations.

The various alternatives cross lands zoned for rural-residential uses, Forest, Urban Residential (UR), Neighborhood, Regional, and Commercial Business (NB, RB, CB), and Industrial (I). According to 21A.08.060, the government/business services and land use matrix in the King County Code, a Utility Facility is a permitted use (excluding bulk gas storage tanks) in all of these zones except the RA zone, where a Utility Facility is permitted conditionally, subject to 21.A.14 when located in an equestrian community identified in the Comprehensive Plan. A majority of the RA land through which some of the alternatives run is designated as equestrian community.

Chapter 21A.24 of the zoning code contains standards to protect environmentally sensitive areas, which include wetlands; streams; and

flood, erosion, coal mine, landslide, seismic, volcanic, and steep slope hazard areas. The provisions of Chapter 21A.24 are applicable to all land uses in King County, unless specifically exempted. As a federal agency, BPA is exempt from the procedural requirements for obtaining local land use permits. However, BPA will comply with the substantive intent of the county zoning regulations.

If the application of this chapter would prohibit a development proposal by a public agency and utility, the agency or utility may apply for an exception.

5.5.10.2 Kittitas County Zoning and Critical Areas Regulations

All but a few small pockets of land in the vicinity of Alternatives B and D are located in the Commercial Forest Zone (White, 2002). Kittitas County's zoning ordinance allows "the erection, construction or substantial alteration of private, public and semi-public gas, electric, water or telecommunication and utility facilities" within its Forest Zone. Chapter 17.61 Utilities, of the zoning ordinance, lists review criteria for special utilities and their associated facilities.

5.5.10.3 Maple Valley Zoning and Sensitive Area Regulations

Maple Valley Municipal Code Title 18, Revised 04/01, lists Major or Regional Utilities as a conditional use in all residential zones and as a permitted use subject to outdoor storage standards in all other zones except neighborhood commercial. BPA is not required to seek a permit from the local government but coordination with the local jurisdiction should ensure that the facility would be consistent with conditional use standards where applicable. Maple Valley Municipal Code Title 18 also codifies the city's Critical Area Review process and criteria (18.60.320). A detailed consideration of critical areas has not been done but considering the existing land uses and levels of disturbance along with the ability of the proposed structures to span areas of concern BPA is anticipated to be able to achieve consistency with the city's Critical Areas ordinance.

5.5.10.4 Covington Zoning and Sensitive Area Regulations

Zoning districts in the City of Covington do not address utility or special utility facilities nor do they include review standards or criteria to be applied to such uses. Adoption of the County's Sensitive Areas Ordinance means the County provisions discussed above should be applied within the city limits as well as outside.

5.5.10.5 City of Seattle Cedar River Watershed Habitat Conservation Plan

The City of Seattle prepared a multi-species HCP (City of Seattle, April 2000) to comply with the federal ESA and to address a variety of natural resource issues. Please see Section 3.1.3, **Cedar River Municipal Watershed**, for more information about the HCP's goals and objectives.

The plan covers the City's entire 90,546-acre Cedar River Watershed and the City's water supply and hydroelectric operations on the Cedar River. In general, the HCP is not for planned development but is a set of mitigation and conservation commitments related to ongoing water supply, hydroelectric power supply, and watershed management activities that are intended to offset any harm caused to individual listed and selected unlisted species by promoting conservation of populations as a whole. The HCP sets forth commitments by the City that relate to the four major components of the HCP: 1) watershed management and restoration, 2) anadromous fish mitigation (for blockage to fish passage at the Landsburg Diversion Dam), 3) instream flows, and 4) research and monitoring to support the first three components. The HCP is intended to conserve habitat of anadromous fish (chinook, coho and sockeye salmon and steelhead) and numerous species of wildlife, including listed species such as the northern spotted owl and marbled murrelet.

The HCP covers only actions by the City of Seattle. Activities undertaken by other agencies within the watershed are not addressed by the HCP and, therefore, require separate review by the USFWS and NMFS. BPA is consulting with the USFWS to ensure compliance with the ESA. Consultation with NMFS has been concluded because NMFS concurred with BPA's determination that there were no adverse effects from the project to federally-listed anadromous fish species (see also Section 5.2.1).

Management and conservation strategies of the HCP are summarized in this section to indicate how the City of Seattle intends to meet ESA requirements, to provide examples of the uses and activities that may be allowed within the Cedar River Watershed, and to indicate whether project activities would be consistent with the HCP management and conservation guidelines. It is BPA's view that the proposed transmission line would leave the HCP wholly intact. This Proposed Action is funded, designed, and implemented by a federal agency, with Congressional approval, and is undergoing a separate and distinct section 7 consultation to comply with the Endangered Species Act. BPA, after assessing impacts to property within the Cedar River Watershed, would compensate for any unavoidable impacts attributed to the federal project, leaving the HCP intact, and whole. BPA is

exploring with the City, the USFWS, and NMFS possible ways to either modify the exiting HCP, or provide sufficient compensatory mitigation to SPU to ensure that the functionality and viability of the HCP is left intact.

Watershed Management — The component of the HCP most applicable to land uses in the watershed is the watershed management mitigation and conservation strategies. The strategies are intended to provide comprehensive long-term protection for the watershed ecosystem, including commitments not to harvest timber for commercial purposes in the watershed, effectively placing all forest outside limited developed areas in reserve status, and protection and restoration of stream, riparian, and upland forest habitats.

The commitment not to harvest timber for commercial purposes does not preclude all tree cutting in the watershed. The City of Seattle may cut trees to protect the water supply, to provide water and hydroelectric power, to meet ecological objectives, to protect the watershed from catastrophic damage (*e.g.*, fire), or for general administration of the watershed and management of its facilities. Activities covered under the HCP include maintenance of rights-of-way for power lines, pipelines, roads, and trails, including removal and control of trees, non-native vegetation, and other vegetation for safety reasons (such as visibility), to maintain the integrity of road surfaces, or to maintain or gain access.

Watershed management guidelines include controlling public access to the watershed. Access is limited to minimize human disturbance, which adversely affects both water quality and many species covered by the HCP. Management guidelines also include prevention and suppression of forest fires. It is the City's policy to *"aggressively suppress all forest fires in the municipal watershed."* One of the reasons for maintaining roads in the watershed is to allow access for forest fire suppression.

Forestland Management —The City may sell trees removed for incidental salvage or ecological thinning, provided net revenues are used to offset costs of the HCP or watershed management. Should the areas be cleared for right-of-way, the City would determine whether cut trees would be sold (Erckmann, pers. comm., 2001). Herbicides may not be used in the watershed, and revegetation of disturbed soils is to be augmented with native seed and/or plant species.

Aquatic/Riparian Ecosystem Management —Additional management guidelines of the HCP for the aquatic and riparian ecosystem limits cutting of trees near streams or wetlands and emphasizes limiting road construction.

Construction of new roads would be minimized, and the existing road system would be substantially reduced. The City expects to

construct no more than five miles of roads during the 50-year term of the HCP and to achieve a net reduction in total road miles of approximately 236 miles.

HCP Implementation — Implementation of the HCP is governed by a formal HCP Implementation Agreement signed by the City of Seattle, USFWS, and NMFS on April 21, 2000, and two related agreements, an Instream Flow Agreement and a Landsburg Mitigation Agreement. An overall HCP Oversight Committee, and later subcommittees or groups as needed, will oversee HCP implementation. The Oversight Committee's function is to advise the City of Seattle concerning HCP implementation, providing an avenue for communication and for identifying issues, and providing periodic review of HCP progress.

5.5.10.6 City of Kent Wellhead Protection Program

The City of Kent owns three parcels that are managed exclusively for well head protection in the vicinity of some alternatives. These parcels include the Clark Springs, Kent Springs Lake Sawyer Wellfield, and Armstrong Springs properties. The City of Kent Wellhead Protection Program document, dated April 2, 1996, maps the capture zones for the "shallow, highly transmissive, glacial outwash aquifers" relied on by the City of Kent for groundwater recharge. Potential sources of contamination are discussed in the protection plan. The program document also summarizes land use, regulatory, and planning strategies.

Contact with the city confirms concern regarding potential impacts to the city's water sources. The city has also confirmed that though the parcels are currently unzoned land annexed for municipal purposes, the city's Wetland and Habitat Conservation Area regulations are applicable to any development within the annexed areas (Peterson and Fitzpatrick, 2002).

5.5.11 Western Utility Group Western Regional Corridor Study

Completed in 1992 by a coalition of utility companies and Federal land management agencies, the goal of this study was to identify future utility corridor needs in eleven western states that could be incorporated into Federal land management plans as they were updated. This study provides guidelines for where corridors may be located and contains a map of best locations for future corridors. This study has been adopted by the U.S. Forest Service and Bureau of Land Management to use as guidance in locating utility corridors (Sierra Pacific 1992).

5.6 Farmland Protection

The Farmland Protection Policy Act (7 USC 4201 et seq.) directs federal agencies to identify and quantify adverse impacts of federal programs on farmlands. The Act's purpose is to minimize the number of federal programs that contribute to the unnecessary and irreversible conversion of agricultural land to non-agricultural uses.

No farmland would be affected by this project.

5.7 Recreation Resources

5.7.1 Federal

Land allocations on National Forest managed lands in the study area show preservation of recreational opportunities is a primary objective. Maintenance of scenic quality and provision for a variety of recreational opportunities are goals on both National Forests.

5.7.1.1 Pacific Crest National Scenic Trail Comprehensive Plan

There is no specific reference made in the Comprehensive Plan regarding utilities. Coordination with the USDA Forest Service should include discussions of potential impacts to the Pacific Crest Trail and necessary mitigation measures to be undertaken to offset any potential impacts from Alternatives B or D.

5.7.1.2 Mountains to Sound Greenway and National Scenic Byway

This corridor along I-90 between North Bend and Cle Elum has been designated as the Mountains to Sound Greenway and also designated as a National Scenic Byway. A mix of state, federal, and privately funded recreational resources has been established along this corridor. The land acquisition and trail development activities of public agencies and the Mountains to Sound Greenway Trust signify the priority placed on recreation in the vicinity. Alternatives B and D would potentially impact this Byway.

WSDOT has drafted the Mountains to Sound Greenway Implementation Plan. The Department is publishing this document for release on their web site and anticipates its availability in summer 2002. The plan contains a combination of policy and conceptual planning.

5.7.2 State of Washington

The Assessment and Policy Plan 1995-2001 is not applicable to this project.

The Rattlesnake Mountain Scenic Area Management Plan prepared jointly by DNR and King County provides for low impact educational and recreational uses of the 1,800-acre scenic area where public use does not compromise natural systems. Additional recreational facilities managed by the state of Washington include Iron Horse State Park, the John Wayne Pioneer Trail, Taylor Mountain Forest, and the Olallie Mountain Bike Trail Study.

5.7.2.1 Iron Horse State Park and the John Wayne Pioneer Trail Management Plan

This plan lists utilities on park lands as a recreational resource issue. BPA will coordinate with park staff to limit disruption of recreation, insure proper public notification, identify limitations of recreational use within the utility corridor, and ongoing maintenance impacts.

5.7.2.2 Ollalie Area Mountain Bike Study

The area in and around Ollalie has many abandoned logging roads that could be linked together to create multiple use loop trails. State parks will develop trails on their own lands but expect that the Forest Service and Cedar River Watershed will likely refer to the plan as they plan any expansions to trails on their own lands. Most trails identified in the study thus far are uphill from the railroad grade and are not near the existing electrical transmission line (Person, 2002).

BPA will continue to check for availability of this document and coordinate with Washington State Parks Puget Sound Region in an attempt to comply with the purpose and intent of the Plan.

5.7.2.3 Taylor Mountain Forest Master Plan

This 1997 Plan states the purpose of the Taylor Mountain Forest is to conserve, protect, and restore the natural resources inherent in the land and water; to restore health and density of the forest and to demonstrate environmentally sound management and the importance of conservation of the County's forestland; and to provide educational and passive recreational opportunities for the public, while preserving the site's ecological wildlife and water quality values.

This parcel was purchased in part by the use of Forest Legacy Funding and is subject to a conservation easement that does not allow new utility easements or rights-of-way to be located within the Property without Grantee's consent. All such utilities must be located underground (Blumen, 2002).

BPA has identified a preliminary corridor within which to locate Alternative C (Options C1 and C2) that avoids direct contact with the Taylor Mountain Forest.

5.7.3 King County

5.7.3.1 King County Countywide Planning Policies

See Section 5.5.5 for more information about King County Countywide Planning Policies. The protection and management of rural areas is a regional concern and major objective of the Planning Policies, including protection and accessibility of open space lands and corridors. The Planning Policies direct local jurisdictions to protect existing open space lands and identify potential new open space lands, particularly those that would provide linkages between existing local and regional recreation facilities and ecologically significant areas. The nine open space policies are directed to local governments and are, therefore, not directly relevant to the proposed project.

5.7.3.2 King County Comprehensive Plan

Chapter 10 of the Comprehensive Plan relates to parks, recreation, and open space. The chapter satisfies Goal 9 of the Growth Management Act to encourage the retention of open space and recreational areas. In rural areas such as the project site, the County serves a local role in the provision and management of parks and open space.

In recent years, there has been a shift toward regional parks and linked open space corridors along greenways and waterways.

DNR is working with King County and other agencies to establish a trail along the Cedar River Watershed's northern boundary. This trail would provide a link to the trails and parks in the region. All alternatives of the proposed transmission line that cross the Cedar River Watershed would intersect the proposed trail. While the County Comprehensive Plan objectives do not specifically mention this proposed trail, it would clearly fit into King County's objectives.

Alternatives B and D would affect the portion of the proposed trail that would continue east along I-90 up to National Forest managed lands.

5.7.3.3 King County Open Space Plan

The King County Open Space plan (King County, 1996) sets forth policies and plans for the development of a countywide system of parks and open space. Lands along the Cedar River from the outskirts of Renton to Landsburg Diversion Dam and Park are designated as an open space corridor system. The open space plan identifies plans to establish the Cedar River Trail. The Cedar River Trail, which runs from Renton to 276th Avenue SE, across from the Landsburg Diversion Dam and Park, has been constructed. The

trailhead is approximately 3.5 miles west of the project area. The proposed project would not impact the trail. The project would not impact Rattlesnake Mountain, a natural area where "development and use will focus on keeping the environment in a nearly undeveloped state...there may be little or limited public access to these areas."

5.7.3.4 Cedar River Trail Plan

The Cedar River Trail Plan, adopted by King County as part of the King County regional trails system, sets forth a program for a coordinated trail system from the mouth of the Cedar River at Lake Washington to the ridge crest north of the Cedar River Watershed boundaries. See comments in Section 5.7.3.3.

5.7.3.5 Peterson Lake Natural Area Site Management Plan

This 1999 Plan recognizes utility easement maintenance as a part of the current character of the site. Continued coordination with King County Department of Natural Resources Division should ensure continued compatibility between the electric transmission line along Alternative A and Peterson Lake Natural Area.

5.7.4 City of Seattle

5.7.4.1 Cedar River Watershed Habitat Conservation Plan

The Cedar River Watershed Habitat Conservation Plan (HCP) (City of Seattle, 2000) lists two purposes and function related to recreation activities. These are public education and public recreation, including the management and use of sites on Chester Morse Lake, at Cedar Falls, (the waterfalls), the Cedar Falls administrative complex, and Rattlesnake Lake; the construction, maintenance, and operation of the new watershed educational center at Rattlesnake Lake, and the maintenance of trails in old growth and other forested areas or areas near wetlands or streams, and certain established vistas and observation points.

The HCP does not include any goals or objectives for recreation sites or activities. Nothing in the plan relates directly to recreation resources within the project area. Chester Morse Lake, Cedar Falls, Rattlesnake Lake, and Landsburg Diversion Dam are all outside the project area. The HCP does establish that recreation is one use within the Cedar River Watershed.

5.8 Floodplain/Wetlands Assessment

In accordance with Department of Energy regulations on compliance with Floodplains/Wetlands environmental review requirements (10 CFR 1022.12), and Executive Orders 11988 and 11990, BPA has prepared the following assessment of the impacts of the alternatives on floodplains and wetlands. BPA published a notice of floodplain/wetlands involvement for this project in the Federal Register on March 28, 2000 and again on May 16, 2002.

5.8.1 Project Description

The need and purpose of the project are described in Chapter 1. Floodplain mapping by the Federal Emergency Management Agency has not been completed for the project area. However, FEMA has mapped the 100-year floodplain along the Cedar River a short distance downstream from the project area. Based on this mapping, it appears that the 100-year floodplain is limited to a narrow area along the active Cedar River channel. The Raging River is in moderately incised channels. As such, it does not have significant floodplains and flooding generally would not overtop the incised channels.

The floodplain of the South Fork of the Snoqualmie River in the vicinity of North Bend has been mapped by FEMA. Here the floodplain is also generally confined to a narrow area along the active channel. Geomorphic conditions and their effect on flooding in the mapped area appear similar to the river upstream of North Bend where Alternatives B and D cross the South Fork Snoqualmie River twice, so that flooding is unlikely to impact these crossings. The east ends of Alternatives B and D cross the Yakima River. No FEMA mapping has been conducted in this reach of the Yakima River Valley. However, the valley is generally broad and flat in this area, and several bog areas occur. These features would tend to indicate periodic flooding does occur where the Alternative B and D routes cross the Yakima River, resulting in potential impacts. Flooding in the Yakima River is controlled to a certain degree by operation of the Keechelus Lake Reservoir, which is about 4 miles upstream of the proposed river crossing.

Tributaries to the Cedar, Raging, South Fork Snoqualmie, and Yakima rivers are in moderately incised channels. Therefore, these streams do not have significant floodplains, and flooding generally would not overtop the incised channels. Towers and roads constructed in the vicinity of these stream channels should not affect or be affected by flooding.

Wetlands that would be affected by the alternatives were identified by three methods: Wetland Inventory Maps prepared by the USFWS for Washington; aerial photo interpretation; and field inspections, beginning with identifying wetland areas, followed by site-specific wetland delineations.

5.8.2 Floodplain/Wetlands Effects

Floodplain impacts are discussed in Chapter 4. Based on preliminary engineering design of the alternatives that cross the Cedar River Watershed, all floodplains would be spanned by the new line, avoiding placement of structures in floodplains. Where improvements need to be made on existing access roads through wetlands and floodplains, soil and vegetation would be disturbed. BPA would implement measures to reduce or avoid impacts where possible.

Upgrading existing access roads in floodplains and wetlands would not significantly increase the risk of flooding or flood damage.

Construction, operation, and maintenance of the proposed action is not expected to affect the long-term survival, quality, or natural and beneficial values of the wetlands involved. Activities in wetlands would be coordinated with King County.

5.8.3 Alternatives

Under Executive Orders 11988 and 11990, developments on floodplains and in wetlands are discouraged whenever there is a practical alternative. All action alternatives would design facilities to have low impacts on floodplains and wetlands as much as possible.

Alternatives C and D, which would be located in new right-of-way locations, would potentially have the most impact on wetlands and floodplains due to the need for new access roads. Where improvements need to be made on existing access roads through wetlands and floodplains, soil and vegetation would be disturbed. In some locations, particularly on the segment of Alternatives B and D that cross Mt. Baker-Snoqualmie National Forest, improvements to existing access roads could be extensive, which would affect the wetlands of this area in the short term, but improve their condition in the long term. BPA would implement measures to reduce or avoid impacts where possible.

5.8.4 Mitigation

Mitigation for site-specific impacts is discussed throughout Section 4.9, **Wetlands**. BPA would strive to avoid siting structures or access roads or the substation expansion in wetlands or floodplains. BPA has delineated all wetlands within the proposed right-of-way for

the preferred alternative and substation expansion to ensure full compliance with the Clean Water Act should these options be implemented. BPA would also work with the appropriate agencies to mitigate fully any actions that would alter the function of any wetlands.

5.9 Executive Order on Environmental Justice

➲ For Your Information

The Executive Order on Environmental Justice (Executive Order 12898) was enacted in February 1994 to ensure that federal agencies do not unfairly inflict environmental harm on economically disadvantaged and minority groups within the United States or any of its territories.

The alternatives would not adversely affect any minority or economically disadvantaged groups in the project area because they do not reside in the project area in large numbers, and are less than 5 percent of the total population. For these reasons, the alternatives would not violate the intent of the Executive Order on Environmental Justice.

5.10 Coastal Zone Management Consistency

The Coastal Zone Management Program is authorized by the Coastal Zone Management Act of 1972 and administered at the federal level by the National Oceanic and Atmospheric Administration's Office of Ocean and Coastal Resource Management, Coastal Programs Division. Management of the program is delegated to the states participating in the program. In Washington, the Department of Ecology (***WDOE***) administers the program. The Coastal Zone Management Act requires that federal development projects and activities directly affecting the coastal zone "*shall be conducted in a manner which is, to the maximum extent practicable, consistent with approved state management programs*" (Section 307(c)(1), (2)).

A Federal agency or applicant for a federal license, permit or financial assistance is responsible for determining whether the proposed activity may affect any natural resource, land use, or water use in Washington's coastal zone. Ecology will concur with a determination if the federal activity is consistent to the maximum extent practicable with the Washington Coastal Zone Management Plan. Consistency with the state program is described below.

5.10.1 Washington State Shoreline Management Act

This Act establishes a planning program and regulatory permit system initiated at the local level under state guidance. While Ecology is designated as the lead state agency, local governments exercise primary authority for implementing the Act. Each local government's planning program consists of a shoreline inventory and a "shoreline master program" (**SMP**) to regulate shoreline uses. Substantial development permits are needed for projects costing over $5,000 that directly affect

State shorelines (the amount increased to $5,000 on June 13, 2002). Applicable regulations contained in local SMPs are summarized below. BPA would contact the WDOE for certification of a consistency determination. WDOE also provides general program overview and support. The Shorelines Hearings Board is the appeal body for shoreline permit decisions.

5.10.2 King County Code, Title 25–Shoreline Management

Title 25–Shoreline Management–of the King County Code (King County, 1978) implements the state Shoreline Management Act and the County's Shoreline Master Program, which was adopted by ordinance in 1978. Title 25 (the "shoreline management code") provides for regulation of development that impacts those areas of King County under the jurisdiction of the Shoreline Management Act. In the project vicinity, it would apply to the Snoqualmie River, Cedar River, Raging River, and other streams with flows of more than 20 cubic feet per second (cfs) in the study area such as Carey and Holder Creeks, and their associated wetlands, together with the lands underlying them. All transmission alternatives would cross one or more of these "shorelines of the state," and therefore, must be consistent with the Washington Shoreline Management Act, the guidelines and regulations of WDOE, and the King County Shoreline Master Program. County jurisdiction extends 200 feet landward of ordinary high water of designated shorelines of the state.

Typically, King County requires substantial development permits for substantial development (defined in the Revised Code of Washington [RCW] 90.58.030) not exempted by RCW 90.58.140(9) and (10). The proposed project meets the definition of substantial development. However, as a federal agency, BPA is not required to obtain local permits. For King County to review the project and determine its consistency with the Shoreline Master Program, BPA would present its support for compliance with permit requirements to the County. The County can review for compliance with local regulations but this review alone does not determine federal act compliance. A request for compliance review by Ecology must be made by the County and BPA (Rankin, 2002).

BPA believes the proposed project does not meet the definition of substantial development, since no ground disturbing activities would take place within 200 feet of either the Cedar or Raging rivers. The conductors would merely cross the Cedar and Raging rivers, with considerable clearance.

BPA submitted a Consistency Determination for Washington's Coastal Zone Management Program to the Washington State Department of Ecology stating the proposed project was consistent to

the maximum extent practicable with Washington's approved coastal zone management program. On February 14, 2002 the Washington State Department of Ecology sent a letter concurring with BPA's determination that the Proposed Action is consistent to the maximum extent practicable with the enforceable policies of the Washington's Coastal Zone Management Program and will not result in any significant impacts to the State's coastal resources (see Appendix V).

5.10.3 Kittitas County Shoreline Master Program

The Shoreline Master program for Kittitas County, adopted March 5, 1975, regulates land uses impacting shorelines of the state in Kittitas County. Alternatives B and D (Options D1 and D2) pass near identified shorelines in Kittitas County, such as Lake Keechelus, Lost Lake, and the Yakima River. The facilities would only impact state shorelines if the towers or access roads would be located within 200 feet of them or their associated wetlands.

SMP regulations pertaining to utilities are listed in Section 37 and state that utilities, which unavoidably cross a body of water or pass through the environment, shall be permitted. Utility services in shoreline areas designated Natural and Conservancy Environments shall be permitted subject to the following regulations:

- *When alternatives exist, overhead utilities shall not parallel shorelines unless for the electrification of railroad lines.*
- *Where such utility systems cross shoreline areas, clearing necessary for the installation or maintenance shall be kept to the minimum necessary to prevent interference by trees and other vegetation with the proposed facilities.*
- *Upon Completion of installation of any underground or overhead system or of any maintenance project which disrupts the environment, the disturbed area shall be regraded to compatibility with the natural terrain and replanted to prevent erosion and provide an attractive vegetation cover which is harmonious with the surrounding area and the project requirements.*
- *When alternatives exist, utilities shall not obstruct parallel or destroy scenic views.*

All transmission alternatives considered would cross or parallel shorelines of the state. Regulations in both counties focus on minimizing impacts. Relative visual impacts of the various alternatives are discussed in Chapter 4. Minimizing grading and disturbance of existing vegetation is also required in both counties. This supports Alternative B, where existing rights-of-way would be used, over Alternative D (Options D1 and D2), where additional rights-of-way would need to be secured and new disturbances in areas previously undisturbed would occur.

5.10.4 Maple Valley Shoreline Master Program

Maple Valley is currently developing its own SMP. Until the city's SMP is adopted and takes affect, King County's SMP will continue to apply (Pennala, 2002).

5.10.5 Covington Shoreline Master Program

Covington has adopted King County's SMP as their own and applies the substantive provisions of the county regulations to reviews within the city limits (City of Covington, 2001).

5.11 Energy Conservation at Federal Facilities

The proposed changes at Echo Lake Substation would not require any new buildings. If changes take place at Covington Substation as a result of Alternative A, then any new buildings would need to comply with energy conservation guidelines.

5.12 Pollution Control at Federal Facilities

Several pollution control acts apply to this project:

Resource Conservation and Recovery Act (*RCRA*) – The Resource Conservation and Recovery Act, as amended, is designed to provide a program for managing and controlling hazardous waste by imposing requirements on generators and transporters of this waste, and on owners and operators of treatment, storage, and disposal (*TSD*) facilities. Each TSD facility owner or operator is required to have a permit issued by EPA or the state. Typical construction and maintenance activities in BPA's experience have generated small amounts of these hazardous wastes: solvents, pesticides, paint products, motor and lubricating oils, and cleaners. Small amounts of hazardous wastes may be generated by the project. These materials would be disposed of according to state law and RCRA.

Toxic Substances Control Act – This Act is intended to protect human health and the environment from toxic chemicals. Section 6 of the Act regulates the use, storage, and disposal of PCBs.

BPA adopted guidelines to ensure that PCBs are not introduced into the environment. No equipment proposed in any of the alternatives would contain PCBs.

Federal Insecticide, Fungicide and Rodenticide Act (*FIFRA*) – This Act registers and regulates pesticides. BPA uses herbicides only under controlled circumstances. Herbicides are used on transmission line rights-of-way and in substation yards to control vegetation, including noxious weeds.

When BPA uses herbicides, the date, dose, and chemical used is recorded and reported to state government officials. Herbicide containers are disposed of according to RCRA standards.

Herbicides would not be used in the Cedar River Watershed.

5.13 Noise Control Act

The Federal Noise Control Act of 1972 (42 U.S.C. 4903) requires that federal entities, such as BPA, comply with state and local noise requirements.

The calculated median level (L_{50}) during foul weather at the edge of the proposed right-of-way is about 50 dBA, which is comparable with levels at the edges of existing 500-kV lines in Washington and lower than the levels from the existing Raver-Echo Lake line in the same corridor. The proposed line would increase the level at the edge of the existing lines by about 1 dB for the 500-kV line and by about 23 dBA for the 115-kV line. This increase at the edge of 500-kV line would not be discernible. During fair-weather conditions, which occur about 81 percent of the time, audible noise levels would be about 20 dBA lower (if corona were present). These lower levels could be masked by ambient noise on and off the right-of-way.

The 50-dBA level would meet Washington Administrative Code limits for transmission lines. It would not meet the requirements of the King County Code for sound from an industrial area into a rural area. Noise levels near the existing Echo Lake-Raver 500-kV line exceed the limits of these jurisdictions. The incremental noise contributed by the proposed line to this existing source would only be about 1 dBA at the edge of the proposed right-of-way and beyond, and would not be discernible.

5.14 Emission Permits under the Clean Air Act

The Federal Clean Air Act as revised in 1990 (PL 101-542, 42 USC 7401) requires the EPA and states to carry out programs intended to assure attainment of the National Ambient Air Quality Standards. In Washington, EPA has delegated authority to the Department of Ecology.

Section 160 of the Clean Air Act requires the protection, preservation or enhancement of air quality in national parks, wilderness areas and monuments. There are no national parks, wilderness areas or monuments in the project area.

General Conformity Rule — 40 CFR Part 51, subpart W, 40 CFR Part 93 subpart B, and 40 CFR section 6.303 assures that federal actions do not interfere with state implementation plans to improve air

quality in non-attainment areas. This project would not interfere with the state implementation plan. Emissions would be temporary.

5.15 Discharge Permits under the Clean Water Act

The Clean Water Act (***CWA***) regulates discharges into waters of the United States.

Section 401 - 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 United States, including wetlands, is issued only after the affected state certifies that existing water quality standards would not be violated if the permit were issued. The Washington Department of Ecology would review permits for compliance with state water quality standards.

Section 402 - This section authorizes discharges of stormwater associated with industrial activities to waters of the United States, under the National Pollutant Discharge Elimination System (**NPDES**) permitting program. For federal facilities in the state of Washington, the U.S. Environmental Protection agency (**EPA**) is the enforcement and permitting authority. Permit requirements are triggered when the proposed construction disturbs a threshold of five or more acres of land (decreasing to 1 acre March 2003), and there will be a discharge of stormwater. Construction activities covered under the permit include: clearing, grading, excavating, demolition, and road building.

BPA would comply with the appropriate conditions for this project, such as filing a Notice of Intent (**NOI**) for coverage under the Federal NPDES General Permit, preparing and implementing a site-specific Stormwater Pollution Prevention (**SWPP**) plan for the project, and filing a Notice of Termination (**NOT**) once construction has ceased and all sites are stabilized. The SWPP plan addresses methods to prevent erosion and movement of sediment and ensure that non-point source pollution does not contaminate the water of the U.S., both during and after construction.

The EPA General Permit also requires that BPA construction projects comply with water quality standards set by the State in the Washington Administrative Code (**WAC**):

Surface Water Quality Standards	WAC Chapter 173-201
Sediment Management Standards	WAC Chapter 173-204
Ground Water Standards	WAC Chapter 173-200

In preparing the SWPP plan, BPA using topographic/geologic, soil, water resource, and endangered species information, identifies sensitive areas, environmental resources, and the construction activities that would impact them. These areas, resources, and known construction activities are combined in a linear construction Mitigation Action Table (**MAT**).

Based on the resource and impact erosion and sediment control "typical" Best Management Practices are developed, and site-specific erosion and sediment control plans (**ESC Plans)** will be developed. Additionally, requirements for installing, inspecting, and maintaining the BMPs as well as water quality monitoring requirements, are included in the plan.

The SWPP plan includes a Spill Prevention, Control and Countermeasure (**SPCC**) plan to address petroleum and hazardous materials handling, management procedures, and emergency response for this project.

In advance of any ground disturbing or construction activities at a specific site, BPA will install the appropriate BMPs. Throughout construction the BMPs will be regularly inspected to ensure they are performing properly and repair or modify the BMPs that are not working. As construction activities at a site are complete, BMPs for permanent stabilization are put into place. Inspections and maintenance will continue on all BMPs until all sites are stabilized as required by the EPA permit. Procedures in the SPCC Plan include preventative and mitigation measures. The water monitoring will record water quality on a regular basis and notify BPA if any major changes are noted. Records of all the activity are maintained at the project site in the SWPP Plan Notebooks.

Section 404 — Authorization from the U.S. Army Corps of Engineers is required in accordance with the provisions of Section 404 of the CWA when there is a discharge of dredged or fill material into waters of the U.S., including wetlands. This includes excavation activities that result in the discharge of dredged material that could destroy or degrade waters of the U.S.

No water crossing culverts need to be replaced or installed for the construction of the Proposed Action. BPA is pursuing permits for replacing three existing culverts to allow for fish passage. If successful in obtaining the necessary permits, BPA would replace these culverts at an appropriate time to allow for the least disturbance to fish and their habitat. Chapter 2 identifies culverts that would likely be replaced after transmission line construction has been completed:

Some existing culverts that are crushed may be replaced where roads approach another road. These culverts are not in wetlands or waters but in ditches that drain water away from access roads. These culverts are all north of the Cedar River Watershed.

New road approach and cross drain culverts may be used throughout this project to improve water movement across roads and allow access to tower sites.

Should water crossing culverts be identified as needed for the construction of this transmission line, all appropriate permits would be obtained prior to any installation.

5.16 Safe Drinking Water Act

The Safe Drinking Water Act (42 U.S.C. sec 300f et. seq.) (SDWA) is designed to protect the quality of public drinking water and its sources. SDWA was adopted in 1974. EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards.

In 1996, Congress amended the Safe Drinking Water Act to address 1) consumer confidence reports, 2) cost-benefit analysis, 3) water system infrastructure assistance through a multi-billion-dollar state revolving loan fund, 4) microbial contaminants and disinfection byproducts, 5) operator certification, 6) public information and consultation, 7) small water systems, and 8) source water assessment programs. In particular, the SDWA amendments require stricter limits on surface water contaminants, such as giardia, cryptosporidium and colliform bacteria.

The Cedar River Watershed is a Group A water source and is regulated under the SDWA and the Washington Administrative Code (WAC) 246-290 Public Water Systems. The WAC code has provisions for planning and operation, design, water quality maintenance, water system operations, surface water treatment, and reporting. A Group A water source is defined by the WAC as "Group A water system providing service to fifteen or more service connections used by year-round residents for one hundred eighty or more days within a calendar year, regardless of the number of people, or regularly serving at least twenty-five year-round (i.e., more than one hundred eighty days per year) residents." The WAC also defines a Group A water source: "A Group A system shall be defined as a public water system providing service such that it meets the definition of a public water system provided in the 1996 amendments to the federal Safe Drinking Water Act (Public Law 104-182, Section 101, subsection b)."

SPU is required under the state Safe Drinking Water Act to prepare a Watershed Control Program for the Cedar River Watershed. These plans are then approved and/or further conditioned by the Washington State Department of Health (**DOH**) to ensure the water purveyor (SPU) meets the appropriate public drinking water standards. The current Watershed Control Plan does not specifically address the

currently proposed BPA project. If BPA decides to construct the Proposed Action, and SPU intends for the Cedar River Watershed to retain its status as an unfiltered public drinking water supply, SPU will have to amend its Watershed Control Plan to address the proposed project and ensure that potential impacts to the drinking water supply have been mitigated sufficiently to protect the public's health. An important issue will be for SPU to demonstrate that they still have sufficient control over activities within the Watershed to prevent contamination of the water supply. Ideally, this amendment to the Watershed Control Plan would be approved by the DOH prior to project construction, but since the amendment process must be initiated by SPU, they would control the timing of the amendment. Similar Watershed Control Plans have been prepared by SPU and by Seattle City Light for construction projects within the Cedar River Watershed.

BPA would comply with state and local public drinking water regulations. None of the transmission alternatives would affect critical aquifers or adversely affect any surface or groundwater water supplies.

5.17 Permits from the Army Corps of Engineers

The U.S. Army Corps of Engineers administers several permit programs, of which Section 404 of the Clean Water Act would apply. Section 404 is described in Section 5.16.

The Corps' authorization is also required under Section 10 of the Rivers and Harbors Act for work or placement of structures below the ordinary high water mark of, or affecting, navigable waters of the U.S. None of the alternatives cross Section 10 navigable waters, so no Section 10 authorization would be required.

5.18 Notice to the Federal Aviation Administration

As part of transmission line design, BPA seeks to comply with Federal Aviation Administration (***FAA***) procedures. Final locations of structures, structure types, and structure heights are submitted to FAA for the project. The information includes identifying structures taller than 200 feet above ground, and listing all structures within prescribed distances of airports listed in the FAA airport directory. BPA also assists the FAA in field review of the project by identifying structure locations. The FAA then conducts its own study of the project, and makes recommendations to BPA for airway marking and lighting. General BPA policy is to follow FAA recommendations.

5.19 Transportation

Washington State Department of Transportation Plan Compliance — Any franchise permits for the I-90 crossings or utility crossing permits on state highways that are triggered by the Proposed Action would be sought by BPA.

Local Jurisdictions — King County has no permitting requirements, however a traffic control plan would be developed in cooperation with King County and other local jurisdictions to identify plans for staging construction and controlling traffic.

5.20 Treaty Rights and Trust Responsibility

Portions of the project area have been and continue to be used traditionally by Indian tribes. To learn about potential effects on traditional cultural properties as well as other concerns of the tribes, BPA conducted a series of meetings and corresponded with potentially affected Indian tribes (Muckleshoot, Snoqualmie and Sauk-Suiattle tribes). BPA's project cultural resources contractor, Historical Research Associates (**HRA**), conducted oral history interviews with the Muckleshoot Tribe. Appendix W contains a consultation record with tribal organizations. BPA also provided copies of the Draft EIS, Draft Cultural Resource Technical Report and Preliminary Supplemental DEIS to these three tribes for their review and comment. Additionally, BPA provided these tribes with the proposed locations of the transmission towers and access roads within the Cedar River Municipal Watershed and offered them the opportunity to recommend that these facilities be relocated along the proposed centerline, with certain restrictions e.g., angle points would not change and facilities would remain in uplands. No changes were recommended.

Some of the activities BPA initiated were tribal scoping meetings on November 28, 2000 in North Bend Washington, inviting the Colville Confederated tribes, the Duwamish Tribe, the Muckleshoot Tribe, the Sauk-Suiattle Tribe, the Suquamish Tribe, the Tulalip Tribes, the Upper Skagit Tribe and the Yakama Nation. Representatives of the Muckleshoot and Snoqualmie tribes attended the meeting and voiced their concerns about the effect the project could have on TCPs in the area. BPA subsequently held a meeting with the Muckleshoot Tribe's Cultural Committee on January 17, 2001 in Enumclaw, Washington. BPA representatives explained the purpose and need of the transmission line project and responded to the Committee's questions. Committee representatives stated their concerns about impacts to sensitive ecological settings, endangered flora and fauna of the region, the proliferation of noxious weeds, the use of resources generated by the clearing of the proposed corridor, and the presence of cultural resources in the project area.

On January 31, 2001, BPA held a scoping meeting in Darington, Washington with the Sauk-Suiattle Tribe to explain the purpose and need for the project and to listen to comments and to hear concerns from interested tribal representatives. A number of tribal members, including the Council Chair, attended the meeting and voiced concern about impacts to culturally significant flora and fauna of the region, and to possible culturally modified trees (CMTs) in the project area.

Muckleshoot Tribal Cultural Committee members attended a tour of a portion of the project area, i.e., within the Cedar River Municipal Watershed, on February 5, 2001. Tribal members expressed concern about the effects of the additional power line on wildlife and native plants, and the spread of noxious weeds along the transmission line corridor. In addition, Committee representatives were interested in the collection of cedar bark and red alder saplings from the proposed right-of-way.

On May 8, 2001 BPA representatives met in Enumclaw, Washington with members of the Muckleshoot Tribe's Cultural Committee to continue tribal consultation and clarify concerns the committee might have about the project. It was agreed that a cultural monitor would join HRA during the cultural resource survey. To discuss similar topics, BPA met with the Cultural Program Director of the Snoqualmie Tribe on May 23, 2001 in Carnation, Washington. BPA representatives provided an update on the project and planned cultural resource survey. It was agreed that the Snoqualmie Tribe would provide a monitor to join the HRA crew in the field.

On October 22, 2001 in Enumclaw, Washington, BPA representatives met with members of the Muckleshoot Tribe's Cultural Committee. Participants discussed proposed tower sites, construction issues and the draft Cultural Resource Technical Report. BPA again met with the Cultural Committee on April 1, 2002 in Enumclaw. Participants discussed the proposed project, construction concerns, an ethnohistory study, impacts to plants and animal resources and management of vegetation on BPA rights-of-way.

To discuss the study of four additional alternatives routes for the supplemental draft EIS, BPA project staff met with representatives of the Muckleshoot Tribe's Cultural Committee on July 29, 2002 and with the Snoqualmie Tribe on July 30. BPA representatives asked the tribes for their concerns about the new alternatives and if they would impact any TCPs. In meeting with the Snoqualmie Tribe, BPA learned that the I-90 corridor was a travel corridor for many tribes and that tribal staff wanted to have its own monitors on-site during construction.

Issues identified in the Muckleshoot meeting included the concerns about how long each alternative could serve the area before more transmission lines would be needed and who would benefit from new development. Committee representatives suggested that BPA should consider double circuiting across the Raging River in addition to the Cedar River. They recommended that the transmission lines should avoid populated areas to minimize impacts from EMF (electromagnetic fields).

The Muckelshoot representatives discussed access to the right-of-way on private land. They recommended that BPA provide leadership in noxious weed control, discuss the control program for CRW in the SDEIS, look at the entire area, and restore habitat that has been removed. The representatives recommended that BPA contact the tribal fisheries department for new data on unclassified streams and conduct mitigation for fish in the same watershed where fish are affected. The tribe believes that state road standards are not adequate because juvenile migrants cannot pass culverts, and that the SDEIS should specify best management practices that should be used. Trees should be left in streams for wood recruitment. The tribe expressed a desire to participate in the meeting with the National Marine Fisheries Service, should consultation be reinitiated.

Representatives recommended that BPA include cultural resource information on the alternatives in the SDEIS. They expressed concern about the level of NHPA work for other alternatives and recommended that BPA review other reports prepared recently including for the I-90 corridor study. They requested that BPA place educational signs along the right-of-way about how the tribe has traditionally used the land. The tribe requested early review and comment on the SDEIS.

In conclusion, BPA has completed background research and intensive surveys of coverage of the transmission line area of potential affect. Much of the route crosses the CRW, where subsurface survey coverage was particularly thorough, following the requirements of SPU's draft Cultural Resource Management Plan. Although two cultural resource sites were identified during the surveys, HRA recommends that both are ineligible for listing on the National Register and that no further research or protective measures be necessary. Although the proposed project crosses the Cedar River Watershed Cultural Landscape, which is likely eligible for listing in the National Register of Historic Places, no adverse effect is anticipated.

Ethnographic research, several meetings with tribal representatives, tribal review of the DEIS, and draft Cultural Resource Technical Report, and interviews with some Muckleshoot tribal elders revealed no TCPs that would be affected by the project. The potential for project impacts on TCPs is limited by the existence of a transmission line along the same route and because forest trees flanking the route would likely screen

views of the proposed transmission line, and result in slight incremental visual and auditory impacts.

In the event of modifications to the proposed route due to unforeseen construction constraints, BPA will arrange for an archaeologist and/or historian to perform record and file searches, and if necessary, survey new locations prior to surface disturbance. The Washington SHPO and concerned Indian tribe(s) will be consulted prior to implementation of any project modifications. BPA also will arrange for archaeological monitoring of construction ground-disturbing activities, following the procedures of the project's archaeological monitoring and unanticipated discovery plan (see Appendix X).

Chapter 6 — EIS Preparers

CATHERINE M. BIALAS, Research Archaeologist, Historical Research Associates. Responsible for completing cultural resource surveys for the preferred alternative. Education: B.A. Anthropology. Experience: Four years of professional experience in cultural resource management and archaeology in Washington and Oregon.

BONNIE BLESSING, Aquatic and Wildlife Biologist, Jones & Stokes. Responsible for assisting with the research necessary to complete the Fisheries Technical Study Report such as aerial photo interpretation and stream gradient analysis. Education: B.S. Microbiology and Immunology. Experience: Six years of experience in wetland and stream surveys, habitat assessment, field surveys for fish and wildlife, and watershed and wetland rehabilitation.

KATHLEEN CONCANNON, Writer/editor and Assistant Environmental Coordinator, Concannon Creative Services. Responsible for writing and editing the EIS, and assisting the environmental lead with project coordination activities. Education: B.S. Earth Sciences. Experience: Environmental analysis, resource planning and NEPA review. With BPA from 1979 to 1990, providing contract services to the agency since that time.

GIGI COOPER, Planner, David Evans & Associates. Responsible for introduction, and proposed action sections of Land Use Technical Study Report, and the affected environment and impacts assessment of the Recreation and Aesthetics Technical Study reports. Education: B.A. Oriental Studies/Political Science. Experience: Land use and transportation planning. With DEA since 1995.

DOROTHY DEVANEY, Environmental and Land Use Planner. Experience: Land use projection and planning; National Environmental Policy Act (NEPA) review; energy facility impact analysis. Education: B.S. Landscape Architecture. With CH2MHill since 2001

TRENT DEBOER, Research Archaeologist, Historical Research Associates. Responsible for preparation of the draft Cultural Resource Sensitivity Report. Education: B.A. Anthropology, M.A. Anthropology. Experience: Six years of professional experience in cultural resource management in Washington, Oregon, Alaska, Arkansas and Wisconsin.

LAURENS DRIESSEN, Project Manager. Responsible for project management of transmission line portion of the project. Education: B.S. Civil Engineering. Experience: Facility siting and project management. With BPA since 1969.

CHRISTOPHER EARLE, Fisheries and Aquatic Biologist, Jones & Stokes. Responsible for conducting a field reconnaissance survey; agency coordination and regulatory review; preparation of the affected environment, impacts, mitigation and regulatory compliance evaluation and preparation of the biological assessment. Education: Ph D., Forest Ecology, University of Washington, 1993. Experience: 14 years of experience in watershed analysis and terrestrial/aquatic ecosystem interactions.

LINDA S. ERDREICH, Managing Scientist in the Health Group at Exponent. Responsible for providing assessment of research regarding EMF (electric and magnetic field) and health. Education: PhD. in Epidemiology and M.S. in Biostatistics and Epidemiology. Experience: Both in government and private industry, Dr. Erdreich has provided rigorous evaluations of the impact on public health and occupational health of a variety of chemicals, therapeutic drugs, and physical agents, including electric and magnetic fields. Currently serving as an Adjunct Associate Professor at the University of Medicine and Dentistry of New Jersey.

JILL M. GASTON, Realty Specialist for BPA's Snohomish Region: Responsible for real estate activities associated with BPA rights-of-way in the Snohomish region. Three years experience with land issues with BPA, and two years experience in the private sector. With BPA as a realty specialist and contracting officer since 1990.

JOHN GLEASON, Senior Environmental Attorney. Responsible for legal sufficiency review. Education: B.S. Sociology. Masters of Education in Recreation Therapy. J.D. in law. Experience: Eleven years experience working for the federal government in environmental law. Prior to BPA worked for U.S. Army Corps of Engineers as Senior Environmental Attorney. Experience with National Environmental Policy Act, Clean Water Act, Endangered Species Act, Coastal Zone Management Act, and National Historical Preservation Act.

FRANK GROZNIK, Landscape Architect, David Evans and Associates. Responsible for Aesthetics and Recreation Technical Study report review. Education: B.S. Landscape Architecture. M.A. Regional Planning. Experience: Aesthetic resource evaluation and visual analysis. With DEA since 1999.

JOHN HOEY, Socioeconomic Analysis. Experience: Environmental impact assessment and land use planning. Education: B.A. in Government, M.A. in Urban and Environmental Policy. With CH2M Hill since 1998.

DAVID JOHNSON, Wetland Biologist, Jones & Stokes. Responsible for assisting with the Wetland Technical Study Report. Education: B.S.

Biology. Experience: Two years of experience in wetland surveys, delineation and mitigation and regulatory compliance and permitting.

DANIAL JONES, Vegetation and Wetlands Biologist, Jones & Stokes. Responsible for: conducting a field reconnaissance survey, agency coordination and participating in the preparation of the affected environment, impacts and mitigation sections of the Wetlands Technical Study Report. Education: M.S. Biology. Experience: Thirteen years of experience in plant taxonomy, fungal taxonomy, vegetation sampling methodology and wetland delineation.

LEIGH KIENKER, CAD/S/Specialist, Jones & Stokes. Responsible for providing GIS assistance. Education: Masters in Urban Planning. Experience: Thirteen years of experience in the CAD/GIS and photogrammetry industries.

MATHEW KILMARTIN, Landscape Designer, David Evans and Associates. Responsible for assistance on affected environment and impacts assessment on Aesthetics Technical Study Report. Education: B.S. Landscape Architecture. Experience: Visual simulations and landscape architecture. With DEA since 1996.

BILL KITTO, Project Manager. Experience: Management of numerous conservation and renewable energy projects; expertise in engineering and environmental aspects of high voltage transmission lines; EIS preparation and review. Education: B.S. Biology, M.B.A. With CH2M Hill since 2001.KYLE KOHNE, Electrical Engineer. Responsible for technical network planning studies. Education: B.S. Electrical Engineering. Experience: Electrical transmission grid planning. With BPA since 1991.

MIKE KREIPE, Process Manager, Network Planning. Responsible for technical system planning studies. Education: B.S. Electrical Engineering. Experience: Electrical transmission grid planning. With BPA since 1968.

LINDA KRUGEL, AICP, Planning Consultant, Krugel and Associates. Responsible for public involvement on the DEIS. Education: B.S. Related arts, Masters degree in City Planning, Masters degree in Public Administration. Experience: Policy development and public involvement. Contractor to BPA since 1984.

JEFFREY LAIRD, C.E.G. Principal Engineering Geologist, Shannon & Wilson, Inc. Responsible for field studies, geologic analysis, and report preparation. Education: B.S. Geology; M.S. Geomorphology. Experience: 14 years of professional experience in geologic field mapping, erosion and sedimentation, and fluvial geomorphology and slope stability. With Shannon & Wilson since 1987.

WILLIAM T. LAPRADE, C.E.G., Engineering Geologist, Vice President, Shannon & Wilson Inc. Responsible for geology and engineering geology review. Education: B.A. and M.A. Geography; B.S. Geological Sciences. Experience: Engineering geology including landslides, tunnels, foundations, dams and pipeline and roadway alignments. With Shannon & Wilson since 1973.

GENE LYNARD, Environmental Specialist, Project Environmental Lead. Responsible for providing environmental clearance on proposed action. Education: B.A. Geography, MCRP, City and Regional Planning. Experience: Twenty years experience in environmental planning and real estate development economics in private and public sectors. With BPA as a contractor and employee since 1984.

LIZ MALLIRIS, Writer/editor and communications consultant, Words by Malliris. Responsible for writing and editing support for the EIS. Education: B.A. Journalism. Experience: Sixteen years writing about electric utility and energy-related issues. Contractor to BPA since 2001.

KRISTINA MCKENZIE, Planner, David Evans and Associates. Responsible for affected environment and impact assessment for land use and environmental consultation, review, and permit sections of the Land Use and Transportation Technical Study Report, and quality review of the Socioeconomics, Recreation, and Aesthetics Technical Study Reports. Education: B.A. Communications. Master of Urban and Regional Planning. Experience: Land use, transportation, and environmental planning. With DEA since 1990.

JUDITH H. MONTGOMERY, Principal of Judith Montgomery/ Communications. Responsible for technical editing of the Electrical Effects Report. Education: A.B. in English literature and a PhD. in American literature. Experience: Dr. Montgomery has provided writing, editing, and communications services to government and industry for twenty years. Her experience includes preparation of National Environmental Policy Act documents and technical papers dealing with transmission line environmental impact assessments and other utility-related activities.

DARRIN MORGAN, Socioeconomic Analysis. Experience: Financial and economic cost-benefit analysis on infrastructure projects. Education: B.A. in Finance. With CH2M Hill since 2002.

JON NOTTAGE, Environmental Planner. Experience: Energy facility research and analysis, land use and environmental planning research and fieldwork. Education: B.S. Biology, M.B.A. With CH2M Hill since 2001.

STEVE PERONE, GIS Analyst. Experience: Geographic information system application development and analysis, including enterprise-wide

spatial database design and implementation. Education: B.S., Business Administration. With CH2M Hill since 2000.

DAN PITZLER, Senior Economist. Experience: Social and economic analysis of infrastructure projects. Education: M.A. in Economics. With CH2M Hill since 1985.

GREG POREMBA, Project Manager, Jones & Stokes. Responsible for overseeing field reconnaissance surveys and preparation of the vegetation, wetlands, and fisheries analyses, and biological assessment. Education: B.A. Sociology, M.A. Sociology, and Ph.D., Sociology. Twenty years experience in undertaking socioeconomic, land use, recreation and aesthetic impact assessments and project management.

THOMAS PRIESTLEY, B.U.P in Urban Planning, M.C.P. in City and Regional Planning; M.I.A in Environmental Planning; Ph.D in Environmental Planning. Experience: land use projections and planning; research on transmission line design and siting issues and perception and property value effects; and environmental impact assessments of transmission line, substation, hydroelectric and thermal power plants and other projects. With CH2M Hill since 2001.

BRUCE M. REYNOLDS, R.P.G., Project Geologist, Shannon & Wilson. Responsible for field studies and geologic analysis. Education: B.S. Geology. Experience: Nineteen years of professional experience in geologic field mapping, subsurface explorations, and construction of slope stabilization measures. With Shannon & Wilson since 1981.

SCOTT RICHMAN, Planner and Project Manager, David Evans & Associates. Responsible for affected environment and impacts assessment of transportation section of the Land Use and Transportation Technical Study Report, the affected environment and impacts assessment of the Socioeconomic Technical Study Report and review of the Recreation Technical Study Report. Education: B.S. Environmental Design. Experience: Transportation/land use relationships, highway, bicycle and transit planning, traffic and environmental analysis. With DEA since 1999.

CHRISTOPHER ROBINSON, PE, C.E.G. Geotechnical Engineer, Project Manager, Shannon & Wilson. Responsible for geotechnical engineering and project management. Education: B.S. and M.S. Geology; M.S. Civil Engineering. Experience: Nineteen years experience in geotechnical engineering, hydrology, slope stability, and seismic geotechnical engineering. With Shannon & Wilson since 1995.

DON ROSE, Environmental Protection Specialist. Responsible for Alternatives B and D analysis, coordination with U.S. Forest Service, and document editing. Education: B.S. Forest Management. Experience: Twenty-one years experience in silviculture, forest

management, and environmental analysis. Nineteen years with U.S. Forest Service in Oregon and Washington. BPA employee since May 2001.

LEROY SANCHEZ, Visual Information Specialist. Responsible for graphic design. Education: Graphics Design, University of Nevada, Las Vegas 1970-1973. Portland State University 1983-1985. Experience: EIS graphics coordination, cartographic technical studies. With BPA since 1978.

STEPHANIE SIMEK, Assistant Project Manager and Wildlife Biologist, Jones & Stokes. Responsible for conducting field reconnaissance surveys, evaluating applicable regulatory compliance issues and preparation of the affected environment, impacts, mitigation and regulatory compliance sections of the fisheries, wildlife, wetlands and vegetation technical study reports. Education: M.S. Environmental and Forest Biology. Experience: Six years experience specializing in wildlife and forest biology, population ecology and assessment, and classification of wildlife habitat and resources.

PHIL SMITH, GIS Specialist, and Soil Scientist. Responsible for assisting project lead with wetland review. Education: BS Agronomy, M.S. Soil Science. Experience: Soils and agriculture analysis. Contractor to BPA since 1981. BPA employee since April 2001.

LARRY STADLER, PE, Electrical Engineer. Responsible for technical network planning studies. Education: BS Electrical Engineering. Experience: Electrical transmission grid planning. With BPA since1990.

RICHARD STEARNS, Electrical Engineer. Responsible for engineering aspects of public health and safety data. Education: B.S. Electrical Engineering, M.S. Electrical Engineering. Experience: Transmission line design issues related to corona and electrical field effects. With BPA since 1978.

MICHAEL STEPHAN, Visualization Specialist, CAE technician, Experience: Computer-generated and computer-enhanced imagery for simulations of visual resources and analysis of visual impact and quality of transmission lines. Education: A.S. in Engineering Drafting Technology. With CH2M Hill since 1991.

KATHY STEPHENSON, Forester. Responsible for all clearing aspects and timber appraissal associated with the proposed project. Education: B.S. Forest Management. Experience: Timber cruising, timber appraissal, danger tree identification, developing clearing contract specifications. With BPA since 1991.

JOHN STUTESMAN, Senior Planner, David Evans & Associates. Responsible for review of Land Use, Aesthetics and Socioeconomic

Technical Study reports. Education: B.A. Anthropology. Masters of Urban and Regional Planning. Experience: Transportation, land use and environmental planning. With DEA since 1995.

THUY TU, E.I.T., Engineer-in-training, David Evans & Associates. Responsible for transportation affected environment and impacts section of Land Use and Transportation Technical Study Report. Education: B.S. Civil Engineering. Experience: Transportation/land use relationship; transportation planning and traffic analysis. With DEA since 1998.

SEAN ROBERTSON, CADS/GIS Specialist, Jones & Stokes. Responsible for providing GIS support. Education: BS, Environmental and Resource Sciences, University of California, at Davis, 1999. Experience: Two years of experience in GIS mapping and evaluations.

JOHN SODEN, Wetland Biologist, Jones & Stokes. Responsible for conducting a field reconnaissance survey, agency coordination, regulatory review, preparation of the affected environment, impacts, mitigation sections of Wetlands Technical Study Report. Education: M.S. Forestry. Experience: Five years experience in wetland delineation and assessment of aquatic resources, resource inventory and classification, riparian and wetland research, and permitting assistance.

STEPHANIE SIMEK, Assistant Project Manager and Wildlife Biologist, Jones & Stokes. Responsible for conducting a field reconnaissance survey, agency coordination and preparation of the affected environment, impacts and mitigation sections of the Fisheries and Wetlands Technical Study Reports. Education: M.S. Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry. Experience: Six years of experience specializing in wildlife and forest biology, population ecology, and assessment and classification of wildlife habitat and resources.

HEIDE TATE, Wildlife Biologist, Jones & Stokes. Responsible for: conducting a field reconnaissance survey, agency coordination, regulatory review and preparation of the affected environment, impacts, mitigation and regulatory compliance sections of the Wildlife Technical Study Report. Education: B.S. Wildlife Biology. Experience: Nine years of experience in natural resource management threatened and endangered species, and preparing biological assessments.

GAIL THOMPSON, Senior Associate Archaeologist, Vice President, Principal and General Manager of the Seattle Office of Historical Research Associates. Expertise: Project management, cultural resources management, Native American issues, hazardous waste assessments. Affiliations: University of Washington Department of Anthropology

(Affiliate Assistant Professor) and the Society for American Archaeology. Twenty years of experience in cultural resources planning. Has conducted and supervised studies in archaeology, history, and Native American issues for numerous projects throughout the western states and Alaska. Responsibilities have included client and agency coordination, personnel supervision, budget and schedule preparation and tracking, background research, field survey and excavation, laboratory analysis and report preparations.

IVY TYSON, Mechanical Engineer, Project Engineer. Responsible for transmission line engineering including line siting, tower spotting, tower siting and conductor sagging. Education: B.S., Mechanical Engineering. Experience: six years experience of facilities engineering, four years of transmission line design engineering and project management. With BPA since 1990.

T. DAN BRACKEN, Principal, T. Dan Bracken Inc. Responsible for preparing electrical effects of proposed action, and alternatives. Education: B.S. in Physics, and M.S. and PhD degrees in physics. Experience: Twenty-seven years experience undertaking research on and characterization of electric and magnetic field effects from transmission lines.

DOUGLAS WITTREN, GIS Analyst, National Systems Research Institute. Responsible for providing geographic coordination, spatial analysis and cartographic support. Education: B.S. Earth Sciences, M/S. Geography. Experience: With BPA as an on-site contractor since 1992.

MARIAN WOLCOTT, Realty Specialist. Responsible for property value analysis. Education: B.S. Forest Management. Experience: Forestry appraisal and Land Branch project coordination. With BPA as a contractor and employee since 1985.

Chapter 7 List of Agencies, Organizations, and Persons Sent the EIS

The project mailing list contains about 7,500 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 this SDEIS and the Final EIS.

FEDERAL AGENCIES

Bonneville Power Administration

Bureau of Indian Affairs

Corps of Engineers

Environmental Protection Agency

Fish and Wildlife Service

Forest Service

National Marine Fisheries Service

TRIBES OR TRIBAL GROUPS

Colville Confederated Tribes

Duwamish Tribe

Kalispel Tribe

Muckelshoot Tribe

Puyallup Tribe

Sauk Suiattle Tribe

Snoqualmie Tribe

Stillaquamish Tribe

Suquamish Tribe

Swinomish Tribe

Tulalip Tribe

Upper Skagit Tribe

Yakama Nation

STATE AGENCIES, WASHINGTON

Department of Fish and Wildlife

Department of Natural Resources

Department of Ecology

Parks and Recreation Commission

PUBLIC OFFICIALS, WASHINGTON

Federal Congressional

US House of Representatives, Jennifer B Dunn

US Senate, Maria Cantwell

US Senate, Patty Murray

Governor

Gary Locke

State Senator and Representatives

Dino Rossi

Brian Thomas

Cheryl A Pflug

Glenn Anderson

Pam Roach

LOCAL GOVERNMENTS, WASHINGTON

City of Bellevue

Bothell

Duvall

Edmonds

Kent

Kirkland

Maple Valley

Mercer Island

North Bend

Redmond

Renton

Seattle

Tukwila

County of King

County of Kittitas

SPECIAL DISTRICTS

Bryn Mawr Lakeridge Water and Sewer

Cedar River Water and Sewer

Cedar River Watershed Council

Coal Creek Utility District

Highline Water District

King Conservation District

King County Water District No. 119 Perry Astrid

King Conservation District No. 125 Russ Austin

King Conservation District No. 20 Ron Malaspino

King Conservation District No. 45 Wendy Muller

King Conservation District No. 49 Dale Cap

King Conservation District No. 83 Phillip Lay

King Conservation District No. 85 Jerry Harris

King Conservation District No. 90 Jamie Mann

Northshore Utility District

Olympic View Water and Sewer District

Shoreline Water District

Skyway Water and Sewer District

Soos Creek Water and Sewer District

Woodinville Water District

BUSINESSES

AEP Energy Services

AT&T Wireless

Avista Corporation

Boeing Company

Bullitt Foundation

Champion International Corporation

C Synapse Group

CKSolutions

Eagle River Inc.

ENSR International

Enumclaw Ski and Mountain Company

Finkbeiner and Associates

Foster Wheeler Environmental Corporation

Fruit Growers Supply Company

G H Bowers Engineering

Golder Associates

Gore Electric Company, Inc.

HDR Engineering

Huckel Weinman Associates

Integrated Resource Consultants

Jack McCann Company, Inc.

Jones & Jones

Jones and Stokes Associates, Inc.

Lare & Associates LLC

Marenakos Inc.

Navigant Consulting

Northwest Indian Fisheries Commission

Pacific Coast Coal Company, Inc.

Palmer Coking Coal Company

Plum Creek Timber Company, Inc.

Portland General Electric

Preston Thorgrimson Shidler Gates and Ellis

Puget Sound Energy Inc.

REI Flagship Store

Resource Management Associates

Seattle City Light

Selleck, Inc.

Skagitt System Coop

Tom Foley Consultants

Trillium Corporation

Vulcan Northwest

Weber Construction Inc.

Weyerhaeuser Company

Weyerhaeuser Paper Company

Weyerhaeuser Real Estate Company

WRQ Inc.

LIBRARIES

City

- Bellevue Regional
- Bothel Regional
- Fairwood (Renton)
- Kirkland
- Maple Valley
- Redmond Regional

County of King

- Foster (Seattle)
- Kent Regional
- Kingsgate (Kirkland)
- Lake Hills (Bellevue)
- Maple Valley
- Mercer Island
- Newport Way (Bellevue)
- North Bend
- Snoqualmie
- Tukwila
- Valley View (Sea Tac)
- White Center Branch

University

- Antioch University, Seattle
- City University, Bellevue
- City University, Renton
- Northwest College, Kirkland
- Seattle Pacific University
- Seattle University
- University of Washington, Bothel
- University of Washington Environmental Outlook (Seattle)
- University of Washington College of Forest Resource (Seattle)
- University of Washington Department of Fisheries (Seattle)
- Washington State University, Richland

UTILITIES

Puget Sound Energy Inc

Seattle City Light

Seattle Public Utilities

Tacoma Power

Tanner Electric Coop

INTEREST GROUPS

Alpine Lakes Protect Society

ALPS (Renton)

Back Country Bicycle Trail Club

Back Country Horesmen

Biodiversity Northwest (Des Moines, Seattle)

Boeing Climbing Company

Bullitt Foundation

C Synapse Group

Cascade Designs Inc.

Cascade Gateway Foundation

Cascade Land Conservancy

Cedar River Council

Cedar River Watershed (Ron Sheadel & Cliff Nichols)

CK Solutions

Clearing Up

Cycle Path

Eagle River Inc.

Earth First

Earth Justice

Eastside Steelheaders

Federation of Fly Fisherman

Forest Wilderness Watch Program

Foster Wheeler Environmental Corporation

Friends of the Cedar River Watershed

Friends of Earth

Historical Research Associates

Green Crow

Groundswell NW

HEPL Trust

Issaquah Alps Trails Club

League of Women Voters

Maple Valley Area Council

Maple Valley Rotary

MidFORC (Seattle)

Miller Park neighborhood Association

Mountain Bicycles

Mountain Rec Management

Mountaineers

Mountains to Sound Greenway

National Wildlife Federation

Nature Conservancy

Nettleton Consulting & Research

North Cascades Conservation Council

Northwest Ecosystems Alliance

Northwest Energy Coalition

Northwest Wilderness Programs

Northwest Indian Fisheries Commission

Oregon State Fair & Expo Center

Pacific Crest Biodiversity Project

Pacific Forest Trust

Pacific Rivers Council

Puget Sound Anglers

Rebound

REI Flagship Store (Seattle)

Resource Management Association

Revocable Living Trust

Seattle Audubon Society

Sierra Club

Sierra Club Road to Trails

Signpost

Single Track Mind Cycling Club

Snopac

Snoqualmie Valley Rifle Club

Snoqualmie Valley Trail Club

Steelhead Trout Club

The Mountaineers

Third Grade Class

Trailblazers

Trout Unlimited

Trust for Public Lands

Valley Camp

Vulcan Northwest

Washington Audubon

Washington Conservation Voters

Washington Kayak Club

Washington Native Plant Society

Washington State Snowmobile Association

Washington Trails Association

Washington Trout

Washington Weeds

Washington Wilderness

Washington Wilderness Coalition

Waterways 2000

Western Washington Mountain Bike Association

Wilderness Society

MEDIA

Eastside Journal (Bellevue)

Everett Herald

Mercer Island Reporter

Seattle Post-Intelligencer

Seattle Times

Seattle Weekly

Snoqualmie Valley Record

South County Journal (Kent)

Voice of the Valley (Maple Valley)

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Chapter 9 — Glossary and Acronyms

This chapter contains a list of acronyms, abbreviations, and technical terms used in this EIS.

Acronyms

AC	Alternating Current
ACS	Aquatic Conservation Strategy
ACSO	Aquatic Conservation Strategy Objective
AM	amplitude modulated
aMW	average megawatt
AN	audible noise
BA	biological assessment
BLM	Bureau of Land Management
BMPs	best management practices
BNSF	Burlington Northern Santa Fe Railway
BPA	Bonneville Power Administration
CB	citizen's band (radio)
CEA	Connectivity emphasis area
cfs	cubic feet per second
CFR	Code of Federal Regulations
CMSP&P	Chicago, Milwaukee, St. Paul, and Pacific Railroad
CMT	culturally modified tree
CO	carbon monoxide
Corps	U.S. Army Corps of Engineers
CRW	Cedar River Municipal Watershed
CSPE	Columbia Storage Power Exchange
CWA	Clean Water Act
dBA	decibels (A-weighted)
dB_uV/m	decibels above 1 microvolt per meter
dbh	diameter breast height
DDES	(King County) Department of Development & Environmental Services

DEIS	Draft Environmental Impact Statement
DG	Distributed Generation
DLC	Direct Load Control
DNR	(Washington) Department of Natural Resources
DOH	Washington State Department of Health
DPS	distinct population segment
DR	Demand Response
DSB	Downstream Benefit
DSI	direct service industries
DSM	Demand Side Management
DU	dwelling unit
DWM	down woody material
EFH	essential fish habitat
EIS	Environmental Impact Statement
EMF	electric and magnetic (electromagnetic) fields
EMI	electromagnetic interference
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
ESCP	Erosion and Sediment Control Plan
ESU	evolutionarily significant unit
FAA	Federal Aviation Administration
FACTS	Flexible AC Transmission Systems
FCC	Federal Communications Commission
FEIS	Final environmental impact statement
FEMA	Federal Emergency Management Agency
FEMAT	Forest Ecosystem Management Assessment Team
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FM	frequency modulated
ft	feet
G	large-scale generation
GIS	Geographic Information System
GMA	(Washington) Growth Management Act

HCP	habitat conservation plan
HPA	hydraulic project approval
HRA	Historical Research Associates
Hz	hertz
IEEE	Institute of Electrical and Electronics Engineers
IPP	Independent power producers
ISO	Independent System Operator
ISP	internet service provider
IVM	Integrated Vegetation Management
KCDNR	King County Department of Natural Resources
kHz	kilohertz
kV	kilovolt
kV/m	kilovolt per meter
L_{50}	calculated median level
L_{dn}	annual average day-night level
LRMP	Land and resource management plans
LWD	large woody debris
MAT	Mitigation Action Table
mG	milligauss
MIS	Management Indicator Species
MOU	Memorandum of Understanding
MW	megawatt
MBTA	Migratory Bird Treaty Act
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NERC	National Electric Reliability Council
NESC	National Electric Safety Code
NF	National Forest
NHP	Natural Heritage Program
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System

NRCA	Natural Resources Conservation Area
NRCP	National Resource Conservation Area
OAHP	Office of Archaeology and Historic Preservation
RMS	Reliability Management System
RMSA	Rattlesnake Mountain Scenic Area
RV	Recreational vehicle
PSE	Puget Sound Energy
PUD	public utility district
OFM	(Washington) Office of Financial Management
RCRA	Resource Conservation and Recovery Act
RMZ	riparian management zone
RI	Radio Interference
ROD	Record of Decision
ROW	Right-of-Way
RTO	Regional Transmission Organization
SCL	Seattle City Light
SDEIS	Supplemental draft environmental impact statement
SDWA	Safe Drinking Water Act (42 USC)
SEPA	(Washington) State Environmental Policy Act
SMP	Shoreline Master Program
SNOH PUD	Snohomish County Public Utility District
SPCC	Spill, Prevention, Control and Countermeasure plan
SPTH	site potential tree height
SPU	Seattle Public Utilities
SR	State Route
SVC	Static Var Compensators
SWPP	Storm Water Pollution Prevention Plan
TCL	Tacoma City Light
TCP	Traditional cultural property
TCSC	Thyristor Controlled Series Capacitor
TSD	Transmission storage and disposal (facilities)
TVI	Television Interference
UGB	urban growth boundary

USDOE	U.S. Department of Energy
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDOE	Washington Department of Ecology
WDNR	Washington Department of Natural Resources
WECC	Western Electricity Coordinating Council
WFPB	Washington Forest Practices Board
WM	Water moniitoring plan
WQCP	Water quality control plan
WRECO	Weyerhaeuser Real Estate Company
WRIA	Water Resource Inventory Area
WSCC	Western Systems Coordinating Council
WSDOT	Washington State Department of Transportation

Technical Terms

Access road — Roads constructed to each structure site first to build the tower and line, and later to maintain and repair it. Access roads are built where no roads exist. Where county roads or other access is already established, access roads are built as short spurs to the structure site (see **Spur Roads**). Access roads are maintained even after construction, except where they pass through cultivated land. There, the road is restored for crop production after construction is completed.

Aldehydes — Colorless, volatile fluids with a strong, unpleasant odor, obtained from alcohol by oxidation.

Alevins — The developmental life stage of young salmonids and trout that are between the egg and fry stage. The alevin has not absorbed its yolk sac and has not emerged from the spawning gravels.

Alluvium — Deposits left by flowing water, usually clay, silt, sand or gravel.

Ampere (A) — A unit of measurement of electric current, which is the rate that electrons flow in a wire; one ampere is 6.023 x 1023 electrons per second. The measurement is similar to gallons per minute of water in a pipe.

Anadromous fish — Chinook, coho and sockeye salmon and steelhead trout, which hatch in fresh water, spend part of their life at sea, and then migrate up rivers to their home waters to spawn.

Anticline — A convex-up fold of stratified rock from whose central axis the strata slope downward in opposite directions. Opposite of **Syncline**.

Aquifer — Water-bearing rock or sediments below the surface of the earth.

Average annual megawatts (aMW) — The unit of energy output over a year, equivalent to the energy produced by the continuous operation of one megawatt of capacity over a period of time.

Bay — An area set aside in a substation for special equipment.

Bedrock — Solid rock beneath the soil and superficial rock.

Best management practices — A practice or combination of practices that are the most effective and practical means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

Biological Assessment — A document required by the Endangered Species Act, which requires an evaluation of potential effects on listed species and critical habitat prior to implementing a proposed action. A proposed action is defined as any activity authorized, funded or carried out by a federal agency.

Blackout — The disconnection of the source of electricity from all electrical loads (users) in a certain geographical area.

Bogs — Wet, spongy ground; a small marsh or swamp.

Brownout — A partial reduction of electrical voltages that causes lights to dim and motor-driven devices to lose efficiency.

Bull trout — Members of the char subgroup of the salmon family (salmonids), which also include the Dolly Varden, lake trout and Artic char.

Bus pedestals — Supports that elevate bus tubing within a substation.

Bus sectionalizing breakers — The opening or disconnecting of a substation bus to permit isolation of equipment or line sections to do work or to locate trouble.

Bus tubing — A metal "bar" used to carry electricity from one piece of equipment to another within a substation.

Canadian Entitlement — Short for Canadian Entitlement Exchange Agreement. Under the Columbia River Treaty, Canada's 50 percent share of the increase in usable energy and capacity downstream from, and based on the filling of three reservoirs at Duncan, Keenleyside, and Mica storage dams in Canada and the reservoir behind Libby Dam in Montana.

Capacity — The maximum load that a generator, piece of equipment, substation, transmission line, or system can carry under existing service conditions.

Carbon monoxide (CO) — An odorless and colorless gas formed from one atom of carbon and one atom of oxygen.

Climax species — The species that eventually comes to dominance and remains dominant as the end result of the natural process of succession in undisturbed plant communities.

Colluvium — Rock fragments, sand, etc., that accumulate on steep slopes or at the foot of cliffs.

Columbia River Basin — The land area drained by the Columbia River. Also called the Columbia Basin.

Columbia Storage Power Exchange (CSPE) — A nonprofit corporation formed by U.S. public utility districts, municipalities, and private utilities to purchase Canada's share of power accruing to U.S. power plants as a result of the Columbia River Treaty storage dams.

Conductor — The wire cable strung between transmission towers through which electric current flows.

Corona — Corona occurs in regions of high electric field strength on conductors, insulators, and hardware when sufficient energy is imparted to charged particles to cause ionization (molecular breakdown) of the air.

Counterpoise — A buried wire system connected to the footings of towers or poles supporting a transmission line. Used to establish a low resistance path to earth, usually for lightning protection.

Crossdrains — Channels or dips constructed across a road to intercept surface water runoff and divert it before erosive runoff volumes and concentrations occur.

Culturally modified tree (CMT) — A tree that has been altered by native people as part of their traditional use of the forest. Non-native people also have altered trees, and it is sometimes difficult to determine if an alteration (modification) is of native or non-native origin. However, the term is commonly used to refer to trees modified by native people in the course of traditional tree utilization.

Culvert — A corrugated metal or concrete pipe used to carry or divert runoff water from a drainage; usually installed under roads to prevent washouts and erosion.

Cumulative impact — Cumulative impacts are created by the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions.

Current — The amount of electrical charge flowing through a conductor (as compared to voltage, which is the force that drives the electrical charge).

Curtailment plan — A plan that calls for a temporary reduction in electric power delivery under emergency conditions, taken after all possible conservation and load management measures have been tried, and prompted by problems in meeting minimum requirements, rather than peaking deficiencies.

Danger trees — Trees (or high growing brush) in or alongside the right-of-way, which are hazardous to the transmission line. These trees are identified by special crews and must be removed to prevent tree-fall into the line or other interference with the wires. The owner of danger trees off the right-of-way is compensated for their value. BPA's Construction Clearing Policy requires that trees be removed that meet either one of two technical categories: Category A is any tree that within 15 years will grow within about 18 feet of conductors with the conductor at maximum sag (212 ° F) and swung by six pounds per square foot) of wind (58 miles per hour); Category B is any tree or high-growing brush that after eight years of growth will fall within about 8 feet of the conductor at maximum sag (176 ° F) and in a static position.

dBA — The first two letters (dB) are an abbreviation for decibel, the unit in which sound is most commonly measured (see decibel). The last letter (A) is an abbreviation for the scale (A scale) on which the sound measurements were made.

Dead-end structures — Heavy towers designed for use where the transmission line loads the tower primarily in tension rather than compression, such as in turning large angles along a line or bringing a line into a substation.

Debris flow — Rapid movement of water-charged mixtures of soil, rock, and organic debris down steep stream channels.

Decibel — A decibel is a unit for expressing relative difference in power, usually between acoustic signals, equal to 10 times the common logarithm of the ratio of two levels.

Depressional areas — Wetland areas that receive water from overland runoff and precipitation.

Diameter breast height — The diameter of a tree at breast height off the ground.

Disbursed recreation — Outdoor recreation in which participants are diffused over relatively large areas.

Distinct population segment — A population that is disjunct and geographically isolated from others with no genetic interchange between them due to natural and man-made barriers.

Double-circuit — The placing of two separate electrical circuits on the same tower.

Downstream power benefits — In a hydro system, the additional amount of power that can be generated at dams downstream from, and due to the construction of, a storage dam.

Drop load — Reduce electrical load on the system by selectively shutting down service to some users, to prevent equipment damage or widespread system collapse. Also called shedding load**.**

Early successional (or **early seral**) — An immature forest often characterized by a single-age class and open canopies; stands are between 1 and 30 years old.

Easement — A grant of certain rights to the use of a piece of land (which then becomes a "right-of-way"). BPA acquires easements for many of its transmission facilities. This includes the right to enter the right-of-way to build, maintain, and repair the facilities. Permission for these activities are included in the negotiation process for acquiring easements over private land.

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

Emergent — Plants that have their bases submerged in water.

Endangered species — Those species officially designated by the U.S. Fish and Wildlife Service that are in danger of extinction throughout all or a significant portion of their range.

Endangered Species Act — A 1973 federal law, amended in 1978 and 1982 to protect troubled species from extinction. NMFS and the USFWS decide whether to list species as threatened or endangered. Under the Act, federal agencies must avoid jeopardy to and aid the recovery of listed species.

Environmental impact statement (EIS) — A detailed statement of environmental impacts caused by an action, written as required by the National Environmental Policy Act.

Essential Fish Habitat (EFH) — Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (Magnuson Fishery Conservation and Management Act).

Evapotranspiration — The total water loss from the soil, including that by direct evaporation and that by transpiration from the surfaces of plants.

Evolutionarily Significant Unit (ESU) — A salmon population or group of populations that are substantially reproductively isolated from other conspecific population units, and contributes substantially to ecological/ genetic diversity of the biological species as a whole.

Exceedence levels (L levels) — The A-weighted sound level that is exceeded for a specified percentage of the time.

Federally listed — Species listed as **threatened** or **endangered** by the U.S. Fish and Wildlife Service.

Fiber optic lines — Special wire installed on the transmission line that is used for communication between one location and another.

Flashover — A disruptive discharge through the air around or over the surface of an insulator produced by the application of a voltage of sufficient magnitude to cause the breakdown path to become ionized and result in an electric arc or fault. Can be caused by lightning surges on a transmission line.

Floodplain — That portion of a river valley adjacent to the stream channel which is covered with water when the stream overflows its banks during flood stage.

Footings — The supporting base for the transmission towers. Usually steel assemblies buried in the ground for lattice-steel towers. See **Plate, grillage** and **rock anchors.**

Forb — Any herbaceous plant that is not a grass or not grasslike.

Ford — A travelway across a stream where water depth does not prevent vehicle movement. Ford construction can include grading and stabilizing streambanks at the approaches and adding coarse fill material within the channel to stabilize the roadbed.

Fore-arc — The zone in front (towards the ocean) of an island arc complex.

Foreground — The viewed landscape from 0 to 0.5 miles from an observer.

Gauss — A unit of magnetic induction.

Geographic Information System (GIS) — A computer system that analyzes graphical map data.

Glacial drift — Sand, gravel, boulders, etc., moved and deposited by a glacier or by water arising from its melting ice.

Glacial meltwaters — Water produced by the melting of glacier snow or ice.

Glacial outwash — Stratified sediment, consisting chiefly of sand and gravel, removed or "washed out" from a glacier by meltwater streams and deposited in front of or beyond the terminal moraine or the margin of an active glacier.

Glacial till — Unstratified, unsorted, glacial drift of clay, silt, sand, boulders and gravel.

Glaciofluvial deposits — Pertaining to the meltwater streams flowing from wasting glacier ice, and especially to the deposits and landforms produced by such streams.

Grillage — Transmission tower footings composed of a 12.5' x 12.5' assembly of steel I-beams that have been welded together and buried 14–16 feet deep. Generally used to support heavier towers, such as **dead-end structures**.

Ground wire (overhead) — Wire that is strung from the top of one tower to the next; it shields the line against lightning strikes.

Habitat conservation plan (HCP) — Plans to protect, improve, or maintain the status or condition of a given habitat.

Habitat types — Lands capable of producing similar plant communities at climax.

Hertz (Hz) — The unit of frequency in cycles per second; power systems in the U.S. operate with a frequency of 60 Hz.

High-voltage — Lines with 230 kV or above electrical capacity.

Hydroperiod — Seasonal occurrence of flooding and/or soil saturation.

Hydrology — The science dealing with the properties, distribution, and circulation of water.

Ice-contact deposits — Stratified glacial drift deposited in contact with melting glacier ice. Normally marked by numerous kettles and hummocky ground.

Incidental radiation device — A device that radiates radio frequency energy during the course of its operation although the device is not intentionally designed to.

Insulators — A ceramic or other nonconducting material used to keep electrical circuits from jumping over to ground.

Intermittent — Referring to periodic water flow in creeks or streams.

Internet service provider — A company providing server capacity and other technical hardware and software necessary for computer users to access the internet.

Invertebrates — Any animal without a backbone or spinal cord; any animal other than a fish, amphibian, reptile, bird or mammal.

Jurisdictional wetlands — Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Kilovolt — One thousand volts. (See **Volt.**)

Lacustrine deposits — Of, relating to, formed in, living in, or growing in lakes.

Landslide — Any mass-movement process characterized by downslide transport of soil and rock, under gravitational stress, by sliding over a discrete failure surface; or the resultant landform. Can also include other forms of mass wasting not involving sliding (rockfall, etc.).

Large woody debris (LWD) — Any piece of downed wood larger than 4 inches in diameter and 6 feet long.

Late successional (or **late seral**) — A forest in which the trees are even older and larger than a mature forest, the canopy is more open, some larger trees have died and become snags, and there is a well developed understory of large trees; stands are typically between 120 and 190 years old.

Lattice steel — Refers to a transmission tower constructed of multiple steel members that are connected together to make up the frame.

Load — The amount of electric power or energy delivered or required at any specified point or points on a system. Load originates primarily at the energy-consuming equipment of customers.

Load growth — Increase in demand for electricity. (See **Load**.)

Low-gradient — With gentle slopes.

Maintenance Area — An area which was previously a nonattainment area but has been redesignated an attainment area. Maintenance areas must abide by EPA-approved maintenance plans which include measures that ensure ambient air quality standards will be maintained.

Management Indicator Species — Species that indicate when an environmental problem is present in a particular habitat.

Mass wasting — The slow downward slope of rock debris.

Mature forest — A forest in which the trees are larger in diameter than a mid-successional forest, the closed canopy has opened more, and trees are typically between 80 and 120 years old.

Megawatts (MW) — A megawatt is one million watts, or one thousand kilowatts; an electrical unit of power.

Micropiles — A type of footing that involves augering holes about 6 inches in diameter to a depth of approximately 30 feet, inserting 1 steel bar into the holes, then grouting the bar in place using a cement grout. Using micropiles reduces the amount of ground disturbance required.

Mid-successional (or **mid-seral)** — A forest often characterized by a single-age class and closed canopies and most commonly harvested in commercial timber operations; stands are typically between 30 and 80 years old.

Mid-regeneration, closed coniferous canopy — Second or third growth coniferous forest. Trees primarily 40 to 80 feet tall and 20 to 35 years of age.

Milligauss (mG) — A unit used to measure magnetic field strength. One-thousandth of a gauss.

Mitigation — Steps taken to lessen the effects predicted for each resource, as potentially caused by the transmission project. They may include reducing the impact, avoiding it completely, or compensating for the impact. Some mitigation, such as adjusting the location of a tower to avoid a special resource, is taken during the design and location process. Other mitigation, such as reseeding access roads to desirable grasses and avoiding weed proliferation, is taken after construction.

Monitor species — Those species for which the State of Washington monitors status and distribution either because they have been listed as state threatened, endangered or sensitive within the previous 5 years; they require a habitat that has limited availability during at least some portion of their life cycle; they are environmental indicators; or their taxonomy is in question and it is unclear whether they should be included as listed species.

Monotypic — Having only one type, as a genus consisting of only one species.

National Environmental Policy Act (NEPA) — This act requires an environmental impact statement on all major Federal actions significantly affecting the quality of the human environment. [42 U.S.C. 4332 2(2)(C).]

National Marine Fisheries Service — The federal agency that oversees threatened and endangered anadromous fish species.

Nitrogen oxides — A group of compounds consisting of various combinations of nitrogen and oxygen atoms.

Non-attainment area — An area which does not meet air quality standards set by the Clean Air Act for specified localities and periods.

Nonrenewable — Not capable of replenishing.

Notice of Intent (NOI) — A public notice that an environmental impact statement will be prepared and considered in the decision making for a proposed action.

Noxious weeds — Plants that are injurious to public health, crops, livestock, land or other property.

Old growth — A forest typically at least 200 years of age with moderate to low canopy closure; a multi-layered, multi-species canopy dominated by large overstory trees; numerous large snags; heavy accumulations of fallen wood; smaller trees in various age classes, as well as shrubs and herbaceous vegetation in the understory and on the forest floor.

Oil spill containment — Units installed in a substation to collect oil spilled from equipment.

100-year Floodplain — Areas that have a 1 percent chance of being flooded in a given year. (See **Floodplain**.)

Outage — Events caused by a disturbance on the electrical system that requires BPA to remove a piece of equipment or a portion or all of a line from service. The disturbances can be either natural or human-caused.

Outwash — Sand and gravel deposited by meltwater streams in front of glacial ice.

Overload — Moving too much current flow over transmission facilities. Equipment has safeguards: in the event of overloading of the system, switches will disconnect sensitive equipment from the flow of electricity.

Oxidant — Any chemical that increases the oxygen content of another compound or causes a compound to lose electrons. A compound that readily gives up its oxygen or removes hydrogen from another compound.

Ozone — Associated with the corona discharge of high-voltage transmission lines. Rapidly recombines back to O_2.

Palustrine — of or relating to a marshy habitat.

Peak useor load — Maximum electrical demand that has occurred or could occur on the system.

Perennial streams or **creeks** — Those with year-round water flow.

Permeable — Capable of transporting liquids.

Physiographic — Pertaining to the features and phenomena of nature.

Plate footings — Transmission tower footing made of 4′ x 4′ steel plates buried 10–12 feet deep.

Pool-riffle morphology — The study of a fast moving stream, including its characteristics and composition of materials forming its substratum.

Power circuit breakers — A switch, installed at a substation, which breaks or restores the flow of current through the line.

Proposed action and alternatives — The proposed action is the preferred alternative. The alternatives to the proposed action are those actions that would likely meet the purpose and need of the project, but are not the agency's preference.

Ravel — The downslope movement of single, granular particles, usually as a result of gravity.

Regeneration is the re-establishment and growth of a given tree species in a forested stand that has been harvested. Regeneration also refers to the establishment and growth of seedlings of a given species during the natural shift in the species composition of a plant community through succession.

Residuum — An accumulation of rock debris and soil formed by weathering and remaining essentially in place as a thin surface layer over the underlying parent material.

Revegetate — Reestablishing vegetation on a disturbed site.

Riffle-glide morphology — Characteristic of a calm stretch of shallow, smoothly flowing water.

Right-of-way (**ROW)** — An easement for a certain purpose over the land of another, such as a strip of land used for a road, electric transmission line, pipeline, etc.

Riparian habitat — The zone of vegetation which extends from the water's edge landward to the edge of the vegetative canopy. Associated with watercourses such as streams, rivers, springs, ponds, lakes, or tidewater.

Riprap — Broken stones put in areas to prevent erosion, especially along river and stream banks.

Rock anchors —Transmission tower footings used when a tower is built on **bedrock**. Holes are drilled into the bedrock, steel anchor rods are secured within the holes with concrete, then the tower footings are attached to these rods.

Scoping — Part of the environmental impact document process where significant issues are identified for detailed analysis.

Sedimentation — The deposition or accumulation of sediment.

Seismicity — The degree to which a region of the earth is subject to earthquakes.

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.

Sensitive viewers — Residents and/or people recreating.

Seral — Pertaining to the stages of ecological succession occurring in communities of plants and animals until the climax is reached.

Shed load — See **drop load**.

Shock wave — A surface of discontinuity in a flow of air, sounds, etc., set up when the flow suddenly changes from subsonic to supersonic, characterized by marked increases in temperature, pressure and density (*e.g.*, a supersonic boom generated by an airplane wing).

Silviculture — The art of cultivating a forest; forestry.

Single-circuit — A line with one electrical circuit on the same tower.

Site potential tree height (SPTH) — The height that trees in the riparian forest may reasonably be expected to achieve within an appropriate time period, often established as 50 or 100 years.

Sole source aquifer - An aquifer designated by the Environmental Protection Agency which provides at least half of an area's drinking water.

Soil creep — Slow mass movement of soil and soil material down slopes driven primarily by gravity, but facilitated by saturation with water and by alternate freezing and thawing.

Species — A group of interbreeding individuals not interbreeding with another such group; similar, and related species are grouped into a genus.

Spur roads — Short roads that are built to access a structure if the structure is not located on a trunk road.

Structures — Refers to a type of support used to hold up transmission or substation equipment.

Subconductor — Wire 1.3 inches in diameter arranged in sets of three for each phase.

Subduction zone — An elongate region along which a crustal block of the earth's surface descends relative to another crustal block.

Substation — The fenced site that contains the terminal switching and transformation equipment needed at the end of a transmission line.

Substation dead ends — Dead end towers within the confines of the substation where incoming and outgoing transmission lines end. Dead ends are typically the tallest structures in a substation.

Substation fence — The chain-link fence with barbed wire on top provides security and safety. Space to maneuver construction and maintenance vehicles is provided between the fence and electrical equipment.

Substation rock surfacing — A three-inch layer of rock selected for its insulating properties is placed on the ground within the substation to protect operation and maintenance personnel from electrical danger during substation electrical failures.

Sulfur oxides — Various combinations of sulfur and oxygen; one of the most common being sulfur dioxide, which is a gas at normal temperatures and pressures in the atmosphere. Sulfur oxides combine with particulates and moisture to produce acid rain.

Supplemental draft environmental impact statement (SDEIS) - A draft EIS that contains new information not contained in an original DEIS, such as additional alternatives analysis.

Survey and Manage Species — Obscure species identified in the Northwest Forest Plan (1994) which had insufficient available knowledge to determine whether their persistence would be ensured by management strategies outlined in the plan. These species have additional required mitigation measures on lands managed by the Forest Service and BLM.

Switches — Devices used to mechanically disconnect or isolate equipment; found on both sides of circuit breakers.

Syncline — A concave-up fold in stratified rocks from whose central axis the beds rise upward and outward in opposite directions. Opposite of **Anticline**.

System reliability — The ability of a power system to provide uninterrupted service, even while that system is under stress.

Take — Any action to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a protected species, or attempt to engage in any such conduct, as defined by the Federal Endangered Species Act.

Talus — Rock debris that has accumulated at the base of a cliff or steep slope.

Tangent structures — Structures used to elevate wires a safe distance above the ground on relatively straight stretches of a line without sharp angles.

Tap — The point at which a transmission line is connected to a substation or other electrical device to provide service to a local load.

Tectonics — A branch of geology concerned with the structure of the crust of a planet (as earth) with the formation of folds and faults in it.

Threatened species — Those species officially designated by the U.S. Fish and Wildlife Service that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Tower — See **Structure**.

Traditional Cultural Properties — A traditional cultural property is defined generally as one that is eligible for inclusion in the National Register of Historic Places because of its association with cultural practices or beliefs (*e.g.,* traditions, beliefs, practices, lifeways, arts, crafts, and social institutions) of a living community that are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community.

Transformers — Electrical equipment usually contained in a substation that is needed to change voltage on a transmission system.

Transmission line — The structures, insulators, conductors, and other equipment used to transmit electrical power from one point to another.

Turbidity — The state or condition of opaqueness or reduced clarity of a fluid, due to the presence of suspended matter.

United States Fish and Wildlife Service (USFWS) — The federal agency that is charged with the protection of threatened and endangered plants and animals.

Upgradient — Refers to slope of the groundwater table. Upgradient is in the upslope direction and opposite to the direction of groundwater flow.

Volcaniclastic — Pertaining to clastic rocks, containing volcanic material in whatever proportions and without regard to its origin or environment.

Volt — The international system unit of electric potential and electromotive force.

Voltage — The driving force that causes a current to flow in an electrical circuit.

Water bars — Smooth, shallow ditches excavated at an angle across a road to decrease water velocity and divert water off and away from the road surface.

Wetlands — An area where the soil experiences anaerobic conditions because of inundation of water during the growing season. Indicators of a wetland include types of plants, soil characteristics and hydrology of the area.

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