Chapter 1 Purpose of and Need for Action

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

Bonneville Power Administration (BPA) is proposing to build a 500-kilovolt (kV) lattice-steel tower transmission line that would run about 70 miles from a new 500-kV substation near Castle Rock, Washington to a new 500-kV substation near Troutdale, Oregon. The proposed transmission line and substations would increase the electrical capacity and transfer capability of BPA's transmission system in this area. BPA is considering four action alternatives (each with several options) that include transmission line routes, three sites for the proposed substation near Castle Rock, and one site for the proposed substation near Troutdale (see Map 1-1). This proposed action is referred to as the I-5 Corridor Reinforcement Project (I-5 project or project).

This chapter provides background information about BPA, its transmission system, and causes of congestion on this system, including local **load** growth, existing contractual obligations, and new requests for use of BPA's system. This chapter describes the need for BPA to increase the electrical capacity and **transfer capability** of its transmission system to respond to the increasing congestion on this system and growing system reliability concerns. This chapter also identifies the purposes that BPA is attempting to achieve in meeting this need, potential transmission system benefits from BPA's proposal, and the agencies involved in development of this environmental impact statement (EIS). Finally, the chapter provides a summary of the public scoping process conducted for the EIS, and information about the scope and organization of this EIS.

For proposed actions with the potential to affect the environment, BPA is required by the National Environmental Policy Act (NEPA) to identify, evaluate, and consider potential environmental consequences of the proposed action and reasonable alternatives before taking action, and to inform decision-makers and the public of these alternatives and their consequences. BPA prepared this draft environmental impact statement in accordance with NEPA, to address the proposed action to build the I-5 project.

1.1 Background

1.1.1 About BPA

BPA is a not-for-profit federal agency based in the Pacific Northwest. Although BPA is part of the United States (U.S.) Department of Energy (DOE), it is self-funded and covers its costs by selling its products and services. BPA markets wholesale electrical power from 31 federal hydroelectric projects in the Columbia River Basin, one nonfederal nuclear plant and several other small nonfederal power plants. The dams are owned and operated by the U.S. Army Corps of Engineers (Corps) and the Bureau of Reclamation (BOR). About one-third of the electric power used in the Northwest comes from BPA. BPA also owns, operates, and maintains about three fourths of the high-voltage (500-, 345-, 230- and 115-kV) transmission lines in its service territory. BPA's service territory includes Idaho, Oregon, Washington, western Montana, and small parts of California, eastern Montana, Nevada, Utah, and Wyoming.

BPA has an obligation to ensure that it has sufficient capability to serve its customers through a safe and reliable transmission system. The Federal Columbia River Transmission Act directs BPA to construct improvements, additions, and replacements to its transmission system that the BPA Administrator determines are necessary to provide service to BPA's customers, maintain electrical stability and reliability, and integrate and transmit power (16 U.S.C. § 838b).

1.1.2 BPA's Transmission System

BPA owns and operates more than 15,000 circuit miles of high-voltage transmission lines in the Pacific Northwest. BPA's transmission system moves most of the Northwest's high-voltage power from facilities that generate the power to customers in the Northwest. Besides the transmission system within the Northwest, BPA has large interregional transmission lines that connect to Canada, California, the Southwest and eastern Montana. BPA's lines carry electricity from federal and nonfederal generating resources to be used within and outside the Northwest.

1.1.2.1 Load Growth, Limited System Capacity, and Congestion

In southwest Washington and northwest Oregon, BPA's system primarily includes high-voltage transmission lines connected through substations to local utilities and generating facilities (see Map 1-2). Local utility customers served by BPA's transmission system include Clark Public Utilities, Cowlitz Public Utility District (PUD), PacifiCorp, and Portland General Electric (PGE).

The Portland, Oregon-Vancouver, Washington metropolitan area (metro area) is the major electric load center in northwest Oregon and southwest Washington. High concentrations of residential, commercial, and industrial loads are served by hydroelectric dams on the Columbia River, **thermal plants** along the Interstate-5 (I-5) corridor west of the Cascade Mountains and a few others in Canada, and wind turbines operating east of the Cascades in Washington and Oregon. Electricity flows from these generating resources to the metro area and beyond over BPA's and other utilities' high- and low-voltage (less than 115-kV) transmission lines throughout the West.

Utilities monitor these lines (or paths) to make sure that the transmission system is functioning safely and reliably. In and around the metro area, the high voltage lines together are known as the South of Allston (SOA) path. Allston is a BPA substation in northern Oregon, across the Columbia River from Longview, Washington (see Map 1-2). When all lines within this path are in service, that is, functioning and available with no outages for maintenance or emergencies, the SOA path can be operated within a range (in **megawatts** [MW]) called the path's system operating limit.

For the last 10 years, BPA studies have shown that this path has become more congested because of higher loads. BPA built the last major high-voltage line in the I-5 corridor area over 40 years ago. Over that same period, the population has grown from about 1 million to more than 2.2 million (Sprague and Picha 2010).

Higher loads create congestion because of the way electrons flow on a transmission line or path. The higher the loads in different areas, the more the power flows to these areas, and depending on the available line or path capacity, the line can become congested and physically unable to reliably accommodate the need for power to flow. The path is like an interstate highway, the higher the loads (or traffic) the more the path becomes crowded or congested.

Transmission lines can also be affected by surrounding air temperatures. Transmission lines are designed to operate up to a maximum temperature that includes a safety buffer so that the lines will not sag into objects on or near the right-of-way. In summer, higher air temperatures can cause conductors to expand and stretch, which increases the sag of the conductors. During these times, lines can reach their maximum operating limit quicker. This decreases the amount of power that could have been carried over the lines (reduced capacity) had the surrounding temperatures been cooler.

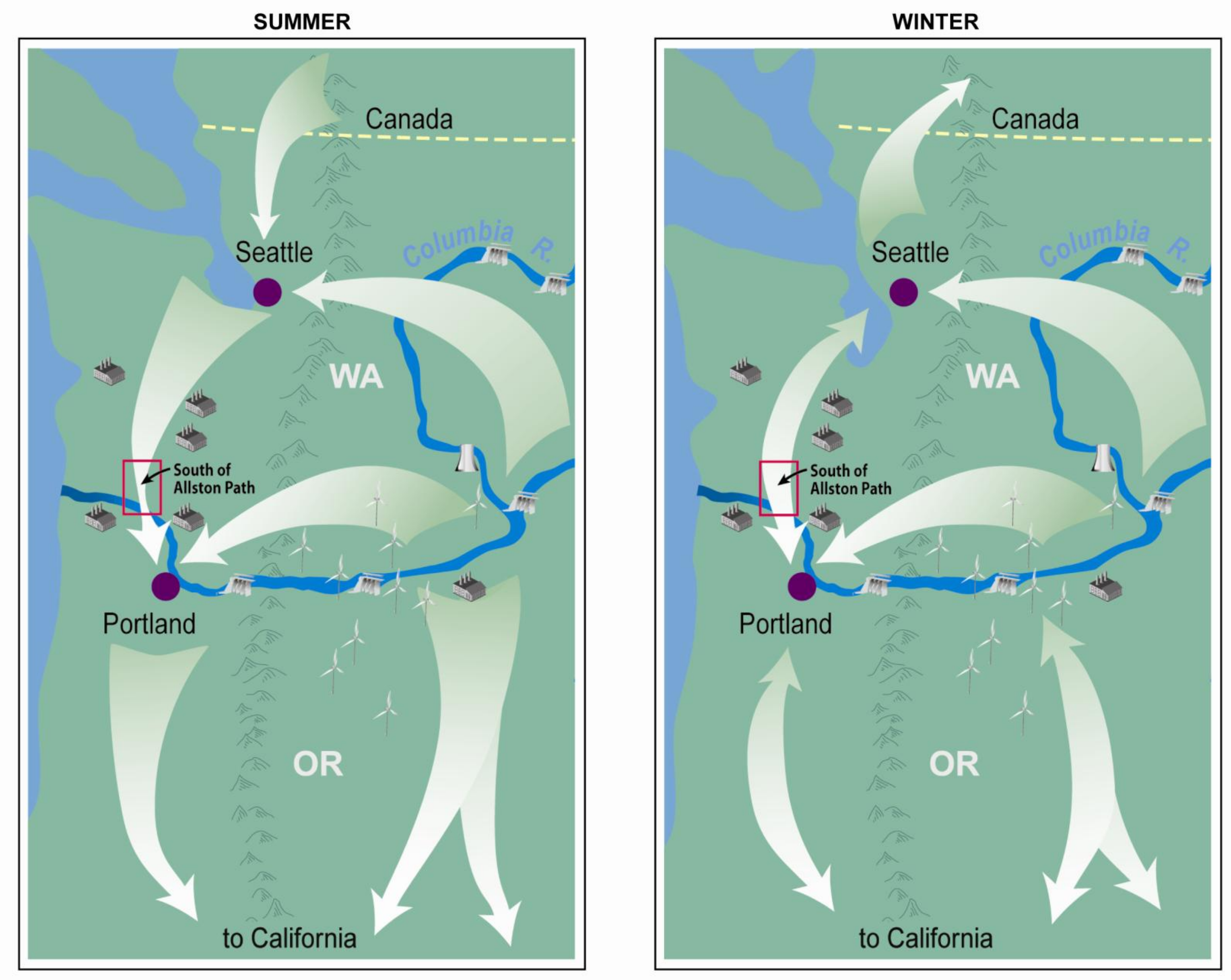
In the past, electrical use in the metro area peaked in the winter, often when a winter storm boosted the need for electric heat. Now, as new homes and commercial buildings are constructed, most have installed air conditioning, and that has increased the demand for energy in the summer. In general, peak electricity use in summer is about equal to winter peak levels.

Power flows in a different pattern in winter than it does in summer, using different transmission paths with different capacities (see Figure 1-1). In winter, power use is greater in the Northwest and Canada. This demand causes power to flow primarily from generation sources east of the Cascades to load centers in the west. Transmission system capacity is adequate to accommodate this flow. In summer, however, power use is concentrated in the Northwest and California, which causes power to primarily flow from north to south (see Figure 1-1). The north-to-south transmission capacity available in summer on the SOA path is about half of the system capacity in winter from east-to-west. This creates a system bottleneck for the summer pattern.

In summary, because of a variety of factors—including growing summer peak loads, new power plants that have interconnected to BPA's transmission system north of the SOA path, and, to a lesser extent, power transfers from Canada through the Northwest to load centers south of the metro area—the SOA path has become congested during the summer months.

With the current forecasts for load growth (up to 2 percent per year), BPA's analysis indicates that by spring 2016 the existing transmission system's capacity will likely be reached, which, in the absence of other measures, could require BPA to reduce power deliveries and this compromises the reliability of the transmission system to serve loads (see Section 1.1.2.2, Reliability and **Non-Wires Measures**).

Figure 1-1 Typical Power Flows (Winter and summer flows vary depending on generation and load patterns)



1.1.2.2 Reliability and Non-Wires Measures

Mandatory reliability standards and principles of good utility practice prohibit BPA from operating the transmission system beyond its capacity. Operating in this manner could **overload** the system and create **voltage** instability, potentially leading to **brownouts** or **blackouts**. When BPA determines that capacity on a particular path is insufficient to meet demand under certain conditions, BPA relies on non-wires measures to the extent possible to help maintain system reliability and maximize use of the existing system facilities before building a new transmission line. For the SOA path, BPA and other utilities have developed a non-wires measure called a remedial action scheme (RAS) that is carried out when needed. RAS uses a high-speed automatic control system designed to protect the transmission system in the event of an unexpected outage of a critical transmission facility. If such an outage occurs, the RAS is activated and rapidly disconnects (or “drops”) selected generation in the Northwest and Canada to reduce the flow of power and avoid overloading the lines that remain in service.

RAS has been used for many years to preserve the reliability of the SOA path. During the summer, as loading increases on the SOA path, successively higher levels of RAS are engaged, and greater amounts of generation are dropped as needed. Using RAS in this manner, however, has some undesirable consequences. BPA has had to prepare to drop up to 2700 MW of generation in the event of a critical outage on this path. To continue to serve the demand if generation is dropped, replacement power, if available, must be found and delivered over alternate paths. Even if replacement power is available, it may be difficult to deliver the replacement power due to constraints on the alternate paths. If replacement power cannot be found or delivered to serve the demand, this could lead to **load curtailments**, particularly in the metro area. As the projected gap between SOA capacity and demand grows, the likelihood of curtailments will increase as well. Furthermore, as the economy and population in the metro area continue to grow, using RAS will become more difficult and less effective.

Providing a high level of system reliability, and avoiding load curtailments, has become even more important in the Pacific Northwest in recent years as new industries that rely on steady, uninterrupted power have come to the area. In the past, Northwest industries, such as lumber mills and aluminum plants, could adjust to short power interruptions and sometimes received a special power rate for their flexibility. Today, high-quality (non-interruptible) power is critical to high-tech manufacturing of products, such as microchips. Power disruptions can ruin products in these plants, and plant operators can only tolerate fluctuations within a narrow range.

In addition to RAS, for the past 2 years BPA has been investigating the feasibility of using other possible non-wires measures to help maintain reliability of the SOA path. To determine how non-wires could help alleviate power flows on the SOA path, BPA contracted with Energy and Environmental Economics, Inc. (E3) to conduct non-wires studies (see inset box). The studies determined that non-wires measures could not eliminate the need for a new line. (See Section 4.7.1, Non-Wires Alternative, for a discussion of the consideration of non-wires measures in meeting the need for the project.) However, the studies did find that upgrades at BPA’s Pearl Substation could potentially defer the need for a new line for reliability purposes by about 2 years beyond spring 2016 (when the existing transmission system’s capacity is likely to be reached). In addition, the studies found that **generation redispatch** may be able to provide an additional deferral of up to about 4 years. Generation redispatch would turn off large generators located north of the metro area, while turning on generators located south of the metro area to reduce power flow on the SOA path. The E3 study did not consider the new commercial demand for transmission service over the SOA path discussed in Section 1.1.2.3, Existing Obligations and New Requests for Transmission Service.

Because of the potential for generation redispatch to help address reliability of the SOA path, BPA is continuing to separately evaluate the operational feasibility of generation redispatch, and whether contracts with regional generators would be cost effective.

If BPA finds that generation redispatch measures are cost effective and commercially and operationally feasible, those measures, along with upgrades at BPA's Pearl Substation, could be separately and independently implemented to maintain system reliability in the I-5 project area. This could delay the date a new line would need to be operational to satisfy reliability needs by 2 to 6 years.

Non-Wires Studies

BPA contracted with Energy and Environmental Economics, Inc. (E3) to conduct a screening study of possible non-wires measures for the I-5 project. The study focused on measures to address the reliability need for the project. E3 completed the Phase I study in January 2011 (see I-5 project website). The study identified four possible non-wires measures, estimated impacts to the SOA path, and determined that non-wires could potentially provide a short-term deferral of the energization date for the I-5 transmission line, but *could not* provide a long-term solution for future overloads on the SOA path. In April 2011, BPA convened the Non-Wires Round Table, a technical forum of non-BPA experts capable of providing external review of non-wires measures being considered as alternatives to transmission projects. The Round Table evaluated the E3 report and recommended a Phase II study be prepared to examine the implementation feasibility of the non-wires measures for a short-term I-5 project deferral. The Phase II study was completed in December 2011 (see I-5 project website) and concluded that upgrades at BPA's Pearl Substation and generation redispatch were the measures that showed the most potential for a short-term deferral of the I-5 project. The study also acknowledged the need for BPA to evaluate operational challenges that generation redispatch would create and the uncertainty as to whether commercial agreements with regional generators would be achievable and cost effective.

1.1.2.3 Existing Obligations and New Requests for Transmission Service

BPA has adopted an Open Access Transmission Tariff (OATT) for its transmission system. BPA follows the open access tariff as a matter of national policy. The tariff defines the terms and conditions of transmission services offered by BPA. This tariff, which is generally consistent with the Federal Energy Regulatory Commission's (FERC) **pro forma open access tariff**, has procedures that provide access to BPA's transmission system for all eligible customers, consistent with all BPA requirements (including the availability or development of sufficient transmission capacity) and subject to an environmental review under NEPA. More information about the tariff is available on BPA's Transmission Services website: http://www.transmission.bpa.gov/business/ts_tariff/.

For many years even before BPA adopted its OATT, BPA provided access to its transmission system to both federal and nonfederal power generators. As a result, BPA and other utilities currently have existing contracts with several power generators (including wind generators and power marketers) in Canada, the Pacific Northwest east and west of the Cascades, and surrounding states to move power across BPA's transmission system. Much of the available capacity for firm transmission service that remains on BPA's transmission system is already under contract.

At the present time, BPA, PacifiCorp, and PGE are the entities that have allocated capacity on the SOA path. PGE and PacifiCorp likely use their allocations to meet their customers' needs for power. BPA's share of that capacity is provided to BPA's **firm transmission service** customers (see inset box). Because of BPA's obligations to serve loads and provide firm capacity on this path, BPA cannot provide firm transmission service to other customers at certain times of the year, because the path has reached the limit of its capacity. Accordingly, BPA can only offer **conditional firm** or **non-firm** service to these other customers at this time (see inset box).

Firm, Conditional, and Non-Firm Transmission Service

Firm transmission service is reserved and/or scheduled for a specific term (usually a year or longer) that is of the same priority as BPA's use of the transmission system.

Conditional firm transmission service is long-term transmission service that BPA may be able to provide when there is not enough firm transmission service, but conditional firm service has constraints that give BPA additional curtailment rights. Conditional firm service has a lower priority than firm service, but is a higher priority than non-firm service.

Non-firm transmission service is not guaranteed to be available and is only available after commitments for firm and conditional firm service have been met.

Firm transmission service is more expensive to users of the system, but it is more desirable because the capacity is available to the power generator or marketer at any time when it is needed, but subject to outages. Non-firm customers, on the other hand, pay less for power, knowing that their power could be first to be interrupted in an emergency or outage.

BPA has received new requests from other utilities and power generators for long-term firm transmission service on the SOA path. Under its OATT, BPA maintains a request queue for long-term, firm transmission service. By the mid 2000s, this queue had become overloaded with requests, and BPA became aware that many requests were speculative. In March 2008, to help manage the queue and identify the new transmission infrastructure that would be needed to provide service that customers had requested, BPA began its first Network Open Season (NOS) process. During this NOS process, utilities and power generators were given the opportunity to submit requests for use of BPA's transmission system to transmit their power. More information about the NOS process is available at BPA's Transmission Services website: http://www.transmission.bpa.gov/customer_forums/open_season/default.cfm.

During the 2008 NOS process, and the subsequent 2009 and 2010 NOS processes, BPA identified firm transmission service requests that would use the SOA path. BPA has no more firm capacity available on the SOA path to accommodate these new requests to transfer power (see Section 1.1.2.1, Load Growth, Limited System Capacity, and Congestion).

In spring 2011, BPA announced its plans to delay the next NOS to conduct a regional discussion on more effective ways to meet the transmission needs of the Northwest and to ensure BPA's policies support those needs. This delay will not affect BPA's work to serve requests received in the 2008, 2009 and 2010 open seasons.

1.1.3 Planning for Transmission Additions in the I-5 Corridor

Load growth and transmission service requests have combined to increase flows on the SOA transmission path to levels that the path cannot accommodate without adding transmission capacity. BPA has taken several steps to reduce congestion on the transmission system without building new lines. BPA has upgraded many facilities to maximize the use of existing transmission lines. To allow new generation facilities to move power on the transmission system, BPA initiated operational procedures such as RAS to maximize usage of the transmission system rather than building new substations and transmission lines (see Section 1.1.2.2, Reliability and Non-Wires Measures). However, increasing RAS and other operational procedures does not create additional capacity on the system and cannot effectively mitigate the stresses on the system without causing other problems.

Under its OATT, BPA must investigate actions it could take, including adding infrastructure, to provide access to the transmission system in response to requests for service.

Accordingly, BPA studied the transmission system in the area and identified where the system needed reinforcements to meet forecasted load growth. BPA's studies found that if an additional transmission line is not built in this area, continued congestion will jeopardize transmission system reliability and, eventually, lead to power interruptions or blackouts in the area. Based on these results, combined with planning studies that began in late 2006 and continued through 2007, BPA developed a plan that included a major infrastructure addition in this area.

In conducting its studies and undertaking transmission planning, BPA follows the reliability standards established by the North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC) (see inset boxes). NERC, the national electric reliability organization, and WECC, the regional reliability organization, help coordinate the operation and planning of the bulk transmission system throughout the region. Electric utilities are required to meet the standards of both organizations when planning new facilities.

BPA also sought review of the I-5 project through WECC's Project Coordination process (formerly known as the Regional Planning Project Review, or "Regional Review," process). The Project Coordination process is part of the initial development phase of a project. BPA coordinated the review through ColumbiaGrid (see inset box) and worked with other utilities and interested parties throughout the Northwest in developing the project.

During the Project Coordination process, BPA shared study results and alternate plans of service with other Northwest utilities. This provided other utilities with an opportunity to review and comment on BPA's plans with the goal of developing the best plan of service with respect to regional benefits and impacts. The Project Coordination process concluded in March 2008 with regional approval for the project.

About the North American Electric Reliability Corporation

NERC is an organization that has been delegated the responsibility to regulate bulk power system users, owners, and operators through the adoption and enforcement of standards for fair, ethical, and efficient practices.

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

As of June 18, 2007, FERC granted NERC the legal authority to enforce reliability standards with all U.S. users, owners, and operators of the bulk power system, and made compliance with those standards mandatory and enforceable. More information is available on NERC's website: http://www.nerc.com (NERC 2010). BPA is required by law to comply with these reliability standards.

About the Western Electricity Coordinating Council

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

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

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

About ColumbiaGrid

ColumbiaGrid is a non-profit membership corporation formed in 2006 to improve the operational efficiency, reliability, and planned expansion of the Pacific Northwest transmission grid. The corporation itself does not own transmission, but its members and the parties to its agreements own and operate an extensive network of transmission facilities. Northwest members include BPA, Avista Corporation, Puget Sound Energy, Snohomish PUD, Tacoma Power, Chelan PUD, Grant PUD, and Seattle City Light.

ColumbiaGrid has substantive responsibilities for transmission planning, reliability, the Open-Access Same-Time Information System (OASIS), and other development services. These tasks are defined and funded through agreements with members and other participants. Development of these agreements is carried out in a public process with broad participation. More information about ColumbiaGrid is available on its website: http://www.columbiagrid.org/ (ColumbiaGrid 2009).

1.2 Need for Action

BPA needs to increase the electrical capacity and transfer capability of its 500-kV transmission system between the Castle Rock area in Washington and the Troutdale, Oregon area, in response to growing local demand for electricity and firm transmission requests that BPA has received to move power across this portion of its system.

A new 500-kV transmission line would increase the 500-kV transmission capacity in the southwest Washington/northwest Oregon area and allow BPA to provide for local load growth, maintain reliable power, and accommodate requests for long-term, firm transmission service. These new facilities would eliminate a transmission capacity constraint for this area, provide an additional electrical pathway, and increase system capacity (see Section 1.4, Transmission System Benefits, for other transmission system benefits related to a new line). Continuing to use BPA's existing transmission system in this area without a new transmission line would eventually cause BPA's transmission system to become overloaded at certain times of the year.

1.3 Purposes

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

- Use ratepayer funds responsibly and efficiently.
- Minimize impacts to the natural and human environment.
- Maintain BPA transmission system reliability and performance.
- Meet BPA's statutory and contractual obligations.

1.4 Transmission System Benefits

In addition to meeting the need for the project (see Section 1.2, Need for Action), the project would have several benefits for operation of BPA's transmission system. The proposed new line and substations would help redistribute the flow of power, which would generally increase the capacity of the region's transmission system. Reinforcing the transmission system would also provide the transmission flexibility required to bring more renewable wind power from the east to population centers along the I-5 corridor.

In addition, the project would allow BPA to schedule outages on existing lines, which is necessary to perform critical maintenance. Because the existing system is so heavily used, it is difficult for BPA to schedule these outages to work on equipment. If critical maintenance is deferred, the reliability of the equipment is jeopardized. Reinforcing the transmission system with another line in this area would considerably improve BPA's ability to perform needed maintenance safely and keep the system functioning reliably.

This project would also reduce overall transmission system **line losses** and reduce BPA's reliance on RAS. Although RAS has provided a means to maximize the use of existing transmission facilities, as demands on the system grow, RAS is becoming more complex yet less effective at mitigating system problems. Reducing reliance on RAS by reinforcing the transmission system would help promote greater reliability for this area. All of these additional benefits would make the transmission system more efficient and reliable.

1.5 Agency Roles

1.5.1 Lead and Cooperating Agencies

BPA is the lead agency responsible for preparing this EIS under NEPA. BPA will use the EIS, along with comments from the public, other stakeholders and interested and affected agencies, to inform the following BPA decisions:

- Whether to build a new 500-kV transmission line to meet the need.
- If the decision is to build a transmission line, which route would be constructed to a new substation near Troutdale, Oregon, and which substation site near Castle Rock, Washington would be constructed at the north end of the line.

The Council on Environmental Quality (CEQ) regulations implementing NEPA allow for the designation of other federal, state, and local agencies and Indian Tribes as cooperating agencies for an EIS where appropriate.

The Corps is a cooperating agency in this process. The Corps' role is primarily to implement the requirements of the federal Clean Water Act (33 CFR) and Section 10 of the Rivers and Harbor Act of 1899 (33 U.S. C. 403). This role includes reviewing and making permit decisions on proposals, such as this project, that may require discharge of dredged or fill material into waters of the U.S., and work within navigable waters of the U.S. The Corps assists with identification of appropriate mitigation under these statutes. The Corps will use the EIS to help meet the requirements for the ongoing Clean Water Act Section 404(b)(1) alternatives analysis process. Under the Section 404(b)(1) Guidelines developed by the Environmental Protection Agency, the Corps may only permit discharges of dredged or fill material into waters of the U.S. that represent the least environmentally damaging practicable alternative, so long as the alternative does not have other significant adverse environmental consequences (see Section 27.10, Clean Water Act).

In furtherance of existing cooperative agreements between BPA and the states of Washington and Oregon, the Washington Energy Facility Site Evaluation Council (EFSEC) and the Oregon Department of Energy (ODOE) are participating in preparation of this EIS as cooperating agencies under NEPA. Among other things, these state agencies are assisting BPA in the environmental evaluation of transmission line routes, developing possible mitigation measures, and identifying state interests that should be addressed in the EIS.

Clark and Cowlitz counties are also cooperating agencies in this process. They are providing knowledge, information, and expertise to BPA about their respective jurisdictions.

1.5.2 Other Agencies That May Use this EIS

Chapter 27 of this EIS identifies other federal agencies that may have permitting, review, or other approval responsibilities related to certain aspects of the project. Certain state, regional, and local agencies also may use all or part of this EIS to fulfill their applicable environmental review requirements for any actions they may need to take for the proposed project (see Chapter 27, Consultation, Review, and Permit Requirements; Chapter 28, Consistency with State Substantive Standards; and Appendix A, Washington Department of Natural Resources Lands Analysis).

Before Washington state agencies can take action to authorize use of state-managed lands or issue permits, they must comply with the requirements of the Washington State Environmental Policy Act (SEPA), Chapter 43.21C Revised Code of Washington (RCW). BPA is coordinating with the state of Washington so that environmental issues relevant to the Washington state agencies and their SEPA needs are addressed to the fullest extent practicable in BPA's NEPA process. These agencies will use relevant information from this EIS to help fulfill their SEPA requirements for their actions related to the project.

Oregon does not have a similar SEPA process, but ODOE and other agencies will review the EIS to ensure that their relevant environmental issues are addressed in the EIS.

1.6 Public Involvement and Major Issues

Early in the development of this EIS, BPA solicited comments from the public; Tribes; federal, state, regional, and local agencies; interest groups; and others to help determine what issues should be studied in this EIS. Because these issues help define the scope of the EIS, this process is called "scoping." As the I-5 project has developed, there have been many opportunities for public involvement and participation to continue.

1.6.1 EIS Scoping Outreach

During the scoping period for the EIS, BPA used several ways to request comments.

BPA published a Notice of Intent to prepare an EIS for the project in the Federal Register in October 2009 (74 Federal Register 52482, October 13, 2009). The scoping period was originally scheduled to close November 23, 2009. On November 18, 2009, in response to requests for more time to submit comments, BPA extended the comment period to December 14, 2009.

BPA notified more than 9,500 landowners within a 500-foot (either side of existing BPA rights-of-way) to 1-mile buffer or study area (greater in some areas) under consideration by BPA engineers for siting a new transmission line, substations, and access roads. BPA also notified other interested individuals, Tribes, elected officials, organizations, and agencies. The notification packet included a letter announcing the project and scoping period, a project fact sheet, project map, comment form, and return envelope. A separate letter and Permission to Enter Property (PEP) form was sent to landowners with property within the notification buffers described above. BPA also posted information, including interactive maps, on the project website: http://www.bpa.gov/go/i5. The website also had an electronic comment form allowing the public to submit comments online.

BPA sent a press release to local media, and placed paid ads in the following newspapers about the scoping period and public scoping meetings:

- Battle Ground Reflector – October 13 and October 18, 2009
- Camas-Washougal Post-Record – October 13 and October 21, 2009
- The Columbian – October 14, October 18 and October 26, 2009
- Gresham Outlook – October 14 and October 28, 2009

- Longview Daily News – October 13 and October 18, 2009
- The Oregonian – October 14 and October 28, 2009

BPA invited comments through a variety of methods, including online, through a dedicated voice messaging system, comment forms mailed or faxed, and written and verbal comments collected at the public scoping meetings. BPA posted all comments it received on the project website.

1.6.2 Public Scoping Meetings

BPA held a series of six open house-style public scoping meetings at six different locations (see Table 1-1).

Table 1-1 Public Scoping Meetings

Meeting Date	Meeting Location	Meeting Attendance[1]
October 27, 2009	Amboy, WA	547
October 28, 2009	Vancouver, WA – Clark College	465
October 29, 2009	Longview, WA	614
November 3, 2009	Camas, WA	480
November 5, 2009	Gresham, OR	47
November 7, 2009	Vancouver, WA – Hazel Dell	344

Note:
1. This column reflects the number of people who signed the meeting sign-in form. Some members of the public declined to sign the form.

Each meeting featured eight stations with topic-specific project information and BPA staff available to answer questions. Maps were available to help landowners locate their property in relation to the notification buffers and multiple transmission line route segments that BPA had identified as part of the buffers. BPA staff recorded verbal public comments in their notes and also on flip charts positioned at each station. A comment station also provided members of the public an opportunity to complete a comment form.

1.6.3 EIS Scoping Comment Summary

Over 2,500 people attended the public scoping meetings. Each meeting was summarized, and meeting summaries were posted to the project website the next work day after each meeting. People expressed opinions about a wide range of issues for BPA to consider, including the following:

- Project purpose and need
- Project decision-making process
- Public involvement
- Regulatory obligations, coordination, and documentation
- Draft EIS approach and content
- Transmission tower, substation, and line design and transmission rights-of-way

- Undergrounding lines
- Transmission technology
- Transmission line and access road construction
- Access road siting and rights-of-way
- Nuisance, safety, and maintenance issues
- Project monitoring and mitigation
- Route segments and alternatives
- Threatened, endangered, and sensitive plant and animal species, and wildlife and wildlife habitat
- Socioeconomics, including cost to landowners, eminent domain and compensation, and environmental justice
- Quality of life issues
- Health and safety including noise and **electric and magnetic field** (EMF) effects
- Aesthetics
- Cumulative impacts
- Existing and planned land uses
- Transportation
- Recreation
- Mining
- Surface and ground water resources, wetlands, and floodplains
- Native and non-native vegetation
- Air quality and climate
- Cultural and historic resources
- Geology and soils

This is a partial list of issues identified from the comments received. All comments received were logged in and forwarded to resource specialists to consider when preparing their environmental impact analyses for the EIS, and to engineers to consider as they continued working on the preliminary project design.

Over 3,000 communications and over 7,000 individual comments were received during the scoping period. A summary of the comments received during the scoping period is available on the project website: http://www.bpa.gov/corporate/i-5-eis/documents/I-5_ScopingSummary.pdf.

BPA continued to take comments on the project after the scoping period ended and will take comments throughout the environmental process. Additional summaries of comments received after the scoping period ended are available on the project website.

1.6.4 Post-Scoping BPA Public Meetings

In August and September, 2010, BPA hosted additional public meetings to present updated project information (see Table 1-2):

Table 1-2 Post-Scoping Public Meetings

Meeting Date	Meeting Location	Meeting Attendance[1]
August 30, 2010	Castle Rock, WA	225
August 31, 2010	Vancouver, WA – Skyview High School	110
September 8, 2010	Amboy, WA	275
September 12, 2010	Camas, WA	130

Note:
1. This column reflects the number of people who signed the meeting sign-in form. Some members of the public declined to sign the form.

BPA sent a press release to local media, and placed paid ads in the following newspapers about the meetings:

- Battle Ground Reflector – August 25, September 1, and September 8, 2010
- Camas-Washougal Post-Record – August 24, August 31, and September 7, 2010
- The Columbian – August 22, August 29, and September 5, 2010
- Longview Daily News – August 22, August 29, and September 5, 2010
- The Oregonian – August 22 and September 5, 2010

BPA also provided project updates and additional opportunities for public input at the following listening sessions:

- On November 3, 2010, BPA hosted a meeting for property owners along a small portion of Segment F where additional field work and modifications to the proposed design caused the notification buffer to be expanded in this area. Expansion of the notification buffer involved 29 new land parcels. Twenty-three people attended this meeting.
- On December 8, 2011, BPA presented a brief project update and took public comment at the Battle Ground Community Center. About 300 people attended this meeting. Thirty-seven people provided verbal comment.

1.6.5 Post Scoping Outreach and Public Comments

In addition to BPA's public meetings, BPA staff attended meetings organized by elected officials, neighborhood groups, community organizations, and others. BPA staff also held meetings with federal, state and local agencies; representatives of Tribes with interests in the area; and other interested parties and individuals. From the scoping period until the release of the draft EIS, BPA continued to update the project website with new information and interactive maps; mailed out frequent project updates and posted them on the website; attended local service club, civic group and neighborhood meetings as requested (or as resources allowed); provided information at local farmers' markets, fairs, community events, and local libraries; and continued to collect comments (see inset box). All BPA's post-scoping public outreach materials for the proposed project are available on the project website: http://www.bpa.gov/corporate/i-5eis/documents/cfm.

Comments received from the close of the scoping period to the release of the draft EIS are contained in supplemental comment reports posted on the project website. The issues included in these comments are similar to those received during scoping (see Section 1.6.3, EIS Scoping Comment Summary). These comments were also used by BPA staff in their engineering and environmental work.

1.7 Issues Outside the Scope of the I-5 Project or this EIS

Most issues raised during the scoping process are considered to be within the scope of the project and are addressed in this EIS. However, a few issues are considered to be either beyond the scope of this EIS or are outside the scope of the project. Issues outside the scope of this EIS are not addressed further in this EIS. Issues outside the scope of the project are not considered in the evaluation of the project itself, but may be further addressed in other EIS chapters (e.g., Chapter 26, Cumulative Impacts).

1.7.1 Regional Generation Development

Some comments received during scoping asked that BPA undertake a programmatic review of all energy generation projects, including new and proposed wind development that may occur throughout the region related to any increased capacity on BPA's transmission system. Generation projects are not proposed, constructed, or operated by BPA. Instead they are proposed and undertaken by private entities and their siting and development is controlled by state or local jurisdictions and other regulating entities. BPA's role is typically limited to deciding whether to interconnect these proposed projects, in compliance with its OATT, after an evaluation of the environmental effects of the proposed interconnection is done under NEPA. As a result, BPA does not have a region-wide program or plan related to wind or other generation projects, and does not dictate or direct where these projects are proposed.

Furthermore, decisions by BPA on whether to interconnect a particular proposed generation project to its transmission system are made independently of a decision on whether to construct the project. More specifically, a decision to interconnect any generation project is not dependent on construction of this transmission line. This transmission line is being proposed to respond to increasing load growth, requests for transmission service from a variety of existing and proposed generation sources, as well as from entities seeking to move their electrical power from one point to another. These requests are already in BPA's queue for transmission service. A decision to proceed with the I-5 project would not be dependent on decisions related to interconnection of any new or proposed generation development projects in the region.

Therefore, new and proposed generation development projects are not considered to be within the scope of the project analyzed in this EIS. However, to the extent that the potential environmental impacts of any reasonably foreseeable new or proposed generation projects in the vicinity of the I-5 project are cumulatively added to the potential environmental impacts of the project, these impacts are discussed and considered in the cumulative analysis in this EIS (see Chapter 26, Cumulative Impacts).

Additional Public Participation Opportunities

Direct mail, email and phone contacts

The I-5 project is one of the largest public involvement efforts BPA has undertaken. Since announcing the project in 2009, BPA has mailed, emailed, met, and spoken with thousands of interested stakeholders. Our mailing list includes more than 11,000 addresses and more than 2,400 email addresses. The project team has sent 11 mailings (available on the project website: www.bpa.gov/goto/i5), and hosted 12 public meetings attended by more than 4,000 people (see Sections 1.6.2, Public Scoping Meetings, and 1.6.4, Post-Scoping BPA Public Meetings).

Local media

Regular local media outlets, such as newspapers and TV stations, have helped us share news and inform the region about project developments and key issues. On several occasions, BPA contacted the media to share elements of the environmental review and other project developments. A BPA representative also was interviewed by staff of the website Couv.com and answered questions about the project and its environmental review. Couv.com is a local website that focuses on issues affecting Vancouver and Clark County, Washington.

Developing newsletters

Using the feedback we received from a survey at our August 2010 public meetings, we learned that most people wanted to receive project information through print and email updates. Project staff then developed a newsletter to provide updates and address key questions and concerns raised by community members and leaders. Between October 2010 and June 2012, BPA mailed seven newsletters that provided new project information and schedule updates; results of exploring suggested changes to the project; and contact information for questions, comments or summaries of public meetings and comments.

Public comment helped shape this Draft EIS

The agency has responded to public comments about this project. We heard many suggestions about alternatives for BPA to consider; these are discussed in Chapter 4 (see Section 4.7, Alternatives Considered but Eliminated from Detailed Study). Comments also shaped our evaluation of the project's potential affect on communities in general, and in specific geographic areas. Because people requested more detail and a web-based mapping tool, we created an interactive map, available on our website for the public to use to see how the project would affect their communities. This and other materials available on the website helped address questions from thousands of property owners and interested citizens.

Additional offers to meet

Given the level of interest in the project, BPA extended several offers, through meetings and mailings, to attend group meetings to discuss the project and answer as many questions as possible. Staff attended meetings with local community groups, rotary clubs, cities, counties, neighborhoods and citizen groups. Clark & Cowlitz County Farm Forestry Association hosted a meeting in September 2010 to discuss how BPA would address access and security issues along newly constructed roads, how BPA would value timber lands, and how future crops would be factored into the value calculation. BPA staff attended to answer questions and listen. In November 2010, Clark and Cowlitz county commissioners hosted a public meeting to hear why BPA is no longer considering options to Pearl Substation in Oregon. BPA Administrator Steve Wright attended and answered a wide range of questions.

Citizen group formation and engagement

Several citizen groups formed since BPA announced the project. BPA began attending meetings organized by groups as early as November 2009. These groups created and maintained their own websites and outreach lists, held meetings and rallies, and purchased or posted hundreds of signs throughout Clark and Cowlitz counties (including billboard space) to share their views. Members or their boards had opportunities to speak with BPA transmission executives and the BPA Administrator about their concerns and ideas. BPA attended and spoke at more than 14 meetings, rallies or community events hosted or organized by citizens. The largest was held at Prairie High School in Battle Ground (between 800 and 1,000 participants). We also attended meetings at other schools, libraries and fire stations.

We will continue our public involvement efforts throughout the life of the project.

1.7.2 Regional Transmission Development

Some comments received during scoping asked that BPA undertake a programmatic review of all of its proposed transmission infrastructure projects in the region. Transmission infrastructure projects are proposed by BPA on a project-specific basis when needed to address various transmission reliability and service issues on portions of BPA's transmission system. Increases in capacity that may occur on BPA's existing transmission system from proposed BPA improvements would be in response to existing requests for transmission service, rather than designed to provide significant additional, unsubscribed capacity. While there may be synergies among the various proposed BPA transmission infrastructure projects in the region, no project is wholly dependent on any other project for its viability or success. Other proposed BPA transmission infrastructure projects in the region are therefore outside of the scope of the I-5 project. Nonetheless, any reasonably foreseeable transmission infrastructure projects with cumulatively additive environmental impacts to the I-5 project are discussed and considered in the cumulative analysis in this EIS (see Chapter 26, Cumulative Impacts).

1.8 Organization of this EIS

The remainder of this EIS is organized as follows:

- Chapter 2 describes how BPA system planners, engineers and other specialists developed potential routes for the transmission line and sites for the new substations. It includes a summary of the route segments that make up the action alternatives.
- Chapter 3 describes the transmission components that make up the project, and construction and maintenance requirements. It also includes mitigation measures that are included as part of the project.
- Chapter 4 describes the action alternatives, the No Action Alternative, and alternatives eliminated from detailed consideration.
- Chapters 5 through25 describe, for each resource, the existing environment that could be affected by the project, environmental consequences of the action alternatives and the No Action Alternative, and mitigation measures that could be used to minimize impacts to resources.
- Chapter 26 discusses cumulative impacts.
- Chapter 27 discusses the permits and other approvals that must be obtained to implement the project.
- Chapter 28 discusses the project's consistency with state substantive standards.
- Chapters 29 through 32 list the references used, individuals who helped prepare the EIS, the individuals, agencies, and organizations notified of the availability of this EIS, and a glossary.
- Chapter 33 contains the document index.
- Supporting technical information is provided in appendices or referenced on the project website: http://www.bpa.gov/go/i5.

Chapter 2 Facility Siting, Route Segments, and Action Alternatives

This chapter describes how BPA system planners, engineers, and other specialists propose locations for new transmission facilities, such as the proposed I-5 Project. It describes the general factors that BPA considers in siting potential new facilities. It then discusses how potential transmission line route segments and substation sites for the project were developed and refined over time. It also explains how these route segments were combined into the action alternatives for this project.

2.1 Facility Siting

Transmission Facility Siting → **Developing Route Segments and Substation Sites** → **Creating Alternatives from Route Segments**

BPA is proposing to build a 500-kV lattice-steel tower transmission line that would run about 70 miles from a new 500-kV substation near Castle Rock, Washington to a new 500-kV substation near Troutdale, Oregon. A transmission project of this size requires many components (see Table 2-1). These components are discussed in detail in Chapter 3, Project Components and Construction, Operation, and Maintenance Activities.

Table 2-1 Project Components

Components	Description
Transmission towers	Single-, double- or triple-circuit towers depending on location; 60 to 280 feet tall depending on voltage and location.
Right-of-way easements	Generally 150 feet wide depending on location.
Wires (lines; conductors)	Conductors to transmit power, ground wire for lightning protection, fiber optic cable for communications.
Access roads	New or improved roads depending on location, and existing roads for access to each tower for construction and maintenance.
Vegetation clearing	Vegetation cleared from the right-of-way, access roads, and substation sites and danger trees outside the right-of-way.
Staging areas	Material and vehicle storage for construction.
Pulling and tensioning sites	Areas to string wire and tighten wires after they are placed on the towers.
Removal of existing structures/towers and lines and rebuilding some towers	Removal of existing transmission structures/towers and lines in some locations to provide room for the new line. Some towers would be removed and rebuilt as double- or triple-circuit towers with the new line and the existing line strung on the new towers.
Substations	A new 500-kV substation at each end of the transmission line. About 25-50 acres would be required for each substation and stormwater retention pond design depending on location.

BPA considers many factors when siting proposed new transmission lines. Once the need for a new line in a particular area or region is identified, BPA's transmission system planning engineers begin developing potential routes for a proposed new line. They determine the size or voltage needed and the beginning and end points for the transmission line based on the needs of the electrical transmission system. Design engineers then determine the type of towers and the amount of right-of-way necessary for safety clearances for the size of line. In general, a 500-kV transmission line has a 150-foot-wide right-of-way. Each tower location must also be accessible for construction and for maintenance, so road access is generally required.

With the technical requirements outlined, including the desired beginning and end points of the line, siting engineers use available information to consider how a new line and substations might be placed effectively to provide for cost-effective construction and reliable operation. The siting engineers also consider potential impacts to people; plants and animals; land use; farms and other businesses; and important local, cultural, and regional features. They look for ways to site new transmission facilities to avoid or minimize these potential impacts to the extent practicable. Some factors considered in this initial transmission facility siting effort include the following:

- Electrical feasibility: New electrical facilities must be compatible with the operation of the existing transmission system. In some areas where there are existing lines, new transmission lines may not be allowed immediately adjacent to these existing lines (see bullet below on line separation). The line length between substations may be limited due to effects the length can have on electrical performance and power distribution across the system. Substations are strategically placed to provide efficient, flexible operation of the system and enhance the flow of power. For this project, the proposed substation sites are in locations that would provide the maximum system performance together with a new transmission line.
- Existing transmission corridors and roads: Engineers determine if BPA or other utilities have any existing corridors with vacant rights-of-way or whether a new line could parallel another existing or proposed line, facility, or road. Building in an established corridor tends to have different impacts to visual resources, land use, wildlife habitats, and people than creating a new corridor. Existing access roads may be able to be used, though they often need to be improved. Building next to an existing line may be less expensive where there is extra right-of-way to accommodate a new line, with little or no need to purchase new easements, but as discussed below, there may be line separation issues. Some maintenance, such as vegetation clearing, could be less expensive when two lines are next to each other, rather than being in different areas.
- Line separation: While use of existing transmission corridors has its advantages, there are situations in which BPA cannot build next to existing lines for reliability reasons. If utilities want to build a transmission line next to an existing line, they are required by WECC and NERC reliability criteria (see Section 1.1.3, Planning for Transmission Additions in the I-5 Corridor) to consider the consequences of an outage that could affect both lines. Utilities consider the following events, among others, that could cause a simultaneous outage of lines:
    - An aircraft flying into both lines
    - Fire in the right-of-way producing smoke, which can cause a flashover between lines

  - Sequential lightning strikes
  - A tower or conductor failing and falling into an adjacent line
  - A landslide taking out towers on more than one line in a corridor
  - A localized high wind or heavy ice event

  The consequences of an outage are greater with the simultaneous loss of two critical lines in an area. These outages could be beyond what the system can withstand and greatly increase the chances for a blackout of the system. To reduce the chances of a blackout from outages of multiple critical lines in an area, BPA limits capacity to reduce the degree to which a part of the system is relied upon (see Section 1.1.2.2, Reliability and Non-Wires Measures).

  If BPA determines that the likelihood and consequence of an outage would not meet WECC and NERC reliability criteria, special design considerations are required. A new line would be required to be separated by at least one span length (about 1,200 feet) from the adjacent line.

  For this project, BPA studied placing the proposed line next to an existing high-voltage 230-kV transmission line. Though WECC reliability criteria require BPA to plan for the simultaneous loss of a new 500-kV line and the existing line, BPA determined that the impacts of such an outage could be mitigated by using RAS (see Section 1.1.2.2, Reliability and Non-Wires Measures), and that placing a new line next to the existing 230-kV transmission line could be considered for the project.

- Houses, other structures, and sensitive cultural resources: Homes, schools, businesses, historic structures and sensitive cultural resource areas are generally avoided during line routing. Because structures (houses, buildings, sheds) are not allowed within the right-of-way for safety reasons, BPA looks to avoid structures while selecting a right-of-way so they need not be removed.

- Existing land uses: In addition to existing houses and structures, land use is an important consideration. Siting engineers try to find compatible land uses, while trying to minimize impacts to residential land, parks and preserves, and any special districts or areas of local or regional interest. Gravel pits are avoided, because pit operators often extract material up to the tower legs, leaving them exposed, unstable, and without maintenance access to the tower. BPA also prefers to avoid airstrips if possible; tries to follow fence lines; and spans agricultural fields, orchards, or vineyards where practical.

- Terrain: BPA looks for gentle terrain if available. Transmission towers and access roads placed on steep slopes are harder to construct and maintain, and may be more susceptible to failures due to erosion or landslides.

- Visual impacts: The size of transmission towers and the potential need to clear trees and develop new roads can increase the visibility of a new line. BPA considers avoiding locations such as homes and roads, river crossings, and parks and other recreation areas, from which people would likely view a new line and substations.

- Sensitive habitats: Engineers consider potential impacts to plants and animals and try to avoid wetlands, nesting sites, threatened and endangered species' habitats, and other sensitive areas wherever practical.

- Costs: BPA tries to develop the most cost-effective alternatives. Shorter transmission line routes usually decrease overall project costs. Straight transmission lines are less costly than lines that turn because when lines turn, stronger, heavier, and more expensive towers are needed. Level routes are less costly than routes across steep terrain because less grading is required. Included in project costs are the purchase of land for substations and possibly substation access roads, and transmission line and access road easements. Easements across agricultural or forest lands are usually less expensive than easements across residential land.

2.2 Developing Route Segments and Substation Sites

Transmission Facility Siting → **Developing Route Segments and Substation Sites** → **Creating Alternatives from Route Segments**

After the general location of a proposed new transmission line is identified, BPA's siting engineers begin the process of more specifically identifying potential sites for the necessary substations at either end of the proposed transmission line, and developing potential routes for the transmission line between these substation sites. The siting engineers use a variety of information sources to further refine the route segments and potential substation sites. They consider the identified transmission system needs and numerous siting factors discussed in Section 2.1, Facility Siting. They take into account the location of existing generating facilities, transmission lines, and substations in the area (see inset box and Figure 2-1). They consult maps and conduct field checks of potential routes and substation sites.

For this project, BPA first identified potential route segments and substation locations in the early 2000s, when the potential need for the I-5 project was initially identified. However, because rising gas prices caused proposed generation plants to be put on hold (delaying expected congestion) and BPA took actions to avoid building new lines in this area (see Sections 1.1.2.2, Reliability and Non-Wires Measures, and 1.1.3, Planning for Transmission System Additions in the I-5 Corridor), BPA was able to put the proposal to build the I-5 project on hold at that time, and work ceased on developing route segments and potential substation sites.

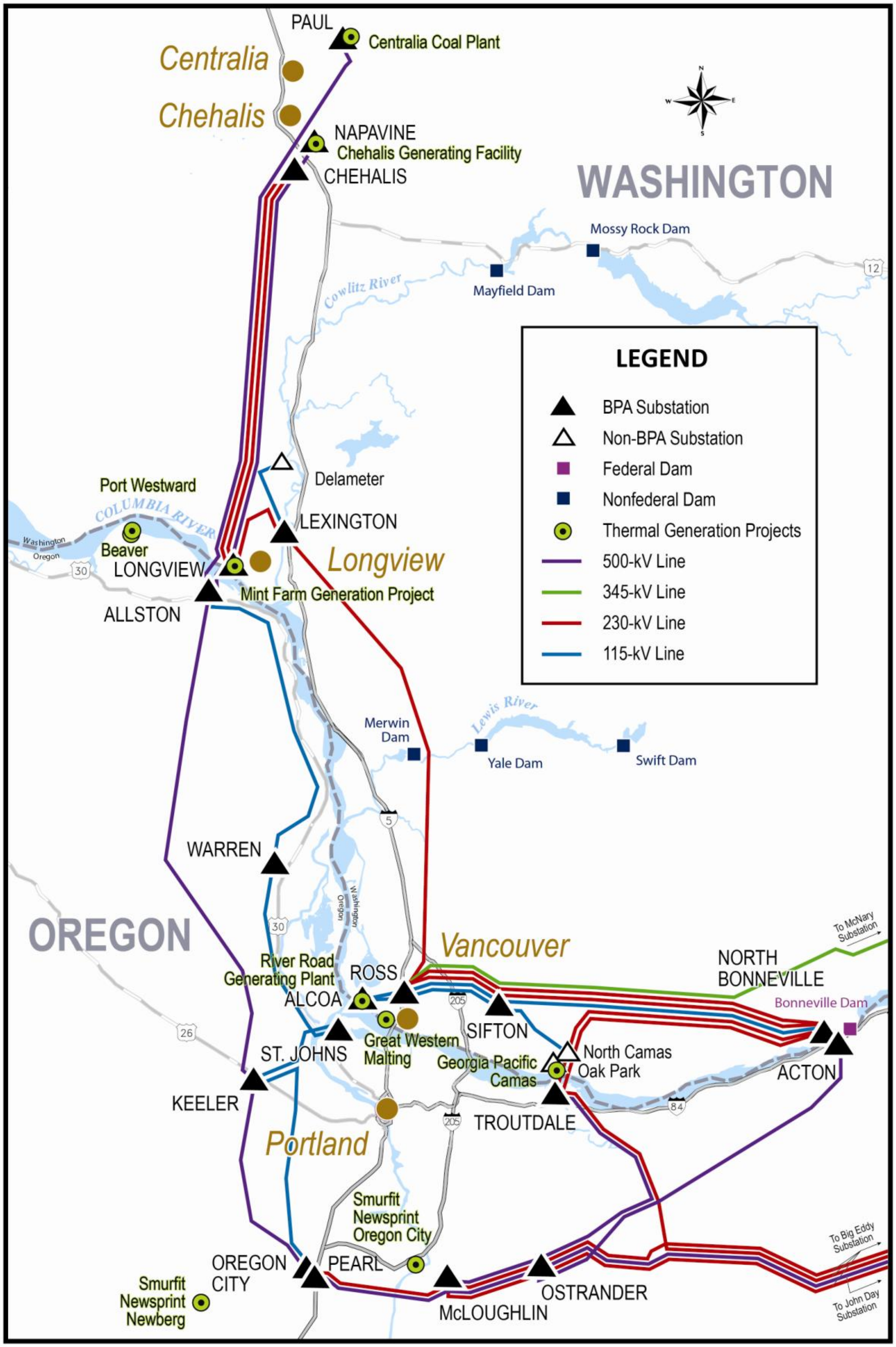
When the need for the project began to re-emerge in the late 2000s, BPA's siting engineers reinitiated work to further develop route segments and potential substation sites. The siting engineers identified an area near existing transmission lines in the vicinity of Castle Rock, Washington for one of the new substations, and a site near BPA's Troutdale Substation in Troutdale, Oregon for the other new substation (see Map 2-1). BPA then began to look at potential routes for a new transmission line between these two endpoints. In theory, there are an almost unlimited number of potential routes between the Castle Rock area and the Troutdale area. Using the information sources discussed above, however, BPA's siting engineers identified a variety of potentially feasible transmission line route segments between the two endpoints. These segments can be combined in many ways that provide a reasonable range of alternate routes to get from one endpoint to the other (see Section 2.3, Creating Alternatives from Route Segments).

BPA and Non-BPA Transmission Lines and Substations in the Project Area

There are many existing transmission lines and substations in the project area (see Map 1-2). Figure 2-1 is a schematic of general line and substation locations. Not all lines listed below are shown on the figure; conversely, not all substations or lines shown on the figure are listed below. In general, lines are named by where they begin and end at substations. For example, the Lexington-Delameter line begins at Lexington Substation and ends at Delameter Substation. Lines and substations are owned by BPA unless noted by an *.

- Lexington-Delameter No. 1 115-kV single-circuit line (BPA leases to Cowlitz PUD)
- Longview-Chehalis No. 1 230-kV single-circuit line
- Lexington-Longview No. 2 230-kV single-circuit line
- Napavine-Allston No. 1 500-kV single-circuit line
- Longview-Chehalis No. 3 230-kV single-circuit line
- Paul-Allston No. 2 500-kV single-circuit line
- Ross-Lexington No. 1 230-kV single-circuit line
- Sifton-Ross No. 1/Bonneville-PH1-Alcoa No. 2 115-kV double-circuit line
- McNary-Ross No. 1 345-kV single-circuit line
- North Camas-Sifton No. 1/Bonneville PH1-Alcoa No. 2 115-kV double-circuit line
- North Bonneville-Ross No. 1/North Bonneville-Ross No. 2 230-kV double-circuit line
- North Bonneville-Ross No. 1 230-kV single-circuit line
- North Bonneville-Ross No. 2 230-kV single-circuit line
- North Bonneville-Troutdale No. 1 230-kV single-circuit line
- North Bonneville-Troutdale No. 2 230-kV single-circuit line
- North Camas-Oak Park 115-kV single-circuit line
- Cowlitz-County PUD Lexington-Corduroy 115-kV single-circuit line
- Georgia Pacific James River East 115-kV single-circuit line*
- Georgia Pacific James River West 115-kV single-circuit line*
- PacifiCorp 230-kV double-circuit line*
- PacifiCorp 115-kV single-circuit line*
- Troutdale Substation
- Paul Substation
- Lexington Substation
- Allston Substation
- Ross Substation

Figure 2-1 Schematic Location of Existing Transmission Lines and Substations



When BPA formally proposed to build the I-5 project in 2009, BPA used the refined route segments and substation locations it had developed to identify landowners and other interested parties, to aid in determining land use and other initial resource information, and to allow the public, Tribes, agencies, and others to comment on the initial proposal (see Section 1.6, Public Involvement and Major Issues). As BPA moves through the planning, preliminary design, and environmental process for this project, these route segments and substation locations are being further refined and adjusted as new information is obtained. The following sections describe changes to the location and number of route segments and substation sites since the project was first proposed. (See Section 4.7, Alternatives Considered but Eliminated from Detailed Study, for additional suggested route locations and alternatives considered but eliminated from further consideration.)

2.2.1 Transmission Line Route Segments

Between the areas identified near Castle Rock, Washington and in Troutdale, Oregon for new substations, BPA's engineers identified 52 preliminary transmission line route segments that could be combined in various ways to form different potential routes for the transmission line. These route segments varied in length and were composed of existing and new rights-of-way or paralleled existing rights-of-way. The preliminary public notification area for each route segment was from 500 feet to greater than 1 mile wide, depending on the terrain and land use. The actual area needed for the transmission line right-of-way is generally 150 feet wide, and about 25 to 50 acres for each new substation.

After hosting public meetings, reviewing comments received during and after the scoping period, and months of study and extensive field work, BPA refined the route segments that would be considered. Changes made between October 2009 and November 2010 included refining segments, removing some segments and portions of others from consideration, and adding segments farther to the north and east (identified with letters) (see Map 2-1). New substation sites near Castle Rock were also developed (see Section 2.2.2, Substation Sites), and segments were developed to extend the transmission line to those sites. (See Section 4.7, Alternatives Considered but Eliminated from Detailed Study, for a description of the segments removed.) After a series of refinements, BPA identified 60 route segments to be analyzed in the EIS (see Map 2-2).

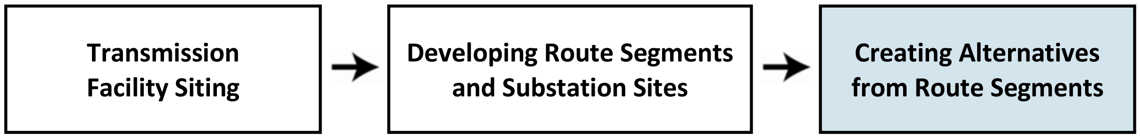
2.2.2 Substation Sites

As discussed earlier in this section, the northern end of the transmission line would connect to a proposed new substation near Castle Rock, Washington. BPA initially considered one general area for a new substation at this location. After public comment, extensive field work, and preliminary substation design work, BPA expanded its substation site alternatives and is now considering three sites for a new substation near Castle Rock: Monahan Creek, Baxter Road, and Casey Road (see Map 2-2). The Monahan Creek site would use an open area at the intersection of existing BPA lines. The Baxter Road and Casey Road sites are alternate sites considered because of their relative remoteness and proximity to BPA lines.

The southern end of the transmission line would connect to a proposed new substation near BPA's existing Troutdale Substation in Troutdale, Oregon. Since this site is located along Sundial Road, it is referred to as the Sundial substation site.

Chapter 4, Proposed Action and Alternatives, describes the work specific to each substation site that would be required to construct a substation at each location.

2.3 Creating Alternatives from Route Segments



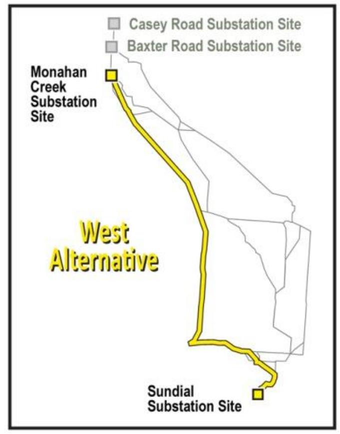
After the refined route segments and potential substation sites were developed, BPA worked to create a range of action alternatives using these project components. In creating these alternatives, BPA continued to consider the many environmental, technical, social and economic siting factors used in developing the route segments (see Section 2.1, Facility Siting). BPA also considered comments received from the public during the various public outreach activities conducted for the project (see Section 1.6, Public Involvement and Major Issues).

BPA has identified four action alternatives for detailed evaluation in this EIS: the West Alternative, the Central Alternative, the East Alternative, and the Crossover Alternative (see Maps 2-3 through 2-6). For each action alternative, three options have also been identified that involve use of slightly different route segments (i.e., where some line segments are replaced with different ones), different substation sites, or a combination of both. Through these action alternatives and options, BPA was able to ensure that each of the 60 identified route segments, and each of the three Castle Rock area substation sites, was used in at least one of the alternatives considered in this EIS. In addition, some of the route segments and substation sites are included in more than one action alternative.

In creating action alternatives, BPA sought to develop a range of alternatives with different considerations. Accordingly, the West Alternative would be located in more urban and developed areas and would use mostly existing right-of-way. The Central and East alternatives would be located in more rural and undeveloped areas on mostly new right-of-way and would be located in generally distinct geographic areas north to south and west to east. The Crossover Alternative would use a combination of existing and new right-of-way.

Each action alternative includes a new substation near Castle Rock, a 500-kV transmission line between 67 and 80 miles long, and the new Sundial Substation near Troutdale, Oregon. All action alternatives cross the Columbia River in the same location. All include fiber optic cable on the towers to provide a communication link between the substations, and equipment changes inside control houses at various BPA substations. The following provides an overview of route segments and substation sites used in each of the four action alternatives and their options. Chapter 4, Proposed Action and Alternatives, describes the alternatives in more detail.

2.3.1 West Alternative and Options



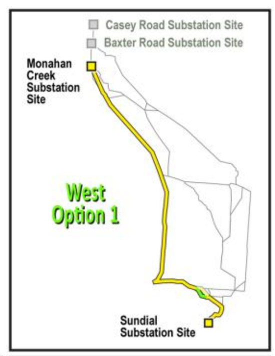
2.3.1.1 West Alternative

The West Alternative begins at the Monahan Creek substation site, then extends south on route segments 2, 4, 9, 25, 36B, 41, 45, 50, and 52 and connects to the Sundial substation site (see Map 2-3 and Table 2-2). The West Alternative is about 67.5 miles long.

Table 2-2 West Alternative and Options

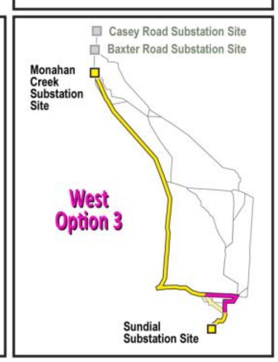
Alternative and Options	Substations and Segments Used to Form Alternative (North to South)	Segments or Substation Site Removed to Form Option	Segments Added to Form Option
West Alternative	Monahan Creek, 2, 4, 9, 25, 36B, 41, 45, 50, 52, Sundial		
West Option 1		36B, 41, 45	36, 40, 46
West Option 2		36B, 41, 45, 50	36, 36A, 37, 38, 43, 48, 51
West Option 3		36B, 41, 45, 50	36, 36A, 37, 38, 39, T, 49, 51

2.3.1.2 West Option 1



West Option 1 includes route segments 36, 40, and 46 instead of segments 36B, 41, and 45 (see Map 2-3 and Table 2-2). West Option 1 is about 3.4 miles long and replaces segments 3.3 miles long, so it is 0.1 mile longer.

2.3.1.3 West Option 2



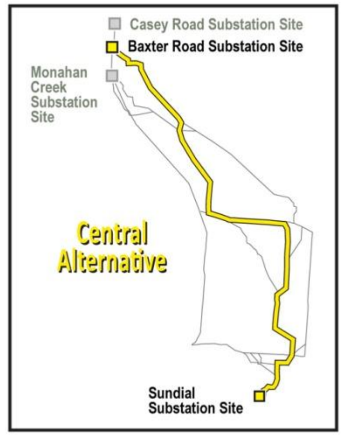
West Option 2 includes route segments 36, 36A, 37, 38, 43, 48, and 51 instead of segments 36B, 41, 45, and 50 (see Map 2-3 and Table 2-2). West Option 2 is about 9 miles long and replaces segments that are 7.4 miles long, so it is about 1.6 miles longer.

2.3.1.4 West Option 3

West Option 3 includes route segments 36, 36A, 37, 38, 39, T, 49, and 51 instead of segments 36B, 41, 45, and 50 (see Map 2-3 and Table 2-2). West Option 3 is about 13 miles long and replaces segments 7.4 miles long, so it is about 5.6 miles longer.

2.3.2 Central Alternative and Options

2.3.2.1 Central Alternative



The Central Alternative begins at the Baxter Road substation site, then extends south on route segments B, F, G, H, 10, 12, 15, 23, L, 18, 28, V, P, 35, T, 49, 51, and 52 and connects to the Sundial substation site (see Map 2-4 and Table 2-3). The Central Alternative is about 77.3 miles long.

Table 2-3 Central Alternative and Options

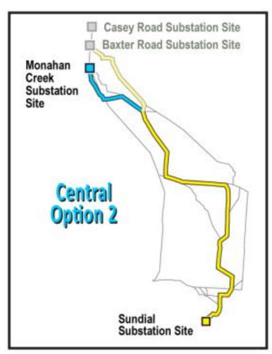
Alternative and Options	Substations and Segments Used to Form Alternative (North to South)	Segments or Substation Site Removed to Form Option	Segments Added to Form Option
Central Alternative	Baxter Road, B, F, G, H, 10, 12, 15, 23, L, 18, 28, V, P, 35, T, 49, 51, 52, Sundial		
Central Option 1		Baxter Road	Casey Road, A
Central Option 2		Baxter Road, B, F, G	Monahan Creek, 1, 4, 5, 8, 11
Central Option 3		L, 18, 28, V	M, 26, 30

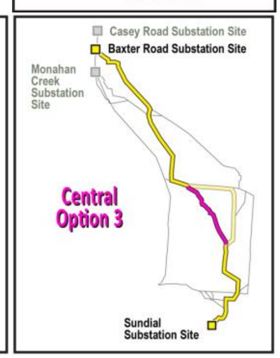
2.3.2.2 Central Option 1

The Central Option 1 route begins at the Casey Road substation site instead of the Baxter Road substation site and includes route Segment A (see Map 2-4 and Table 2-3). Central Option 1 is about 2.5 miles long and does not replace any other segments.

2.3.2.3 Central Option 2

Central Option 2 begins at the Monahan Creek substation site instead of the Baxter Road substation site and includes route segments 1, 4, 5, 8, and 11 instead of segments B, F, and G (see Map 2-4 and Table 2-3). Central Option 2 is about 15.7 miles long and replaces segments that are 18 miles long, so it is about 2.3 miles shorter.

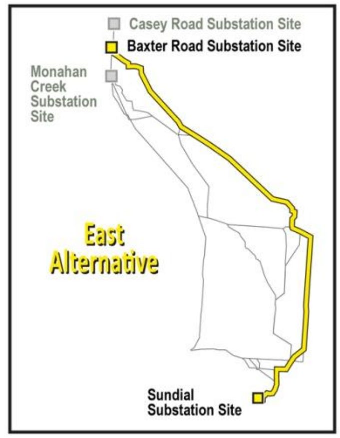




2.3.2.4 Central Option 3

Central Option 3 includes route segments M, 26, and 30 instead of segments L, 18, 28, and V (see Map 2-4 and Table 2-3). Central Option 3 is about 15 miles long and replaces segments that are about 21 miles long, so it is about 6 miles shorter.

2.3.3 East Alternative and Options



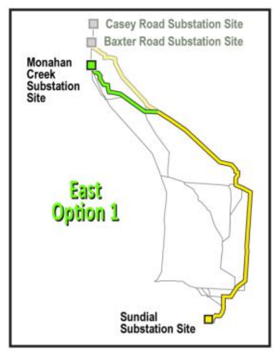
2.3.3.1 East Alternative

The East Alternative begins at the Baxter Road substation site, then extends south on route segments B, F, I, K, W, O, Q, S, 49, 51, and 52 and connects to the Sundial substation site (see Map 2-5 and Table 2-4). The East Alternative is about 75.5 miles long.

Table 2-4 East Alternative and Options

Alternative and Options	Substations and Segments Used to Form Alternative (North to South)	Segments or Substation Site Removed to Form Option	Segments Added to Form Option
East Alternative	Baxter Road, B, F, I, K, W, O, Q, S, 49, 51, 52, Sundial		
East Option 1		Baxter Road, B, F, I	Monahan Creek, 3, 7, 11, J
East Option 2		O, Q, S	U, V, P, 35, T
East Option 3		Q	R

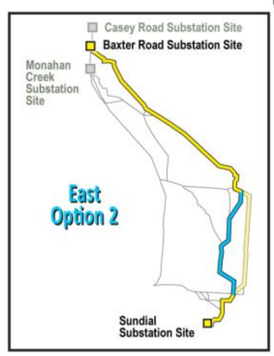
2.3.3.2 East Option 1



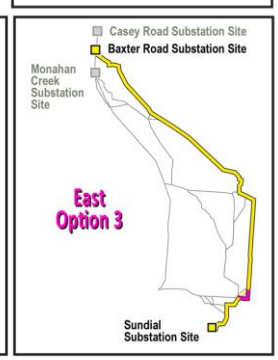
The East Option 1 route begins at the Monahan Creek substation site instead of the Baxter Road substation site and includes route segments 3, 7, 11, and J instead of segments B, F, and I (see Map 2-5 and Table 2-4). East Option 1 is about 17.6 miles long and replaces segments that are 19.4 miles long, so it is about 1.8 miles shorter.

2.3.3.3 East Option 2

East Option 2 includes route segments U, V, P, 35, and T instead of segments O, Q, and S (see Map 2-5 and Table 2-4). East Option 2 is about 23.5 miles long and replaces segments that are 22.5 miles long, so it is about 1 mile longer.

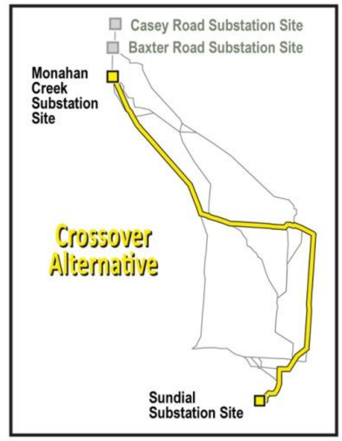


2.3.3.4 East Option 3



East Option 3 includes route segment R instead of segment Q (see Map 2-5 and Table 2-4). East Option 3 is about 3.7 miles long and replaces a segment that is 2.6 miles long, so it is about 1.1 miles longer.

2.3.4 Crossover Alternative and Options



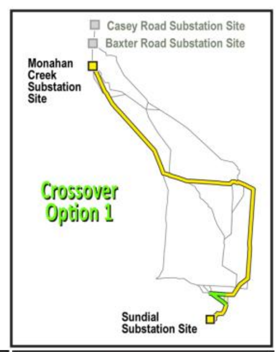
2.3.4.1 Crossover Alternative

The Crossover Alternative begins at the Monahan Creek substation site, then extends south on route segments 2, 4, 9, 14, 15, 23, L, 18, N, W, O, Q, S, 49, 51, and 52 and connects to the Sundial substation site (see Map 2-6 and Table 2-5). The Crossover Alternative is about 74 miles long.

Table 2-5 Crossover Alternative and Options

Alternative and Options	Substations and Segments Used to Form Alternative (North to South)	Segments or Substation Site Removed to Form Option	Segments Added to Form Option
Crossover Alternative	Monahan Creek, 2, 4, 9, 14, 15, 23, L, 18, N, W, O, Q, S, 49, 51, 52, Sundial		
Crossover Option 1		51	47, 48, 50
Crossover Option 2		Monahan Creek	Baxter Road, C, E
Crossover Option 3		Monahan Creek	Baxter Road, D, E

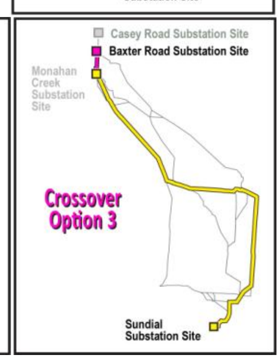
2.3.4.2 Crossover Option 1



Crossover Option 1 includes route segments 47, 48, and 50 instead of segment 51 (see Map 2-6 and Table 2-5). Crossover Option 1 is about 7.3 miles long and replaces a segment that is 2.1 miles long, so it is about 5.2 miles longer.

2.3.4.3 Crossover Option 2

Crossover Option 2 begins at the Baxter Road substation site instead of the Monahan Creek substation site, and includes route segments C and E (see Map 2-6 and Table 2-5). Crossover Option 2 is about 4.3 miles long and does not replace any other segments.



2.3.4.4 Crossover Option 3

Crossover Option 3 begins at the Baxter Road substation site instead of the Monahan Creek substation site, and includes route segments D and E (see Map 2-6 and Table 2-5). Crossover Option 3 is about 4.2 miles long and does not replace any other segments.

Chapter 3 Project Components and Construction, Operation, and Maintenance Activities

This chapter provides an overview of the components of the proposed project and the typical area of disturbance created by these components. This chapter also discusses project design activities; and construction, operation, and maintenance requirements for the project, including removing and replacing existing transmission lines; and lists mitigation measures included as part of the project (see Table 3-2 at the end of this chapter).

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

3.1 Easements and Land Purchases

Much of the project area is private property, with some federal and state ownership, and municipal lands such as land owned by cities, counties, and the Port of Portland. Construction of the project would require easements (rights for use and access) for transmission line rights-of-way and access roads in some locations, and land purchases for the substations and possibly the substation access roads.

In general, BPA would need a 150-foot-wide right-of-way easement for the new 500-kV transmission line and a 50-foot-wide easement for new access roads, and would purchase 25 to 50 acres for each new substation. In addition, BPA would purchase rights where needed to remove vegetation off the right-of-way that could interfere with the safe operation of the proposed transmission line (see Section 3.11, Vegetation Clearing). The 150 feet required for the transmission line right-of-way is BPA's standard width for 500-kV transmission line rights-of-way, and is intended to ensure that the line is a safe distance from other objects and structures such as trees and buildings. The entire 150-foot-wide right-of-way required for a transmission line could be disturbed by construction and operation of a new line depending on the existing land use, vegetation, roads, and other elements found in the right-of-way area.

The action alternatives require varying amounts of new right-of-way and are described in more detail in Chapter 4, Proposed Action and Alternatives. Each alternative has specific right-of-way requirements and configurations, including existing right-of-way widths available for a new line, and whether and how a new line could be placed next to, or in place of, an existing line. These configurations would affect how much new right-of-way would need to be acquired, and consequently how many acres might be occupied by proposed transmission facilities. For example, some portions of the West Alternative have space available for a new line within existing BPA right-of-way next to existing lines, so no new right-of-way would be needed. In another section of the West Alternative, an existing line could be torn down (removed) and the new line could be built in its place. No new right-of-way would be needed in this case.

There are other possible configurations for the action alternatives. In some areas, only a small amount (such as about 12 feet) of new right-of-way would be needed to fit the new line into existing BPA right-of-way that is now vacant (BPA has an easement, but no line exists). In other areas, one or more existing lines would need to be completely removed, and different towers for these lines and for the new transmission line would be built. In these cases, the existing and new lines could be carried together on **double**- or **triple-circuit towers** instead of the typical **single-circuit tower** (see Section 3.2, Transmission Towers).

In locations where the new transmission line right-of-way (typically 150-feet wide) and access roads would be outside an existing BPA right-of-way, BPA would purchase easements from the underlying landowner. Easements for the transmission line would give BPA the rights to construct, operate, and maintain the line in perpetuity. Although the underlying landowner would still own and use the property, BPA would not permit any uses of the transmission line right-of-way that are unsafe or might interfere with constructing, operating, or maintaining the transmission facilities. These restrictions would be part of the legal rights that BPA would acquire for the transmission line. Easements for transmission line access roads would give BPA legal rights to use the roads to access the line when needed for maintenance and emergencies.

BPA would purchase the land for the proposed substations at each end of the line. BPA would acquire about 25 to 50 acres for each of the proposed substations, with exact acreage depending on the parcel selected and the substation design. BPA would purchase fee (absolute) title to each substation property so that it has full ownership rights for the property. BPA may do the same for the substation access road or it may just purchase an easement with shared rights to the use of the road.

3.2 Transmission Towers

3.2.1 Tower Types

Generally, BPA is proposing to use single- or double-circuit 500-kV lattice-steel towers for the proposed transmission line (see Figure 3-1 and inset box). In some locations, triple-circuit towers are proposed. Typically, the single-circuit 500-kV tower would be between 120 and 150 feet tall, depending on terrain and right-of-way configuration. Double- or triple-circuit towers between 180 and 200 feet tall are proposed where removing and replacing existing lines would make room for the new 500-kV line on existing right-of-way.

Tower Types

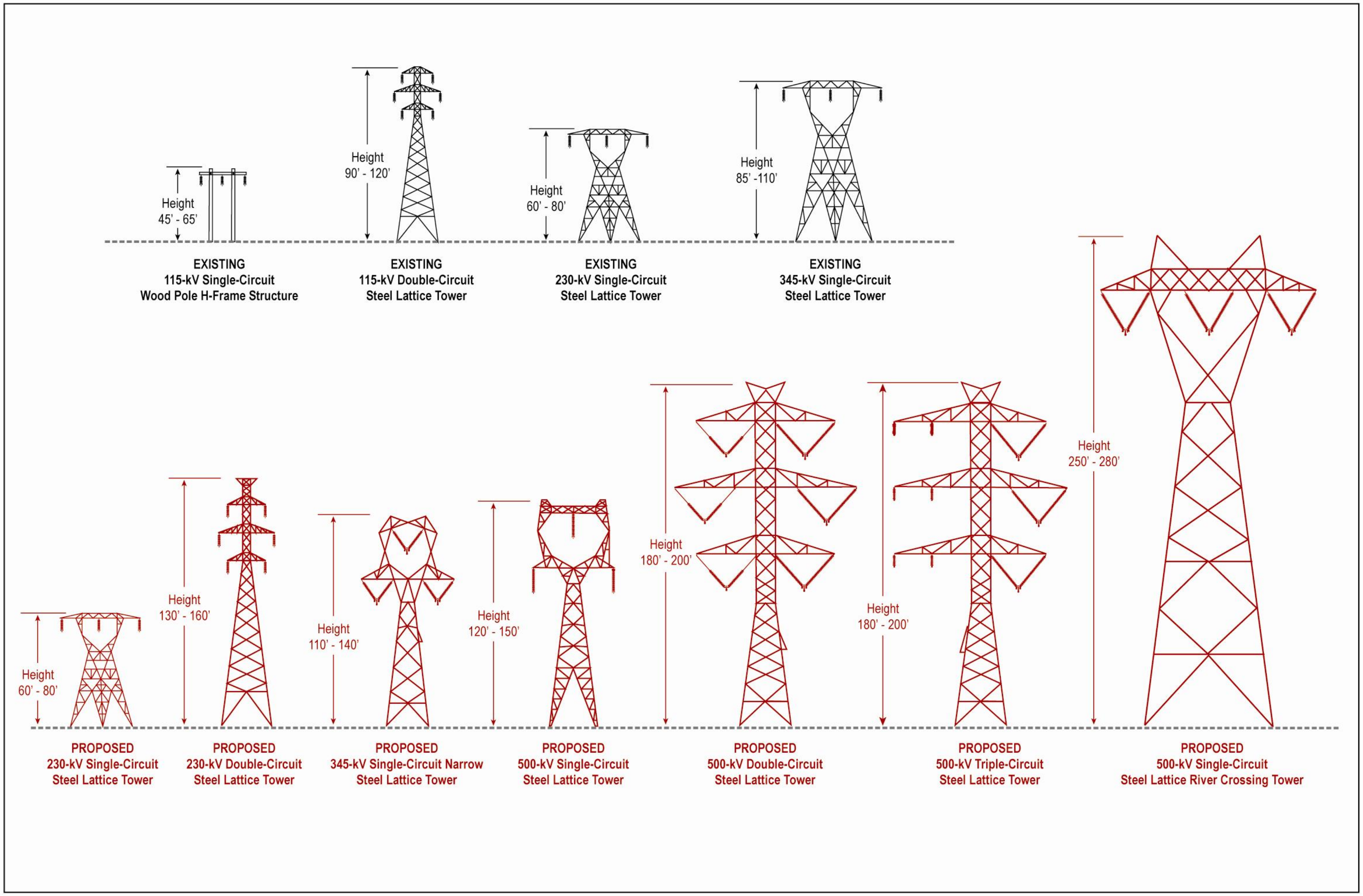
Six types of lattice-steel towers could be constructed for this project (see Figure 3-1):

- single-circuit (SC) 500-kV
- double-circuit (DC) 500-kV
- triple-circuit (TC) 500-kV (would hold one 500-kV line and two 115-kV lines)
- SC 345-kV
- SC 230-kV
- DC 230-kV

Spans between individual towers are typically about 1,150 feet, with about five towers needed for each mile of line. Towers would be made of galvanized steel and may appear shiny for 2 to 4 years before they dull from weathering. About 375 to 390 transmission towers would be needed for the new transmission line. The actual number of towers would depend on the length of the action alternative selected and the actual span length between towers.

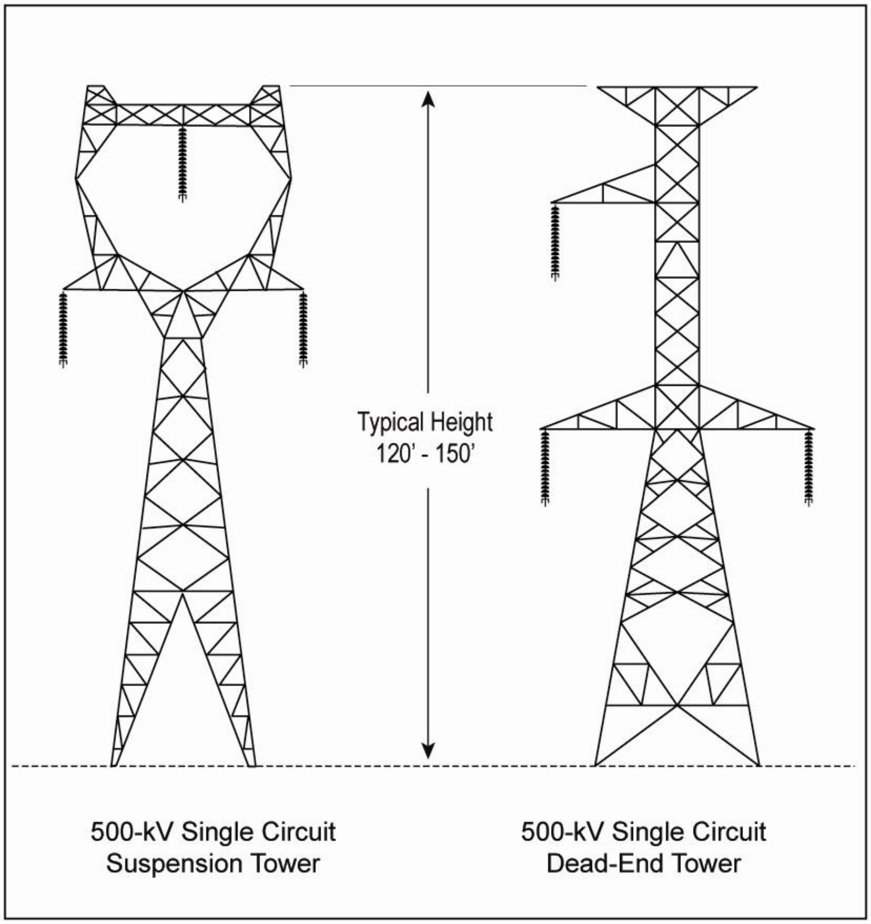
The single-circuit transmission line towers (except for the few river crossing towers) would have a delta configuration where one set of conductors hangs above the other two (see Figure 3-1). Double-circuit towers would have three sets of conductors on either side of the tower. Using the single-circuit delta configuration towers or using double-circuit towers helps reduce electric and magnetic field levels (see Chapter 8, Electric and Magnetic Fields) and uses less right-of-way.

Figure 3-1 Existing and Proposed Structure and Tower Types



Two types of towers would be used for both single- and double-circuit towers: **suspension towers** and **dead-end towers** (see Figure 3-2). Suspension towers would be used to hold the conductors along a straight path. Dead-end towers would be used where the line takes a turn or enters a substation. Dead-end towers are stronger and heavier than suspension towers, and more expensive. Most towers proposed for this project would be suspension towers.

Figure 3-2 500-kV Suspension and Dead-End Towers



Towers at the Columbia River crossing could be up to 280 feet tall (see Figure 3-1). Any towers taller than 200 feet (generally, double-circuit towers and towers used at river crossings) and transmission lines exceeding that height may be considered an obstruction by the Federal Aviation Administration (FAA). Shorter towers and lines can also be considered obstructions depending on their proximity to airport runways. As obstructions, they must be marked according to FAA rules, which may require lighting on each tower and installation of marker balls on the wires that span the space between the tall towers (see Section 3.4, Overhead Ground Wire and Counterpoise and 3.7, Obstruction Lighting and Marking). Specific areas that may require marking are discussed under each alternative (see Chapter 4, Proposed Action and Alternatives).

3.2.2 Tower Footings

Transmission towers would be securely attached to the ground with footings. Footings are assemblies of metal in the ground at each of the four tower corners. Five types of footings could be used to secure the towers: plate, grillage, rock anchor, concrete shaft, and pile footings. Most towers on this project would use either plate or grillage footings.

Plate footings are used for suspension towers. They consist of a 4-foot by 4-foot steel plate buried about 11 feet deep for each tower foot.

Grillage footings are used for dead-end towers. They consist of a 15-foot by 15-foot assembly of steel I-beams that have been welded together and buried 14 to 16 feet deep for each tower foot.

Spread footings with rock anchors are required when suspension towers are built on solid bedrock located less than 2 feet below the surface. Six-inch-diameter holes are drilled into the bedrock about 11 feet deep and steel anchor rods are secured within the hole with concrete.

Concrete shaft footings are used at river crossings or in areas where towers must sustain a higher load and require additional support. Concrete shaft footings can be built on solid bedrock or in soils unfavorable for grillage footings. Concrete shaft footings are engineered columns of concrete reinforced by steel rods about 4 to 10 feet in diameter. Footing depth depends on site-specific engineering requirements.

Micropile footings are used in rare situations where the typically larger excavation for plate and grillage footings is not appropriate. Four to five 4- to 12-inch-diameter holes are augured for each footing so that steel rods can reinforce the base. Those rods are then grouped together and capped with a reinforced concrete pile cap. The tower can then be placed atop the concrete piles.

For plate and grillage footings, a track hoe would be used to excavate an area for the footings. The excavated area would be at least 2 feet larger than the plate or grillage footings to be installed (if the soil is loose or sandy, then a wider hole may be necessary). If the soil and rock removed for plate or grillage footings is suitable, it would be used to backfill the excavated area once the footings are installed. Otherwise, suitable soil would be brought in from another location for backfill.

For spread footings or concrete shaft footings, a drill would be used to make appropriately sized vertical shafts for the footings. Soil and rock removed for rock anchor or concrete shaft footings would either be spread out onto an approved location or removed from the project area. Once foundations are set and cured, each tower would be assembled in multiple sections off-site. The tower sections would be flown in and installed via helicopter or by a large crane.

3.2.3 Tower Disturbance Areas

Typical tower disturbance areas per tower regardless of footing type have been calculated (see Table 3-1). These amounts assume suspension towers are used. Dead-end towers would slightly increase the acreage. The total area could include disturbance from vehicles, construction equipment, crane pads, etc. Compacted soils in most of this disturbance area would be broken up and reseeded after project construction to reestablish close to original conditions. While the area directly below and immediately next to the tower is also reseeded, it is considered unavailable for other uses and therefore a permanently disturbed area and a permanent impact.

Table 3-1 Transmission Tower Estimated Disturbance Areas (Acres)

Tower Type	Type of Disturbance			
	Total Tower Disturbance (Clearance Area) during Construction	Permanent Tower Impact after Construction	Temporary Tower Disturbance during Construction	Extraction Footprint/ Teardown Disturbance
500-kV Single-circuit	0.52	0.08	0.44	0.52
500-kV Triple- or double-circuit	0.69	0.08	0.61	--
345-kV Single-circuit	0.52	0.08	0.44	0.52
230-kV Single-circuit	0.69	0.08	0.61	0.43
230-kV Double-circuit	0.52	0.15	0.37	0.52
115-kV Single-circuit	--	--	--	0.11
115-kV Double-circuit	--	--	--	0.23

Notes:
-- Indicates a tower type that would not be removed or constructed as part of this project.

Along existing right-of-way in the Camas/Vancouver and Lexington areas, some existing wood pole H-frame 115-kV structures, double-circuit 115-kV, single-circuit 354-kV, and single-circuit 230-kV steel towers would be removed and replaced with a new tower configuration to make room for the new line. In most cases, new towers would be constructed on the centerline of the existing line, but not necessarily at the same location as the existing structures or towers, depending on site conditions and land use.

If existing lines are removed, the entire structure or tower footing would only be removed if the footing interfered with placement of the new tower. Otherwise, when the structure or tower is removed, that portion of the footing up to a foot below the surface would be removed (up to 3 feet deep in agricultural areas). The area disturbed when wood pole structures are removed would be about 0.1 acre, and would be about 0.4 acre for lattice-steel towers (see Table 3-1).

3.2.4 Tower Construction in the Columbia River

The Columbia River crossing would include in-water construction activities. Two types of tower footing foundations are proposed: spread footings with rock anchors and micropile-supported footings. For each footing type, construction would likely require a shallow **coffer dam** enclosure to allow **dewatering** of the work zone inside. Work would be conducted from barges stationed near lone Reef (a reef in the middle of the Columbia River at the river crossing where existing towers are located), out of the navigation channel. Barges could be stabilized by gravity weights or rock anchors. All spoils would be collected from within the sealed coffer dam and transferred to a spoils barge.

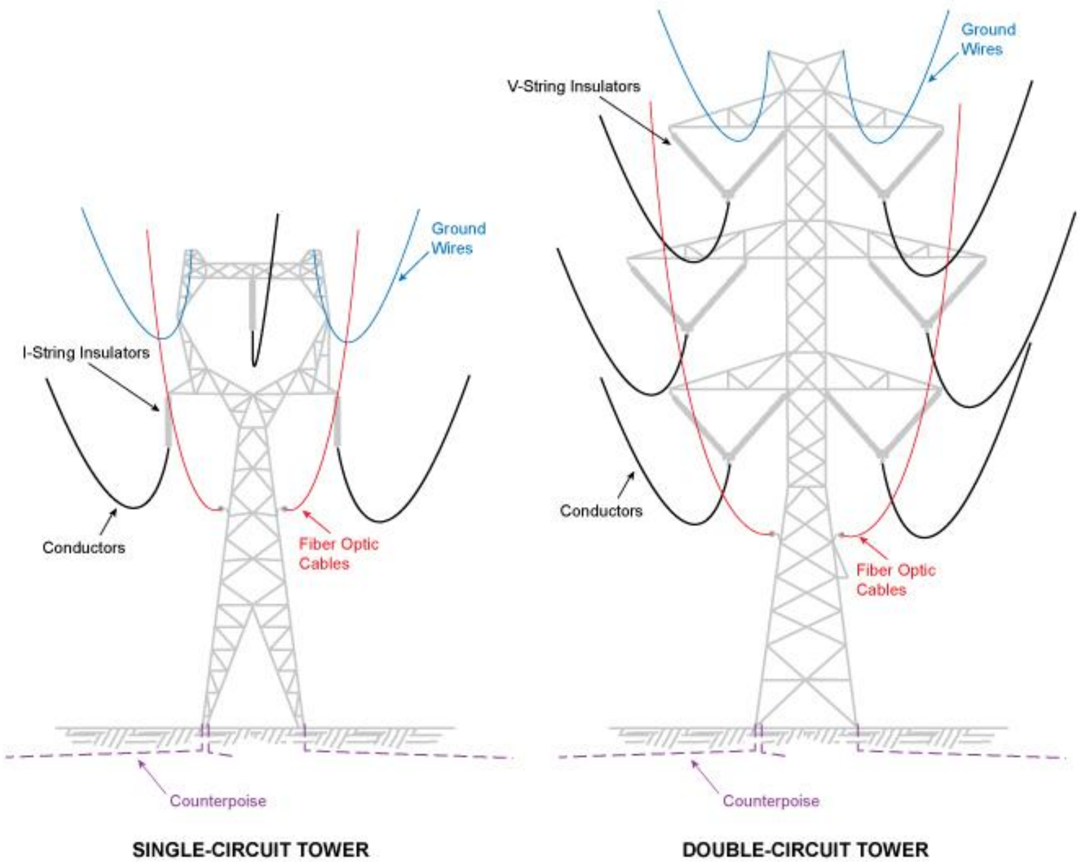
Tower columns would be about 50 feet apart. The cross section would be open to stream flow and round column shapes would allow for large debris passage. Column and framing beam design would accommodate debris impacts (large trees) and impacts from small vessel collisions.

3.3 Conductors

The wires that carry the electrical current on the transmission line are called conductors. The line carries three sets of conductors, called phases. Each phase consists of a bundle of three 1.3-inch-diameter conductors held in a triangular configuration by spacer brackets 16 to 20 inches apart. From a distance, a bundle looks like a single wire.

Conductors are made of steel and are often modified to reduce their reflectivity and brightness. The conductors are attached to the towers using insulators (see Figure 3-3). Insulators are bell-shaped devices that prevent the electricity from jumping from the conductors to the tower and down to the ground. The insulators are made of porcelain or fiberglass and are non-reflective. The conductor would need to be fitted together where one reel of conductor ends and a new reel begins. Conductor fittings would be made using hydraulic compression. Hydraulic compression uses a press that compresses the fittings on the conductor. Nine conductors (three bundles each with three conductors) would need to be fitted once about every 1.5 to 2 miles, depending on the length of conductor on the reel.

Figure 3-3 Conductor, Insulator, Ground Wire and Fiber Optic Cable Positions on a Typical 500-kV Tower



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

3.4 Overhead Ground Wire and Counterpoise

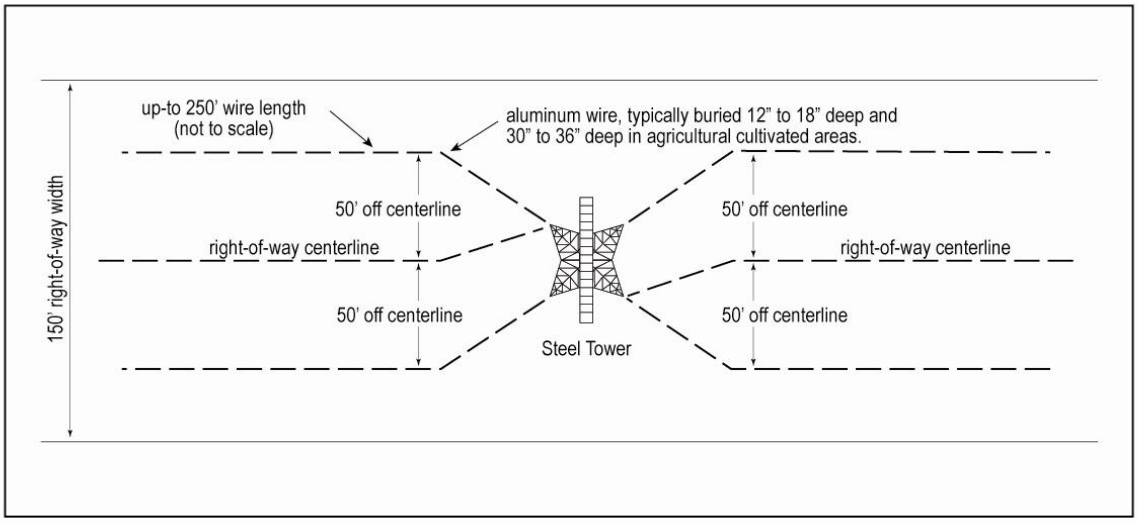
Two small wires (0.5-inch diameter), called overhead **ground wires**, would be attached to and strung between the tops of each transmission tower (see Figure 3-3). Ground wires are used for lightning protection. When lightning strikes, the overhead ground wires take the charge instead of the conductors.

Wires that exceed certain height criteria (such as when spanning rivers or deep ravines) or are within a certain distance of airports are required by the FAA to be marked with marker balls to make them more visible to aircraft in the area. For this project, marker balls would be required on the uppermost ground wires crossing the Columbia River and could be required in other locations where the action alternatives cross deep ravines. The marker balls would be 36 inches in diameter and orange, white, and yellow in varied sequences on the line. They would be placed 400 feet apart on each of the two overhead ground wires, but would be staggered on the two lines about 200 feet apart.

To take the lightning charge from the overhead ground wire and dissipate it into the earth, a series of wires called **counterpoise** would be buried in the ground at the base of the towers. Counterpoise could be needed at most towers, depending on the soil types present. Counterpoise designs vary and are dependent on tower type and site conditions. The most common design would include six runs of wire that extend up to 250 feet from the tower (three counterpoise ahead-on-line and three back-on-line (see Figure 3-4). BPA would use aluminum wire (3/8-inch diameter) typically buried 12 to 18 inches deep, except in cultivated areas where it is buried about 30 inches deep or deeper where farmers use deeper plowing methods. When three counterpoise wires run in the same direction, one counterpoise will run down the centerline of the right-of-way with the other two extending at a 45-degree angle away from the tower, then turning and running along the right-of-way at a distance of 50 feet off centerline. When obstructions or environmentally sensitive areas are encountered, the counterpoise can be redesigned to avoid these areas.

During construction, the counterpoise can be installed in several ways. Installers could use backhoes, trenchers, vibrating plows, or occasionally hand dig trenches depending on the depth, soils, terrain and size of buried rock. With a backhoe, the trench would be 12 or more inches wide. Removed soil and rocks would be piled to the side and placed back in the trench to cover the counterpoise. A trencher would open up a 4- to 6-inch wide trench and lift up the soil to the side, which would be pushed back into the trench after the counterpoise is installed. Large tractors use a vibrating plow to force a blade into the ground. The counterpoise would then run through a hole in the blade and trail out behind the blade at a specified depth. In areas where a tower would be built on solid rock, the counterpoise would be placed in crevices where possible; otherwise counterpoise would not be used.

Figure 3-4 Typical Counterpoise Placement



3.5 Communications and Control Equipment

Fiber optic cable would also be strung on the steel towers (see Figure 3-3) from the new Castle Rock area substation to the existing Troutdale Substation, and from the existing Troutdale Substation to the nearby new Sundial Substation. The cable would be used as part of a communication system that can gather information about the system (such as whether the line is in service, the amount of power being carried, meter readings at interchange points, and status of equipment and alarms). The fiber optic cable allows voice communications between power dispatchers and line maintenance crews and provides instantaneous commands that control power system operation.

The fiber cable would be less than 1 inch in diameter and would be mounted under the conductors. Every 3 to 5 miles there would be a splice box/reeling location that allows tension to be placed on the fiber optic cable. The splice box would be about 22 inches by 8.5 inches by 6 inches and would be installed in a vault in the ground between the tower legs, mounted on the towers, or placed on the ground next to the tower and covered with rock. Vault boxes would be about 4 feet by 4 feet by 4 feet. There would also be fiber vaults outside the fences at the substations and possibly fiber optic wood poles near these vaults to help transition the fiber cable from overhead to underground inside the substations. Once inside the substation, the fiber cable would be underground in conduit and trenches to the substation control house. Changes would be made to equipment inside existing substation control houses to accommodate the new cable.

Between towers that cross the Columbia River, fiber optic cable would be installed above the conductors because the typical placement of the cable below the conductor for safety during maintenance does not meet minimum clearances for ship navigation. The fiber optic cable would also act as the overhead ground wire and is reinforced to be strong enough for the long span required to cross the river.

3.6 Pulling and Tensioning Sites

Pulling and tensioning sites are those areas from which the conductor and fiber optic cable are pulled and tightened to the correct tension once they are mounted on the transmission towers. Conductor is packaged and transported on reels that can hold up to 9,500 feet of conductor. Depending on the size of the reel, pulling and tensioning sites (or reel sites or conductor tensioning sites) can be from 1.75 to 3.5 miles apart. These sites are also dependent on the topography and typically disturb about 0.7 acre each (about 300 feet long by 100 feet wide). A flat area is needed at each pulling site for the large flatbed trailer with the reels of conductor and tensioning machine. Pulling sites are generally placed within the right-of-way; however, where the line takes a turn (at angle points), sites are often outside of the right-of-way. The appropriate areas are determined by the construction contractor using environmental and land use information provided by BPA. Depending on conditions, the site could be graded, graveled with crushed rock, reseeded, or a combination of these activities. Additional environmental review would be conducted for these areas when they are identified, if necessary.

When stringing conductor, a **sock line** (thick rope) is placed in the travelers (small wheels hung from the towers) by hand or by helicopter from tensioning site to pulling site (one pull). The end of the sock line is then attached to a hard line (wire thinner than conductor but stronger than sock line) and pulled back to the end of the pull where the conductor is sitting in a reel. The hard line is connected to a “gator” plate that holds the three wires in each bundle (a phase). Each gator and triple bundle is pulled through the travelers to the other end of the pull and before the conductor is pulled to its final tension, it is often “snubbed.”

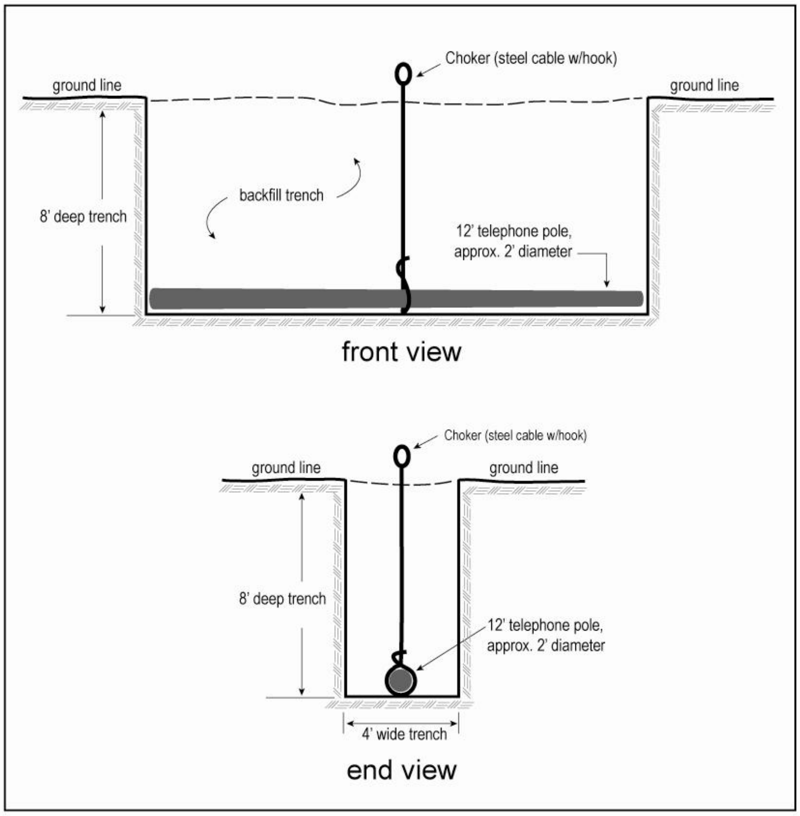
Snubs are trenches about 8 feet deep by 4 feet wide by 12 feet long used to tie off the conductor after it is pulled through the towers and before it is strung under tension (see Figure 3-5). These trenches are excavated and then backfilled to weigh down the snub so line tension can be maintained without breaking. In some instances, a concrete slurry mix is added to the top 2 feet of the trench to add density to hold the tension. After the snubs are used, the choker (a steel cable with a hook) is snipped below the surface and the wood pole is left behind. In some instances, such as in agricultural fields, the pole is reclaimed and the trench is backfilled.

In areas where conductor is strung over existing roads, highways, railroads, or water, guard structures are installed as a safety precaution. Guard structures are similar to 115-kV H-frame wood structures and are usually installed within the right-of-way on either side of the road, highway, etc. during construction and then removed once the conductor stringing is complete. The temporary disturbance area is about 0.11 acre. Additional environmental review would be conducted for these areas when they are identified and if they need to be positioned outside of the proposed right-of-way.

Conductors are not put under designed tension until all conductors are hung. When all conductors have been installed (hung) on the line and one end of the conductor has been connected to a tower (usually a dead-end tower), the conductor is pulled by equipment (usually a bulldozer or tractor) on the other end of the conductor (up to 3 or more miles away depending on the location of the next dead-end tower or the end of the conductor, whichever is closest) to the correct amount of tension (conductor sag). The correct conductor sag ensures proper ground clearance, and that supporting towers are not overloaded under ice and wind.

Jumpers are then installed. Jumpers are wires that connect conductors on one side of a dead-end tower to conductors on the other side of the same tower. Putting tension on the fiber optic cable would occur at the same pulling sites used for the conductor and would require smaller equipment to pull the cable (no "snubs" required) because the fiber optic cable has a smaller diameter and is lighter than the conductor.

Figure 3-5 Typical Snub Placement



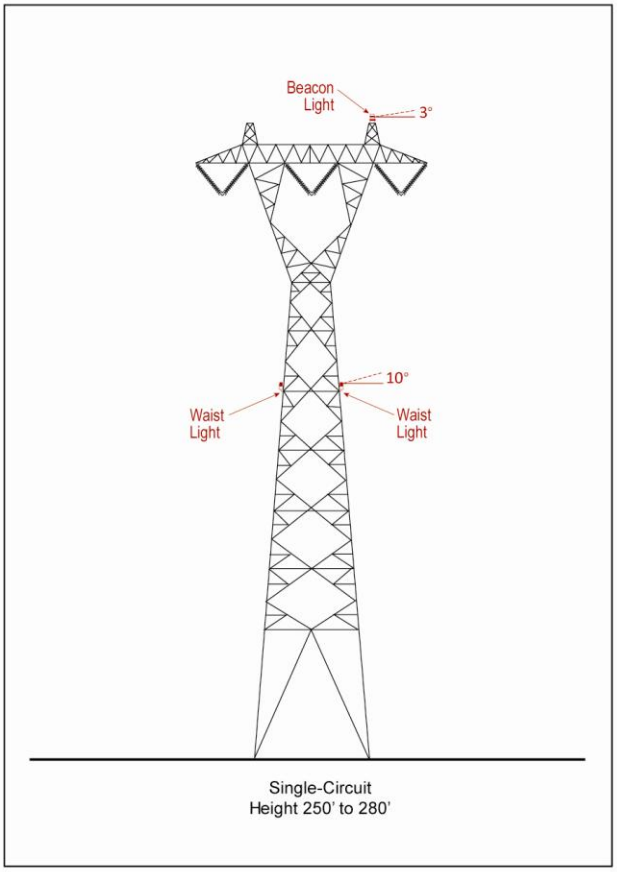
3.7 Obstruction Lighting and Marking

The FAA requires transmission structures, such as steel towers, that exceed certain criteria to have lighting and/or marking. These criteria are usually based on (but not limited to) the structure's height, proximity to an airport, river crossing, or a combination of these factors depending on the situation. The lighting and marking of structures and the conductors between them serve as a visual aid to help pilots avoid accidents. In the past few years, BPA has carried out a lighting program that uses the latest technology for structure lights to meet FAA's requirements, while minimizing visual impacts to landowners and others on the ground.

The most common lighting scheme BPA uses is a dual color (white/red) "medium- intensity" beacon on top of the structure and two red "low-intensity" waist lights mid-structure (see Figure 3-6). The top beacon flashes white during daylight hours and red when daylight diminishes to a level defined by the FAA. When the light turns red the intensity is reduced, but the light remains visible to pilots.

The beacon is designed to emit light straight out horizontally from the structure and upwards at a 3 degree angle. This means that most of the light emitted is visible from only above the towers. The low-intensity waist lights do not operate during daylight hours. At night they burn red steadily and at a lower intensity than the top beacon. The low-intensity lights are also designed to emit light straight out horizontally, and upwards at a 10 degree angle. Similarly, they are not typically seen except when level with the lights or from above the tower.

Figure 3-6 Example of Beacon and Waist Lighting for a Typical 500-kV Tower[1]



[1] Single-circuit 500-kV towers used to cross the Columbia River may be different (see Figure 3-1).

An alternative lighting solution sometimes required by the FAA is known as a "Catenary" scheme. This configuration has a dual color (white/red) medium-intensity beacon at the top, middle, and bottom levels. This eliminates the low-intensity lighting at the middle level. This lighting scheme is usually installed on two structures forming a crossing of some type (i.e., river or canyon) alerting pilots of an obstruction between the two structures.

Occasionally, the FAA requires marking spheres (balls) be installed on the conductors between two structures. These are often required in addition to structure lighting. The FAA has approved 36-inch spheres in three colors (orange, white and yellow), specifically patterned based on the length of the crossing, with a certain spacing between each one. The spheres emit no light and serve strictly as a daytime warning.

3.8 Substations

Substations are vital hubs for transmission lines. Among other things, they can connect different transmission lines together, allow switching between lines and isolate lines when necessary. The substations proposed for this project would not be traditional substations, that is, they would not have transformers. Instead they would operate as switching stations and would have equipment for controlling power flow only.

About 25 to 50 acres would be required for each substation, depending on the site and design used. Each substation area would include the substation yard (equipment within the fence) and grading outside of the fence. Construction crews would first clear and grade the substation site.

Conduits, drainage pipes, and the grounding system would be trenched or dug several feet into the ground. Footings for the equipment and the foundation for the control house would be dug up to 8 feet into the ground (substation dead-end tower footings would be deeper). All equipment would then be placed in appropriate positions. A chain-link fence would be installed around the substation. About 6 inches of rock would be laid, with a 10-foot gravel buffer extending outside the substation fence.

The 500-kV equipment that would be installed at the substations includes the following:

- Power circuit breakers: A breaker is a switching device that can automatically interrupt power flow on a transmission line at the time of a fault, such as a lightning strike, tree limb falling on the line, or other unusual events. The breakers would be installed at the substation to redirect power as needed. Several types of breakers have been used in BPA substations over the years. The breakers planned for this project, called gas breakers, are insulated by special non-conducting gas (sulfur hexafluoride). These breakers would contain no oil, but would contain a small amount of hydraulic fluid. Power circuit breakers are about 24-feet tall and about 22-feet long.
- Generator and coupling capacitor voltage transformers (CCVT): A CCVT is used to step down high voltage signals to low voltage signals for the purpose of measurement or to operate a protective relay. A **protective relay** is a safety measure designed to calculate operating conditions on an electrical circuit and to trip circuit breakers when a fault is detected.
- Shunt reactor: A shunt reactor is an electromagnetic device used to absorb reactive power (**capacitance**) and to lower system voltage. Shunt reactors need oil containment. If required, a shunt reactor would be constructed at the Sundial substation site to maximize the electrical performance of the transmission system.
- Series capacitor bank: A capacitor is a device that stores electrical energy and releases it back into the power system when required. Transmission lines, like any other wire, have an inherent property called **impedance**, which causes some resistance to the flow of power. Series capacitor banks compensate for some of this impedance, reducing power losses and allowing the line to carry more power. A series capacitor bank would be used at Sundial Substation.
- Surge arrestors: A surge arrestor is an electrical device used to protect equipment from lightning.
- Buswork: Buswork is a series of flat strips of copper or hollow tubes of aluminum that conduct large currents of electricity and allow heat to dissipate more efficiently over short distances. They are not insulated.

- Switches: These devices are used to mechanically disconnect or isolate equipment. Switches are normally located on both sides of circuit breakers. Switches are about 23 feet tall and about 16 feet long.
- Substation dead-end towers: These are the towers within the substation where incoming or outgoing transmission lines end. Substation dead-ends are typically the tallest structure within the substation.
- Substation rock surfacing: A 6-inch layer of rock (extending about 10 beyond the fence line), selected for its insulating properties, is placed on the ground within the substation to protect operation and maintenance personnel from electric shock during substation electrical failures.
- Control house: The substation control house contains electrical panels, meters, relays, and other equipment needed to control the transmission line operation.
- Ground mat: A system of interconnected bare conductors arranged in a pattern or grid, normally buried below the surface of the substation, primarily to provide safety for workers by limiting voltage differences within its perimeter to safe levels. Also called a ground grid.
- Stormwater retention system: Stormwater management involves measures to prevent sediment and other pollutants from entering surface or groundwater, treatment of runoff to reduce pollutants, and flow controls to reduce the impact of altered hydrology. All Castle Rock substations would include a stormwater detention pond (a pond is not needed at Sundial Substation).
- Substation electrical service: Substations need local electrical service to power the lights, fans, and equipment in the substation. That service is provided by the local utility via a wood pole electric line similar to lines that provide service to local area homes and businesses.
- Back-up generator: The back-up generator has a 2,500-gallon diesel tank and would be used if the local substation electrical service fails.

3.9 Access Roads

Access roads are the system of roads that BPA's construction and maintenance crews would use to get to the towers or tower sites along the transmission line route and to substations. BPA has a policy and standards for access road design and construction. Engineers design the roads to be used by cranes, excavators, supply trucks, boom trucks, log trucks, and line trucks. Roads are built within the transmission line right-of-way as much as possible if terrain and land use allow. The road system used to access the transmission towers and substations would be a mix of public, private, and BPA access roads across public and private land. BPA typically purchases 50-foot-wide easements for new roads and access roads in areas off the right-of-way. Access roads typically require a 14-foot-wide travel surface (wider on curves). Typically, easements for existing private roads (such as driveways, farm roads, and timber roads) are about 20 feet.

Access roads to substations are wider and are built for a heavier weight load than those for the transmission line. Substation access roads would be graveled and would require a 30-foot-wide travel surface, with about a 75-foot-wide total area disturbed. A 75-foot-wide substation access road would typically be purchased in fee. In some cases, though, only an easement would be purchased for the road that would allow construction and maintenance activities (similar to roads that access towers).

A new transmission line would also require some improvements of existing roads and construction of new roads (including spurs to individual tower sites), with the following requirements:

- Road improvements: Roads would be graded, and rock would be placed where the soil is unstable. Vegetation removal could be required if roads have become overgrown or need to be widened. Improved roads typically require up to a 20-foot-wide disturbance area (including drainage ditches). Dirt roads often become slippery and impassible when wet. Depending on the season, roads would be graveled where needed for load bearing, stability, and dust abatement.
- New roads: New roads typically include up to a 30-foot-wide disturbance area (including travel surface and drainage ditches). New road sites are cleared and graded. Maximum road grades vary depending on the erosion potential of the soil: 6 to 8 percent on erodible soils, 10 to 15 percent for erosion-resistant soils, and steeper grades for access to towers where the road would have no joint use. When wet, the soil on most dirt roads in the project area becomes slippery and can become impassable; these roads would be graveled to make them passable. Where new roads cross year-round, seasonal, or fish-bearing streams, open bottomed culverts or bridges would be needed. **Drain dips** or **water bars** may also be needed on steep slopes or where access roads cross drainages that carry seasonal runoff. New stream and drainage crossings would be avoided where possible.

In coordination with landowners, BPA installs gates across entrances to access roads to prevent public access to private lands and the transmission line right-of-way. Gates in the project area are also used to separate animals or denote property lines. Swing gates would be installed or would replace barbed-wire or broken gates. Gate locks would be coordinated with the landowners to ensure that both BPA and the landowner could unlock the gates.

If towers are placed in agricultural fields, BPA would typically only build temporary access to the tower site to construct the line. Once construction is complete, the road would be removed and compacted soil would be broken up for continued agricultural use. If the tower needed to be accessed later for maintenance or emergency situations, and BPA affects crops, BPA would pay the landowner, as appropriate, for any crop damage resulting from BPA activities.

During construction, additional other private local roads or public roads and highways would be used to move materials, equipment and workers to the construction area. If these roads could accommodate construction vehicles and materials, these roads would not need to be improved. As mentioned previously, BPA would obtain rights to use private roads.

3.10 Staging Areas

Several temporary staging areas would be needed along or near the transmission line for construction crews to store materials and construction vehicles, and to assemble tower segments for helicopter erection. Staging areas can be from 5 to 15 acres depending on the amount of materials and number of locations needed. The contractors hired to construct the transmission line would be responsible for determining appropriate staging area locations.

Often the contractor rents empty parking lots or already developed sites for use as staging areas, which may be located within and outside of the right-of-way. Environmental review of staging areas would be conducted prior to approval for use.

3.11 Vegetation Clearing

BPA would develop contract specifications to guide the construction contractor hired for vegetation clearing. The specifications would identify the area within and next to the right-of-way and access roads where existing vegetation would need to be removed and specific types and locations of vegetation that could be left.

As a general rule, all tall-growing vegetation would be removed from the 150-foot right-of-way at the time of construction. All low-growing vegetation over 4 feet would typically be removed depending on the vegetation and specific construction, operation, or mitigation requirements. All vegetation in construction areas for substations and for access roads, pulling sites, and staging areas outside of the right-of-way would be disturbed or removed. At the tower sites, all brush below 4 feet and stumps more than 22 inches in diameter would be removed. This removal includes root systems from a typically 50-foot by 50-foot area.

Any tree (stable or unstable) outside of the acquired transmission line right-of-way deemed a present or future hazard to the transmission line is considered a **danger tree** and is removed prior to construction of the line. A tree would be identified as a danger tree if it could fall into, bend into, or grow into the conductor or be close enough to the conductor as it swings to cause a flashover of current from the conductor.

The greatest potential for the removal of danger trees for this project would be in cases where the line crosses forest lands with stands of trees over 20 years old. In these locations, danger trees could be taken from as far away as 200 feet from the edge of the right-of-way depending on the topography and condition of the trees. Tall-growing trees may be left or topped where the right-of-way crosses drainages or stream crossings if there is adequate safety clearance (considering a number of years of growth) between the trees and the transmission line. Fewer danger trees are cleared where the line crosses recent clearcuts or forests less than 20 years old, although scattered large trees or snags that may be hazards to the transmission line could be removed. Typically, about 80 percent of the trees that need to be removed are found within 20 feet of the edge of the right of-way.

When an existing stand of trees next to the right-of-way is found to be so highly compromised that it is unstable as a whole, all trees from outside the right-of-way from the last tree tall enough to hit a conductor to the edge of the right-of-way would be removed. This strip of removed trees outside the edge of the right-of-way is called a **safety backline**. Creating a safety backline ensures that no trees will fall into the line in the future and provides reliability for the line. A safety backline is used only when necessary. Unlike trees in the right-of-way, trees removed for a safety backline are allowed to grow back unless they are later determined to be a danger to the transmission line.

Because of this project's location west of the Cascades, existing trees would need to be cleared along new and existing rights-of-way, new and improved access roads, staging areas, pulling sites, and substations. Vegetation has been allowed to grow on vacant areas of existing right-of-way as long as it has not created hazardous conditions for existing lines.

For safe and uninterrupted operation of a transmission line, vegetation within a right-of-way is not allowed to grow above a certain height. If vegetation grows or falls close to a transmission line it can cause an electrical arc, which can start a fire, cause an outage of the line, and or injure or kill someone. Management of right-of-way vegetation varies depending on many factors, including line voltage; vegetation species, height, and growth rates; ground slope and topography; conductor elevation above ground and conductor swing; clearance distance required between the conductors and other objects; and electrical loading on the line.

Vegetation is not allowed to grow in substation electric yards or in the 10-foot buffer around the yard because it could interfere with the operation of the ground mat. A ground mat is a metal grid buried under the soil to “ground” the electrical equipment of the substation. A plant growing up through the ground mat could provide another grounding path for electricity. If a person were to touch the plant when there is a fault (like a short circuit) on the system in the substation he or she could be electrocuted.

3.12 Mitigation Measures

Mitigation measures are actions that can be taken to minimize or avoid potential impacts to the human and natural environment from a proposed project. A table of all mitigation measures that BPA has included as part of the project is at the end of this chapter (see Table 3-2 at the end of this chapter). Mitigation measures in this table are categorized by resource; some are repeated under more than one resource. All mitigation measures included as part of the project would be implemented prior to, during, or immediately after construction.

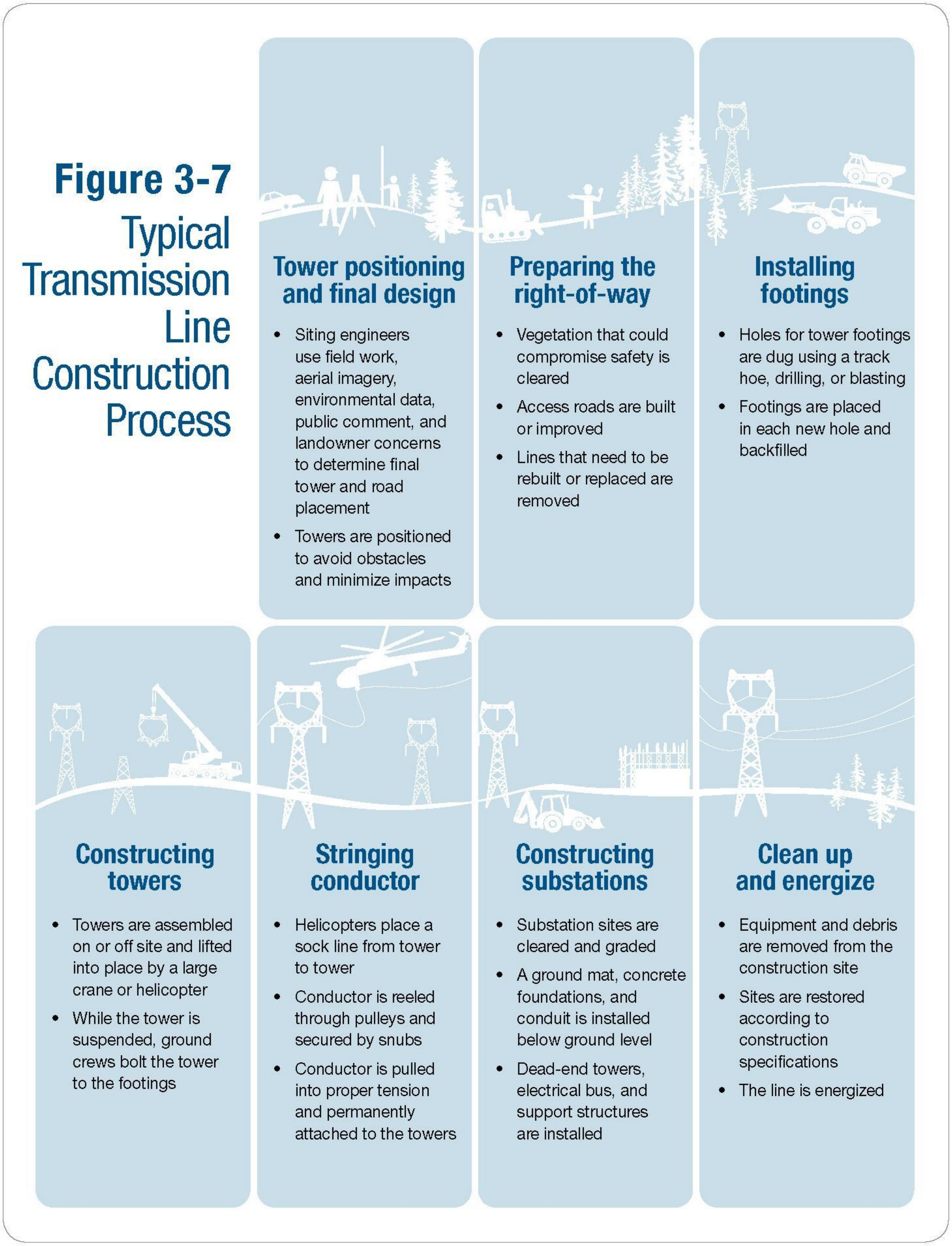
In addition to mitigation measures included as part of the project, other mitigation measures, including compensatory mitigation, have or will be identified through preparation of this EIS. These additional mitigation measures could also be implemented to reduce, eliminate, or offset potential adverse impacts of the project. These additional mitigation measures, if known at this time, are identified in the EIS resource chapter to which they apply (see Chapters 5 through 22).

If BPA decides to build the I-5 project, a Mitigation Action Plan (MAP) would be prepared for the project at the time of that decision and before implementing the project. The MAP would explain how mitigation measures identified for the project will be planned and implemented. Monitoring during and after construction would help ensure implementation and success of the mitigation measures.

3.13 Final Project Design and Construction Process

After completion of environmental review under NEPA, if a decision is made to construct the project, final design of the transmission line, including the precise location of towers, would be completed (see Figure 3-7). To determine exact tower locations along a transmission line right-of-way, BPA typically uses field information from siting engineers and collects terrain data using Light Detection and Ranging (LiDAR) data, a remote sensing technology employing eye-safe laser pulses originating from a helicopter or airplane. BPA augments these sources as necessary with other terrain data collection methods such as photogrammetry and survey crews working on the ground. High-resolution aerial imagery is also collected to aid in tower siting.

Figure 3-7 Typical Transmission Line Construction Process



Towers are positioned using the terrain data and aerial imagery to provide adequate conductor clearances above ground and avoid obstacles while generally minimizing the frequency, height, and impact of the towers. This same data is also used to locate access roads. Engineers also use environmental information and discussions with landowners to help determine tower and access road locations.

Construction begins with preparation of the right-of-way. Vegetation would be cleared as described in Section 3.11, Vegetation Clearing, and access to the right-of-way would be established or improved where necessary. If the proposed new line would be constructed by rebuilding an existing line, any existing wood pole structure or steel tower transmission line that needs to be replaced would be taken out of service and existing conductor and structures or towers removed. Existing poles would be cut off at ground level and removed. Guy anchors and counterpoise would be cut 1 foot below ground and removed. In instances where a new tower is placed in the same location as the old structure, the construction contractor would remove as much old pole, guy anchor and counterpoise as is necessary and the area then would be further excavated for the new tower footings.

Holes for tower footings would be dug with a track hoe (drilling or blasting may also occur if rock is present) and footings would be put in place at each tower site. Towers would be either assembled at the tower site and lifted into place by a large crane (30- to 100-ton capacity) or assembled at a staging area off site and set in place by a large skycrane helicopter. The towers or tower segments would then be bolted to the footings.

The conductor would then be strung from tower to tower through pulleys on the towers using a sock line (see Section 3.6, Pulling and Tensioning Sites). The sock line is placed in the pulleys and pulled through by a helicopter much smaller than the skycrane. The fiber optic cable would also be strung using a helicopter, with pulling sites on the ground to tighten the cable.

When one reel of conductor ends and a new one begins, the conductor has to be fitted together. Hydraulic compression is used to compress the fittings on the conductor. Three conductors would need to be fitted about once every 1.5 to 2 miles.

After the towers, conductors, and fiber optic cable are installed, the construction contractor would remove construction equipment and debris and restore the disturbed areas. Soils used for agriculture in the temporary disturbance area that become compacted would be restored and reseeded after project construction to reestablish close to original conditions.

At the substation site, several construction activities would occur. The site would be excavated to bring the topography to grade. Once a layer of soil material is laid down, the concrete foundations for all the high voltage equipment and structures would be installed. The stormwater retention system and ground mat and conduit for control cables would also be installed.

After all the below grade substation work is completed, the above grade construction work would begin with the erection of the dead-end towers and aluminum pedestals to support the electrical bus. Then, other support structures would be installed for the high voltage equipment. The high voltage equipment would be bolted on the support structures and connected to the electrical bus by seismic flexible jumpers. Control cables would be attached to the high voltage equipment and routed to the control house.

3.14 Construction Schedule and Work Crews

The timeframe needed for construction of the project is about 30 months. Under the current schedule, if a decision is made to proceed with the project after completion of the NEPA process, construction could begin as early as 2014. Line construction generally would occur after road construction. Construction work would be staged with one type of activity taking place in one area (such as road construction) and another activity taking place in another area where roads exist (such as vegetation removal and tower construction). A typical crew can usually construct about 10 miles of transmission line in 4 months. In areas where terrain is steep, progress may be slower. Construction of roads and tower pads (if required) usually takes about 3 to 5 months including close-out repairs of any roads damaged during construction. The remainder of the construction period would include substation work including connecting the new line and other existing lines into the substations, and tower site restoration work.

Helicopters could be used for clearing and would be used intermittently for 6 to 7 months during removal of existing lines and construction of new lines. A small helicopter would be used to remove wood poles in inaccessible areas and for stringing the sock line.

The transmission line and substations would be constructed by two or more construction contractors. A typical transmission line construction crew and equipment for a 500-kV line would include the following:

- 50 to 60 construction workers (70-100 at the peak of construction; actual workforce numbers would vary over time)
- 45 vehicles (pickups, vans, trucks)
- 3 bucket trucks
- 1 conductor reel machine
- 3 large excavators (bulldozers, backhoes)
- 1 line **tensioner**, 1 puller, 1 reel trailer
- 2 helicopters (small helicopter and skycrane; size dependent on lifting required)
- 1 to 2 large (210-ton) and mid-sized (50-ton) cranes
- Road construction equipment (dump trucks, rollers, graders, dozers, excavators, water truck)

A typical substation construction crew and equipment for a 500-kV line would include the following:

- 20 to 30 construction workers (40-50 at the peak of construction)
- 5 vehicles (pickups, vans, trucks)
- 2 bucket trucks
- 3 scrapers
- 2 large excavators (bulldozers, backhoes)
- 2 water trucks
- 1 mid-sized (50-ton) crane

A crew can typically construct a 500-kV substation in 13 to 24 months in three phases. The first phase would include site leveling and bringing in appropriate ground materials such as soil and rock, then completing work below ground (ground mat, footing, drainage and foundations). The second phase would complete outdoor work (set structures and equipment, install bus between equipment, build control house, and run cable to control house). The third phase would complete indoor work (install electronic controls, install telecommunications system, and perform testing on all substation equipment).

3.15 Maintenance

During the life of the project, BPA would perform routine, periodic maintenance and emergency repairs to the transmission line. For lattice-steel towers, maintenance usually involves replacing insulators.

BPA typically conducts routine inspection patrols of its transmission lines throughout the Pacific Northwest by helicopter. BPA has conducted these types of inspection patrols by helicopter since 1950. Patrols are essential to determine where line maintenance is needed and ensure the continued reliability of the transmission system. Helicopter teams look for damaged insulators, damaged support members, washed-out roads, hazardous vegetation, encroachments, and problems indicating that a repair may be needed. Helicopter inspection of the new line would occur twice annually.

BPA’s aerial inspections of its lines are typically followed by annual ground inspections for each line. Maintenance vehicles would use access roads where established and maintenance workers may walk through agricultural fields to avoid damage to crops. In emergencies and some other situations, vehicles and equipment would need to be driven through fields and could cause damage to crops, vegetation, and other property. BPA determines the damages and, if appropriate, compensates landowners for these damages.

Vegetation also would be maintained along the line for safe operation and to allow access to the line. The project area would need continual vegetation maintenance because of its location west of the Cascades. BPA’s vegetation management would be guided by its Transmission System Vegetation Management Program EIS (available at http://efw.bpa.gov/environmental_services/Document_Library/Vegetation_Management). BPA adopted an integrated vegetation management strategy for controlling vegetation along its transmission line rights-of-way. This strategy involves choosing the appropriate method for controlling the vegetation based on its type and density, the natural resources present at a particular site, landowner requests or agreements, regulations, and costs. BPA may use a number of different methods: manual (hand-pulling, clippers, chainsaws), mechanical (roller-choppers, brush-hogs), biological (insects or fungus for attacking noxious weeds), and herbicides.

Herbicides used at substations would likely be applied in granular form or with a backpack sprayer to spot treat individual plants. As with any BPA herbicide use, label instructions for application rates and weather conditions would be adhered to, which would eliminate potential run-off or air drift issues. Prior to controlling vegetation, BPA would send notices to landowners and request information that might help in determining appropriate methods and mitigation measures (such as herbicide-free buffer zones around springs or wells).

Noxious weed control is also part of BPA’s vegetation maintenance program. In general, BPA controls weeds on BPA fee-owned rights-of-way (mostly substations and some transmission lines), except where agricultural easements exist. Along easements, the underlying landowner is responsible for noxious weed control, but BPA works with landowners and county weed control districts and incorporates weed control measures into regularly scheduled maintenance.

Table 3-2 Mitigation Measures Included as Part of the Project[1]

Resource	Mitigation Measures
Land and Recreation	• Compensate landowners for any new BPA land rights required for right-of-way or access road easements. • Compensate landowners for any damage to property during construction. • Compensate landowners for reconfiguration of irrigation systems due to placement of towers or access roads. • Provide 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 clear understanding of the relocation process and assist these parties in filing claims for relocation benefits. • Provide compensation to restore compacted cropland soils, as needed. • Reseed disturbed areas (see mitigation measures in Vegetation). • Implement measures to reduce the possible spread of noxious weeds (see mitigation measures in Vegetation). • Implement measures to control dust (see mitigation measures in Geology and Soils). • Implement measures to control construction noise (see mitigation measures in Noise). • Minimize or eliminate public access to project facilities through postings and installation of gates and barriers at appropriate access points, and at the landowner's request. • Stay on established access roads and designated access road areas across agricultural fields during routine operation and maintenance activities. • Submit final tower locations and conductor heights to the FAA for review. Install lights and/or marker balls as required (see mitigation measures in Transportation).
Visual Resources	• Implement construction site maintenance and clean-up. Keep construction areas free of debris. • Provide regular maintenance of access roads and gates within and leading to the corridor. • Reseed disturbed areas (see mitigation measures in Vegetation). • Implement measures to reduce the possible spread of noxious weeds (see mitigation measures in Vegetation). • Implement measures to control erosion and dust (see mitigation measures in Geology and Soils, and Greenhouse Gas). • Use non-reflective conductors. • Use non-reflective insulators (i.e., non-ceramic or porcelain). • Locate new access roads within previously disturbed areas wherever possible. • Revegetate disturbed areas with approved species (see mitigation measures in Vegetation).
Public Health and Safety, EMF	• Notify landowners located along the corridor prior to construction activities, including blasting. • If blasting is required, take appropriate safety measures and follow all state and local codes and regulations. Lock up or remove all explosives from work sites at the end of the workday.

Resource	Mitigation Measures
Public Health and Safety, EMF (continued)	• Hold crew safety meetings at the start of each construction workday to review potential safety issues. • Prepare and implement a Spill Prevention and Control (SPC) plan (see mitigation measures in Water) to manage hazardous materials and respond to emergency situations. • Prepare and maintain an on-site safety plan in compliance with state requirements. • Prepare for fire control (see mitigation measures in Vegetation).Fueling of construction vehicles and equipment on-site will be done in accordance with applicable construction permits, regulated construction practices, and state and local laws. Helicopters will be fueled and housed at local airfields or at staging areas. • Secure the site at the end of each workday to protect equipment and the general public. Ensure that BPA contractors flying helicopters prioritize public safety during flights. • Implement appropriate airport safety measures. • Clear vegetation according to BPA standards to avoid contact with transmission lines. • Manage construction waste through reuse and recycling. • Report possible hazardous materials, toxic substances, or petroleum products discovered within the transmission line or access road right-of-ways that would pose an immediate threat to human health or the environment, including large dump sites, drums of unknown substances, suspicious odors, stained soil, etc. • Adhere to appropriate specifications for grounding fences and other objects on and near existing and proposed rights-of-way. • Construct and operate the new transmission line according to the NESC. • Use established access roads during routine operation and maintenance activities. • As part of the Storm Water Pollution Prevention Plan (SWPPP), an SPC plan will be prepared to address petroleum and hazardous materials handling and emergency spill response (see mitigation measures in Water). • Use transmission line designs that keep EMF levels and corona generation as low as reasonably practical. • Restore reception quality if radio or television interference occurs as a result of constructing the transmission line so that reception is as good as or better than before the interference.
Noise	• Ensure standard sound-control devices, including mufflers, are on all construction equipment and vehicles. • Notify landowners located along the corridor prior to construction activities, including blasting.
Socioeconomics	• Compensate landowners at market value for any new BPA land rights for right-of-way or access road easements. • Compensate landowners for damage to property or crops during construction or operation and maintenance activities. • Compensate landowners for irrigation systems that must be reconfigured to accommodate new transmission infrastructure. • Prepare for fire management (see mitigation measures in Vegetation). • Initiate discussions with local fire districts prior to construction and work with the districts and other appropriate emergency response entities to develop a Fire and Emergency Response Plan that addresses potential wildland fires and other emergencies.

Resource	Mitigation Measures
Transportation	• Coordinate with county road departments where upgrades of county roads are necessary. • Coordinate routing and scheduling of construction traffic with state and county road staff, Columbia River operators, and railroad operators. • Employ traffic control flaggers and post signs warning of construction activity and merging traffic, when necessary for short interruptions of traffic. • Conduct regular maintenance on access roads and gates within and leading to the corridor. • Prepare and implement a SWPPP to prevent sediment from being transported onto adjacent roadways (see mitigation measures in Geology and Soils). • Limit tracking of soil onto paved roads (see mitigation measures in Geology and Soils). • Design roads to limit erosion (see mitigation measures in Geology and Soils).Restore public roadways to preconstruction conditions upon completion of project construction activities. Coordinate with the Washington State Department of Transportation (WSDOT) Aviation Division and comply with FAA regulations for marking or lighting (including painting and/or lighting towers and installing marker balls on overhead ground wires in specific locations). • Ensure standard sound-control devices, including mufflers, are on all construction equipment and vehicles. • Notify landowners located along the corridor prior to construction activities, including blasting. • Obtain a Haul Road Agreement and any additional permits or approvals from state and local agencies prior to construction. These documents will identify any special conditions to be addressed by BPA and their contractors during construction and operation of the project. • Route traffic around affected intersections if construction vehicles cause temporary traffic blockages on local roadways. • Comply with applicable seasonal road restrictions for construction traffic, where practicable.
Cultural Resources	• Locate transmission line towers and access roads to avoid cultural resources and minimize the potential for trespass access, where possible. • Use existing access roads where possible to limit possibility of new disturbances. • Develop an Inadvertent Discovery Plan that details crew member responsibilities for reporting in the event of a discovery during construction. This plan should include directives to stop work immediately and notify local law enforcement officials (if appropriate), appropriate BPA personnel, Tribes, and the Washington Department of Archaeology and Historic Preservations (DAHP) or Oregon State Historic Preservation Officer (SHPO) if cultural resources are discovered. • Plan for survey and review as needed of additional disturbance areas not identified during the NEPA process (e.g., staging areas, stringing and pulling sites, guard structure areas, etc.). • Improve the existing road system in a manner that minimizes new roads and avoids cultural resource sites. If improvements are needed on existing roads that cross through cultural resources sites, such improvements would be constructed in a manner to avoid/minimize impacts, such as using fabric and rock or other mitigation agreed to during the consultation process.

Resource	Mitigation Measures
Cultural Resources (continued)	• Consult with the Washington DAHP, the Oregon SHPO as applicable, the Confederated Tribes of the Chehalis, Cowlitz Indian Tribe, Confederated Tribes of Grand Ronde, Nez Perce Tribe, Quinault Indian Nation, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Reservation of Oregon, and Confederated Tribes and Bands of the Yakama Nation regarding NRHP eligibility of historic and cultural sites and if eligible, consult on addressing any adverse effects.
Geology and Soils	• Minimize the project ground disturbance footprint, particularly in sensitive areas (i.e., steep slopes and landslides areas). • Prepare and implement a SWPPP for construction activities to lessen soil erosion and control stormwater runoff. • For the SWPPP, use management practices contained in the Washington State Department of Ecology, Stormwater Management Manual for Western Washington (e.g., use silt fences, straw wattles, interceptor trenches, or other perimeter sediment management devices; place them prior to the onset of the rainy season and monitor and maintain them as necessary throughout construction) (http://www.ecy.wa.gov/pubs/0510030.pdf). • Use water trucks or BPA approved palliatives on exposed soil surfaces in areas disturbed during construction. • Construction materials and stockpiles will be managed to prevent impacts by the erosive forces of wind and rain. Stabilize access road surfaces in areas of sustained wind and potential dust erosion. • Ensure construction vehicles travel at low speeds on access roads and at construction sites to minimize dust. • Limit the amount of time soils are left exposed. • Design roads to limit water accumulation and erosion; install appropriate access road drainage (ditches, water bars, cross drainage, or roadside berms) to control and disperse runoff. • Design substations to accommodate seismic shaking, per BPA's seismic policy (STD-DS-000001). This policy references the International Code Council's International Building Code (IBC) (2009) for buildings in substations and the Institute of Electrical and Electronics Engineers (IEEE) 693(2005) for electrical equipment in the substations.
Water and Wetlands	• Minimize the project ground disturbance footprint, particularly in sensitive areas such as stream crossings and wetlands, and stream and wetland buffers. • Develop and implement a SPC plan to minimize the potential for spills of hazardous materials, including provisions for storage of hazardous materials and refueling of construction equipment outside of riparian zones, spill containment and recovery plan, and notification and activation protocols. • Prepare and implement a SWPPP to control stormwater runoff (see mitigation measures in Geology and Soils). • Properly manage drilling fluids, muds, and dewatering activities so as not to impact surface waters, including wetlands. • Properly manage concrete waste. • Take all necessary precautions to ensure that sediment, debris, petroleum products, chemicals, cement-like materials, or other contaminants do not enter wetlands and flowing or dry watercourses. • Install culverts or bridges for access roads in the dry season or during low-flow conditions if possible to minimize sediment delivery to streams.

Resource	Mitigation Measures
Water and Wetlands (continued)	• Limit tracking of soil onto paved roads by gravelling road approaches, washing vehicle wheels, and cleaning mud and dirt from paved roads to reduce sediment delivery to roadside ditches and nearby streams. • Avoid use of heavy equipment and vegetation removal, if possible, in wetlands and wetland buffer zones to avoid soil compaction, destruction of live plants, and potential alteration of surface water patterns. Use track equipment or matting, if appropriate. • Avoid placing staging areas in wetlands or stream buffers. • Fence, flag, or otherwise mark wetland buffer zones in the field to avoid inadvertent activity (e.g., parking and driving) in wetlands or buffers or streams. • Reseed disturbed areas (see mitigation measures in Vegetation). • Design culverts and drainage controls placed in non-fish bearing streams to preserve natural drainage patterns. • Maintain unobstructed passage for water at all culverts placed in non-fish bearing streams and promptly remove any blockages to protect the roadbed and prevent sedimentation of downstream water bodies. • Install and maintain water and sediment control measures at all water bodies (including dry water bodies) crossed by access roads or otherwise impacted by surface disturbance. • Regularly inspect and maintain the condition of access roads, culverts, and sediment control measures to prevent long-term impacts during operation and maintenance. Avoid storing, transferring, or mixing of oils, fuels, or other hazardous materials where accidental spills could enter surface or groundwater. Have spill response and clean-up materials on site and clean up all spills immediately. • Maintain, fuel, and repair heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident. • Fixed bulk fuel storage facilities will be designed with impervious secondary containment berms capable of capturing spills that may occur during fueling operations. • All equipment fueling operations shall use pumps and funnels and absorbent pads. Refuel equipment away from natural or manmade drainage conveyance including ditches, catch basins, ponds, wetlands, and pipes. Additional fueling requirements apply in some sensitive resource areas. Do not store equipment near water bodies and secure equipment when not in use overnight.
Vegetation	• Limit tree removal in sensitive areas such as stream crossings to the extent possible. • Cut or crush vegetation rather than blade in areas that would remain vegetated to maximize the ability of native plants to resprout. • Conduct invasive weed surveys prior to and following construction to determine potential weed spread and appropriate corrective actions. • Use weed-free mulch, if mulch is used for erosion control. • Equip all vehicles with basic fire-fighting equipment, including extinguishers and shovels to prevent fires that could encourage weed growth. • Limit ground-disturbing activities to tower sites, access roads, staging areas, and other necessary construction sites.

Resource	Mitigation Measures
Vegetation (continued)	• Limit road improvements to the minimum amount necessary to safely move equipment, materials, and personnel into and out of the construction area. • Consult with the U.S. Fish and Wildlife Service (USFWS) concerning any federally listed threatened and endangered plant species that are identified and implement mitigation measures to eliminate or reduce adverse impacts to these species. • Limit herbicide application to hand spraying at least 100 feet from all fish-bearing stream channels and use only EPA-approved herbicides that are non-toxic to aquatic resources. • Maintain a 164-foot no-spray buffer around well head locations. These locations are identified on all BPA plan and profile drawings and identified in work instructions to vegetation maintenance contractors. • Seed all disturbed areas to prevent colonization by weeds and facilitate reestablishment of the preconstruction plant community. Use approved (local Farm Service Agency) native seed mixtures in high quality vegetation communities and a combination of native and non-native seed in disturbed vegetation communities. Include the dominant native species from the impacted community in the seed mix.
Wildlife and Fish	• Limit tree removal in sensitive areas such as stream crossings to the extent possible. • Reseed disturbed areas (see mitigation measures in Vegetation). • Equip all vehicles with basic fire-fighting equipment, including extinguishers and shovels to prevent fires that could potentially harm wildlife habitats. • Minimize the project's ground disturbance area, reseed disturbed areas, and install culverts during appropriate in-water work window (see mitigation measures in Vegetation and Water) to limit sedimentation affecting fish habitat. Prepare and implement a SWPPP and a SPC plan (see mitigation measures for Geology and Soils and Water) to protect wildlife, fish, and wetland habitats. • Consult with the USFWS and National Oceanic Atmospheric Administration (NOAA Fisheries) concerning any federally listed threatened and endangered wildlife species that are identified and implement mitigation measures to eliminate or reduce adverse impacts to these species.
Climate	• Design and construct transmission facilities for worst-case wind-, snow-, and ice-loading. • Design transmission facilities to accommodate sagging during prolonged hot weather. • Design and construct access roads to withstand predicted climatic events.
Air Quality	• Use water trucks and/or palliatives to control dust during construction operations where appropriate. • Stabilize construction materials if they are a source of blowing dust. • Limit the amount of exposed soil, including dirt piles and open pits, to a minimum. • Dispose of trees and brush by means other than burning. • Ensure construction vehicles travel at low speeds on gravel roads and at the construction sites to minimize dust. • Comply with applicable state tailpipe standards for all on-road vehicles. • Ensure all vehicle engines are in good operating condition to minimize exhaust emissions.

Resource	Mitigation Measures
Air Quality (continued)	• Use low sulfur fuel when available for on-road diesel vehicles.
Greenhouse Gases	• Implement vehicle idling and equipment emissions measures, where practicable. • Encourage carpooling and the use of shuttle vans among construction workers to minimize construction-related traffic and associated emissions. • Locate all staging areas as close to construction sites as practicable to minimize driving distances between staging areas and construction sites. • Locate staging areas in previously disturbed or graveled areas to minimize soil and vegetation disturbance where practicable. • Use the properly sized equipment for the job, when practicable. • Use alternative fuels for generators at construction sites, or use electrical power where practicable. • Reduce electricity use in the construction office by using compact fluorescent bulbs, and powering off computers every night. • Recycle or salvage non-hazardous construction and demolition debris. • Use locally sourced rock for road construction, where available. • During construction, all vehicles will comply with applicable federal and state air quality regulations for tailpipe emissions. • Maintain all construction equipment is in proper working condition according to manufacturer's specifications. • Train equipment operators in the proper use of equipment.

Notes:

1. For additional mitigation measures that have been identified through preparation of this EIS and that also could be implemented to reduce or eliminate potential adverse impacts of the project, please see Chapters 5 to 22 of this EIS.

Chapter 4 Proposed Action and Alternatives

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

This chapter describes the Proposed Action (the action alternatives), the No Action Alternative, and alternatives that were considered but eliminated from detailed study.

4.1 Proposed Action Alternatives

BPA considered a variety of environmental, technical, social and economic siting factors (see Section 2.1, Facility Siting), as well as comments from the public (see Section 1.6, Public Involvement and Major Issues), to develop a reasonable range of alternatives to evaluate in this EIS. For each potential alternative, BPA assessed whether the alternative would meet the identified need for the project and achieve the project's purposes (see Section 1.3, Purposes). BPA developed four action alternatives from combinations of the route segments and substation sites (see Chapter 2, Facility Siting, Route Segments and Action Alternatives).

Each alternative includes a new substation near Castle Rock, Washington, a new 500-kV transmission line, a new Sundial Substation near Troutdale, Oregon, and new and improved access roads to these facilities. Also common to the action alternatives are the following: fiber optic cable installation on the transmission line for communications and equipment changes inside control houses at various BPA substations. All action alternatives cross the Columbia River in the same location.

Each action alternative includes three options that use different route segments and substation sites to complete the transmission line route. In this chapter, options and substation sites are described under each action alternative. Tower configurations also differ among the action alternatives. For some alternatives, existing transmission lines in certain locations would be removed and replaced. In some cases, new towers would be built in the same location as the removed towers; in other cases the new towers would be in different locations.

The project elements being considered are as follows (preferred project elements are noted with an *; common elements are noted in the description):

- Transmission Line Routes:
    - West Alternative and Options
    - Central Alternative and Options*
    - East Alternative and Options
    - Crossover Alternative and Options
- Substations:
    - New substation near Castle Rock at one of the following sites:
        - Monahan Creek site
        - Baxter Road site
        - Casey Road site*

  - New Sundial Substation near Troutdale (common to all action alternatives, this includes tower removal and relocation of other utilities' lines)

- Access Roads (common to all action alternatives, this includes using existing access roads, improving existing roads, and constructing new roads)
- Communications and Control Equipment (common to all action alternatives):
  - Installation of fiber optic cable
  - Equipment changes inside existing control houses at various BPA substations

Maps and Figures

Maps of the alternatives referred to in this chapter can be found in Chapter 2. A table describing each action alternative, the actions that would occur within each alternative and option, and the resulting right-of-way configuration (the location of towers and lines on existing and proposed rights-of-way) for the different alternatives and options is included in Appendix B. Figures depicting the existing and proposed right-of-way configurations for the different alternatives and options are also referenced in the table and included in Appendix B. Figures of the designs proposed for different substation sites are included in this chapter. In addition, photomaps of all segments (that form the alternatives and options) and substations are included in Appendix C.

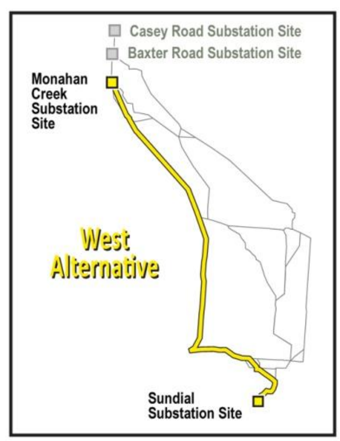
Tower Numbering

Tower numbers are based on the segment numbers. The first number of a specific tower is the segment number. For example, Tower 25/1 is the first tower in Segment 25. The first and last tower of each segment may have more than one number where segments intersect. For example, towers 1/18, 2/28 and 4/1 are the same tower, but have three designations because the tower is part of segments 1, 2, and 4.

Existing and New Right-of-Way

For portions of an action alternative where existing BPA right-of-way would be used, no new right-of-way would be needed unless noted in the text, tables, and figures. New right-of-way is typically 150-feet wide. There may be some areas where new right-of-way may be wider because of terrain, conductor swing, or other factors (see Appendix B).

4.2 West Alternative



The West Alternative begins at the Monahan Creek substation site in Cowlitz County, west of Castle Rock (see Map 2-3 and Section 4.2.4, Substation Sites). From the Monahan Creek site this alternative runs southeast along Segment 2. From towers 2/1 to 2/18, about 28 wood H-Frame structures of the existing 115-kV single-circuit Lexington-Delameter No. 1 line would be removed from existing BPA right-of-way and replaced with 500-kV single-circuit lattice-steel towers (see box). The route crosses Delameter Road, many drainages, Trout Lakes Road, and other local roads, and rolling forested land in this area.

From towers 2/18 to 2/27, about 15 wood H-frame structures of the Lexington-Delameter No. 1 line would be removed. The new 500-kV line would not be built in its place, but built on the other side of BPA's existing right-of-way in a forested area. From Tower 2/27 to about 265 feet past Tower 4/1, the line would require new 150-foot-wide right-of-way. From towers 4/2 to

4/3, the route crosses existing BPA property around BPA's Lexington Substation. Residential development surrounds the northeast side of Lexington Substation. From towers 4/3 to 4/5, the route parallels BPA's Ross-Lexington No. 1 230-kV line on existing right-of-way, and crosses the Cowlitz River.

BPA's Lexington-Delameter No. 1 115-kV Line

Cowlitz County PUD's Lexington-Corduroy 115-kV Line

BPA's Lexington-Delameter No. 1 115-kV line is on Segment 2 and would be removed in the West Alternative. The Lexington-Delameter No. 1 115-kV line is currently leased by Cowlitz County PUD. Cowlitz County PUD is upgrading its system. When the upgrades are completed, the PUD will no longer need this line and will terminate its lease with BPA. BPA has no other use for this line.

On Segment 9, Cowlitz County PUD leases BPA's right-of-way for the PUD's Lexington-Corduroy 115-kV line. This lease can be revoked by BPA with 2 years notice. The West Alternative would remove this line to make room for the 500-kV line. BPA has met with Cowlitz County PUD and the PUD is aware that removing this line is part of the West Alternative. BPA would give Cowlitz County PUD notice if a decision is made to build a new line, and if the West Alternative is chosen route. In that case, because this 115-kV line is an integral part of Cowlitz County PUD's system, Cowlitz County PUD would need to replace the line in a new location.

From towers 9/1 to 9/11, about 11 structures of the existing Cowlitz PUD 115-kV line would be removed so the 500-kV line could be built in existing right-of-way (see inset box). From towers 9/1 to 9/20, the route crosses the I-5 freeway and local roads, and continues on vacant, mostly forested, BPA right-of-way next to rural residential land and crosses the Coweeman River. Between towers 9/20 and 9/21, about 22.5 feet of new right-of-way would be required. From towers 9/21 to 9/82, the route continues through rural residential and forested land and some forested existing right-of-way, and parallels BPA's Ross-Lexington No. 1 230-kV line. The Washington Department of Natural Resources (WDNR) holds a forest riparian conservation easement near Tower 9/26. The route crosses the Kalama River, other smaller drainages, and many local roads.

From towers 25/1 to 25/18 the route continues to parallel the Ross-Lexington No. 1 230-kV line on existing right-of-way through forested, rural residential and agricultural land, crosses the Lewis River and State Route (SR) 503 near the city of Woodland, then turns due south. Between towers 25/18 and 25/19, about 12.5 feet of new right-of-way would be required as the route continues to parallel the Ross-Lexington line. At Tower 25/19 the transmission line route continues south paralleling the Ross-Lexington line in existing right-of-way through a mix of residential, agricultural, and forested land. It crosses the East Fork Lewis River, Salmon Creek, and other smaller drainages, SR 502, and many local roads, moves through a primarily residential area in Vancouver, crosses I-205, and turns west just north of Minnehaha.

Near BPA's Ross Substation in Vancouver at about Tower 25/106, the West Alternative transmission line route turns east on existing right-of-way and parallels the Sifton-Ross No. 1/Bonneville PH1-Alcoa No. 2 115-kV double-circuit line. Between towers 25/110 and 25/141, the existing McNary-Ross No. 1 345-kV line would be removed (about 32 towers) and rebuilt in the same location, but using narrower towers so the new line could be built on existing right-of-way. This portion of Segment 25 crosses I-205, and runs through industrial, commercial and residential development next to the existing right-of-way. Between towers 25/141 and 25/151, an additional 30 feet of new right-of-way on the north side would be needed for the 500-kV towers. The route runs through agricultural land and near residential areas. Between towers 25/151 and 25/152, on the south side of the right-of-way, the Sifton-Ross No. 1/Bonneville PH1-Alcoa No. 2 double-circuit line becomes the Bonneville PH1-Alcoa No. 2/North Camas-Sifton double-circuit line after the line enters and exits Sifton Substation.

Between towers 36B/1 and 36B/2, the route crosses existing right-of-way over agricultural land and 155 feet of new right-of-way would be required for the new line. Between towers 36B/2 and 36B/7, the route continues east in new 155-foot-wide right-of-way paralleling the North Camas-Sifton No. 1/Bonneville PH1-Alcoa No. 2 double-circuit 115-kV line. From towers 36B/7 to 36B/8 the new 500-kV line would parallel the existing double-circuit line for one span through forested area, then replaces the double-circuit line at Tower 36B/8 (also referred to as 41/1) with a triple-circuit tower.

Between towers 41/1 and 41/8, about 10 towers of the North Camas-Sifton No. 1/Bonneville PH1-Alcoa No. 2 double-circuit 115-kV line would be removed and replaced with triple-circuit towers that would carry the two 115-kV lines on one side and the new 500-kV line on the other. In this area, the route turns southeast and 50 feet of new right-of-way would be needed (25 feet on either side) for the new line. This area is forested, rural residential, and recreation land (golf course). From towers 45/1 to 45/3, 50 feet of new right-of-way would be needed (25 feet on either side) to accommodate new triple-circuit towers. About three towers would be removed.

Between towers 45/3 and 45/6, the route turns south and requires 150 feet of new right-of-way. The transmission line route crosses over two existing lines and through forested land near rural residential development. From towers 50/1 to 50/3, the route continues south, then turns east to Tower 50/5, and requires 150 feet of new right-of-way. At Tower 50/5, the route turns southeast and parallels the North Camas-Sifton No. 1/Bonneville PH1-Alcoa No. 2 double-circuit 115-kV line until Tower 50/13, and would require 130 feet of new right-of-way through agricultural and rural residential land.

From towers 50/13 to 50/21 about eight towers of the North Camas-Sifton No. 1/Bonneville PH1-Alcoa No. 2 double-circuit line would be removed and replaced with nine triple-circuit towers. Fifty feet of new right-of-way would be needed, 25 feet on either side of the existing right-of-way, to accommodate the new towers. From towers 50/21 to 50/26, the route parallels the North Camas-Sifton No. 1/Bonneville PH1-Alcoa No. 2 double-circuit line in 130 feet of new right-of-way. The route runs through rural residential and agricultural land.

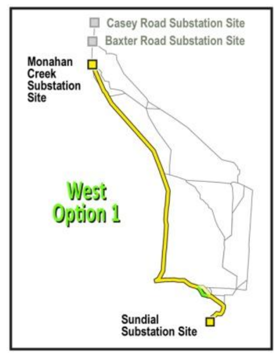
The route turns south on Segment 52. From towers 52/1 to 52/17, about 34 towers of the North Bonneville-Troutdale Nos. 1 and 2 230-kV lines would be removed and replaced with about 17 double-circuit 230-kV towers to make room for the new 500-kV line. The existing two 230-kV lines would be carried on the new double-circuit 230-kV towers on the east side of the existing right-of-way. The new 500-kV line would be built in existing right-of-way on the west side of the right-of-way through agricultural land, across the Washougal River, and west onto Lady Island in the Columbia River close to industrial, commercial, and residential areas. From towers 52/17 to 52/24 on Lady Island, 150 feet of new right-of-way would be required for the line. The route crosses the Columbia River between existing utility lines. South of the Columbia River, the route turns and runs through an industrial area to the Sundial substation site. Larger towers would be needed to cross the river (towers 52/20 to 52/22). These towers and the new towers built to carry the line into Sundial and Troutdale substations would be marked according to FAA requirements to minimize risk to air traffic (see Sections 3.2.1, Tower Types and 3.7, Obstruction Lighting and Marking).

The West Alternative is about 68 miles long (see Table 4-1) and would cost about $385 million. Cost estimates for the action alternatives are preliminary and include engineering design; environmental analysis, compliance, and mitigation; easements; property acquisition; and materials and construction costs for all facilities, including substations.

Table 4-1 West Alternative and Options—Line Lengths (Miles)

Alternative and Options	Added	Removed	Total
West Alternative	**--**	**--**	**67.5**
West Option 1	+3.4	-3.3	+0.1
West Option 2	+9.0	-7.4	+1.6
West Option 3	+13.0	-7.4	+5.6

4.2.1 West Option 1



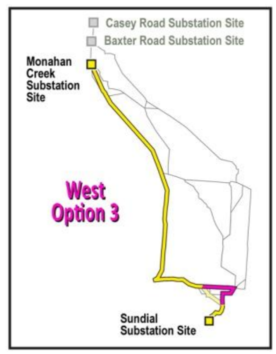
For West Option 1, segments 36, 40, and 46 are used in place of segments 36B, 41, and 45 (see Map 2-2 and Table 2-1). From towers 36/1 to 36/2, 30 feet of new right-of-way in agricultural land would be needed next to the north side of BPA's existing McNary-Ross 345-kV line to accommodate the new 500-kV line. From towers 40/1 to 40/11, the route immediately crosses two existing lines through agricultural land, and continues south within new 150-foot-wide right-of-way. Between towers 40/10 and 40/11, the route crosses two additional existing lines. Between towers 40/8 and 40/13, the route runs through a WDNR Natural Area Preserve that is part of a larger proposed Natural Resource Conservation Area. Additional new right-of-way of varying widths would be needed between towers 40/11 and 40/12 where the route turns east to an area where double-circuit towers would be used. From towers 40/11 to 40/14, about three towers of the North Bonneville-Troutdale No. 1 230-kV line would be removed and replaced with double-circuit 500-kV towers. From Tower 46/1 the route crosses Lacamas Creek and two towers of the North Bonneville-Troutdale No. 1 230-kV line would be removed and replaced with double-circuit 500-kV towers on existing right-of-way.

4.2.2 West Option 2

For West Option 2, segments 36, 36A, 37, 38, 43, 48, and 51 are used in place of segments 36B, 41, 45, and 50 (see Map 2-3 and Table 2-2). Segment 36 is described under West Option 1. From towers 36A/1 to 36A/4, the route continues from Segment 36, with 30 feet of new right-of-way to accommodate the new line. Between towers 36A/4 and 36A/6, three towers of the McNary-Ross 345-kV line would be removed and replaced using a narrower tower design to accommodate the new line on the north side of the existing right-of-way. From towers 37/1 to 37/2, two towers of the McNary-Ross 345-kV line would be rebuilt using a narrower tower to accommodate the new line in existing right-of-way. A residential development is next to the existing right-of-way. From towers 37/2 to 37/4 and towers 38/1 to 38/5, the route parallels the McNary-Ross 345-kV line on the north side of the existing right-of-way through forested area. At Segment 43, the route heads southeast on new 150-foot-wide right-of-way through forested land (WDNR-owned land between towers 43/4 and 43/6 is proposed for school development) to Tower 43/5, then due south through agricultural and near rural residential land to Tower 43/9. At Tower 43/9, the route crosses two existing lines, then turns east, where new right-of-way of varying widths would be needed before it joins the existing right-of-way at about Tower 43/10. One tower of the existing North Bonneville-Ross No. 1 230-kV line would be removed and replaced with a double-circuit tower for the new line and the North Bonneville-Ross No. 1 line.

From towers 48/1 to 48/14, about 14 towers of the existing North Bonneville-Ross No. 1 230-kV line would be removed and replaced with a double-circuit tower for the new line and the North Bonneville-Ross No. 1 line. This area is rural residential land, with some development next to the right-of-way. Between towers 48/13 and 48/14, about 100 feet of new right-of-way on forested land would be required as the route approaches Tower 51/1 and turns south. Between towers 51/1 and 51/11, about 11 towers of the North Bonneville-Troutdale No. 2 230-kV line and 11 towers of the North Bonneville-Troutdale No. 1 line would be removed and replaced with double-circuit 230-kV towers on the east side of the right-of-way. The new 500-kV line would be built on the west side of the existing right-of-way through rural residential land.

4.2.3 West Option 3



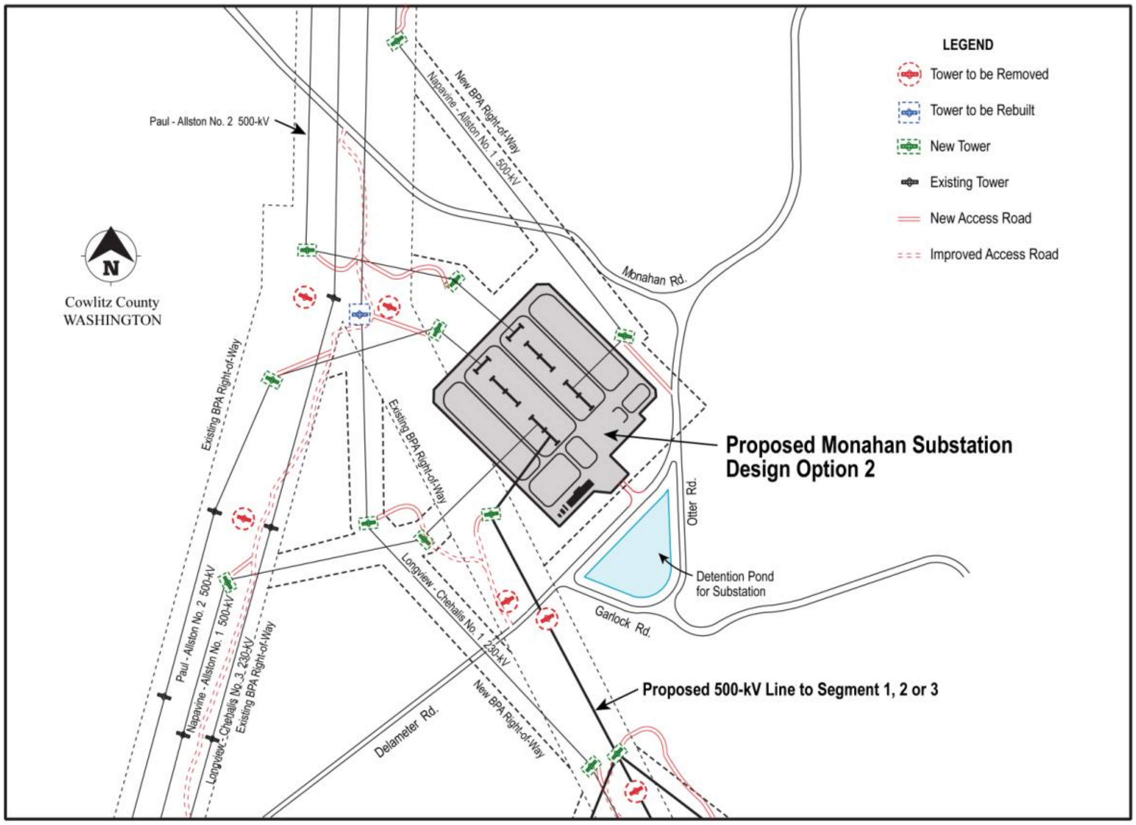
For West Option 3, segments 36, 36A, 37, 38, 39, T, 49, and 51 are used in place of segments 36B, 41, 45, and 50 (see Map 2-3 and Table 2-2). Segments 36, 36A, 37, and 38 are described under West Option 1 and 2. From towers 39/1 to 39/20, a new 500-kV line would be built next to the McNary-Ross 345-kV line on currently vacant right-of-way through rural residential and forested land. From towers 39/20 to 39/23, the route crosses the McNary-Ross 345-kV line and continues east on 105 feet of new right-of-way on forested land to Tower 39/27. From towers T/1 to T/3, 150 feet of new right-of-way would be needed to accommodate the new line on forested land. The route then continues southwest on 150 feet of new right-of-way to towers 49/1 through 49/7 through a rural area. From towers 49/7 to 49/10, 105 feet of new right-of-way would be needed north of the North Bonneville-Troutdale Nos. 1 and 2 230-kV lines. From towers 49/10 to 49/15, four towers of the North Bonneville-Ross No. 2 line towers would be rebuilt to double-circuit 500-kV towers to accommodate the new line on existing right-of-way.

4.2.4 Substation Sites

4.2.4.1 Monahan Creek

The Monahan Creek site is in Cowlitz County, about 3.5 miles west of Castle Rock, Washington (see Figure 4-1). The site is near the intersection of Monahan and Delameter roads on a gently sloping to fairly steep parcel of private property used for grazing. A few rural residences are near or next to the site. The site is next to a series of existing BPA lines, including the Paul-Allston No. 2 single-circuit 500-kV line, Longview-Chehalis No. 3 single-circuit 230-kV line, Longview-Chehalis No. 1 single-circuit 230-kV line, Napavine-Allston No. 1 single-circuit 500-kV line, and the Lexington-Delameter No. 1 single-circuit 115-kV line leased by Cowlitz PUD. (See Section 3.8, Substations, for a description of substation components.)

Figure 4-1 Monahan Creek Substation



The Monahan Creek substation site is about 806 feet by 780 feet, or about 14.4 acres. A 2.25-acre detention pond would be constructed at the intersection of Delameter, Garlock, and Otter roads to collect and filter substation water runoff. About 0.1 mile of new road would be constructed to access the substation from Delameter Road. No existing roads would be improved for the substation access road. Typically, when a new 500-kV substation is built and there are existing 500-kV lines in the vicinity, the lines are redirected into the new substation to further divide (or sectionalize) the system and ensure greater reliability so that in the event of an emergency or scheduled outage, different lines can be isolated. At this substation site, the Paul-Allston No. 2 and Napavine-Allston No. 1 500-kV lines would be redirected into and out of the new substation, which requires relocating these and other existing lines. The reconfiguration requires removing about 5 existing towers, rebuilding one tower, and constructing about 10 new towers. New spur roads would be needed and some existing access roads would need to be improved for the reconfiguration. The new 500-kV line would exit south of the new substation and continue to segments 1, 2, or 3, depending on the action alternative. If the project moves forward, redirecting the Paul-Allston No. 2 500-kV line could be done at a later time.

4.2.4.2 Sundial

The Sundial substation site is about 1 mile north of I-84 and just south of the Columbia River in Troutdale, Oregon (see Figure 4-2). The site is part of a light industrial complex owned by the Port of Portland. BPA's existing Troutdale Substation and non-BPA-owned substations are east of the site. The substation site is about 652 feet by 1,155 feet, or about 17.3 acres.

No detention pond would be required. The substation would be accessed by about 0.5 mile of new road.

Several BPA-owned and non-BPA-owned transmission lines are in or near the Sundial site. Some of these lines would be removed, relocated, or rebuilt to accommodate the new substation, substation access road, and the new 500-kV line (Segment 52) as it enters Sundial Substation. New spur roads would be constructed and some existing access roads would be improved to access towers. The existing North Bonneville-Troutdale Nos. 1 and 2 single-circuit 230-kV lines and the Big Eddy-Troutdale No. 1 single-circuit 230-kV line that enter Troutdale Substation would be unchanged.

The existing Ostrander-Troutdale No. 1 single-circuit 500-kV line that enters Troutdale Substation would be redirected into the new substation and would be renamed the "Ostrander-Sundial No. 1" line. This redirection would be done so that the 500-kV system can be further divided (or sectionalized). A small segment of new 500-kV transmission line named the "Sundial-Troutdale No. 1" line would then be built to connect Sundial Substation to Troutdale Substation.

4.2.5 Access Roads

About 63 miles of access roads would be needed for the West Alternative (see Table 4-2). Access roads would be a combination of new roads and improved existing roads.

Table 4-2 West Alternative and Options—Access Road Lengths (Miles)

Alternative and Options	New Roads			Improved Roads		
	Added	Removed	Total	Added	Removed	Total
West Alternative	--	--	**29.5**	--	--	**33.5**
West Option 1	+1.8	-1.3	+0.5	+3.0	-4.1	-1.1
West Option 2	+5.7	-3.7	+2.0	+4.8	-6.4	-1.6
West Option 3	+6.8	-3.7	+3.1	+8.1	-6.4	+1.7

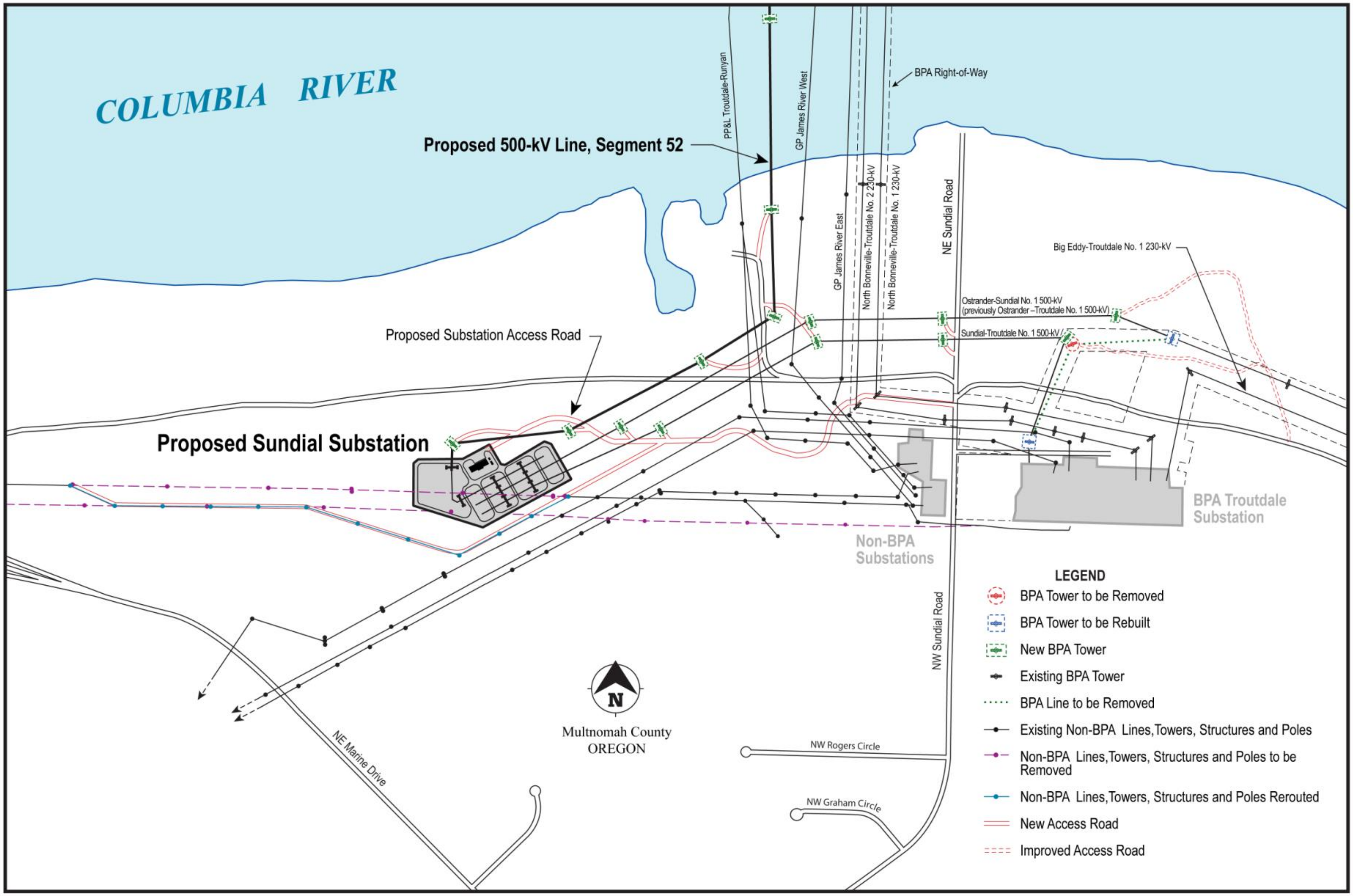
4.2.6 Communications and Control Equipment

Fiber optic cable would be strung on the steel towers (see Figure 3-3) from the new substation in the Castle Rock area to Troutdale Substation, and from Troutdale Substation to the new Sundial Substation (see Section 3.5, Communications and Control Equipment).

The following equipment changes would be made inside existing control houses at three BPA substations (these changes would not create any impacts):

- Modify relay and controls and add communications panels at Allston, Napavine, and Ostrander substations.
- Add line loss equipment at Ostrander Substation.

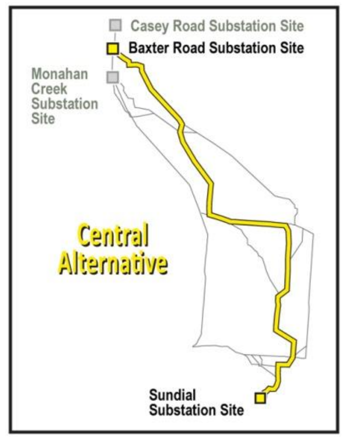
Figure 4-2 Sundial Substation



4.3 Central Alternative

The Central Alternative begins at the Baxter Road substation site in Cowlitz County, northwest of Castle Rock (see Map 2-4 and Section 4.3.4, Substation Sites). From the Baxter Road site, the route runs east along Segment B. From towers B/1 to B/5 the route runs southeast on new 150-foot-wide right-of-way through forested land. The route crosses local roads and small drainages and continues on new right-of-way from towers F/1 to F/10 through forested land. The route crosses Military Road and small drainages and turns south at Tower F/10. At Tower F/13 the route turns east near a residential area along Gassman Road, and crosses the Westside Highway, the Cowlitz River, railroad tracks and right-of-way, I-5, the old Pacific Highway, SR 504, and commercial and rural residential areas. At Tower F/23, the route heads southeast to Tower F/75 through forested land, across local roads and small drainages, and across Headquarters Road, Fir Lane Road, and the Coweeman River on new right-of-way. Clusters of rural residences and home sites are near Headquarters and Fir Lane roads.

From towers G/1 to G/8, the route heads southwest on new right-of-way through forested land. The route continues to Segment H near Mahafrey Road. Segment H heads southeast on forested land on new right-of-way from towers H/1 to H/8, then the route continues along Segment 10 from towers 10/1 to 10/34 through forested land owned by WDNR, Longview Timber Corporation, and Weyerhaeuser Company, and crosses small drainages and the Kalama River. From towers 12/1 to 12/20, the route turns due south and continues on new right-of-way through WDNR-owned forested land and crosses Aho Carson Creek Road. There are also some rural residences near where this route crosses major drainages.



Segment 15 turns to the east and southeast and crosses Tangen Road continuing on all new right-of-way from towers 15/1 to 15/9, then the route continues along Segment 23, crosses SR 503 and parallels the Lewis River until Tower 23/7. Segments 15 and 23 parallel an existing PacifiCorp line. From towers L/1 to L/5 the route crosses the Lewis River within a quarter mile of Merwin Dam recreational area owned by PacifiCorp. PacifiCorp also manages much of their land in this area for the benefit of wildlife. The route continues east through rural and forested land. From towers L/5 to L/9 the route parallels an existing PacifiCorp 115-V line on the south side. Between towers 18/1 and 18/22 the route continues east parallel to the existing PacifiCorp 115-kV line, and at Tower 18/22, it continues east on new right-of-way, crossing rural residential and forested land. The route for towers 28/1 to 28/27 heads southeast across SR 503 on new right-of-way through mixed forest, and crosses Healy Road and rural residential land.

From towers V/1 to V/20, the route crosses mostly forested land heading south across Weaver Creek Road, South Falls Road, and the East Fork Lewis River on new 150-foot right-of-way. At Tower V/20, the route heads southwest on new right-of-way, crosses Berry Road, and ends at Tower V/27. The route then heads south through forested land on towers P/1 to P/24 on new right-of-way and crosses the Yacolt Burn State Forest Road. From towers P/24 to P/39, the route turns southeast on new right-of-way through forested land. Segments V and P are mostly forested land with some rural residential development nearby.

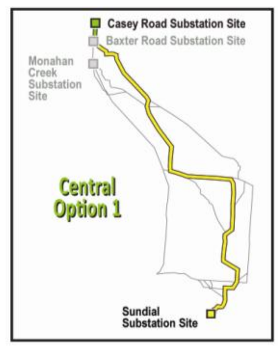
At Segment 35, the route continues south on new right-of-way through forested land and along the edge of the City of Camas watershed, as well as scattered rural residential development, until it meets up with existing right-of-way and crosses over the McNary-Ross and North Bonneville-Ross No. 2 lines between towers 35/14 and 35/15. The route continues along Segments T, 49, 51, and 52 previously described under the West Alternative and West Option 3.

The Central Alternative is about 77 miles long (see Table 4-3) and would cost about $459 million.

Table 4-3 Central Alternative and Options—Lengths (Miles)

Alternative and Options	Added	Removed	Total
Central Alternative	**--**	**--**	**77.3**
Central Option 1	+2.5	--	+2.5
Central Option 2	+15.7	-18.0	-2.3
Central Option 3	+14.9	-20.8	-5.8

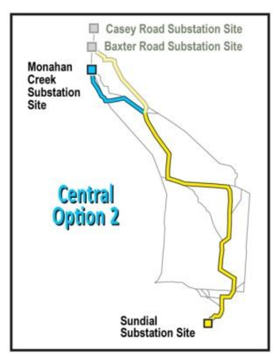
4.3.1 Central Option 1



Central Option 1 begins at the Casey Road substation site instead of the Baxter Road substation site and follows Segment A (see Map 2-4 and Section 4.3.4, Substation Sites). From towers A/1 to A/9 the route runs south out of the substation site through hilly, forested land on new 125-foot-wide right-of-way on the east side and next to existing BPA right-of-way. From towers A/9 to A/12, the new right-of-way would be 150 feet wide.

4.3.2 Central Option 2

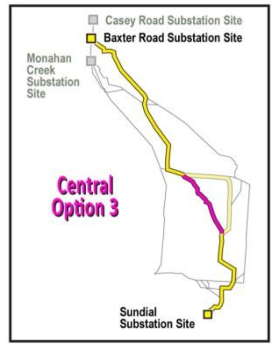
Central Option 2 begins at the Monahan Creek substation site instead of the Baxter Road substation site and includes segments 1, 4, 5, 8, and 11, instead of segments B, F, and G (see Map 2-4, Section 4.3.4, Substation Sites, and Table 2-3).



From towers 1/1 to 1/11, the route continues southeast through forested land on new 150-foot-wide right-of-way and crosses Delameter Creek, Leckler Creek and Delameter and McKee roads. At Tower 1/11 the route turns southeast through forested land. Between towers 1/16 and 1/17, the route crosses the Longview-Chehalis No. 1 and Lexington-Longview No. 2 230-kV double-circuit line and the Lexington-Longview No. 1 115-kV line on existing right-of-way. The route continues southeast through forested land to Tower 1/27, where it crosses existing right-of-way and the Lexington-Longview No. 2 230-kV line, the Lexington-Delameter No. 1 115-kV line, and the Lexington-Longview No. 1 115-kV line to Tower 1/28 near BPA's Lexington Substation. Segment 4 is already described under the West Alternative.

Segment 5 begins in existing right-of-way. Before it crosses I-5, new 150-foot-wide right-of-way would be required through forested land to Tower 5/10 where rural residences are located nearby. The route crosses Holcomb Road. From towers 8/1 to 8/9, the route crosses forested land on new 150-foot-wide right-of-way running northeast. Segment 11 heads southeast through forested land, with some scattered rural residences nearby, and crosses the South Fork of Ostrander Creek on new right-of-way. The route crosses the Coweeman River and Rose Valley Road between towers 11/14 and 11/15 and continues to Tower 11/21.

4.3.3 Central Option 3



Central Option 3 includes segments M, 26, and 30, instead of Segments L, 18, 28 and V (see Map 2-4 and Table 2-3). At Tower M/1, Segment M crosses the Lewis River near Merwin Dam and heads southeast on new right-of-way, crosses Pup Creek Road and Pup Creek through forested land to Tower M/11. Segment 26 crosses Cedar Creek and Cedar Creek Road on new right-of-way through forested and agricultural land and crosses SR 503 west of Amboy on rural residential and some agricultural land. Segment 30 continues southeast on new right-of-way, crosses Mystic Drive and the East Fork Lewis River, and continues across mostly forested land to Tower 30/31. Some rural residential development is scattered within these areas and WDNR has about 40 acres of land in forested genetic reserves near Tower 30/24.

4.3.4 Substation Sites

4.3.4.1 Baxter Road

The Baxter Road substation site is about 4 miles north of the Monahan Creek substation site, 4 miles west of the Westside Highway in Cowlitz County, northwest of Castle Rock, and next to existing BPA right-of-way (see Figures 4-4 and 4-5). The site is located on Sierra Pacific Industries-owned forested land surrounded by forested wetlands. (See Section 3.8, Substations, for a description of substation components.)

The substation site is about 813 feet by 904 feet, or 17 acres. A 2.5-acre detention pond south of the site would also be constructed to collect and filter substation water runoff. About 2 miles of existing road would need to be improved to access the new substation.

The Baxter Road site is next to four existing BPA lines: the Paul-Allston No. 2 single-circuit 500-kV line, Longview-Chehalis No. 3 single-circuit 230-kV line, Longview-Chehalis No. 1 single-circuit 230-kV line, and the Napavine-Allston No. 1 single-circuit 500-kV line. To further divide (or sectionalize) the system, the Paul-Allston No. 2 and Napavine-Allston No. 1 500-kV lines would be redirected into and out of the new substation. To accommodate this change, some towers would be removed or rebuilt. To make room for new lines crossing over the right-of-way, some towers on the Longview-Chehalis No. 3 and Longview-Chehalis No. 1 lines would be removed and rebuilt, depending on the action alternative. New spur roads would be constructed and some existing access roads would be improved to access towers. The new 500-kV line would exit south of the new substation to continue along segments B, C or D, depending on the action alternative (see Figures 4-4 and 4-5).

Figure 4-3 Baxter Road Substation—Segment C

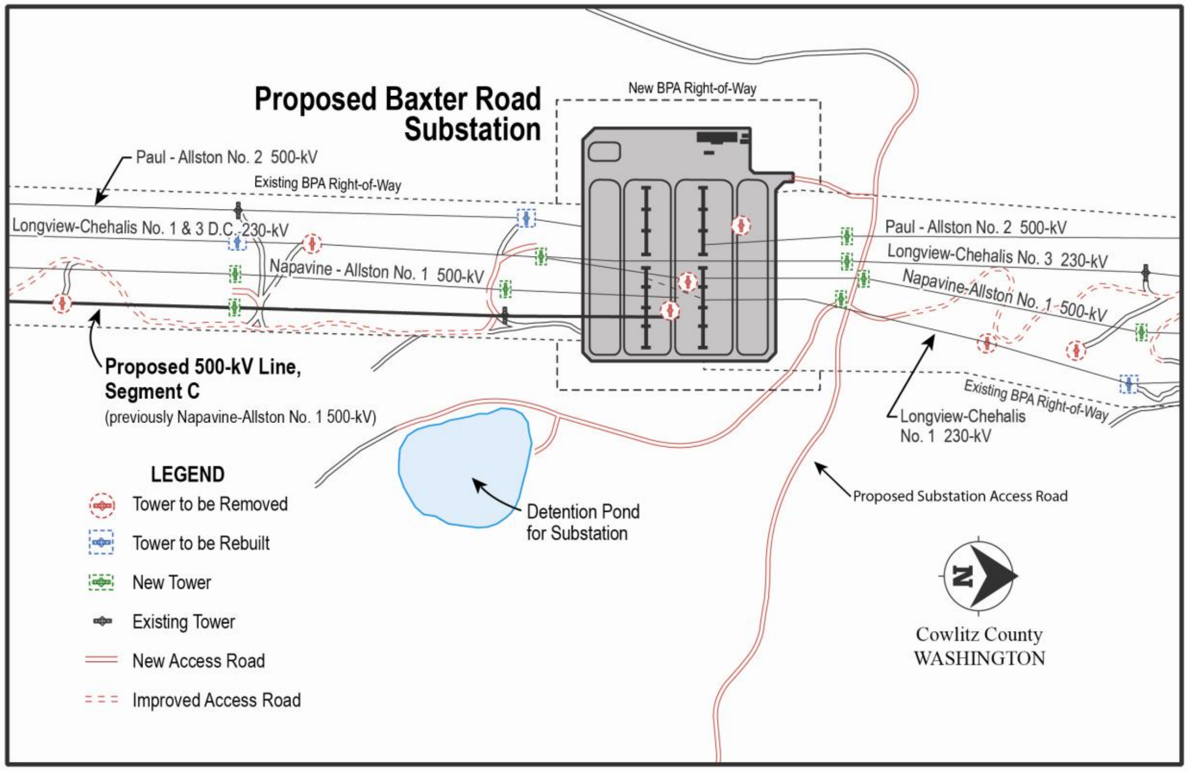
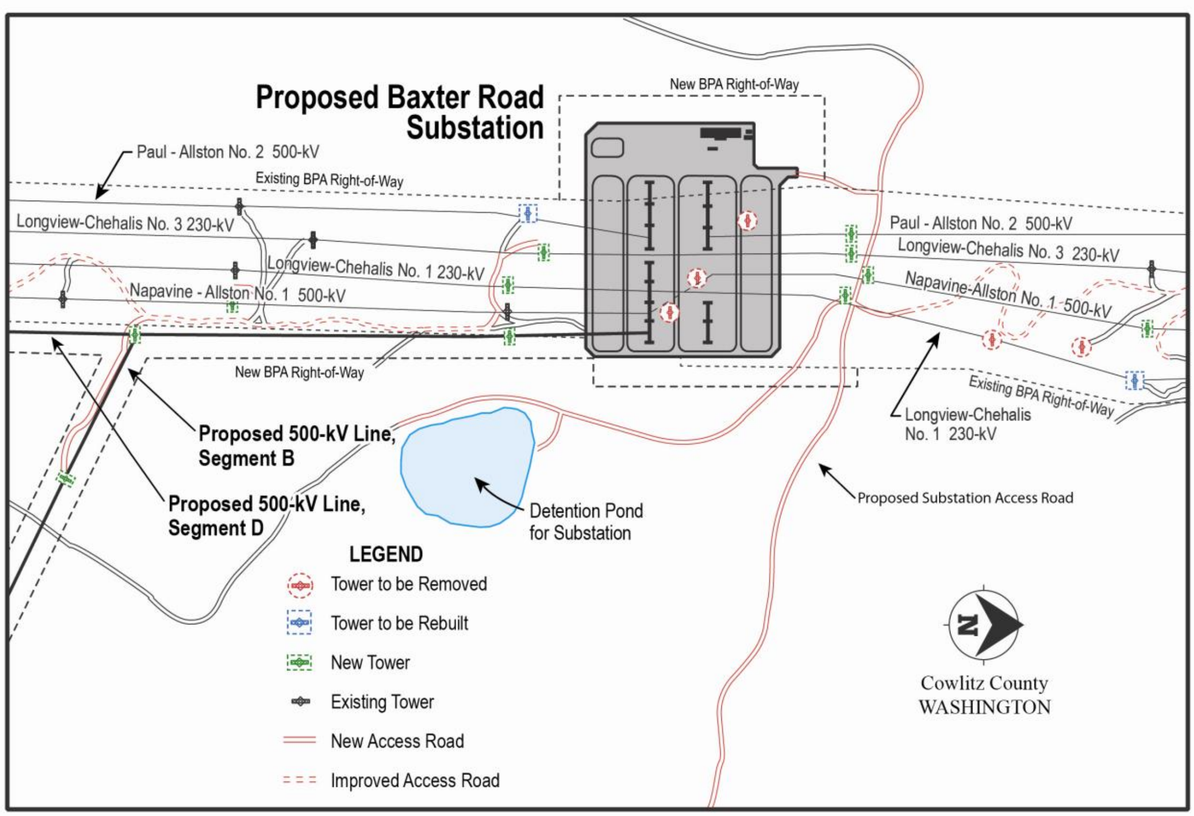


Figure 4-4 Baxter Road Substation—Segment B and D

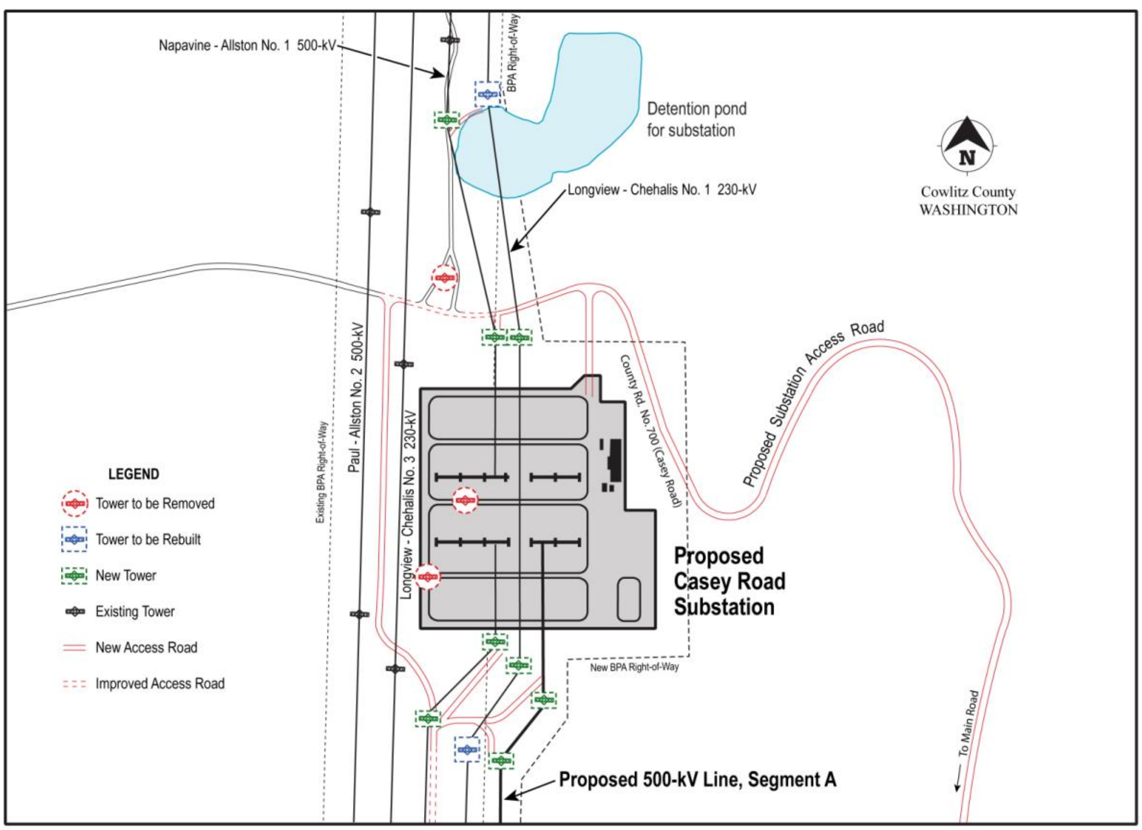


4.3.4.2 Casey Road

The Casey Road substation site is about 2 miles west of the Westside Highway in Cowlitz County, Washington, northwest of Castle Rock, next to existing BPA right-of-way (see Figure 4-6). The substation site (825 feet by 773 feet) is on about 14.6 acres of WDNR-owned property in a recently cleared, hilly area. Just north of the site, a 2.5-acre detention pond would be constructed to collect and filter substation water runoff. About 2.8 miles of existing road would need to be improved to access the new substation site.

The substation site is next to four existing BPA lines: the Paul-Allston No. 2 single-circuit 500-kV line, Longview-Chehalis No. 3 single-circuit 230-kV line, Napavine-Allston No. 1 single-circuit 500-kV line, and the Longview-Chehalis No. 1 single-circuit 230-kV line. To further sectionalize the system, the Napavine-Allston No. 2 500-kV line would be redirected into and out of the new substation. The Longview-Chehalis No. 1 230-kV line would be redirected over the substation, but would not be connected electrically. This change would require removing about three existing towers, rebuilding two existing towers, and constructing eight new towers. New spur roads would be constructed and some existing access roads would be improved to access towers. The new 500-kV line would exit south of the new substation to connect to Segment A.

Figure 4-5 Casey Road Substation



4.3.4.3 Sundial

Sundial Substation is described under the West Alternative (see Section 4.2.4.2, Sundial).

4.3.5 Access Roads

About 160 miles of access roads would be needed for the Central Alternative (see Table 4-4). Access roads would be a combination of new roads and improved existing roads.

Table 4-4 Central Alternative and Options—Access Road Lengths (Miles)

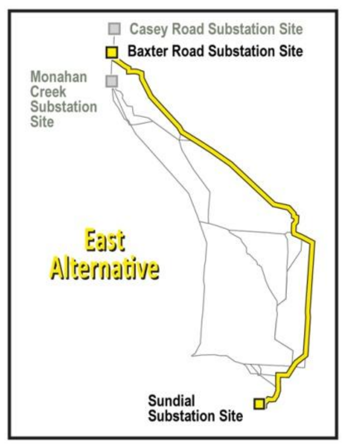
Alternative and Options	New Roads			Improved Roads		
	Added	Removed	Total	Added	Removed	Total
Central Alternative	--	--	**41.4**	--	--	**117.9**
Central Option 1	+1.4	-0.4	+1.0	+13.3	-5.3	+8.0
Central Option 2	+10.3	-6.5	+3.8	+27.8	-37.4	-9.6
Central Option 3	+8.9	-9.5	-0.5	+11.8	-20.0	-8.2

4.3.6 Communications and Control Equipment

The installation of fiber optic cable on the transmission line for communications and the equipment changes inside control houses at various BPA substations described for the West Alternative (see Section 4.2.6, Communications and Control Equipment) also would occur under this alternative.

4.4 East Alternative

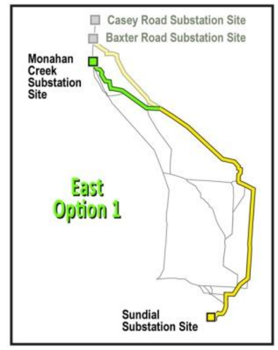
The East Alternative begins at the Baxter Road substation site and extends south along segments B and F, which are discussed in the Central Alternative (see Map 2-5 and Section 4.3.4, Substation Sites). From towers I/1 to I/13 the route is on new right-of-way through private forested land. The route continues southeast through state and private timber land on new right-of-way from towers K/1 to K/94. Between towers K/23 and K/24 the route crosses Gobar Creek, between towers K/28 and K/29 the route crosses Bear Creek, and between towers K/41 and K/42 the route crosses the Kalama River. Between towers K/78 and K/79, the route crosses SR 503 and continues through a rural residential area and forested land. At Tower K/93 the route crosses the Lewis River and PacifiCorp lands to K/94. From towers W/1 to W/6 the route continues southeast on new right-of-way and crosses Canyon Creek and forested land owned by PacifiCorp and Weyerhaeuser. All the PacifiCorp lands surrounding the crossing of the Lewis River are managed for wildlife. From towers O/1 to O/9 the route continues southeast over forested and private timberland and again crosses Canyon Creek. At Tower O/9, the route heads due south through forested land and crosses many small drainages. The route crosses Little Fly Creek between towers O/32 and O/33. Near O/46, it crosses the East Fork Lewis River, after which it crosses mostly WDNR land.



Between towers Q/1 and Q/13, the route would be on new right-of-way through forested land and the City of Camas watershed. The route crosses NE Boulder Creek Road near Tower Q/9. Between towers S/1 and S/2, the route crosses over the McNary-Ross single-circuit 345-kV line and the North Bonneville-Ross Nos. 1 and 2 double-circuit 230-kV lines that are on existing right-of-way; after crossing the existing right-of-way, the route continues to Tower S/3 on new 150-foot-wide right-of-way through forested land. The route continues to segments 49, 51, and 52 already described under the West Alternative and West Option 3. The East Alternative is about 76 miles long (see Table 4-5) and would cost about $489 million.

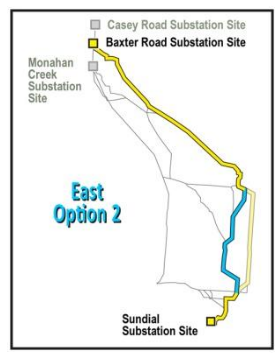
Table 4-5 East Alternative and Options—Line Lengths (Miles)

Alternative and Options	Added	Removed	Total
East Alternative	--	--	**75.5**
East Option 1	+17.6	-19.4	-1.8
East Option 2	+23.5	-22.5	+1.0
East Option 3	+3.7	-2.6	+1.1



4.4.1 East Option 1

East Option 1 begins at the Monahan Creek substation site instead of the Baxter Road substation site and includes segments 3, 7, 11, and J instead of segments B, F, and I (see Map 2-5 and Section 4.2.4, Substation Sites). Segment 3 begins on new right-of-way and heads southeast through forested land (with some scattered rural residences nearby), crosses Hazel Dell Road, heads southwest and then southeast, and at Tower 3/22 heads due east. The route crosses SR 411 (also referred to as the Westside Highway) and the Cowlitz River and heads south through rural residential and agricultural lands, then heads east and crosses Pleasant Hill Road and I-5. The route crosses Ostrander Road and continues southeast over forested land on new right-of-way. From towers 7/1 to 7/10, the route crosses forested land on new right-of-way and crosses the South Fork of Ostrander Creek. Segment 11 is described under Central Option 2. From towers J/1 to J/13 the route crosses forested land on new right-of-way.



4.4.2 East Option 2

East Option 2 includes segments U, V, P, 35, and T instead of Segments O, Q, and S (see Map 2-5 and Table 2-4). Segment U heads due south in private forested land east of Tumtum Mountain. The route crosses Canyon Creek, heads southwest and crosses Cedar Creek, and continues until Tower U/26. Segments V, P, 35, and T are described under the Central Alternative.

4.4.3 East Option 3

East Option 3 includes Segment R instead of Segment Q (see Map 2-5 and Table 2-4). The route heads south along Segment R on WDNR-owned forested land on new right-of-way and crosses the Yacolt Burn State Road. At Tower R/10, the route meets existing BPA right-of-way and parallels the McNary-Ross single-circuit 345-kV line and the North Bonneville-Ross Nos. 1 and 2 double-circuit 230-kV lines on the north side of the right-of-way on 105 feet of new right-of-way to Tower R/19.

4.4.4 Substation Sites

The Monahan Creek and Sundial sites are described under the West Alternative (see Sections 4.2.4.1, Monahan Creek and 4.2.4.2, Sundial). Baxter Road is described under the Central Alternative (see Section 4.3.4.1, Baxter Road).

4.4.5 Access Roads

About 207 miles of access roads would be needed for the East Alternative (see Table 4-6). Access roads would be a combination of new roads and improved existing roads.

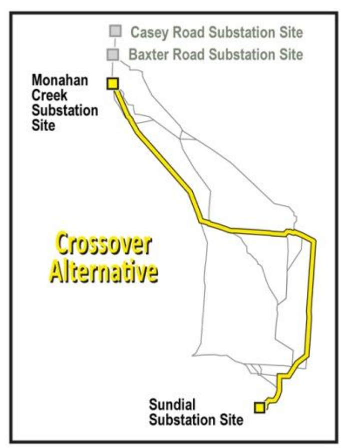
Table 4-6 East Alternative and Options—Access Road Lengths (Miles)

Alternative and Options	New Roads			Improved Roads		
	Added	Removed	Total	Added	Removed	Total
East Alternative	--	--	**34.2**	--	--	**173.2**
East Option 1	+8.8	-6.3	+2.6	+31.0	-41.6	-10.6
East Option 2	+12.7	-13.9	-1.2	+25.2	-52.0	-26.8
East Option 3	+1.1	-2.0	-0.8	+2.7	-2.4	+0.3

4.4.6 Communications and Control Equipment

The installation of fiber optic cable on the transmission line for communications and the equipment changes inside control houses at various BPA substations described for the West Alternative (see Section 4.2.6, Communications and Control Equipment) also would occur under this alternative.

4.5 Crossover Alternative



The Crossover Alternative begins at the Monahan Creek substation site in Cowlitz County, west of Castle Rock (see Map 2-6 and Section 4.2.4, Substation Sites). The route follows segments 2, 4, and 9, all discussed previously under the West Alternative. From towers 14/1 to 14/7, the route travels east on new 150-foot right-of-way and crosses Davis Peak Road over hilly, forested land. The route follows segments 15, 23, L, and 18, all discussed previously under the Central Alternative.

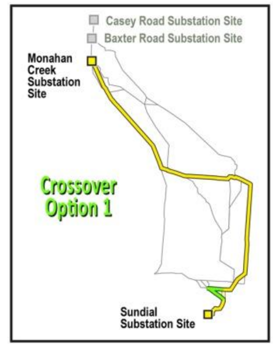
From towers N/1 to N/9, the route heads northeast before continuing east parallel to Merwin Lake within PacifiCorp lands managed for recreation and wildlife. The route crosses SR 503 and rural residential and forested land. The route follows segments W, O, Q, and S, previously discussed under the East Alternative.

The route continues along segments 49, 51 and 52 already described under the West Alternative and options. The Crossover Alternative is about 74 miles long (see Table 4-7) and would cost about $442 million.

Table 4-7 Crossover Alternative and Options—Line Lengths (Miles)

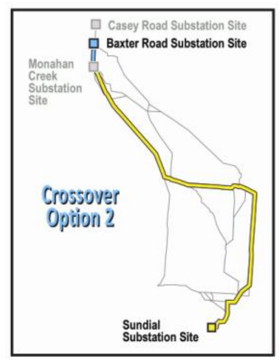
Alternative and Options	Added	Removed	Total
Crossover Alternative	**--**	**--**	**74.0**
Crossover Option 1	+7.3	-2.1	+5.2
Crossover Option 2	+4.3	--	+4.3
Crossover Option 3	+4.2	--	+4.2

4.5.1 Crossover Option 1



Crossover Option 1 includes segments 47, 48 and 50 instead of Segment 51 (see Map 2-6 and Table 2-4). From towers 47/1 to 47/4 about four towers of the North Bonneville-Ross No. 1 line would be removed and rebuilt with a 500-kV double-circuit line. Between towers 47/1 and 47/2, the route crosses the North Camas-Sifton/Bonneville PH1-Alcoa No. 2 double-circuit 115-kV line. Segments 48 and 50 are described under the West Alternative and West Option 2.

4.5.2 Crossover Option 2



Crossover Option 2 begins at the Baxter Road substation site instead of the Monahan Creek substation site, and includes segments C and E (see Map 2-6, Section 4.3.4, Substation Sites, and Table 2-4). The Baxter Road substation site is described under the Central Alternative. From towers C/1 to C/17, about 26 towers of the Longview-Chehalis Nos. 1 and 3 230-kV lines would be removed and rebuilt to double-circuit, and the new 500-kV line would be built where the Longview-Chehalis No. 1 line is now on existing right-of-way. From towers E/1 to E/6, about 10 towers of the Longview-Chehalis Nos. 1 and 3 230-kV lines would be removed and rebuilt to double-circuit, and the new 500-kV line would be built where the Longview-Chehalis No. 1 line is now on existing right-of-way. The route crosses Monahan Road between towers E/5 and E/6. From towers E/6 to E/7, the route parallels the existing Longview-Chehalis No. 1 line in existing right-of-way.

4.5.3 Crossover Option 3

Crossover Option 3 begins at the Baxter Road substation site instead of the Monahan Creek substation site, and includes route segments D and E (see Map 2-6, Section 4.3.4, Substation Sites, and Table 2-4). The route along Segment D requires 125 feet of new right-of-way in forested land on the east side of existing BPA right-of-way to accommodate the new 500-kV line. The new line would be next to Growler's Gulch Spur Road, and between towers D/16 and D/17 the line would cross the Napavine-Allston No. 1 500-kV line. Segment E is described under Crossover Option 2.

4.5.4 Substation Sites

The Monahan Creek and Sundial sites are described under the West Alternative (see Sections 4.2.4.1, Monahan Creek and 4.2.4.2, Sundial). The Baxter Road site is described under the Central Alternative (see Section 4.3.4.1, Baxter Road).

4.5.5 Access Roads

About 127 miles of access roads would be needed for the Crossover Alternative (see Table 4-8). Access roads would be a combination of new roads and improved existing roads.

Table 4-8 Crossover Alternative and Options—Access Road Lengths (Miles)

Alternative and Options	New Roads			Improved Roads		
	Added	Removed	Total	Added	Removed	Total
Crossover Alternative	**--**	**--**	**34.0**	**--**	**--**	**92.8**
Crossover Option 1	+5.3	-1.9	+3.4	+2.6	-1.2	+1.4
Crossover Option 2	+1.2	-0.1	+1.1	+9.4	--	+9.4
Crossover Option 3	+1.6	-0.1	+1.5	+9.6	--	+9.6

4.5.6 Communications and Control Equipment

The installation of fiber optic cable on the transmission line for communications and the equipment changes inside control houses at various BPA substations that are described for the West Alternative (see Section 4.2.6, Communications and Control Equipment) also would occur under this alternative.

4.6 No Action Alternative

Under the No Action Alternative, BPA would not construct the proposed project. Accordingly, BPA would not build the proposed substation near Castle Rock, the proposed Sundial Substation, or a new 500-kV transmission line between these two substations. BPA also would not construct new access roads, improve existing access roads, install fiber optic cable, or make project-related changes to existing facilities.

Under this alternative, BPA would not increase the electrical capacity of its transmission system along the SOA path to respond to increasing congestion on the system, load growth, and new requests for transmission service. Although BPA would continue to implement RAS and other operational procedures for the SOA path, transmission system congestion along this path would be expected to continue to increase (see Section 1.1.2, BPA's Transmission System, for more information about the reasons for increasing congestion in this area). As discussed in Chapter 1, Purpose of and Need for Action, the SOA path is critical in supporting Vancouver and Portland area loads. If the transmission system in the SOA path is not upgraded, BPA would have difficulty preserving system reliability along this path, which could lead to unplanned outages (brownouts or blackouts) as the system is stressed as loads continue to grow. Unplanned outages could cause damage to equipment and the loss of load service in some areas. In addition, BPA would likely need to curtail path flows to keep the system within operating limits, which would make it difficult for local utilities to schedule power to their customers. This could lead to the curtailment of load.

4.7 Alternatives Considered but Eliminated from Detailed Study

This section describes alternatives that were considered by BPA but eliminated from detailed study in this EIS. In developing this EIS, BPA has considered a number of potential alternatives to the action alternatives. These include alternatives developed by BPA and alternatives that either were suggested or responded to concerns raised during and after the scoping process for this EIS. For each potential alternative, BPA assessed whether the alternative was reasonable under NEPA and warranted further detailed evaluation in this EIS, or was unreasonable and should be eliminated from detailed study.

In determining which alternatives to evaluate further and which should be eliminated from detailed study, BPA considered whether the potential alternative would meet the identified need for the project and achieve the project's purposes (see Section 1.3, Purposes). BPA also considered whether an alternative would have obvious, potentially greater adverse environmental effects than other alternatives. Because an almost unlimited number of alternatives could be created, BPA cannot consider in depth every conceivable alternative suggested. Consistent with CEQ guidance, BPA focused on evaluating a reasonable range of alternatives considering the purpose and need for the project, and environmental, technical, social, and economic factors. In so doing, BPA has sought to ensure that the EIS contains a reasonable range of alternatives to permit a reasoned choice.

4.7.1 Non-Wires Alternative

BPA considered whether there could be a solution to the project need that would not require the construction of a transmission line, otherwise referred to as a "non-wires" alternative. As described in Section 1.1.2.2, Reliability and Non-Wires Measures, BPA has historically used a non-wires measure called RAS to maintain reliability in emergency situations and maximize use of existing SOA path facilities. However, continuing to use RAS for this path is becoming more difficult and less effective as the local economy and population grow.

BPA contracted with Energy and Environmental Economics, Inc. (E3), to conduct a screening study of possible non-wires measures for the I-5 project (see Section 1.1.2.2, Reliability and Non-Wires Measures). The possible non-wires measures identified in E3's studies for consideration included the following:

- Energy efficiency—increasing efficiency of existing buildings or appliances to reduce electricity use
- Demand response—managing when power is used at its source
- Distributed generation—using small diesel generators or solar power at or close to the source of load
- Generation redispatch—changing which large generation source(s) serves the load

E3's studies determined that these non-wires measures potentially could defer the need for the proposed new line for up to a few years. However, these measures could not eliminate the need for this new line. The following discussion summarizes the key findings of the E3 studies related to each of the potential non-wires measures. E3's studies are available on the project website: http://www.bpa.gov/corporate/I-5-EIS/documents.cfm.

The energy efficiency measures considered in E3's studies would increase the efficiency of existing buildings and electrical appliances, and reduce electricity use in the metro area during summer peak periods. The Northwest Power and Conservation Council's (NWPCC) Sixth Power Plan identifies energy efficiency targets and measures (such as the recent partnership with North Pacific Paper Corporation), which are then evaluated and verified through the NWPCC's Regional Technical Forum. Examples of measures include the installation of more efficient cooling systems, insulation, electronic equipment power save modes, and lighting controls. BPA considered working with local utilities to accelerate the installation of measures that would most directly reduce summer peak power demand. The measures would have been installed in residential, commercial, and industrial facilities in the metro area and service territories of Clark Public Utilities, PGE, and PacifiCorp, and would have required agreements and cooperation from these utilities.

Demand response is a way to manage the amount of power that is being used at its source. E3 studied demand response through direct local control — where devices would be placed on water heaters or air conditioners in the metro area so they automatically turn off or are turned down during high peak times to lessen the need for power. E3's studies also considered demand response through adjusting electrical rates to make them more expensive during peak times (summer daytime during the week), so users are motivated to postpone electrical use for non-peak hours (e.g., doing laundry in the evenings or on weekends).

For distributed generation, small generators are used at the source of need or load, such as solar panels on a house or business, or diesel generators at buildings, grocery stores, or local utility substations (these diesel generators are often used as back-up emergency generators). These generators could be switched on by a central system operator during summer peak load to help serve local power needs, reducing the amount of power that would need to flow over the SOA path from the north. Distributed generation would be required 5 to 20 days per year, depending on the weather. Local utilities in the Portland area have a number of distributed generators installed. However, BPA would likely be unable to use these existing generators because the number of hours and days they can be used are highly regulated, and these generators are used by local utilities, often for the same reasons and during the same time frames that BPA would need them. The installation of new generators, which would be used on hot summer days when air quality concerns are greatest, may be inconsistent with BPA's overall environmental objectives because of air quality impacts.

Based on the numbers from E3's report, the combined impact from these non-wires measures (energy efficiency, distributed generation, and demand response) is relatively small. By 2016 (when the existing transmission system's capacity is likely to be reached), the cumulative effect of these measures is estimated to be only about 5 percent of the forecasted total load for the metro area. This amount is insufficient for long-term congestion relief on the SOA path.

Generation redispatch would require turning off large generators located north of the metro area, while turning on generators located south of the metro area to reduce the power flow on SOA. Generally, this would allow loads in the metro area to be served from the south or east, and power serving loads in California would not have to flow through the area. E3's studies showed that generation redispatch could offer the greatest relief to the SOA path and would only need to be implemented 5 to 20 days per year. However, generation redispatch could only potentially help defer the I-5 Project's energization date for 2 to 6 years.

Overall, the non-wires studies revealed that even with aggressive implementation of all four non-wires measures, the amount of power reduced on the SOA path would not be enough to meet the need after 2020. Also, as described in Section 1.1.2.2, Reliability and Non-Wires Measures, the studies did not address the commercial requests for new transmission service on the SOA path. Because the Non-Wires Alternative would not meet the need for the project, it was eliminated from further study as a long-term solution. However, since generation redispatch may help delay a new line energization date by 2 to 6 years, BPA is continuing to separately analyze the operational and commercial feasibility of generation redispatch to help maintain short-term system reliability (see Section 1.1.2.2, Reliability and Non-Wires Measures).

4.7.2 Transmission Line Routing Alternatives

4.7.2.1 Alternate Routes from Castle Rock, Washington to near Wilsonville, Oregon (Pearl Routes)

Early in the project planning process, BPA considered a number of potential transmission line routes that extended from the Castle Rock area generally south to BPA's existing Pearl Substation near Wilsonville, Oregon (Pearl Routes). These routes were divided into over 40 route segments. BPA reviewed these routes and found they had several constraints that affected the reasonableness of using these segments for a new transmission line route.

No existing BPA right-of-way was vacant and available for any of the segments in the proposed Pearl Routes. All Pearl Route segments would require new rights-of-way through rural and heavily populated areas in Washington and Oregon, and would likely require removing private homes, significantly increasing projects costs and social impacts.

The Pearl Routes also would require a new Columbia River crossing near Longview, Washington with much different conditions than the proposed crossing into Troutdale, Oregon. For example, it would require a new crossing with new marine and air transportation safety issues as compared with alternatives that use the existing Columbia River crossing. At the location needed for the Pearl Routes, the river is wide and new towers would need to be much higher, possibly over 400 feet tall—more than twice the height of standard 500-kV towers. In addition, towers would be located on islands currently managed for wildlife habitat. Environmental impact to wildlife species, habitat, and visual resources could be high at this crossing.

Pearl Substation is surrounded by mostly industrial buildings. Though there would be space to bring in a new 500-kV line, there is no space available for future expansions. BPA typically purchases additional space around substations for such expansions to prepare for potential future activities and development.

Although the Pearl Routes could address the transmission capacity issue, the inability of these routes to use any existing vacant transmission rights-of-way, the high social impacts of housing removal, the technical issues with a new Columbia River crossing, the likely higher environmental impacts, and the limitations at the Pearl Substation combined to make these routes not reasonable alternatives. These routes, therefore, were considered but eliminated from detailed study in this EIS.

4.7.2.2 Castle Rock to Troutdale Route Segments

In December 2009, 52 route segments were proposed for the transmission line (see Chapter 2 and Map 2-1). In response to public input and further BPA study, the following segments were partially or wholly eliminated from consideration for the following reasons.

- **Segments 10 and 6**: The northern half of Segment 10 was eliminated from consideration due to prohibitively steep terrain and proximity to homes (compared to northern portion of Segment 11). Segment 6 was originally selected to connect to the northern half of Segment 10. Because that portion of Segment 10 was eliminated from consideration, Segment 6 was no longer needed and was also eliminated from consideration.
- **Segment 11:** The southern half of Segment 11 crossed steep terrain, went through two parks/recreation areas at Merwin Lake including campgrounds, proceeded through a large old growth timber stand important to bald eagles, went through spotted owl habitat and would be visible to the recreation areas and many homes. The lower portion of Segment 11 was replaced with Segment K.
- **Segment 13**: This segment was originally located as a more direct route to Segment 17. Segment 13 is on WDNR and Weyerhaeuser land, and crosses very steep terrain with no homes nearby. Segment 13 crossed near Davis Mountain on WDNR property where a cluster of communication towers could be affected by high-voltage interference. Segment 13 has steep terrain and slopes greater than 35 percent that would increase construction costs and negatively impact WDNR’s timber harvest practices by blocking access to large areas down slope outside of the potential right-of-way locations. BPA determined Segment 12 could instead be used to reach middle and far eastern routes, because it crosses gentler terrain and would create fewer impacts to logging practices than Segment 13. Segment 13 was eliminated from consideration.
- **Segment 17**: This segment is almost entirely located on PacifiCorp land and crosses the Lewis River just above and upstream of Merwin Dam. It was originally included to provide a direct route to Segment 26 and to take advantage of Segment 13’s more direct path. Segment 17 is in direct view of the popular Merwin Dam recreation area and crosses critical wildlife habitat on the south side of the reservoir where old-growth trees provide bald eagle habitat and structure for a known osprey nest. With Segment 13 removed from analysis, and because of potential impacts to wildlife and recreation, Segment 17 was eliminated from further consideration.
- **Segment 16**: Segment 16 runs parallel to an existing PacifiCorp transmission line. It was originally located to connect segments 12 and 15 to Segment 17. Because Segment 17 was dropped from consideration, Segment 16 was no longer needed and was eliminated from further consideration.
- **Segment 24**: This Segment was initially proposed as a means of connecting Segment 17 to Segment 26. Because Segment 17 was eliminated from consideration, Segment 24 was also eliminated from further consideration.
- **Segments 19, 20, 21, and 22**: These four segments were modified into Segment N.

- **Segments 29, 32, 33, and 34**: In response to public input, Segment 29 was eliminated from further consideration as the easternmost segment, and Segment O was developed farther east away from homes. Segments 32, 33, and 34 were eliminated from further consideration because new segments O and P were developed. Segments O and P were located to mostly follow property and section lines to minimize potential impacts to logging practices, affect fewer recreation resources, and avoid a potential wind generation area.
- **Segments 28, 30 and 35**: Portions of segments 28, 30, and 35 were eliminated from consideration because the segments to which they were connected had changed and those portions were no longer needed. The newer segments Q, R, S, and T allowed new segments P and O to connect back to the Sundial substation site.
- **Segments 27, 31, 42, and 44**: These four segments used an existing PacifiCorp right-of-way that was suggested to BPA early in the process. Upon investigation, however, BPA discovered that this existing right-of-way is only 100 feet wide along these segments. These segments also cross a developed community, and many homes have been built up to the edge of the existing right-of-way and some homes are within the existing right-of-way at many locations. Because a 150-foot-wide right-of-way is required for the project, BPA would have needed to buy an additional 50 feet of right-of-way to use those segments, which would have required removing many homes. For this reason, those segments were eliminated from further consideration.

4.7.2.3 Reconfigure Existing 500-kV lines near Longview, Washington

BPA received a suggestion to separate existing 500-kV lines that are now parallel to each other in the Longview, Washington area and across the Columbia River. Under this alternative, BPA would increase the separation between the existing parallel 500-kV lines in the Longview area and at the existing Columbia River multi-line crossing at Longview so that they could be allowed to operate at full capacity (which varies by season and operating patterns). The suggestion stated that this realignment could help relieve congestion in the Longview vicinity, eliminate the need for a new substation at Castle Rock, and allow BPA to move the northern end of the transmission line to BPA's existing Allston Substation in Oregon and reconsider the route to Pearl Substation (see Section 4.7.2.1, Alternate Routes from Castle Rock, Washington to near Wilsonville, Oregon [Pearl Routes]).

Separating the existing 500-kV lines would require extensive reconfiguration, including tearing down a set of existing towers, foundations, and conductors for about 12 miles from Castle Rock to the Columbia River, and building a new set of 500-kV towers, foundations and conductors with added line crossings, transition towers, and line swapping. This alternative also would require extensive work at the Columbia River crossing at Longview, Washington. To create adequate separation distance between the 500-kV transmission lines, a new river crossing about 3,000 feet downstream would be needed. This crossing would have similar impacts as the river crossing described for the Pearl Routes (see Section 4.7.2.1, Alternate Routes from Castle Rock, Washington to near Wilsonville, Oregon [Pearl Routes]). This reconfiguration would require six special towers and two new unique river crossing towers over 450 feet tall. BPA would need to design these non-standard towers for the specific location and height. This would require extensive design work, and unique towers for which no backup tower or replacement tower would be available. The environmental and visual impacts of this option would be greater than under the action alternatives.

The operating limit of this alternate path would be lower when compared to the direct routes proposed from Castle Rock to Troutdale. The only way to achieve a comparable operating limit would be to reconfigure the existing 230-kV lines in the Longview vicinity and build a new 230-kV line into Longview Substation, in addition to the extensive work already described.

Although this alternative could eliminate the need for a new Castle Rock substation, Allston Substation would still need to be expanded to accommodate a new 500-kV line to Pearl Substation. The expansion would require new right-of-way in an area that does not have vacant right-of-way available. Any route originating at Allston Substation would need to connect to Pearl Substation. However, the routes to Pearl Substation were determined not to be reasonable alternatives and were eliminated from further consideration (see Section 4.7.2.1, Alternate Routes from Castle Rock, Washington to near Wilsonville, Oregon [Pearl Routes]). For these reasons, this alternative was eliminated from further consideration.

4.7.2.4 Northeastern Alternative, North of Silver Lake, Washington

Several comments suggested using a transmission line route heading east from the proposed Casey Road substation site north of Silver Lake, Washington, then heading south to Troutdale, Oregon. Comments suggested that this alternative would reduce impacts to private landowners and homes. BPA conducted an initial evaluation of this suggestion in late 2010 and provided this analysis in a project update newsletter in February 2011 (available at the project website: www.bpa.gov/corporate/i-5-EIS/documents.cfm). Subsequently, BPA received additional, more specific comments and suggestions about developing this route and decided to study the suggestion in more detail.

Over several months, BPA studied this route using public input, aerial photography, helicopter reconnaissance, field trips, and meetings with public and private owners of large timberland parcels and affected utilities. After careful study, BPA concluded that although this route may relieve one set of landowners from impacts, it would affect a new population of landowners instead, particularly just east of Cougar, and to some degree north of Castle Rock along the Cowlitz River. In addition, this route would be longer (10 to 15 miles), cross very steep terrain, require more miles of new access roads, and constrain timber management/harvests. It could also impact critical habitat for endangered species and wetlands.

Impact tradeoffs between the suggested route and already proposed routes tend to generally be the same, and for some project components such as cost, constructability, and the environment, this suggested route would likely have greater impacts than the action alternatives because of its length and the terrain it would cross. For these reasons, this alternative was eliminated from further consideration (see *Evaluation of Northeastern I-5 Route* at: www.bpa.gov/corporate/I-5-EIS/documents/Decision-northeastern-route-Jan2012.pdf).

4.7.2.5 Interstate 5 Highway Median Alternative

Several comments suggested that the I-5 freeway median be used to accommodate the new line. BPA engineers considered this suggestion. The median is extremely narrow in most areas, with little or no room to accommodate 500-kV towers or a 150-foot right-of-way. Due to extensive development along much of the freeway, there is no path available from the freeway to connect to any other existing transmission line corridor or segment. To build a 500-kV transmission line in the median, BPA would have to obtain rights from the Federal Highway Administration (FWHA) to use the land, and also schedule traffic closures to build and maintain the line. In general, FHWA seeks to accommodate utility facilities within the rights-of-way of federal highways such as I-5, when such use and occupancy of the highway right-of-way do not adversely affect highway or traffic safety, or otherwise impair the highway or its aesthetic quality, and do not conflict with the provisions of federal, state or local laws or regulations (see 23 CFR 645 subpart B). The new transmission towers would create a new safety hazard for motorists and potentially aircraft, and interfere with future highway expansion. For these reasons, BPA eliminated this alternative from consideration.

4.7.2.6 Trojan Nuclear Plant Facilities

During the scoping period, BPA received comments that suggested using existing facilities including transmission lines that were constructed for PGE's Trojan Nuclear Plant in Rainier, Oregon.

Though PGE decommissioned and removed the Trojan Nuclear Plant, PGE essentially replaced the resource with an equivalent amount of thermal generating plants owned and operated by PGE to serve their local load. PGE added a gas-fired generation plant (Port Westward) in 2007, and has an existing gas-fired generator (Beaver), both interconnected at Trojan. Together, both facilities have a combined output of about 900 MW of generation. The facilities in this area are still used to transport power to loads. PGE's generation near Trojan Substation reaches loads in Longview, Washington through two of PGE's 230-kV lines that are connected to BPA's Allston Substation. The PGE 230-kV lines are critical transmission lines, serving loads in the Portland/Vancouver metro area. Because the lines that connect to Trojan Substation are owned by PGE, and because they are already being used, this alternative was eliminated from further consideration.

4.7.2.7 Transmission Line Routes Bordering U.S. Forest Service and WDNR Land East of the Project Area

BPA considered line routes bordering U. S. Forest Service (USFS) Gifford Pinchot National Forest and WDNR land east of Segment O, which was added in August 2010 in response to requests to develop a route farther east. These routes are less reasonable when compared to Segment O. Segment O was proposed after discussions with large landowners such as Weyerhaeuser, Longview Timber, USFS, and WDNR. Routing options farther east than Segment O would cross the Silver Star Scenic Area (Gifford Pinchot National Forest), a popular recreation area near Silver Star Mountain; be longer; cross prohibitively steep terrain; require more turns and dead-end towers to stay close to the WDNR/USFS border; and require longer access roads in an area with limited accessibility and poor road conditions during winter. These routing options would also cross land designated or proposed for roadless areas. These lands could also be designated as wilderness areas in the future. For these reasons, BPA eliminated this alternative from consideration.

4.7.2.8 Transmission Line Route East to Bonneville Dam

During the scoping process, several comments suggested routing a line farther east from Castle Rock to a location near Bonneville Dam in the Columbia River Gorge. A route that could adequately reinforce the project area from a Castle Rock substation site to Bonneville Dam would be at least 99 miles long, much longer than any route currently under consideration. Because the load center is not in the Bonneville Dam area, BPA would still have to build a new line back to either Troutdale or Ostrander substations, which would add another 24 to 32 miles of line. The additional line length would increase construction and operation costs, and would reduce technical performance. With a Bonneville Dam route, a loss of about 350 MW of capacity could be expected because of the longer route. **Series compensation** could recover some of the lost capacity (at additional cost), but this alternative would shorten the time before the next major reinforcement was needed in the area.

A route from Bonneville Dam to the Troutdale area would also require building a portion of the line through the Columbia River Gorge National Scenic Area (NSA), an area of federally protected land managed by the USFS. The area is valued for its scenery and recreational opportunities. This alternative was eliminated due to the added cost needed for additional transmission line length, and reduced capacity and diminished technical performance.

4.7.3 Lower Voltage Line Upgrades

BPA considered upgrading lower voltage lines to meet the need for the project. The cumulative amount of required line upgrades needed to adequately reinforce the system exceeds 200 miles and would require upgrades to lines beyond BPA's jurisdiction that are owned by other utilities. Some of the lines that would need upgrades are already high-capacity lines and would require bundled conductors (more than one conductor per phase of the line) to increase the capacity further. Because adding more wires per phase would make the line heavier, it would likely require completely rebuilding the line with stronger towers to support the bundled conductors. Ultimately, upgrading existing lines would not provide the voltage support that the current proposal provides and could result in much higher costs because of the miles of line that would need to be upgraded. For these reasons, upgrading lower voltage transmission lines was eliminated from further consideration.

4.7.4 Reynolds Aluminum Plant Facilities

During the scoping period, BPA received comments that suggested using existing transmission facilities that served the Reynolds Aluminum plant in Longview, Washington. The Reynolds Aluminum plant closed several years ago and equipment has been removed from the site. The plant's closure provided some relief for the need to reinforce the transmission system in the Longview/Vancouver/Portland area. However, load growth (more people moving into the area and increased installation and use of air conditioning) is expected to use up the available capacity by 2016 (see Chapter 1, Purpose of and Need for Action). Because this available capacity could not meet the need for the project, this suggestion was eliminated from further consideration.

4.7.5 High Voltage Direct Current (HVDC) Technology

Some commentors suggested using HVDC technology for the entire line instead of the High Voltage Alternating Current (HVAC) 500-kV line proposed. HVDC is generally used to move large amounts of power over long distances. HVAC lines used over long distances need to be heavily compensated, that is, have devices such as capacitors or voltage regulators to improve performance of the system, and that could be more expensive. However, HVDC is also expensive because it would require DC terminals at each end of a line, which are also expensive. Because of these competing costs, HVDC is generally used when the length of the line (in kilometers) exceeds the voltage of the line (in kilovolts), which is a general guideline that accounts for these costs. In our case, the line length (about 120 kilometers) is much less than the 500 kilovolts needed for the line and so this project does not meet this general guideline.

HVDC is a reliable tool for transmitting power over long distances, but because of its prohibitively high cost for the length of the proposed project, and because BPA would still need to build a transmission line with similar impacts as the proposed project, it is not considered a reasonable alternative and was eliminated from further consideration.

4.7.6 Columbia River Underwater Alternative

Some comments suggested using underwater cables for the whole length of the line from Longview, Washington to Troutdale, Oregon or just across the Columbia River where the proposed project crosses from Washington into Oregon. Underwater cables are often considered where an overhead route is impossible, such as for long water crossings. For example, BPA's uses 2- and 5-mile sections of 115-kV alternating current underwater transmission cables in the San Juan Islands. Underwater cables are required because there is no ability to string overhead lines across the water.

For this project, we have several overhead route options, including one on mostly existing BPA right-of-way. For the Columbia River crossing, we have the opportunity to locate the new line among existing overhead transmission lines in an existing utility corridor, with an island in the middle that makes the span lengths between towers reasonable and relatively short.

Manufacturing and installing underwater cable in the Columbia River would cost several times more than going overhead. In addition, if damage or failure occurs, since the line is buried underwater and cannot be inspected directly, it can be difficult and time consuming to determine where the problem has occurred and the length of damaged cable. Uncovering and replacing the buried submarine cable is a specialized process and takes much longer than repairing an overhead line. For these reasons, outages on buried submarine cables tend to be much longer and can compromise the reliability of the system.

There are environmental tradeoffs also. With overhead lines, towers can typically be placed 1,000 to 1,500 feet apart and can span sensitive natural or manmade areas. Burying submarine cables requires continuous trenching and continuous access, resulting in potentially more impacts to the environment. The line would be located in parts of the river where large ships can disturb the river bottom with their propellers and prop wash, and in areas where dredging is done on a regular basis to accommodate ship traffic. Both issues make it risky and difficult to locate and bury a cable deep enough to avoid damage from ships or dredging, and yet not so deep that it cannot be removed and replaced in the future should a problem occur. Locating outside the ship traffic and dredging area involves disturbing sensitive riparian and wildlife habitat along the shore.

Placing one or more portions of the 70-mile new line under water would have the same reliability and environmental issues, plus higher per mile cost due to the initial design and set-up requirements for manufacturing a shorter length of cable. In addition, expensive transition facilities would be required at each end of any section of submarine cable. For these cost, reliability and environmental reasons, placing the transmission line underwater has been considered but eliminated from detailed study in this EIS.

4.7.7 Undergrounding the Transmission Line

During the scoping process, comments suggested burying the new transmission line underground either for its entire length or for certain lengthy portions such as through the Camas and Washougal areas. In response to scoping comments, BPA updated its information about the technical requirements and feasibility, and potential environmental impacts of using an underground cable system for its high-voltage transmission line projects (see Appendix D). This section summarizes the information contained in Appendix D.

Underground distribution cables of lower voltage are fairly common, but underground transmission cables of higher voltage such as that needed for the proposed project are not. In addition, underground high-voltage transmission cables typically are used only for relatively short distances in areas where it is physically impossible to install towers for overhead transmission lines. BPA is not aware of any instances where a utility has placed a transmission line of the proposed project’s length and voltage (i.e., 70 miles of 500-kV line) underground.

There are several reasons why underground transmission lines of this length and voltage have not been built. The cost of underground is typically 10 to 20 times more expensive than overhead lines. It is also difficult to keep high voltage underground transmission cables from overheating. When they get overloaded and overheat, the insulation material used can breakdown quickly and cause a failure at the time of overheating, or later from damage caused by overheating. Since the line is buried and cannot be inspected directly, it can be difficult and time consuming to determine where the damage has occurred and the length of damaged cable. Uncovering and replacing the buried cable is a specialized process and can take much longer than repairing an overhead line. For these reasons, outages on underground cables tend to be much longer and can compromise the reliability of the system.

There are environmental tradeoffs also. With overhead lines, towers can typically be placed 1,000 to 1,500 feet apart and can span sensitive natural or manmade areas. Placing lines underground requires continuous trenching and a continuous access road system, resulting in potentially more impacts to the environment.

Placing portions of the 70-mile new line underground would have the same reliability and environmental issues, plus higher per mile cost due to the initial design and set-up requirements for manufacturing a shorter length of cable. In addition, expensive transition facilities would be required at each end of any section of underground. For these cost, reliability and environmental reasons undergrounding the transmission line has been considered but eliminated from detailed study in this EIS.

4.8 Comparison of Alternatives

BPA has evaluated the action alternatives and the No Action Alternative, and has compared the alternatives based on the information found in the chapters and appendices in this EIS. The results of the comparison are summarized in Tables 4-9, 4-10, and 4-11.

All action alternatives (West, Central, East, and Crossover and their options) would meet the need for the project; the No Action Alternative would not.

4.9 Preferred Alternative

BPA has evaluated the alternatives and options, considered the purpose of and need for the proposed project, the affected environment, and environmental consequences, and based on these factors, BPA's preferred alternative at this time is the Central Alternative, using Central Option 1.

Table 4-9 Comparison of Alternatives to Project Purposes

Alternatives	Use Ratepayer Funds Responsibly And Efficiently	Minimize Impacts To The Natural And Human Environment	Maintain BPA Transmission System Reliability And Performance	Meet BPA's Statutory And Contractual Obligations
West Alternative	About $385 million. Would be the least expensive because existing right-of-way is available for most of the length of the line. Some existing lines would need to be removed and replaced, which adds costs.	The project has been designed to minimize impacts to the environment where feasible, and mitigation measures are identified to avoid or reduce these impacts. Please see Table 4-10 for a comparison of the environmental impacts of the alternatives.	1. The project would increase the ability to serve the Portland/Vancouver metro area during summer and increase system flexibility should there be an interruption in the operation of one of the area's other transmission lines. It would also allow BPA to grant requests for transmission service while maintaining reliability of the electrical grid to BPA and industry standards. 2. Adds inherent risk to system reliability by placing the new line in the same corridor as other BPA lines transmitting power north-south.	Though BPA has no expressed contractual or statutory obligation to build the proposed project, the project would help BPA further its statutory mandates and tariff provisions that direct BPA to construct additions to the transmission system to integrate and transmit electric power and maintain system stability and reliability, as appropriate.
Central Alternative	About $459 million	Same as West Alternative	1. Same as West Alternative 2. N/A	Same as West Alternative
East Alternative	About $489 million. Would be the most expensive because it would be the longest route, and would require new right-of-way for most of its length.	Same as West Alternative	1. Same as West Alternative 2. N/A	Same as West Alternative
Crossover Alternative	About $442 million	Same as West Alternative	1. Same as West Alternative 2. Same as West Alternative	Same as West Alternative
No Action Alternative	No immediate costs would be incurred if the project is not built.	This alternative has the least environmental impacts. Please see Table 4-10.	Benefits of the project (increased system flexibility and capacity to Portland/Vancouver metro area in the summer) would not be gained. It would limit BPA's ability to provide service to new transmission requests because the capacity of existing lines in the area cannot accommodate the requests without compromising reliability of the system.	By not constructing the project, BPA would not be acting in furtherance of its applicable statutory mandates or tariff provisions.

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Table 4-10 Summary of Environmental Impacts by Alternative[1]

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Land	***Land Ownership***: Up to 401 acres of new easement would be acquired for right-of-way and new or improved roads - least of the alternatives. **Low-to-moderate** impacts where line or roads would be built on existing BPA easements. **High** impact in areas that require new right-of-way that would restrict land use. Because the alternative occupies 98% existing right-of-way, it would have the least high impacts on landowners among the alternatives. ***Land Use***: About 1,097 acres of existing right-of-way for about 66 miles would be used and 127 acres would be converted to new right-of-way. The alternative crosses the most urban/suburban, rural, agricultural, and open space land of the action alternatives (7%, 7%, 14%, and 68%, respectively). The alternative crosses the least timber production land (1%) of the action alternatives. See Chapter 5 for impacts on these individual land uses.	***Land Ownership:*** Up to 2,113 acres of new easement would be acquired for right-of-way and new or improved roads. Same impacts in existing and new right-of-way as the West Alternative, but greater amount of new right-of-way (90%) means potentially more high impacts on landowners. ***Land Use:*** The alternative follows existing right-of-way for about 8 miles. About 1,287 acres would be converted to new right-of-way and new and improved access roads, most on timber production land. The alternative crosses 1% urban/suburban land, 2% rural land, 67% timber production land, 2% agricultural land, and 26% open space land. See Chapter 5 for impacts on individual land uses.	***Land Ownership:*** Up to 2,376 acres of new easement acquired for right-of-way and new or improved roads. Same impacts as Central Alternative (90% new right-of-way). ***Land Use:*** The alternative follows existing right-of-way for about 8 miles. About 1,255 acres would be converted to new right-of-way and new and improved access roads, most on timber production land. The alternative crosses 1% urban/suburban land, 2% rural land, 72% timber production land (most of the alternatives), 3% agricultural land, and 22% open space land. See Chapter 5 for impacts on individual land uses.	***Land Ownership:*** Up to 1,420 acres of new easement acquired for right-of-way and new or improved roads. Slightly more high impacts on landowners than the West Alternative (55% new right-of-way), but less than the Central and East alternatives. ***Land Use:*** The alternative follows existing right-of-way for about 33 miles. About 772 acres would be converted to new right-of-way and new and improved access roads. The alternative crosses 1% urban/suburban land, 7% rural land, 48% timber production land, 3% agricultural land, and 43% open space land. See Chapter 5 for impacts on individual land uses.	**No** impact on land use.
	West Options 1, 2, 3	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Options 1, 2, 3**	
	Same overall impacts on land ownership and land use as the alternative, but in different locations. See Chapter 5.	Same overall impacts on land ownership and land use, but in different locations. See Chapter 5.	Same overall impacts on land ownership and land use, but in different locations. See Chapter 5.	Same overall impacts on land ownership and land use, but in different locations. See Chapter 5.	
Recreation	Tower placement would permanently impact 0.9 acre of park land; new and improved roads would permanently impact 7.4 acres of park and <0.1 mile of trail. This is the most recreation land impacted by any alternative. **Low** impacts on <0.1 acre each of Oak Park and the Port of Camas-Washougal Marina and **moderate** impact on 0.3 acre of Washougal River Greenway converted to right-of-way and access road. (The preceding are impacts common to all alternatives.) **Moderate** impact on Green Meadows Golf Course (3 acres) and Camp Currie (2 acres) where towers and roads would occupy existing rights-of-way. **High** impact on East Fork Lewis River Greenway, WSU Vancouver campus trail and Ellen Davis Trail where just over 3 miles of new and improved access roads would be built. **No-to-low** impact where the line would cross Northern Clark County Scenic Drive in existing right-of-way.	Tower placement would permanently impact 0.1 acre of parks; new and improved roads would permanently impact <0.4 acre of park and <0.2 mile of trail. This is the least recreation land impacted by any alternative. **Low** impacts on <0.1 mile each of Bells Mountain Trail and Riverfront Trail (East) by access roads. Some visual intrusion where right-of-way would cross Spirit Lake Memorial Highway (SR 504) or be seen from Merwin Park, Goot Park, and the Western Yacolt Burn Forest; **no-to-low** impacts. Same impacts on Oak Park, Washougal River Greenway and a marina as the West Alternative.	Tower placement would permanently impact about 0.1 acre of park land and <0.1 mile of trail. New and improved access roads would permanently impact <0.4 acre of park and <0.5 mile of trail. **Low** impact on <0.1 mile of Riverfront Trail (East) where an access road would be improved. **Moderate** impact where about 0.2 mile of road would be improved along the Jones Creek Trail, potentially improving trail experience for ATV users. **Moderate** visual impact on hikers along the Silver Star Trail on Silver Star Mountain. **Moderate-to-high** impact on Tarbell Trail, which would be crossed 8 times and paralleled for about 1 mile; <0.3 mile of trail would be permanently converted to towers or roads. Same impacts on Oak Park, Washougal River Greenway and a marina as the West Alternative. Same impacts on recreationists using Merwin Park, Goot Park, Western Yacolt Burn Forest, and Spirit Lake Memorial Highway (SR 504) as the Central Alternative.	Same park acreage permanently impacted as East Alternative. Slightly less trail mileage impacted (<0.1 mile of Riverfront Trail [East] is avoided). Same impacts as East Alternative because the alternative follows a similar path across recreation land.	**No** impact on recreation resources.

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Recreation (continued)	**West Option 1**	**Central Option 1**	**East Option 1**	**Crossover Option 1**	**No** impact on recreation resources.
	Net reduction in permanent impacts on golf courses (about 2 acres), net increase in permanent impacts on trails (0.5 mile). **Moderate** impact on Camas Meadows Golf Club (0.5 acre) and Lacamas Heritage Trail (0.5 mile). Avoids Green Meadows Golf Course.	Same impacts as the alternative, but avoids crossing Spirit Lake Memorial Highway.	Net reduction in permanent impacts on trails (<0.1 mile). **Moderate** impact from visual intrusions around Riverside Park. Would avoid Riverfront Trail (East) and Spirit Lake Memorial Highway.	Net increase in permanent impacts on parks (1.2 acres). **Moderate** impact to 1.2 acres of Camp Currie from tower and access road placement.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Net increase in permanent impacts (0.2 acre). **Low** permanent impact on 5.2 acres of infrequently used Green Mountain Park. Avoids Green Meadows Golf Course and Camp Currie.	Net reduction in permanent impact on trails of <0.1 mile. Avoids Riverfront Trail (East) and Spirit Lake Memorial Highway.	Net reduction in permanent impacts on trails (<0.4 mile). **Moderate** additional impact on <0.1 mile of Bells Mountain Trail.	Same impacts as the alternative.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Net decrease in permanent impacts (1.2 acres). **Low** permanent impact on 3.8 acres of infrequently used Green Mountain Park. Avoids Green Meadows Golf Course and Camp Currie.	Net increase in permanent impact on about 0.8 acre of park and <0.2 mile of trail. **High** impacts where 0.8 acre of Moulton Falls Park and <0.2 mile of Lucia Falls/Moulton Falls Trail would be converted to towers or access roads. **Moderate** impact where it crosses the Northern Clark County Scenic Tour.	Net increase in permanent impacts on trails (<0.3 mile). **Moderate** additional impact to about 0.3 mile of Jones Creek Trail (Connector A) where right-of-way would cross the trail multiple times.	Same impacts as the alternative.	
Visual	**Moderate-to-high** impacts**.** The West Alternative's route has a low scenic quality rating but high viewer sensitivity. It would travel primarily in existing right-of-way where transmission lines already have affected views, although new towers would be taller than existing towers. It would have **moderate** impacts on visual resources for most of its length with localized areas of **high** impacts on some parks and natural areas and on residences near Longview/Kelso (including the West Side Highway neighborhood) and east of Vancouver.	**Low-to-moderate.** Because most of this alternative would run through sparsely populated land with few sensitive viewers and low scenic quality, most visual impacts would be **low**, with a few **moderate** impacts around Castle Rock, Ariel, Lake Merwin, the Lewis River and Camas and on residences close to the right-of-way.	**Low-to-moderate.** Because most of this alternative would run through sparsely populated or unpopulated land with few sensitive viewers and low scenic quality, most visual impacts would be **low**, with a few **moderate** impacts in and around the Cowlitz River and SR 504 on the north, Camas on the south and the Western Yacolt Burn State Forest.	Mostly **low-to-moderate**. While this alternative would share its northern portion with the West Alternative, which would have localized areas of **high** impacts, the rest of the route passes through sparsely populated or unpopulated land, such as around Ariel, Lake Merwin and the Lewis River, where it would have **low-to-moderate** impacts on most viewers.	**No** impact on visual resources.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Same overall impact as the alternative. It would reduce impacts on a few residents and the Green Mountain Golf Course east of Vancouver and north of Camas, but cross Camp Currie, Camas Meadows Golf Course and pass near other residences and roads.	Same overall impact as the alternative. Starting the transmission line at the Casey Road substation site instead of the Baxter Road substation site would extend it through unpopulated land with few distinctive viewpoints.	Slightly higher overall impact than the alternative. Starting the transmission line at the Monahan Creek substation site means it would travel south of Castle Rock, crossing through largely sparsely populated or unpopulated areas. The option would remove visual impacts north of Castle Rock but introduce impacts where it crosses the Cowlitz River farther south. Monahan Creek substation would also have a slightly higher impact on viewer sensitivity (medium) than the other substation sites.	Slightly higher overall impact than the alternative. The option would replace a small segment running north-south through rural residential areas north of Camas with a longer route running west along existing right-of-way and then southeast through open fields and more rural residential areas. The option moves visual impacts from one residential neighborhood to another, where taller towers could dominate surroundings.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Visual (continued)	**West Option 2**	**Central Option 2**	**East Option 2**	**Crossover Option 2**	**No** impact on visual resources.
	Slightly higher overall impact than the alternative. The option would avoid Green Mountain Golf Course, but have potentially high impacts on a greater number of residents and Green Mountain Park farther east due to required new right-of-way and longer line length.	Slightly higher overall impact than the alternative. Starting the transmission line at the Monahan Creek substation site means it would travel south of Castle Rock, crossing through sparsely populated or unpopulated areas except for the unincorporated community of West Side Highway, where it would have potentially high visual impacts. Monahan Creek substation would also have a slightly higher impact on viewer sensitivity (medium) than the other substation sites.	Same overall impact as the alternative. It would replace route segments between Yale and the rural residential areas north of Camas with similarly rated segments traveling farther to the west, removing visual impacts on outdoor and recreational users east of the alternative but introducing impacts on nearby rural residences.	Slightly lower overall impact than the alternative. The option would start the new transmission line farther north at the Baxter Road substation site (which has a lower visual impact rating than the Monahan Creek site). It would travel through sparsely populated land.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Same overall impact as West Option 2, although it affects slightly fewer residents.	Slightly higher overall impact than the alternative. It would move the Lewis River crossing near Ariel farther downstream to a visually sensitive area that attracts recreational users and would take a direct southeast route toward Venersborg on new right-of-way through more populated (rural residential) areas.	Same overall impact as the alternative. It would replace a very short route segment north of Camas traveling through unpopulated land.	Slightly lower impact than the alternative. The option would start at the Baxter Road substation site (which has a lower visual impact rating than the Monahan Creek site). It would travel through sparsely populated land but require additional right-of-way parallel to an existing line.	
EMF	Electric and magnetic field (EMF) impacts would be similar for each action alternative. Construction standards and grounding requirements would minimize potential nuisance shocks from electrical fields in the right-of-way. Electric fields would meet all BPA guidelines, ranging from 0.7 to 2.4 kV/m at edge of right-of-way and 8.7 to 9 kV/m directly under the line. Maximum magnetic fields at edge of right-of-way would range from 26 to 59 mG, or 3-15 mG under normal conditions, comparable to existing 500-kV lines in the area. All fields would dissipate to normal surrounding levels within a few hundred feet.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	**No** change in electric shock risk or potential radio and TV interference. Electric and magnetic fields near existing lines would increase as loads on those lines increase.
	West Options 1, 2, 3	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Options 1, 2, 3**	
	Same overall impact as the alternative.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	
Noise	**Low-to-moderate** temporary impacts during line construction activities, which would last a few days or weeks at a time at any one location. Temporary **moderate-to-high** impacts for residents near substation sites, because construction would occur over 13 months. Temporary **high** impacts if blasting is required in rocky areas. **No-to-low** long-term impacts. Some corona noise may occur along the conductors during foul weather events, but would not exceed BPA design criteria, statutory noise limits or USEPA guidelines. Maintenance activities would be infrequent. If chainsaws or other loud equipment must be used, there could be temporary **moderate** impacts.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	**No** noise impacts.

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Noise (continued)	**West Options 1, 2, 3**	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Options 1, 2, 3**	**No** noise impacts
	Same overall impact as West Alternative.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	Same overall impact as West Alternative, except for Crossover Option 2, which may exceed USEPA guidelines for corona noise at the edge of right-of-way by 1 dBA.	
Public Health and Safety	**Low** impact where the alternative would cross the Reynolds Metals Superfund site. EPA and ODEQ consider current health risk acceptable. **No** impact where about 600 feet of improved access road would impact BPA's Ross Complex control area. Restricted access and minimization of soil disturbance would mitigate impacts.	**Low** impact along Segment 28 where new towers and access road would be located on the eastern edge of the International Paper Company Mill site. The location is not likely within potentially contaminated areas. On-site investigation would determine risk and potential mitigation prior to construction.	**Low** impact where the alternative would cross the Reynolds Metals Superfund site. EPA and ODEQ consider current health risk acceptable.	**Low** impact where the alternative would cross the Reynolds Metals Superfund site. EPA and ODEQ consider current health risk acceptable.	**No** impact. However, if the transmission system's reliability is affected by growing loads, this could disrupt essential public safety services that rely on adequate and continuous electrical power.
	West Options 1, 2, 3	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Option 1, 2, 3**	
	Same impact as the alternative.	Same impact as the alternative.	Same impact as the alternative.	Same impact as the alternative.	
Socioeconomics and Environmental Justice	The project would cause long-term decreases in government revenues by diminishing the property tax base, reducing future timber-related revenue from state trust lands, and decreasing future revenue from taxes on private timber harvests—potential **high** impacts on Cowlitz or Clark counties in some years. Potential **low** impacts on farmers producing products for niche markets if impacted crops are not allowed to regrow, but **no** long-term impacts on the regional agricultural market. **No** long-term impacts on the private timber market or on environmental justice populations. Short-term increases in timber-harvest revenues on state trust lands $2,386; increases in timber-harvest tax revenues, $941; increases in private timber production revenues $18,810; and decreases in agricultural production revenues, $820,000; Long-term decreases in trust revenues from forgone timber harvests $1,864; decreases in timber-harvest tax revenues $2,613; decreases in private timber production revenues $52,260; and decreases in agricultural production revenues $5.1 million.	**Same** impacts on government revenues, agricultural and private timber markets, and environmental justice populations. Short-term increases in timber-harvest revenues on state trust lands, $2.3 million; increases in timber-harvest taxes, $65,950; increases in private timber production revenues, $1.3 million; and decreases in agricultural production revenues, $3,000. Long-term decreases in trust revenues from forgone timber harvests $1.8 million; decreases in timber-harvest tax revenues, $183,200; decreases in private timber production revenues, $3.7 million; and decreases in agricultural production revenues, $120,000.	**Same** impacts on government revenues, agricultural and private timber markets, and environmental justice populations. Short-term increases in timber-harvest revenues on state trust lands, $1.2 million; increases in timber-harvest taxes, $94,340; increases in private timber production revenues, $1.9 million; and decreases in agricultural production revenues, $160. Long-term decreases in trust revenues from forgone timber harvests, $949,500; decreases in timber-harvest tax revenues, $262,100; decreases in private timber production revenues, $5.2 million; and decreases in agricultural production revenues, $5,300.	**Same** impacts on government revenues, agricultural and private timber markets, and environmental justice populations. Short-term increases in timber-harvest revenues on state trust lands, $1.6 million; increases in timber-harvest taxes, $37,300; increases in private timber production revenues, $746,200; and decreases in agricultural production revenues, $2,800. Long-term decreases in trust revenues from forgone timber harvests, $1.3 million; decreases in timber-harvest tax revenues, $103,600; decreases in private timber production revenues, $2.1 million; and decreases in agricultural production revenues, $110,000.	**No** impacts. In the long-term, reduced transmission system reliability would cause direct and indirect costs for electricity consumers and residents in Oregon and Washington due to electrical outages, and affect economic growth if businesses that rely on reliable power locate in other states.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Same impacts as the alternative.	Same impacts as the alternative except: More short-term increases in timber-harvest revenues on state trust lands, +$255,600; and less increase in timber-harvest taxes, -$1,112; and private timber production revenues -$22,230. More long-term decreases in trust revenues from forgone timber harvests, +$199,700; and smaller decreases in timber-harvest tax revenues, -$3,088, and in private timber production revenues, -$61,750.	Same impacts as the alternative except: Smaller short-term increases in timber-harvest taxes, -$9,401, and private timber production revenues, -$188,030; and a slightly smaller decrease in agricultural production revenues, -$160. Smaller long-term decreases in timber-harvest tax revenues, -$26,110; private timber production revenues, -$522,240; and agricultural production revenues, -$5,100.	Same impacts as the alternative except: More short-term decreases in agricultural production revenues, +$650. More long-term decreases in agricultural production revenues, +$3,700.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Socioeconomics and Environmental Justice (continued)	**West Option 2**	**Central Option 2**	**East Option 2**	**Crossover Option 2**	**No** impacts. In the long-term, reduced transmission system reliability would cause direct and indirect costs for electricity consumers and residents in Oregon and Washington due to electrical outages, and affect economic growth if businesses that rely on reliable power locate in other states.
	Same impacts as the alternative except: More short-term increases in timber-harvest revenues on state trust lands, +52,410; and more short-term decreases in agricultural production revenues, +$650. Additional long-term decreases in trust revenues from forgone timber harvests +$40,950, and in agricultural revenues, +$4,700.	Same impacts as the alternative except: Smaller short-term increases in timber-harvest taxes, -$11,350, and private timber production revenues, -$227,030; and less short-term decreases in agricultural production revenues, -$160. Smaller long-term decreases in timber-harvest tax revenues, -$31,530; in private timber production revenues, -$630,570; and agricultural production revenues, -$5,100.	Same impacts as the alternative except: More short-term increases in timber-harvest revenues on state trust lands, +$260,000; but less short-term increases in timber-harvest taxes, -$8,396, and private timber production revenues, -$167,930. More long-term decreases in trust revenues from forgone timber harvests, +203,100; but less long-term decreases in timber-harvest tax revenues, -$23,320, and private timber production revenues, -$466,410.	Same impacts as the alternative except: More short-term increases in timber-harvest taxes, +$4,020, and private timber production revenues, +$80,460. More long-term decreases in timber-harvest tax revenues, +$11,170, and private timber production revenues, +$223,500.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Same impacts as the alternative except: More short-term increases in timber-harvest revenues on state trust lands, +$36,650; timber-harvest tax revenues, +$2,040; and private timber production revenues, +$40,810; and more short-term decreases in agricultural production revenues +$790. Added long-term decreases in trust revenues from forgone timber harvests, +$28,630; timber-harvest tax revenues, +$5,667); private timber production revenues, +$113,300; and agricultural production revenues, +$4,300.	Same impacts as the alternative except: Smaller short-term increases in timber-harvest revenues on state trust lands, -$431,950; timber-harvest taxes, -$10,000; and private timber production revenues, -$200,010); and a larger short-term decrease in agricultural production revenues, +$35,000). Smaller long-term decreases in trust revenues from forgone timber harvests, -$337,450; timber-harvest tax revenues, -$27,780; and private timber production revenues, -$555,550; and a larger long-term decrease in agricultural production revenues, +$400,000.	Same impacts as the alternative except: More short-term increases in timber-harvest revenues on state trust lands, +$170,900; but less short-term increases in timber-harvest taxes, -$1,137, and private timber production revenues, -$22,740. More long-term decreases in trust revenues from forgone timber harvests, +$133,500; but less long-term decreases in timber-harvest tax revenues, -$3,160, and private timber production revenues, -$63,150.	Same impacts as the alternative except: More short-term increases in timber-harvest taxes, +$5,620, and private timber production revenues, +$112,400. More long-term decreases in timber-harvest tax revenues, +$15,600, and private timber production revenues, +$312,000.	
Transportation	**No-to-low** impact during operation and maintenance of the line. New and improved roads built within rights-of-way would not be public, although they could encourage trespassing. Roads built outside the right-of-way may affect local transportation slightly by improving or adding to existing roads used for other purposes (by the landowner or public). The West Alternative would require the least mileage of roads, 10 miles new and 20 miles improved, outside the right-of-way. **Low-to-moderate** impact during construction due to temporary and intermittent traffic disruptions. The alternative crosses areas with more developed road systems meant to serve larger populations, which could partially mitigate impact from traffic disruption.	Same long-term impacts as the West Alternative. The Central Alternative would have the second highest mileage of new or improved roads outside the right-of-way (25 miles new, 109 miles improved). Same temporary construction impacts as the West Alternative. The alternative would cross more rural areas with fewer existing roadways; however there would be less traffic subject to disruption.	Same overall impacts as the Central Alternative. The East Alternative would have the highest mileage of new or improved access roads outside the right-of-way (21 miles new, 161 miles improved).	Same overall impact as the Central Alternative. The Crossover Alternative would have 19 miles new and 78 miles of improved access roads constructed outside the right-of-way.	**No** impact on transportation.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Same overall impact as the alternative.	Same overall impact as the alternative. This option does not add any additional crossings of public roads although many logging roads would be crossed.	Same overall impact as the alternative. Similar to Central Option 2, this option would cross West Side Highway but avoid crossing SR 504.	Same overall impact as the alternative. This option would add 3 miles of new access road, and 1 mile of improved access road.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Transportation (continued)	**West Option 2**	**Central Option 2**	**East Option 2**	**Crossover Option 2**	**No** impact on transportation.
	Same overall impact as the alternative.	Same overall impact as the alternative. This option would cross SR 411 (West Side Highway) but avoid crossing SR 504.	Same overall impact as the alternative. This option would require 2 fewer miles of new access roads and 27 fewer miles of improved access roads.	Same overall impact as the alternative. This option would cross additional roads mostly used for logging activities and would require improvements of 9 to 10 more miles of access road.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Same overall impact as the alternative.	Same overall impact as the alternative.	Same overall impact as the alternative.	Same overall impact as Crossover Option 2.	
Cultural	**Moderate-to-high** impacts. The West Alternative has the highest sensitivity score among the alternatives (498), likely because it would cross some large population centers that contain a greater number of known sites. Segments with the highest probability of cultural resources present are 25, 40, 46 and 52. Segments that have resources located at proposed tower sites are 2, 4, 9, 25, 36b, 41, 45, 50, and 52. Resources include trails, village sites, an ethnographic fishing location and prairie, a cemetery and other possible burial sites, an historic grave marker, an historic Northern Pacific Railroad site, the Ostrander Tunnel and Portal, village sites and lithic scatters. Segment 52, the southernmost segment shared by all alternatives, has a lithic scatter, a historic site and the NRHP-listed Parkersville site.	Save overall impacts as the West Alternative. The Central Alternative has the second lowest sensitivity score (435), partly because this alternative would run in a less-populated area with fewer previous surveys completed. Segments with the highest probability of cultural resources present are 4 and 52. Segments that have resources located at proposed tower sites are 10, 28, and 52, B and F. Resources include trails, villages and lithic scatters.	Save overall impacts as the West Alternative. The East Alternative has the lowest sensitivity score (394), because it would cross a less-populated area with more slopes and higher elevations that are less likely to have been used by Tribes. Segments with the highest probability of cultural resources present are 3 and 52. Six segments have resources located at proposed tower sites (52, B, F, K, O, W). Resources include historic military roads, trails, lithic scatters and ethnographic sites.	Save overall impacts as the West Alternative. The Crossover Alternative has the second highest sensitivity score (463), likely because a number of its segments cross highly populated areas where more surveys have been conducted. Segments with the highest probability of cultural resources present are 4 and 52. Seven segments have resources located at proposed tower sites (2, 4, 9, 52, N, O, W). Resources include trails, village sites and lithic scatters.	**No** impact on cultural resources.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Slightly higher sensitivity score (+21) than the alternative. It would remove 3 segments with known resources, but 2 of 3 replacement segments would also have resources. Segments 40 and 46 have an historic road and grave marker, among other resources.	Slightly higher sensitivity score (+12) than the alternative. It would add Segment A, which has the same trail at a tower location as segments B and F.	Slightly higher sensitivity score (+11) than the alternative. It would remove 2 segments where towers would impact resources, but 1 (3) of four replacement segments (3, 7, 11, J) has a known village site that may be affected by tower locations.	Higher sensitivity score (+57) than the Crossover Alternative. It would remove 1 segment and add 3 segments (47, 48, 50), 2 of which (47, 50) have towers located where they could impact ethnographic prairies and a village site.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Higher sensitivity score (+53). It would remove 4 segments where towers could impact resources, but add 4 more sensitive segments that also have resources at tower sites (segments 36, 36a, 37, 43), including a village and ethnographic prairie.	Higher sensitivity score (+51). It would remove 2 segments where towers could impact resources, but add 3 more sensitive segments with resources at tower sites (1, 4, 5), including a village site and ethnographic site likely to contain burials.	Higher sensitivity score (+31). It would remove three segments with known resources, but one (U) of five replacement segments (35, P, T, U, V) has a known cultural site (trail) that could be impacted by a tower.	Higher sensitivity score (+35) than the Crossover Alternative, because 1 (C) of 2 replacement segments (C, E) has a tower located where it could affect an historic military road.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Higher sensitivity score (+42) because it would remove 4 segments where towers could impact resources, but add 3 more sensitive segments (36, 36a, 37) that also have resources at tower sites.	Slightly lower score (-26). It would replace one segment with another (30) that has less impact on an ethnographic trail.	Nearly the same impact as the alternative (lower sensitivity score of -5). It would replace one segment with another, which contains no known sites at proposed tower locations.	Higher sensitivity score (+34) because 2 replacement segments (D, E) have towers located where they could affect the same historic military road as Option 2.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Geology and Soils	The northern portion of the West Alternative (north of the Lewis River) is within potentially landslide-susceptible terrain and crosses mapped landslides. The alternative would disturb about 211 acres of soil with severe erosion potential, the least of the action alternatives. Erosion impacts would be greatest during and immediately after construction; by using best management practices, impacts would be **low-to-moderate.** Longer term erosion impacts, such as from infrequent operation and maintenance activities, would be **low**. Soils along this alternative have generally low-to-moderate resistance to soil compaction. Construction would have temporary **low-to-moderate** impacts on soil compaction; long-term impacts would be **low** in areas not under towers and roads, but **high** on about 238 acres of soil that would be permanently compacted under towers and roads.	Most of the Central Alternative is within potentially landslide-susceptible terrain and would cross several mapped landslides. The alternative would disturb about 596 acres of soil with severe erosion hazard, the second highest among the action alternatives. However, temporary and long-term erosion impacts would be the same as the West Alternative. Soils along the northern and southern portions of this alternative have generally low resistance to soil compaction; soils along the middle portion have moderate resistance. Same temporary and long-term soil compaction impacts as the West Alternative, although more soil (262 acres total) subject to permanent compaction, a **high** impact.	The East Alternative would be constructed along the most remote and rugged route of the action alternatives. Most of the alternative would cross potentially landslide-susceptible terrain, including several mapped landslides. The alternative would disturb about 664 acres of soil with severe erosion hazard, the highest among the action alternatives. However, temporary and long-term erosion impacts would be the same as the West Alternative. Similar to the Central Alternative, soils along the northern and southern portions of the East Alternative have generally low resistance to soil compaction; soils along the middle portion have moderate resistance. Same temporary and long-term soil compaction impacts as the West Alternative, although slightly less soil (235 acres total) subject to permanent compaction, a **high** impact.	Most of the Crossover Alternative is within potentially landslide-susceptible terrain and would cross several mapped landslides. The alternative would disturb about 478 acres of soil with severe erosion hazard, mostly located along its middle and lower portions. Temporary and long-term erosion impacts would be the same as the West Alternative. Soils along the northern and southern portions of this alternative have generally low-to-moderate resistance to soil compaction; the middle portion has moderate resistance. Same temporary and long-term soil compaction impacts as the West Alternative, although more soil (253 acres total) subject to permanent compaction, a **high** impact.	**No** impact on geology and soil.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Would cross slightly less soil (-5 acres) with severe erosion potential, but slightly more soil (+1 acre) with low resistance to compaction, with the same overall erosion and compaction impacts as the alternative.	Would cross more soil (+33 acres) with severe erosion potential near Castle Rock, having **low-to-moderate** erosion impacts in these areas. It would permanently compact slightly more soils (+3 acres) with low resistance to compaction, with same compaction impacts.	Would cross mapped landslide areas near the Cowlitz River and soil with severe erosion potential near Lexington (a **low-to-moderate** impact), but would cross less soil (-47 acres) overall with severe erosion potential. It would permanently compact more soil (+28 acres) with low resistance to compaction, but have same compaction impacts.	Would cross slightly less soil (-3 acres) with severe erosion potential. It would permanently compact slightly more soil (+14 acres) with low resistance to compaction, but have same compaction impacts as the alternative.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Would cross slightly more soil (+12 acres) on steeper slopes with moderate-to-severe erosion potential than the alternative, having **low-to-moderate** erosion impacts in these areas. It would permanently compact slightly more soil (+8 acres) with low resistance to compaction, but have same overall compaction impacts.	Would cross a mapped landslide near Longview and soil with severe erosion potential near Lexington (a **low-to-moderate** impact), but would cross less soil (-38 acres) overall with severe erosion potential. It would permanently compact more soil (+31 acres) with low-to-moderate resistance to compaction, but have the same compaction impacts.	Would cross mapped landslide areas along Salmon Creek and soil with severe erosion potential south of Yale Dam and east of Amboy (a **low-to-moderate** impact), but would cross nearly 10% less soil (-60 acres) overall with severe erosion potential. It would permanently compact slightly less soil (-4 acres) with low-to-moderate resistance to compaction, with same compaction impacts.	Would cross about 14% more soil (+67 acres) with severe erosion potential near Castle Rock (a **low-to-moderate** impact). It would permanently compact less soil (-14 acres) with low resistance to compaction, but have same compaction impacts as the alternative.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Would cross a mapped landslide area near Matney Creek. It would cross about 20% more soil (+44 acres) with severe erosion potential than, having **low-to-moderate** erosion impacts in these areas. It would permanently compact slightly more soils (+13 acres) with low resistance to compaction, but have same compaction impacts.	Would cross mapped landslide areas near Amboy and the East Fork Lewis River and some soil with moderate-to-severe erosion potential southeast of Amboy (a **low-to-moderate** impact), but would cross less soil (-31 acres) overall with moderate-to-severe erosion potential. It would permanently compact slightly less soil (-3 acres) with moderate resistance to compaction, with same compaction impacts.	Would cross soils with severe erosion potential east of the upper reaches of the Washougal River (a **low-to-moderate** impact) but would cross only slightly more soil (+3 acres) overall with severe erosion potential. It would permanently compact slightly less soil (-2 acres) with low resistance to compaction, with same compaction impacts.	Would cross about 12% more soil (+59 acres) with severe erosion potential near Castle Rock (a **low-to-moderate** impact). It would permanently compact slightly less soil (-19 acres) with low resistance to compaction, but have same compaction impacts as the alternative.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Water	**Low** overall impact on watershed functions. Although isolated actions could cause **high** impacts on some streams (same for all alternatives), they would be spread over a watershed area of 161,000 acres. Would create 82 miles of newly exposed soil, causing the smallest increase in runoff (0.09%) but greatest increase in sediment delivery to streams (0.25%) of the action alternatives. Would require clearing riparian vegetation at 47 forested crossings of fish-bearing streams. **Low** impacts at 28 crossings where existing shade level is already low; **high** impacts at 19 crossings where loss of existing shade could result in temperature increases. This is the smallest number of riparian crossings and high riparian impacts among the action alternatives. **No** impacts on water temperatures (or fecal coliform levels) where it would cross 5 impaired streams because vegetation in the right-of-way has already been removed; potential **low** impacts on these streams from turbidity (caused by erosion). **Low** impact on 100-year floodplains where 32 towers and 6 miles of improved access roads would be built (this alternative has the greatest number of project components in floodplains). **No** long-term impacts on groundwater. It would cross about 20 miles of wellhead protection areas, the most of the action alternatives.	**Low** overall impact on watershed functions because impacts would be spread over 218,000 acres of watershed. Would create 103 miles of newly exposed soil, the most of the action alternatives, but cause relatively moderate increases in runoff (0.59%) and sediment delivery to streams (0.15%). Would require clearing riparian vegetation at 68 forested crossings of fish-bearing streams, with **low** impacts at 19 crossings and **high** impacts at 49 crossings. This is the greatest number of riparian crossings and high riparian impacts among the action alternatives. **Low** impacts on water temperatures and turbidity where it would cross 2 impaired rivers; most vegetation in the right-of-way has already been removed. **Low** impact on 100-year floodplains where 11 towers and about 1 mile of new or improved access roads would be built. **No** long-term impacts on groundwater where the project would cross about 6 miles of wellhead protection areas.	**Low** overall impact on watershed functions because impacts would be spread over 209,000 acres of watershed. Would create 96 miles of newly exposed soil and cause the most increase in runoff (1.03%), but cause nearly no sediment delivery to streams. Would require clearing riparian vegetation at 52 forested crossings of fish-bearing streams, with **low** impacts at 17 crossings and **high** impacts at 35 crossings. **Low** impacts on water temperatures and turbidity where it would cross the same 2 impaired rivers as the Central Alternative. **Low** impact on 100-year floodplains where about 10 towers and 1 mile of new or improved access roads would be built. **No** long-term impacts on groundwater where the project would cross about 6 miles of wellhead protection areas.	**Low** overall impact on watershed functions because impacts would be spread over 184,000 acres of watershed. Would create 93 miles of newly exposed soil, causing relatively moderate increases in runoff (0.47%) and sediment delivery to streams (0.17%). Would require clearing riparian vegetation at 55 forested crossings of fish-bearing streams, with **low** impacts at 23 crossings and **high** impacts at 32 crossings. **Low** impact on water temperatures and turbidity where it would cross 1 impaired river. **Low** impact on 100-year floodplains where about 12 towers and 2 miles of access road would be built. **No** long-term impacts on groundwater where the project would cross just under 10 miles of wellhead protection areas.	**No** impact on water.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Same overall water impacts as the alternative. Would cross 2 more impaired streams, but have **low** impacts because vegetation has already been cleared. Net additions of 10 towers and 2 miles of access roads in 100-year floodplains, still a **low** impact.	Same overall water impacts as the alternative. Would clear vegetation with high shade function along 1 additional creek.	Same overall water impacts as the alternative. Would cross 2 additional impaired streams. However, it would avoid clearing vegetation with high shade function along 11 creeks. One less tower and slightly less access road construction (-0.1 mile) in floodplains.	Same overall water impacts as the alternative. Would clear vegetation with high shade function along 1 additional creek.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Same overall water impacts. Would avoid clearing vegetation with high shade function along 1 creek. Net addition of 1 tower and reduction in access roads (-0.8 mile) in floodplains.	Same overall water impacts as the alternative. Would avoid crossing the East Fork Lewis River and avoid clearing vegetation with high shade function along 9 creeks. There would be 1 less tower and less access road construction (-0.1 mile) in floodplains.	Same overall water impacts as the alternative. Would clear vegetation with high shade function along 5 more creeks.	Same overall water impacts as the alternative. Would cross 2 more impaired streams, having **low** impacts on both.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Same overall water quality impacts. Would clear vegetation with high shade function along 1 additional creek. Net addition of 2 towers and reduction in access roads (-0.7 mile) in floodplains.	Same overall water impacts as the alternative. Would avoid crossing the Coweeman River and avoid clearing vegetation with high shade function along 2 creeks. There would be slightly more access road construction (+0.2 mile) in floodplains.	Same overall water impacts as East Option 2. Would clear vegetation with high shade function along 4 more creeks.	Same overall water impacts as Crossover Option 2. Would cross the same 2 impaired streams. Would also require clearing vegetation with high shade function along 1 more creek.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
	Right-of-way clearing would affect about 54 acres of forested wetlands and 62 acres of scrub-shrub wetlands (both **high** impacts), the most of the action alternatives. Fill for tower footings (and access roads) would impact an additional 25 acres of forested and non-forested (scrub-shrub, emergent and aquatic bed) wetlands in the following locations: two towers along the Coweeman River (**high** impact); 20 towers in the area north of the East Fork Lewis River south to Salmon Creek (**high** impact); 26 towers along Lacamas Creek and north of Lacamas (**high** impact, and a **moderate** impact from potential noxious weed introduction); and14 towers near Camas where the line would cross the Columbia River (**low-to-high** impact, same for all action alternatives).	Right-of-way clearing would affect about 69 acres of forested wetlands and 16 acres of scrub-shrub wetlands (both **high** impacts). Fill for tower footings (and access roads) would impact an additional 8 acres of forested and non-forested wetlands in the following locations: two towers near the Cowlitz River (**high** impact); two towers east of Amboy along the Chelatchie River (**high** impact); two towers near Big Tree Creek (**high** impact) northeast of Camas; 14 towers near Camas where the line would cross the Columbia River (**low-to-high** impact).	Right-of-way clearing would affect about 61 acres of forested wetlands and 23 acres of scrub-shrub wetlands (both **high** impacts). Fill for tower footings (and access roads) would impact an additional 10 acres in the following locations: two towers near the Cowlitz River (**high** impact); seven towers east of Amboy (**high** impact); five towers northeast of Camas along the Washougal River (**high** impacts); 14 towers near Camas where the line would cross the Columbia River (**low-to-high** impact).	Right-of-way clearing would impact about 53 acres of forested wetlands and 35 acres of scrub-shrub wetlands (both **high** impacts). Fill for tower footings (and access roads) would impact an additional 13 acres in the same general locations as the East Alternative.	**No** impact on wetlands.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Would require clearing more (+7 acres) scrub-shrub and forested wetlands and filling more (+5 acres) forested and non-forested wetlands to place 14 towers with access roads within the Lacamas Creek floodplain northwest of Lacamas Lake, affecting some high-functioning wetlands—a **high** impact.	Would require clearing more (+2 acres) medium-to-high quality forested and scrub-shrub wetlands near the southern end of the option, where it would have **moderate-to-high** impacts. Would fill slightly more (+<1 acre) forested and non-forested wetlands.	Would require clearing more (+10 acres) forested and shrub-scrub wetlands and filling more (+3 acres) of forested and non-forested wetlands to place eight towers with access roads in the Cowlitz River floodplain, a **high** impact.	Would require clearing more (+9 acres) forested and scrub-shrub wetlands and filling more (+2 acres) forested and non-forested wetlands—**high** impacts—within the same wetlands described for West Option 3.	
Wetlands	**West Option 2**	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Would require clearing fewer (-11 acres) forested and scrub-shrub wetlands and filling fewer (-4 acres) forested and non-forested wetlands. However, clearing in scrub-shrub wetlands and fill in emergent and scrub-shrub wetlands would still occur in the Lacamas Creek floodplain, having a **high** impact where wetland functions are rated high. The option would cross more agriculturally disturbed wetlands where functions are rated low or medium. Clearing in forested and scrub-shrub wetlands northeast of Camas and along the Little Washougal River would have **moderate-to-high** impacts.	Would require clearing more (+5 acres) forested wetlands (but -1 acre scrub-shrub wetlands) and filling slightly more (+1 acre) forested and nonforested wetlands for four towers where the option would cross into Lexington near the Cowlitz River, a **high** impact.	Would require clearing fewer (-3 acres) forested and scrub-shrub wetlands and filling fewer (-3 acres) forested and non-forested wetlands, but would still place five towers with roads in wetlands near Cedar Creek and the Little Washougal River—a **high** impact.	Would require clearing more (+4 acres) forested and scrub-shrub wetlands and filling more (+<1 acre) forested and non-forested wetlands near Baxter Creek—a **high** impact. Two or three towers with roads would be placed in or near wetlands between the Baxter Road and Monahan Creek substation sites.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Impacts similar to West Option 2. Would require clearing fewer (-7 acres) forested and scrub-shrub wetlands and filling fewer (-4 acres) forested and non-forested wetlands. Same **high** impact in Lacamas Creek floodplain where wetland functions are rated high. Clearing in forested and scrub-shrub wetlands northeast of Camas and along the Little Washougal River and along Matney Creek would have **moderate-to-high** impacts.	Impacts similar to Central Option 2, although this option would require clearing fewer (-3 acres) forested and scrub-shrub wetlands and most likely avoid the alternative's potentially high impact along the East Fork Lewis River. Would fill slightly more (+1 acre) forested and non-forested wetlands, including forested wetlands at the southern end of the option. Clearing of forested wetland and construction of two towers would occur along Cedar Creek within high quality forested and emergent wetlands and in smaller scrub-shrub wetlands along drainages west and south of Amboy.	Would require clearing slightly more (+1 acre) forested wetlands and fewer (-1 acre) scrub-shrub wetlands, and filling slightly more (+1 acre) forested and non-forested wetlands. Two towers with roads would be placed within a forested wetland south of the East Fork Little Washougal River—a **high** impact.	Impacts similar to Crossover Option 2. Would require clearing more (+5 acres) forested and scrub-shrub wetlands and filling more (+<1 acre) forested and non-forested wetlands near Baxter Creek—a **high** impact. Same two or three towers with roads would be placed in or near wetlands between the Baxter Road and Monahan Creek substation sites.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Vegetation	**No-to-low** impacts on 241 acres of rural and urban/suburban landscape; **low** impacts on 366 acres of shrubland, 106 acres herbaceous vegetation (where it must be permanently cleared) and 13 acres of production forest; m**oderate** impact on 345 acres of forest vegetation; **high** impact on 27 acres of mature forest. Potential **moderate-to-high** impacts on 3 special-status species, small-flowered trillium (4 acres), dense sedge (1 acre) and Nuttall's quillwort (0.5 acre), depending on whether activities contribute to the need for federal listing. If present, potential **high** impact on Oregon coyote-thistle or **moderate-to-high** impacts on Hall's aster, tall bugbane or western wahoo. Potential **high** impacts on some special-status plant habitats: 44 acres in the Lacamas Prairie Natural Area, which requires removing some Oregon white oak woodlands; a WDNR Forest Riparian Conservation Easement; and <0.1 acre of Bradshaw's lomatium habitat.	**No-to-low** impacts on 71 acres of rural and urban/suburban landscape; **low** impacts on 1,261 acres of production forest, 74 acres of shrubland, and 60 acres herbaceous vegetation; **moderate** impact on 303 acres of forest; **high** impact on 13 acres of mature forest. Potential **high** and **moderate-to-high** impacts, respectively, on 2 special status species: hairy-stemmed checker-mallow (1 acre), and small-flowered trillium (5 acres). If present, potential **moderate** impacts on soft-leaved willow or tall bugbane. No known special-status plant habitats potentially affected by the alternative.	**No-to-low** impacts on 99 acres of rural and urban/suburban landscape; **low** impacts on 1,386 acres of production forest, 89 acres of shrubland, and 65 acres of herbaceous vegetation; **moderate** impact on 214 acres of forest; **high** impact on 13 acres of mature forest. Potential **high** impacts on 1 special status plant habitat, the North Pacific herbaceous bald and bluff priority ecosystem along Segment O; and on 1 special-status species, small-flowered trillium (5 acres). If present, potential **moderate** impacts on soft-leaved willow and tall bugbane.	**No-to-low** impact on 147 acres of rural and urban/suburban landscape; **low** impact on 787 acres of production forest, 274 acres of shrubland, and 63 acres of herbaceous vegetation; **moderate** impact on 315 acres of forest; and **high** impact on 44 acres of mature forest (most of the alternatives). Same potential **high** impacts on the North Pacific herbaceous bald and bluff priority ecosystem and small-flowered trillium (5 acres) as the East Alternative. If present, potential **moderate** impacts on tall bugbane and **moderate-to-high** on bolandra.	**No** impact on vegetation.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	More **moderate-to-high** and **high** impacts on special-status habitats and species than the alternative or its other options. Right-of-way and towers and roads would affect more (+34 acres) of the Lacamas Prairie Natural Area (and proposed WNHP preserve), additional high impacts where trees (particularly +1 acre of Oregon white oak) would be removed. Additional high impacts on Bradshaw's lomatium (+4 acres) and small-flowered trillium (+20 acres). Added moderate-to-high impacts on three state-designated species: Oregon coyote-thistle (+0.4 acre), Hall's aster ((+0.2 acre), and Nuttall's quillwort (+3 acres). Would impact less forest land (-15 acres) than the alternative.	Little or no change in moderate to high impacts on vegetation types. Same or similar impacts as the alternative on special-status plant habitats and species.	Would have additional **high** impacts on mature forest (+7 acres) and added **moderate** impacts on forest (+34 acres). Same or similar impacts as the alternative on special-status plant habitats and species.	Would have additional **moderate** impacts on forest (+17 acres) and could disturb the Lacamas Prairie Natural Area (+8 acres), a **high** impact, but would not affect any known WNHP priority ecosystems in this area.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Would disturb less (-18 acres) of the Lacamas Prairie Natural Area and avoid the WDNR Forest Riparian Conservation Easement and Oregon white oak woodland, reducing high impacts. Would also avoid documented populations of dense sedge, reducing moderate-to-high impacts. However, it would clear more (+5 acres) mature forest, an added **high** impact. Would reduce moderate impacts on forest land (9 acres).	Would have additional **high** impacts on mature forest (+7 acres) and additional **moderate** impacts on forest land (+60 acres). Same or similar impacts on special-status plant habitats and species.	Would have less high impacts on mature forest (-8 acres), but additional **moderate** impacts on forest (+22 acres). Same or similar impacts on special-status plant habitats and species.	Would reduce moderate impacts on forest land (-3 acres). Same or similar impacts as the alternative on special-status plant habitats and species.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Vegetation (continued)	**West Option 3**	**Central Option 3**	**East Option 3**	**Crossover Option 3**	**No** impact on vegetation.
	Mostly the same impacts as West Option 2, except this option reduces high impacts by clearing slightly less (+3 acres total) mature forest land and would have additional **moderate** impacts on forest land (+31 acres).	Similar to Central Option 2, this option would have additional **high** impacts on mature forest (+3 acres) and additional **moderate** impacts on forest (+57 acres). Could also impact a WDNR special-status plant habitat, which could be a **high** impact, but would also avoid a hairy-stemmed checker-mallow site, reducing high impacts.	Would reduce moderate impacts on forest (-9 acres) but have additional **low** impacts on production forest (+23 acres). Same or similar impacts on special-status plant habitats and species.	Would have additional **moderate** impacts on forest land (+14 acres). Same or similar impacts on special-status plant habitats and species.	
Wildlife	The West Alternative would create the least new fragmentation of wildlife habitat because it would require only 3 miles of new right-of-way; however, widening of existing right-of-way could expand existing fragmentation, particularly in forested habitats. Because the new transmission line would be higher than parallel existing lines, it could increase the risk of bird collisions in many areas. Impacts on most (non-special-status) wildlife would be **low** where habitat is lost to right-of-way clearing or towers and roads and **moderate** from increased mortality risks (e.g. prey species of raptors would be more visible; birds colliding with the line). The alternative would remove or alter some WDFW priority habitats, having **high** impacts on 27 acres of mature forest, 6 acres of westside prairie in the Lacamas Prairie Natural Area, 61 acres of biodiversity areas and corridors, and 3 acres of the Sifton/Lacamas Oregon White Oak and Washougal Oak woodlands. It could have **low-to-high** impacts on 160 acres of riparian habitat and 175 acres of freshwater wetlands, depending on habitat value and wildlife species present (**moderate-to-high** impact on Coweeman Wetlands). Special-status species that could be impacted include Western pond turtle (**moderate-to-high** impact), purple martin (**moderate** impact), California floater mussel (**low-to-moderate** impact); bald eagles (**moderate** impact), northern spotted owl (**low** impact) and marbled murrelet (**low** impact). (See full list in chapter.) Infrequent maintenance activities would generally have **low** impacts on wildlife habitats and species.	Requiring mostly new right-of-way, the Central Alternative would increase habitat fragmentation primarily in forested habitats; however most of the new line would not parallel existing lines and so pose less collision risk for birds than the West Alternative. Impacts on most wildlife would be similar to the West Alternative (**low** from habitat loss; **moderate** due to increased mortality risk). The alternative would remove or alter some WDFW priority habitats, having **high** impacts on 12 acres of mature forest, 11 acres of biodiversity areas and corridors, 3 acres of the WDFW North Fork Lacamas Snags priority area, and 2 acres of the Washougal Oak Woodlands. It could have **low-to-high** impacts on 116 acres of riparian habitat and 96 acres of freshwater wetlands, depending on habitat value and wildlife species present. Overall impacts on special-status species, and on all wildlife from maintenance activities, would be similar to the West Alternative.	Like the Central Alternative, the East Alternative requires mostly new right-of-way and would increase habitat fragmentation primarily in forested habitats, but pose less collision risk for birds than the West Alternative. Impacts on most wildlife would be similar to the West Alternative (**low** from habitat loss; **moderate** due to increased mortality risk). The alternative would remove or alter some WDFW priority habitats, having **high** impacts on 13 acres of mature forest, 10 acres of biodiversity areas and corridors, 45 acres of the WDFW Rock Creek Snag-Rich priority habitat near Yale Dam, and 2 acres of the Washougal Oak Woodlands and 1 acre of talus; and **low** impacts on 0.5 acre of the Larch Mountain SDFW herbaceous bald priority habitat and 0.05 acre along the edge of a WDFW cave-rich priority area in production forest. It could have **low-to-high** impacts on 107 acres of riparian habitat and 90 acres of freshwater wetlands, depending on habitat value and wildlife species present (**high** impact where parts of the Fraser Creek Wetland would be altered or removed). Overall impacts on special-status species, and on all wildlife from maintenance activities, would be similar to the West Alternative (exception: **moderate** impact on northern spotted owl).	The Crossover Alternative would require mostly new right-of-way along its southern half, but parallel existing transmission lines along much of its northern half, and so would pose greatest collision risks to birds along the northern portion. Impacts on most wildlife would be similar to the West Alternative (**low** from habitat loss; **moderate** due to increased mortality risk). The alternative would remove or alter some WDFW priority habitats, having **high** impacts on 45 acres of mature forest and 10 acres of biodiversity areas and corridors. It would have the same impacts on the following as the East Alternative: **high** impacts on 2 acres of the Washougal Oak Woodlands and 1 acre of talus; and **low** impacts on 0.5 acre of the Larch Mountain SDFW herbaceous bald priority habitat and 0.05 acre along the edge of a WDFW cave-rich priority area. It could have **low-to-high** impacts on 149 acres of riparian habitat and 87 acres of freshwater wetlands, depending on habitat value and wildlife species present. Overall impacts on special-status species, and on all wildlife from maintenance activities, would be similar to the West Alternative (exception: **moderate** impact on northern spotted owl).	**No** impact on wildlife.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Would remove or alter more freshwater wetlands (+11 acres), riparian habitat (+2 acres), and westside prairie (+6 acres) than the alternative. Would remove more WDFW wood duck priority areas (+7 acres, a **moderate** impact), but remove or alter less (-13 acres) biodiversity areas and corridors, avoiding the Columbian black-tailed deer population in this area.	Would alter or remove more riparian habitat (+4 acres) and WDFW Roosevelt Elk Winter Range Priority Area (+78 acres, a **low** impact) than the alternative. An access road would cross riparian habitat within 1 mile of 2 documented occurrences of Dunn's salamander, a potential **moderate** impact.	Would remove more freshwater wetlands (+4 acres) and forest (+42 acres), and remove or alter more riparian habitat (+11 acres) than the alternative. Would avoid a WDFW waterfowl concentration priority area, but remove more WDFW bald eagle priority area (+3 acres)—the Cowlitz Bald Eagle Feeding Habitat—and cross within the buffers of two additional bald eagle nests (although another nest would be avoided).	Would alter more riparian habitat (+8 acres) and remove or alter more wetland habitat (+11 acres) than the alternative. Would come within 1 mile of a WDFW wood duck priority area that is avoided by the Crossover Alternative, but not cross it, having a **low-to-moderate** impact.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Wildlife (continued)	**West Option 2**	**Central Option 2**	**East Option 2**	**Crossover Option 2**	**No** impact on wildlife.
	Would remove or alter more mature forest (+5 acres) and habitat within a biodiversity area and corridor that supports Columbian black-tailed deer (+12 acres), but fewer freshwater wetlands (-18 acres).	Would remove more mature forest (+7 acres), forest (+68 acres) and riparian habitat (+10 acres).	Would remove less freshwater wetlands (-7 acres), mature forest (-8 acres), and habitat from northern spotted owl circles (-75 acres). Would avoid a talus slope, the Larch Mountain herbaceous bald and a cave-rich area, although it would remove more habitat in a snag-rich area (+3 acres). Would avoid crossing within 1 mile of several special-status species, including 3 of the 5 occurrences of Rocky Mountain tailed frog, and 3 of the 6 occurrences of Cascade torrent salamander. Would remove less WDFW Columbian black-tailed deer priority area (-12 acres).	Would remove less riparian habitat (-10 acres), but alter more of this habitat along the right-of-way (+9 acres). Would alter more WDFW Roosevelt Elk Winter Range Priority Areas (+70 acres), a **low** impact.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Similar to West Option 2. Would remove or alter more mature forest (+3 acres) and habitat within a biodiversity area and corridor that supports Columbian black-tailed deer (+11 acres), but less freshwater wetlands (-13 acres). Would also remove or alter additional riparian habitat (+14 acres) and forest (+34 acres).	Would remove or alter more mature forest (+3 acres) and forest (+60 acres), but less riparian habitat (-10 acres). Would cross a forested riparian area within 1 mile of a WDFW cavity-nesting duck priority area, a **moderate** impact, and avoid 2 of the 5 documented occurrences of Cascade torrent salamander, 1 of 3 documented occurrences of western pond turtle (the 1 occurrence in Washington), and the 1 documented occurrence of Vaux's swift.	No change in habitat acreage impacted except for freshwater wetlands (+<1 acre).	Similar to Crossover Option 2. Would remove less riparian habitat (-9 acres) but alter more of this habitat along the right-of-way (+7 acres, and would alter more WDFW Roosevelt Elk Winter Range Priority Areas (+66 acres), a **low** impact.	
Fish	Riparian vegetation would be cleared at 47 forested crossings of fish-bearing streams, having **high** impacts at 19 crossings from shade loss and 10 crossings from loss of large woody debris potential (both impacts can occur along the same stream). This is the smallest number of high impacts on riparian functions among the action alternatives. **Low** impacts on fish from runoff and potential sediment delivery to streams (see watershed impacts summary in Water section). **Low** impact on floodplain functions that could affect fish—18 acres of floodplains impacted by right-of-way clearing, towers and roads. **Low** overall impacts on ESA-listed and general fish populations—about 0.11% based on the Integrated Fish Index and the least of the action alternatives.	Riparian vegetation would be cleared at 68 forested crossings of fish-bearing streams, having **high** impacts at 49 crossings from shade loss and 46 crossings from loss of large woody debris potential. This is the greatest number of high impacts on riparian functions among the action alternatives. **Low** impacts on fish from runoff and potential sediment delivery to streams (see watershed impacts summary in Water section). **Low** impact on floodplain functions that could affect fish—19.2 acres of floodplains impacted by right-of-way clearing, towers and roads. **Low** overall impacts on ESA-listed and general fish populations—about 0.15% based on the Integrated Fish Index.	Riparian vegetation would be cleared at 52 forested crossings of fish-bearing streams, having **high** impacts at 35 crossings from shade loss and 38 crossings from loss of large woody debris potential. **Low** impacts on fish from runoff and potential sediment delivery to streams (see watershed impacts summary in Water section). **Low** impact on floodplain functions that could affect fish—10.9 acres of floodplains impacted by right-of-way clearing, towers and roads. **Low** overall impacts on ESA-listed and general fish populations—about 0.19% based on the Integrated Fish Index.	Riparian vegetation would be cleared at 55 forested crossings of fish-bearing streams, having **high** impacts at 32 crossings from shade loss and 31 crossings from loss of large woody debris potential. **Low** impacts on fish from runoff and potential sediment delivery to streams (see watershed impacts summary in Water section). **Low** impact on floodplain functions that could affect fish—9 acres of floodplains impacted by right-of-way clearing, towers and roads, least of the action alternatives. **Low** overall impacts on ESA-listed and general fish populations—about 0.2% based on the Integrated Fish Index, the highest among the action alternatives.	**No** impact on fish.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Same overall impacts as the alternative.	Same overall impacts as the alternative. Would cross 1 more stream with high shade function and high potential for large woody debris.	Same overall impacts as the alternative. Would have fewer crossings that affect streams with high shade function (11) and high potential for large woody debris (11).	Same overall impacts as the alternative. Would cross 1 more stream with high shade function.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Same overall impacts as the alternative. Would cross 1 less stream with high shade function.	Same overall impacts as the alternative. Would have fewer crossings that affect streams with high shade function (9) and high potential for large woody debris (7).	Same overall impacts as the alternative. Would have more crossings that affect streams with high-functioning shade (5) and high potential for large woody debris (6).	Same overall impacts as the alternative.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Fish (continued)	**West Option 3**	**Central Option 3**	**East Option 3**	**Crossover Option 3**	**No** impact on fish.
	Same overall impacts as the alternative. Would have more crossings that affect streams with high shade function (1) and high potential for large woody debris (2).	Same overall impacts as the alternative. Would have fewer crossings that affect streams with high shade function (2) and high potential for large woody debris (3).	Same overall impacts as the alternative. Would have more crossings that affect streams with high shade function (4) and high potential for large woody debris (4).	Same overall impacts as the alternative. Would have more crossings that affect streams with high shade function (1) and high potential for large woody debris (1).	
Climate	**No** impact on climate.	**No** impact on climate.	**No** impact on climate.	**No** impact on climate.	**No** impact on climate.
	West Options 1, 2, 3	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Options 1, 2, 3**	
	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	
Air Quality	**Low** impact during construction and maintenance activities from exhaust emissions and airborne dust; **no** impacts from corona during operation because pollutants emitted would be very small, temporary, and not detectable above background levels.	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	**No-to-low** impact. If emergency generators must be run in the region because the power transmission system is congested, this would contribute added diesel particulate emissions.
	West Options 1, 2, 3	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Options 1, 2, 3**	
	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	
Greenhouse Gas	**Low** impact. Construction and maintenance activities would result in annualized emissions of about 4400 metric tons of CO_2 equivalent.	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	**No-to-low** impact. If emergency generators must be run in the region, this would contribute to GHG emissions.
	West Options 1, 2, 3	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Options 1, 2, 3**	
	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	

Notes:
1. Permanent impacts, unless noted. Construction and maintenance impacts are temporary and only discussed in this summary table where relevant for some resources.

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Table 4-11 Summary of Environmental Impacts by Substation[1]

Resource	Sundial Substation Site	Castle Rock Substation Sites		
		Casey Road	Baxter Road	Monahan Creek
Land Use	**High** impact on land ownership; about 40 acres of Port of Portland property within the Troutdale Reynolds Industrial Park would be removed from future use. **No** impact on land use, which is already industrial.	**High** impacts on land ownership and land use. About 25-50 acres of WDNR property would be purchased and removed from timber production. **Moderate** impact on unauthorized target shooters, who would be displaced.	**High** impact on land ownership and land use. About 25-50 acres of Sierra Pacific Industries property would be purchased and removed from timber production.	**High** impact on land ownership and land use. About 25-50 acres of rural and open space property would be purchased and removed from private ownership. Grazing on-site may or may not continue.
Recreation	**No** impact on recreation resources.	**Potential low** impact on unauthorized dispersed recreation users.	**No** impact on recreation resources	**No** impact on recreation resources.
Visual	**Low** impact. The site is near many existing transmission lines and two existing substations in an industrial park.	**Low** impact. The site is in a remote area with low scenic quality adjacent to four transmission lines.	**Low** impact; same as Casey Road site.	**Low** impact. While also adjacent to a transmission corridor, the site is less remote and would likely be visible to a few surround residents and local motorists.
EMF	Electric and magnetic levels at the perimeter of the substation' yard would reflect fields generated by the new 500-kV line alone. Same overall impact as the selected alternative.	Electric and magnetic levels at the perimeter of the substation' yard would reflect fields generated by the new 500-kV line alone. Same impact as the selected alternative.	Same impact as Casey Road site.	Same impact as Casey Road site.
Noise	Because substation construction can take about 13 months, noise from construction activities could have **moderate-to-high** impacts on nearby residents. Once operating, any audible noise at the station perimeter would predominantly reflect foul weather corona noise from incoming and outgoing transmission lines. Same overall impact as the selected alternative.	Potential **moderate-to-high** impacts on some area residents during construction. Once operating, any audible noise at the station perimeter would predominantly reflect foul weather corona noise from incoming and outgoing transmission lines. Same overall impact as the selected alternative.	Same impacts as Casey Road site.	Same impacts as Casey Road site. (Construction noise may be heard by more people because of the surrounding residential area.)
Public Health and Safety	**Low** impact from potential hazardous waste disturbance. The substation and part of Segment 52 (common to all alternatives) would be built within the Reynolds Metals Superfund site in Troutdale, but special care would be taken during excavation, most contaminated soils have been removed, and health risk levels are considered acceptable by USEPA and ODEQ. **No-to-low** impact from toxic substances (including diesel and oil) used during construction and in substation equipment, due to strict adherence to all regulations and proper equipment design. **No-to-low** other impacts on the general public; only maintenance workers could gain entry.	**No-to-low** impact from toxic substances used during construction and in substation equipment, due to strict adherence to all regulations and proper equipment design. **No-to-low** other impacts on the general public; only maintenance workers could gain entry.	Same impacts as Casey Road site.	Same impacts as Casey Road site.
Socioeconomics and Environmental Justice	Potential for increases or decreases in revenue for the Port of Portland, depending on the effect of the substation on the value of remaining lots in the industrial park. **No** impact on environmental justice populations.	Timber harvested during construction would create a short-term increase in timber harvest revenues on WDNR state trust land ($159,000). Long-term decrease in state trust timber harvest revenues from forgone future harvests currently valued at $124,100, a **moderate** impact. **No** impact on environmental justice populations.	BPA purchase of site would cause a long-term decrease in property tax revenue for Cowlitz County ($7,900 or -0.001%) and state ($2,000). Timber harvested during construction would create short-term increases in Sierra Pacific timber harvest revenue ($71,300), and timber harvest tax revenues for Cowlitz County and the state ($2,900 and $700, respectively)). Converting the property permanently would cause a long-term decrease in revenue for Sierra Pacific from forgone future harvests currently valued at$198,000. **Moderate** impact on county, but **no** impact on timber market. **No** impact on environmental justice populations.	BPA purchase of site from multiple landowners would cause a long-term decrease in property tax revenue for Cowlitz County ($3,400 or -0.001%) and state ($900). Private timber producers would experience a short-term increase in timber harvest revenue ($30,900) with a corresponding increase in timber harvest tax revenues of $1,200 for Cowlitz County and $300 for the state. Long-term conversion of the property would decrease revenue for private timber producers of $86,000). Same impacts at Baxter Road site (**moderate** on county, **none** on timber market, **none** on environmental justice populations).

Resource	Sundial Substation Site	Castle Rock Substation Sites		
		Casey Road	Baxter Road	Monahan Creek
Transportation	Construction at the site would periodically disrupt local motorists and existing truck traffic and workers in the larger industrial park over 13-24 months, a temporary **moderate** impact. Infrequent maintenance activities would have **no-to-low** long-term impacts.	Construction vehicles could temporarily delay logging trucks in the area, a **low** impact, and interrupt traffic along Casey Road and West Side Highway (SR 411) for long periods, a **moderate** impact. Infrequent maintenance activities would have **no-to-low** long-term impacts on surrounding traffic and roads.	Construction vehicles could temporarily delay logging trucks and area residents along Beebe Road, a **moderate** impact. Same long-term impact as Casey Road site.	During construction, intermittent traffic delays on Delameter Road, possible detours, and increased traffic would cause short-term **moderate** impacts. Same long-term impact as Casey Road site.
Cultural	Cultural sensitivity score of 25. **Moderate** impact because the site has a high probability for disturbing historic resources due to the nearby Troutdale Substation, a historic property that has been determined NRHP-eligible. This site has a very low probability for disturbing archaeological or ethnographic resources, due to its location in a previously-disturbed industrial area near other substations and transmission lines.	Lowest cultural sensitivity score among the three Castle Rock area sites (15). The site is in a remote area that has been previously logged and is next to existing transmission lines that may have disturbed archaeological resources previously. However, logging activities and existing transmission lines may contribute to a higher possibility that historic resources are present (i.e., historic transmission lines and logging camps), resulting in a **moderate** impact.	Same impact as Casey Road site, despite a higher cultural sensitivity score of 24, which is likely due to its proximity to creeks.	Same cultural sensitivity score as the Baxter Road site because of nearby creeks, but same impact as Casey Road site.
Geology and Soils	**Low** soil erosion impacts; the site is flat and has only a slight erosion-hazard potential. **High** long-term impact on soil from compaction directly under the substation, but temporary **moderate** and long-term **low** compaction impacts beyond the substation footprint.	Due to the site's underlying geology, it is unlikely to be subject to liquefaction during earthquakes. No mapped landslides, but soil is considered to have severe erosion potential. Still, erosion impacts would be temporarily **low-to-moderate** during construction and **low** when the substation is operating, due to mitigation measures. **High** long-term impact on soil from compaction directly under the substation, but temporary **moderate** and long-term **low** compaction impacts beyond the substation footprint.	Same underlying geology, soil erosion potential and erosion/compaction impacts as Casey Road site.	Slightly less erosion potential (moderate-to-severe rating). However, same underlying geology and erosion/compaction impacts as Casey Road site.
Water	**No water** impacts; the site is not near any water bodies except the Columbia River, but storm water runoff would not be discharged into the river and the site is outside the river's 100-year floodplain. Potential **moderate** impact on groundwater if contamination (such as from herbicides) occurs because of the aquifer's moderate depth and high permeability; however, mitigation measures would be taken to avoid this.	The substation would be built over 2 intermittent, non-fish-bearing streams, but would not prevent subsurface water flow to nearby streams. **Low** impacts on surface water quality from potential added turbidity, **no** impact on stream temperatures because riparian vegetation has already been cleared, and **no** impact on floodplains. **No** long-term impacts on existing wells from construction dewatering (if required). **Low** risk of groundwater contamination because of moderate-to-deep, bedrock-sealed wells within 1 mile of the site and low soil permeability. Once operating, the substation would have **low** impacts on surface water quality; storm water runoff would be discharged to a detention pond north of the site.	Water impacts same as Casey Road site. Most streams would be avoided and erosion control measures would minimize impacts to streams that flow to Baxter Creek; no riparian vegetation would be cleared.	Water impacts same as Casey Road site except for **no-to-low** impacts on floodplains; about 1,100 square feet of the site is within the 100-year floodplain of Monahan Creek. Nearby Monahan and Delameter creeks, located 450-500 feet away and separated from the site by roads, are both listed as impaired for elevated temperatures, but no riparian vegetation would be cleared (having **no** impact).
Wetlands	**High** impact on about 11 acres of emergent wetlands that could be filled. Although these wetlands are located in an industrial setting, they are of medium quality and functions such as water quality improvement would be lost.	**No-to-low** impacts because wetlands are outside the substation disturbance area, but there is the potential for operation and maintenance activities to spread dust, sediment or contaminants in adjacent wetland buffers (a short-term **low** impact).	**High** impact—the highest wetlands impact of the three substation sites—because it could require filling 0.6 acre of mostly forested, medium-quality wetlands.	**No** impacts on wetlands.
Vegetation	**Low-to-moderate** impact on 40 acres of herbaceous vegetation that would be permanently removed, including 11 acres of disturbed, moderately functioning herbaceous emergent wetlands.	**Low** impact on already disturbed vegetation. About 38 acres of production forest, 24 acres of shrubland and 1 acre of rural landscape would be permanently removed.	**Low** impact on 47 acres of previously harvested production forest.	**Low** impacts on 46 acres of rural landscaped vegetation, 18 acres of production forest and 1 acre of shrublands, but **high** impact on 2 acres of mature forest that would be permanently removed. Potential **moderate-to-high** impacts on a special-status species, western wahoo, given documented occurrences near the site.

Resource	Sundial Substation Site	Castle Rock Substation Sites		
		Casey Road	Baxter Road	Monahan Creek
Wildlife	**Low** impacts on most wildlife from permanent loss of disturbed wetland habitat; potential **moderate-to-high** impact on state-listed western pond turtle if present (documented within 1 mile).	**Low** impacts on most wildlife from removal of production forest and shrubland habitat. **Low** impact on Willapa Roosevelt elk from removal of winter range. **No** impacts on marbled murrelet or northern spotted owl (no suitable habitat present) or other special-status species (none documented within 1 mile).	Same impacts on most general and special-status wildlife species as Casey Road site except where a small section (0.1 acre) of scrub-shrub wetland priority habitat would be cleared, a **low-to-high** impact depending on quality and wildlife supported.	Same impacts on most general and special-status wildlife species as Casey Road site except potential **high** impact where mature forest priority habitat must be cleared. However, impacts would be **low** to marbled murrelet and bald eagles because neither species has been documented within 1 mile, and location makes it unlikely the species would be present.
Fish	**No** impact; the site is not close enough to any water bodies to affect water quality or fish habitat, and is located outside the Columbia River's 100-year floodplain.	**No-to-low** impacts; the site is about 1,800 feet upslope of Rock Creek, which has presumed presence of Lower Columbia River coho and potential occurrence of Lower Columbia River steelhead. The project would not remove any vegetation along the creek.	**No-to-low** impact; the site is about 1,000 feet upslope of Baxter Creek, which has presumed presence of Lower Columbia River coho and steelhead. Construction would remove vegetation from 3 non-fish-bearing streams only, with no vegetation removal along Baxter Creek.	**No-to-low** impact; the site is between Monahan and Delameter creeks, about 450-500 feet from each, separated by roads. These creeks have documented occurrence of Lower Columbia River coho, steelhead and Chinook salmon, and presumed presence of Columbia River chum, but no vegetation would be removed along them.
Climate	**No** impact.	**No** impact.	**No** impact.	**No** impact.
Air Quality	**Low** impact during construction and maintenance activities from exhaust emissions and airborne dust; **no** impacts from operation.	**Low** overall impact during construction and maintenance activities from exhaust emissions and airborne dust; **no** impacts from operation.	**Same** impacts as Casey Road site.	**Same** impacts as Casey Road site.
Greenhouse Gas	**Low** impact on the atmosphere from construction and maintenance vehicles emitting GHGs.	**Low** overall impact on the atmosphere from construction and maintenance vehicles emitting GHGs and from permanent conversion of forested areas.	**Same** impact as Casey Road site.	**Same** impact as Casey Road site.

Notes:
1. Permanent impacts, unless noted. Construction impacts are temporary and only discussed in this summary table where relevant for some resources.

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Chapter 5 Land

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

This chapter describes existing land ownership and use in the project area, and how the project alternatives could affect these resources. Related information can be found in Chapters 6 through 22, which discuss individual resources on this land such as visual, recreation, cultural, soil, wetland, vegetation, wildlife, or air quality.

5.1 Affected Environment

For the purposes of this analysis, the project area consists of lands at and in the immediate vicinity of proposed project facilities in Cowlitz and Clark counties, Washington, and Multnomah County, Oregon. This includes the unincorporated portions of these counties and the city of Kelso in Cowlitz County, the cities of Vancouver, Camas, and Washougal in Clark County, and the cities of Troutdale and Fairview in Multnomah County. This section describes existing general land ownership and use patterns in the project area, followed by more specific descriptions of land ownership and use along each of the proposed action alternatives.

5.1.1 Land Ownership

While there is a wide variety of land ownership in the general project area, land along the action alternatives is predominately privately owned, with some public ownership scattered throughout (see Maps 5-1A through 5-1D). Public owners include federal and state agencies, and city and county governments. There are also many large and small private landowners.

Most private land includes small parcels or holdings by individual landowners, and large parcels or holdings owned by PacifiCorp and private commercial timber companies including Longview Timberlands LLC (Longview Timber), Sierra Pacific Industries, and Weyerhaeuser Company. Public agencies that own or manage lands directly crossed by the project include WDNR, the city of Camas, and the Port of Portland. A more detailed analysis of WDNR lands in the project area is in Appendix A.

5.1.2 Land Use

In the counties and cities where the action alternatives are located, there are five general categories of existing land use: **urban/suburban**, **rural**, **timber production**, **agriculture**, and **open space** (which include both forested and non-forested areas) (see Maps 5-2A through 5-2D). Cowlitz County has large areas of mostly forested open space and timber production. Agriculture and rural residences are also scattered throughout the county. Clark County also has large areas of forested open space and timber production, but has more agriculture and rural residences than Cowlitz County. Higher density urban/suburban areas occur in and around the cities of Kelso and Longview to the north and in the greater Portland–Vancouver metropolitan area to the south, which includes land in Multnomah County.

5.1.2.1 Urban/Suburban

Urban and suburban land uses within the project area are mainly in the many incorporated cities in Cowlitz, Clark, and Multnomah counties. Incorporated cities in Cowlitz County include

Castle Rock, Kelso, Longview, Kalama, and Woodland. The urban and suburban land uses that make up these cities include typical mid- to high-density development, such as single and multi-family residential uses, commercial uses (e.g., retail space, restaurants, gas stations, and office buildings), public and municipal buildings, churches, parks, industrial uses, and associated utility facilities, roads, and impervious surfaces (e.g., parking lots).

Incorporated cities in Clark County include Battle Ground, Camas, La Center, Ridgefield, Vancouver, Washougal, Woodland, and Yacolt. With the exception of Vancouver, these cities tend to be of similar scale and mix of land uses as the cities in Cowlitz County. Vancouver, the largest city in southwest Washington both in population and areal extent, has a broader spectrum of land uses, and more intensive land uses, than the other cities in the project area.

The southern portion of each action alternative after it crosses the Columbia River, including the proposed Sundial substation site, is within unincorporated Multnomah County, Oregon, and the cities of Troutdale and Fairview in Multnomah County. These two cities are within the urban growth boundary for the Portland metro area. These cities offer a combination of multi-family residential, single-family residential, commercial and industrial uses, parks, and open space areas. Public infrastructure in urban/suburban areas includes hospitals, roads and highways, and schools.

Clark County schools in the vicinity of the proposed action alternatives include Beacon Hill Elementary School, Burnt Bridge Creek Elementary School, Cedar Creek School, Covington Junior High School, Kings Way Christian School, Minnehaha Elementary School, Orchards Elementary School, Pleasant Valley Middle School, Pleasant Valley Primary School, Walnut Grove Elementary School, Pacific Junior High School, Sunnyside School, and Lacamas Heights Elementary School. Butler Acres Elementary School is in Cowlitz County.

5.1.2.2 Rural

Rural land uses within the project area are dispersed throughout Cowlitz and Clark counties. Rural, unincorporated communities in Cowlitz County include Yale, Lexington, Ariel, and Cougar. These areas are generally near the Lewis River and along transportation corridors, such as SR 503. Typical land uses in these and immediately surrounding areas include mostly low-density land uses, such as single-family residential uses on relatively large lots, small commercial areas, dispersed industrial uses, parks, churches, public and municipal buildings, and associated infrastructure. Schools in the rural areas of Cowlitz County include Yale Elementary School and Green Mountain Elementary School.

Rural, unincorporated areas in Clark County include Amboy, Brush Prairie, Chelatchie Prairie, Fargher Lake, Hockinson, and Meadow Glade. Clark County identifies these areas as **rural centers**. Rural centers are distinct areas that have small lot patterns for residential development, small-scale businesses that provide convenience shopping and services to nearby rural residents, access to arterial roadways, and are surrounded by protected rural landscapes of generally open land used for agriculture, forestry, large lot residential, recreation, and environmental protection. Rural areas typically have maximum densities of one unit per acre (Clark County 2010). No schools in the rural areas of Clark County are close to the project.

5.1.2.3 Timber Production

Lands used for timber production activities are predominately located in the northern and eastern portions of the project area. These lands are owned or managed by timber companies (Weyerhaeuser, Longview Timber, and Sierra Pacific), utilities (PacifiCorp), or the state (WDNR) and are mostly used for timber production, although other uses occur on these lands including mushroom, cedar bough, salal, and other floral products collection, conservation easements, wildlife management, recreation, and agriculture. (See Chapter 11, Socioeconomics for more information about the economics of timber harvesting and how WDNR manages its trust lands). These lands are forested (some with mature forests and forested wetlands), cleared, or have been replanted. Access roads that were built mainly for hauling cut timber are present within these areas.

5.1.2.4 Agriculture

Lands used for agriculture are scattered about the project area but mostly occur along the Cowlitz River, northeast of Amboy, and along northern portions of Segment 25. Crop production and livestock grazing are the current agricultural uses on these lands. The primary crops grown in the project area include nursery stock, vegetables, berries, Christmas trees, and forage, such as hay, for livestock. Livestock production within the project area includes poultry and cattle (Washington State Department of Agriculture 2010). Agricultural uses in existing BPA rights-of-way occur as allowed under existing easements or agreements between BPA and the underlying landowner (see Chapter 11, Socioeconomics).

Some agricultural land has been removed from production through the federal Conservation Reserve Program (CRP). Under this program, farmers receive annual rent payments to remove highly erodible or other sensitive land from production, and re-establish and maintain natural plant communities for a certain number of years (USDA 2011a). Of the 1,140 total square miles within the boundaries of Cowlitz County, about 15 acres are currently enrolled in the CRP (USDA 2011b). Of the 630 total square miles within the boundaries of Clark County, about 128 acres are currently enrolled in the CRP (USDA 2011b).

Prime Farmland and **Farmland of Statewide Importance** are abundant in the project area. Prime farmland is defined as land not already targeted for urban development or water storage that has the best physical and chemical characteristics for producing items such as food, feed, forage, fiber, and oilseed crops (Code of Federal Regulations [CFR] 730-733 Section 657.5). The designation is largely based on soils, slope, and irrigation availability. About 40,380 acres in Cowlitz County and about 117,450 acres in Clark County are prime farmland (NRCS 2009a, 2010a, 2010b).

Farmland of statewide importance, a distinct category from prime farmland, is land that may not meet prime farmland criteria, but that has the potential to economically produce high yields of crops as defined by state agencies. About 293,840 acres in Cowlitz County and about 66,800 acres in Clark County are farmlands of statewide importance (NRCS 2009a, 2010a, 2010b).

Designated prime farmlands and farmlands of statewide importance are also used for residential development and other uses. The designations do not prohibit other uses.

5.1.2.5 Open Space

Open space areas are not developed and have the potential to be used for both production and non-production forest, and for non-forest uses such as rural residential, agriculture or recreation.

Some forests within areas categorized as open space (identified as Open Space – Forested on Maps 5-2A through 5-2D) are being managed for commercial timber production, but by much smaller private landowners not included in the timber production category. Other forested areas within open space could be used for commercial timber production by individual landowners, but are not currently being used for this purpose. Existing vacant BPA rights-of-way cross areas that contain trees that could be harvested and sold as commercial timber. Wetland habitats, shrublands, and rivers and lakes also occur in non-forested open space.

Open space areas (both forested and non-forested) provide opportunities for recreation in the project area. Recreational activities within Cowlitz, Clark and Multnomah counties include boating, fishing, hunting, camping, hiking, bird and wildlife watching, all terrain vehicle (ATV) use, sightseeing, horseback riding, and mountain biking. General day-use activities, including swimming, picnicking, and sports games, also occur in the project area within developed areas such as designated parks and trails (see Chapter 6, Recreation). Open space areas provide opportunities for recreational activities on public lands in the eastern portion of the project area, such as on lands managed by WDNR. The western portion of the Yacolt Burn State Forest provides opportunities for camping, hiking, hunting, fishing, horseback riding, off-road vehicle use, and mountain biking. Open space areas on PacifiCorp lands along the Lewis River near Merwin and Yale dams are also used for recreation.

Open space areas are also used to manage natural resources. WDNR has trust lands set aside for research plots and **genetic reserves** (these areas have the same purpose as conservation areas plus a goal of maintaining and protecting the genetic diversity and integrity of a target species), forest riparian conservation easements, recreation, and habitat conservation for wildlife. Mitigation lands managed by PacifiCorp along the Lewis River provide habitat for and support many fish and wildlife species.

Open space areas are also used for utility and transportation corridors. There are existing transmission lines and rights-of-way within the western and southern parts of the project area. Major transportation corridors near the project include I-5, I-205, SR 14, SR 411 (Westside Highway), SR 500, SR 502, and SR 503. There are also railroad lines within the project area. Burlington Northern Santa Fe (BNSF) owns two mainline rail lines that carry freight and passengers (via Amtrak) through Clark County: the BNSF Seattle/Vancouver line and the BNSF Vancouver/Eastern Washington line. Clark County also owns the 33-mile-long short line Lewis and Clark Railroad (also known as the Chelatchie Prairie Railroad or the Clark County Railroad; see Chapter 12, Transportation).

5.1.3 General Land Ownership and Use—West Alternative and Options

The West Alternative begins at the Monahan Creek substation site in Cowlitz County, about 3 miles west of the city of Castle Rock. This site is on private land and the existing land use is a combination of rural, agriculture, and open space. The site is mostly used for grazing. Forested areas and buildings are on and next to the site. Several BPA transmission lines are located west of the site.

The West Alternative parallels existing transmission lines (mostly BPA lines) for about 66 miles of its length, which is almost 98 percent of the total distance. The West Alternative is almost entirely (99 percent) located on private land, and is only 1 percent public land (i.e., WDNR lands).

The West Alternative passes through the cities of Kelso, Vancouver, Camas, Washougal, Troutdale and Fairview, the Longview urbanized area, the Vancouver Urban Growth Boundary, the Camas North Urban Growth Area, the Washougal Urban Growth Boundary, and an urban reserve area in Multnomah County.

Commercial, single-family residential, and multi-family residential areas are crossed within the city of Kelso. The zoning in these residential areas allows maximum densities of 4 to 32 residential units per acre.

As the West Alternative crosses the Lewis River, it begins to pass through many neighborhood associations' boundaries in Clark County, both within and outside the cities of Vancouver, Camas, and Washougal. These include the North Fork Lewis River, East Fork Frontier, Ridgefield Junction, Fairgrounds, Pleasant Highlands, Ramblin' Creek Estates/South Salmon Creek Avenue, Sherwood, Northeast Hazel Dell, West Minnehaha, East Minnehaha, Andresen/St. Johns, Green Meadows, Maple Tree, Sunnyside, Sifton, North Image, Burnt Bridge Creek, Fisher-Mill Plain, Fern Prairie, and Washougal River neighborhood associations.

In the city of Vancouver, the alternative passes through single-family and multi-family residential areas (maximum density 2.2 to 35 residential units per acre), light industrial, and commercial areas (Golder 2011).

The West Alternative passes through residential, commercial, and industrial areas in the city of Camas. These areas are zoned for multi-family residential (maximum density 24 residential units per acre), single-family residential (maximum density 6 residential units per acre), industrial, business park, and commercial uses.

The West Alternative crosses residential and commercial areas of the city of Washougal. These areas are zoned for single-family residential (maximum density 8.7 residential units per acre) and both heavy and light industrial uses. Some areas next to the existing right-of-way have been developed, and some undeveloped areas have been set aside for residential development.

Within the Evergreen and Vancouver school districts (Segment 25), three schools (Orchards Elementary School, Covington Junior High, and King's Way Christian School) are within 500 feet of the edge of the right-of-way. Two state-licensed daycares in the city of Vancouver are also within 500 feet of the edge of the right-of-way.

Lands along the West Alternative outside of city boundaries are used for rural residential uses, schools, commercial areas, undeveloped uses, timber production, agriculture, recreation, and utility and transportation corridors. Agricultural areas are used to grow berries, Christmas trees, hay/silage, grapes, and nursery stock (Washington State Department of Agriculture 2010). WDNR land crossed by the alternative is mostly in the southern part of Cowlitz County. These lands are mostly used for timber production, but one area along Segment 9 has a forest riparian conservation easement. Recreation areas include parks, golf courses, Camp Currie, and the

Lacamas Prairie Natural Area. As the West Alternative approaches the Columbia River, it crosses the North Urban Growth Area for Camas, parks, marinas, and trails (see Chapter 6, Recreation).

As with all the action alternatives, the route crosses the Columbia River and ends at the Sundial substation site. This site is currently used as open space within the Port of Portland's Troutdale Reynolds Industrial Park (Port of Portland 2011), which has planned and existing developed industrial uses, such as existing transmission lines and light industrial businesses such as Federal Express. The site is within Troutdale's and Fairview's city limits in Multnomah County.

Because West Options 1, 2, and 3 are very close to the West Alternative, they generally cross the same land uses and ownership as the West Alternative. There are a few exceptions. West Options 1, 2, and 3 cross portions of Clark County within the urban areas of Vancouver, Camas, and Washougal, but not within these cities' limits. West Option 1 crosses the Camas Meadows Corporate Center and West Option 2 crosses WDNR land (Segment 43) where a school may be planned. The options do not cross the recreation areas closer to the Columbia River.

5.1.4 General Land Ownership and Use—Central Alternative and Options

The Central Alternative begins at the Baxter Road substation site in Cowlitz County, 4 miles northwest of the city of Castle Rock. This site and the surrounding area are on property owned by Sierra Pacific Industries and are used for timber production. Part of the site is within the existing BPA right-of-way and is already cleared.

The Central Alternative parallels existing transmission lines for about 8 miles of its approximately 77-mile length (about 10 percent of the alternative's total distance). Most urban and suburban areas crossed by the Central Alternative are near the northern and southern ends of this alternative, with mostly rural residential, forest, and agricultural areas in between. Most land (73 percent) is privately owned; WDNR (26 percent) and the city of Camas (1 percent) own the remainder.

Similar to the West Alternative, the Central Alternative passes through the cities of Camas, Washougal, Troutdale, and Fairview. Within these urban and suburban areas, land is zoned for commercial, industrial, and residential uses. Although the densities of residential units are similar to the West Alternative and in some cases are higher, the amount of urban and suburban areas is lower.

The Central Alternative passes through several neighborhood associations' boundaries including Proebstel, Washougal River, and Fern Prairie.

The Central Alternative passes through unincorporated areas of Cowlitz County zoned for single-family residential use (maximum density 7.26 units per acre). The alternative also passes through a number of unincorporated Clark County neighborhoods zoned for single-family (maximum density 7.3 units per acre) and multi-family (maximum density 18 units per acre) residential use (Golder 2011). No schools or state-licensed daycares are within 500 feet of the edge of the right-of-way for this alternative.

Rural lands along the route include scattered residences and a small number of agricultural uses. Forested lands cover most of the area crossed by this alternative and are used for recreation by rural residents. The same large timber companies identified for the West Alternative have extensive holdings both in the north and central parts of the alternative in Cowlitz County. Timber production also occurs on smaller private holdings in both counties (mostly in Clark County). PacifiCorp manages its lands along the Lewis River for both wildlife and recreation. Trails on public lands (WDNR land on Segment V and Riverfront Park closer to Longview on Segment F) are also crossed. The City of Camas owns land within a watershed that is sometimes used to supply a portion of the city's drinking water. Similar to all action alternatives, the Central Alternative crosses recreation areas as it approaches the Columbia River, then, crosses the Columbia River into the Sundial substation site (see Section 5.1.3, General Land Ownership and Use—West Alternative and Options).

Central Option 1 uses the Casey Road substation site instead of Baxter Road. This site is about 2 miles north of the Baxter Road substation site, northwest of the city of Castle Rock in Cowlitz County, on WDNR property used for timber production. Most of this site has been cleared for timber production activities. Land along the option between Casey Road and Baxter Road substation sites is owned by Sierra Pacific Industries and WDNR and is used for timber production.

Central Option 2 uses Monahan Creek substation site instead of Baxter Road (see Section 5.1.3). It crosses residential areas within the urbanized area of Longview. Outside of the urbanized area, it crosses timber production land owned by Longview Timber and Weyerhaeuser. It also crosses open space lands (some possibly being used for timber production by smaller landowners) with some scattered agricultural areas and rural residences.

Central Option 3 crosses mostly privately owned rural residential and open space land with some scattered agricultural land. This option crosses Moulton Falls State Park and Lucia Falls/Moulton Falls trail within the park. WDNR is a landowner along a smaller portion of this option and has a permanent research plot and genetic reserve along Central Option 3 (Segment 30) in the central part of Clark County.

5.1.5 General Land Ownership and Use—East Alternative and Options

The East Alternative begins at the Baxter Road substation site and parallels existing transmission lines for about 8 miles of its approximately 76-mile length (almost 11 percent of the total distance). Similar to the Central Alternative, it passes through some urban and suburban areas near the beginning and end of its length, but most land along the alternative is rural residential, agricultural, and forest land. About 85 percent of the land is privately owned, and WDNR (14 percent) and city and county governments (less than 1 percent) own the remaining land.

Similar to the West and Central alternatives, the East Alternative passes through the cities of Camas, Washougal, Troutdale, and Fairview. However, there is a smaller amount of urban and suburban areas along the East Alternative, and lower residential property densities due to a relatively greater amount of rural areas (Golder 2011).

The East Alternative passes through unincorporated areas of both Cowlitz and Clark counties, and the same neighborhood associations' boundaries and zoning districts discussed in the Central Alternative (see Section 5.1.4, General Land Ownership and Use—Central Alternative and Options). No schools or state-licensed daycares are within 500 feet of the edge of the right-of-way for this alternative.

Forested lands cover most of the area crossed by this alternative, and are managed mostly for timber production. Publicly owned forested lands are also managed for recreation (trails) and wildlife habitat, including the Yacolt Burn State Forest. PacifiCorp manages its lands along the Lewis River for both wildlife and recreation. The City of Camas owns land within a watershed that is used at times to supply a portion of the city's drinking water. Timber companies own large tracts in the north and central parts of the alternative in Cowlitz County. Rural land along the route is used for grazing or other agricultural uses, and small areas are developed with rural residences.

Similar to all action alternatives, the East Alternative crosses recreation areas closer to the Columbia River and crosses the Columbia River into the Sundial substation site (see Section 5.1.3, General Land Ownership and Use—West Alternative and Options).

East Option 1 uses the Monahan Creek substation site instead of Baxter Road (see Section 5.1.3). It crosses timber production land owned by Longview Timber and Weyerhaeuser. It also crosses open space lands (some possibly being used for timber production by smaller landowners) with some scattered agricultural areas and rural residences.

Similar to the East Alternative, forested lands cover most of East Option 2, and are managed mostly for timber production. Publicly owned forested lands (WDNR) are also managed for recreation (trails) and wildlife habitat, including the Yacolt Burn State Forest. The City of Camas owns land within a watershed that is used at times to supply a portion of the city's drinking water. Timber companies own large tracts along the northern part of the option and small tracts to the south in Clark County. Rural residences occur along the southwestern boundary of this option.

East Option 3 is on WDNR and a portion of existing BPA right-of-way and avoids the Camas City watershed.

5.1.6 General Land Ownership and Use—Crossover Alternative and Options

The Crossover Alternative begins at the Monahan Creek substation site and parallels existing transmission lines for about 33 miles of its approximately 74-mile length (almost 45 percent of the total distance). About 79 percent of the land is privately owned. The remaining land is owned by WDNR (20 percent) and city and county governments (less than 1 percent).

The Crossover Alternative follows the West Alternative from the Monahan Creek site and passes through forest lands to intersect with and follow the route of the Central Alternative. The Crossover Alternative runs northeast parallel to Merwin Lake, where it passes through rural residential and forest lands. Turning south, it follows the same route as the East Alternative. Most land is forested and managed for timber production. Forested lands not managed for timber production are used for recreation and wildlife habitat, including the Yacolt Burn State Forest. Rural lands support a small number of rural residences and agricultural uses.

Similar to all action alternatives, the Crossover Alternative passes through the cities of Kelso, Camas, Washougal, Troutdale, and Fairview, and the Longview urbanized area. The Crossover Alternative passes through unincorporated areas of both Cowlitz and Clark counties, and the same neighborhood associations' boundaries and zoning districts discussed in the Central

Alternative (see Section 5.1.4, General Land Ownership and Use—Central Alternative and Options) (Golder 2011).

No schools or state-licensed daycares are within 500 feet of the edge of the right-of-way for this alternative.

Similar to all action alternatives, the Crossover Alternative crosses recreational areas closer to the Columbia River and crosses Columbia River and into the Sundial substation site (see Section 5.1.3, General Land Ownership and Use—West Alternative and Options).

Crossover Option 1 crosses open space, agricultural, and rural residential areas in the Camas North Urban Growth Area, and several recreation areas including the Lacamas Prairie Natural Area and Camp Currie. It crosses the Fern Prairie neighborhood on existing BPA right-of-way.

Crossover Options 2 and 3 both begin at the Baxter Road substation site (see Section 5.1.4, General Land Ownership and Use—Central Alternative and Options). Land along the options between the Baxter Road and Monahan Creek substation sites is mostly owned by Sierra Pacific and Weyerhaeuser with some smaller, private landowners. Timber production is the primary land use with some rural residential area towards the south.

5.2 Environmental Consequences

General impacts that would occur for the action alternatives are discussed below, followed by impacts unique to each alternative. Impacts specific to WDNR lands in the project area are also discussed in Appendix A.

5.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- A permanent change in land use that is incompatible with existing land use
- A permanent change to landowner property use where new right-of-way or easements are required
- A permanent change in land ownership
- A new unauthorized land use or access that may or may not be compatible with existing land use

Impacts would be **moderate** where project activities would cause the following:

- A permanent change in land use that is compatible with existing land use
- A permanent change to landowner property use within an existing easement
- Permanently limited access to agricultural or timber production areas (**stranded use**)
- An increase in unauthorized land use or access that may or may not be compatible with existing land use
- A temporary (more than one month at a time) change in or interruption to land use or access to existing land uses

Impacts would be **low** where project activities would cause the following:

- A temporary (one month or less at a time) change in or interruption to land use or access to existing land uses
- A temporary or permanent (but very minor) change in landowner property use within an existing easement or where new right-of-way or easements are required
- A temporary unauthorized land use or access that may or may not be compatible with existing land use

No impact would occur where existing land uses or ownership could continue as before.

5.2.2 Impacts Common to Action Alternatives

5.2.2.1 Construction

Urban/Suburban and Rural

During construction, everyday activities in urban/suburban and rural areas could be interrupted by construction workers, noise and dust from heavy equipment, helicopters, or rock blasting, and by land access restrictions for safety and security (see Chapter 10, Public Health and Safety; Chapter 12, Transportation; Chapter 20, Climate; and Chapter 21, Air Quality).

Project construction would take place over about 30 months. In general, crews could complete about 10 miles of transmission line in 4 months. Construction would occur at any one location for only a few weeks at a time, but multiple crews would simultaneously be working on different activities in different areas along the route over the 30-month period. Construction activities would include vegetation clearing and grubbing; construction of access roads, tower foundations and towers; and conductor stringing and tensioning (see Chapter 3, Project Components and Construction, Operation and Maintenance Activities). Road construction or improvements would occur before line construction, causing similar localized noise and dust. Materials and vehicles would be stored and staged at staging areas. Construction activities, and the interruptions they would cause to developed and rural land uses, would be temporary, a **low** impact.

Because most of the existing right-of-way proposed to be used by some alternatives has been vacant for decades, adjacent landowners and others have used the right-of-way for the activities described in Section 5.1, Affected Environment. In urban/suburban and rural areas, trails and other recreational facilities have been a popular and sometimes compatible and acceptable use within the existing right-of-way. Other compatible uses for the existing, vacant, right-of-way are commercial and industrial parking lots, and public road crossings.

Other existing uses, referred to by BPA as **encroachments,** occur but may not be a compatible or allowed use within the existing right-of-way, depending on existing easements and land use agreements. Types of encroachments on the existing right-of-way include tall-growing landscaped vegetation; unauthorized recreation such as ATV use; storage of RVs, cars and boats; permanent structures such as garages, sheds, shops, and detached apartments; fences through tower legs; decks; and swimming pools. These encroachments, while compatible with urban/suburban and rural land uses, would likely not be compatible with the project and would likely need to be removed prior to construction. BPA would notify landowners, and, consistent with existing easement and land use agreements, would require the right-of-way be cleared of encroachments, a permanent change to landowner property use and a **low-to-moderate** impact.

Timber Production

During construction, timber production areas would be cleared for the new right-of-way, roads, and substations. No timber production lands have been identified on vacant existing right-of-way. Danger trees or trees within a safety backline would also be cleared outside of the new right-of-way (see Section 3.11, Vegetation Clearing). Since these lands are being used for timber production, harvest of mature timber with fair compensation to the landowner would be consistent with the existing land use and would not affect this type of land use during construction. If timber is not ready for harvest, BPA would compensate the landowner for clearing timber earlier than planned. **No-to-low** impacts would occur during construction since construction activities would be temporary (see Section 5.2.2.2, Operation and Maintenance, for long-term, permanent impacts from clearing) and BPA would notify and coordinate with landowners regarding construction and harvest schedules. These areas are not populated and the typical interruptions from construction would not affect day-to-day activities. Construction staging areas and conductor pulling areas that were not within the right-of-way would be cleared, and owners would be compensated.

Agriculture

Depending on the time of year, crops could be damaged by construction activities. Heavy machinery, materials stored on the ground, trenches for counterpoise, and other activities could damage crops and compact soils, causing a temporary loss of soil productivity. The damage would depend on the type of crop (vineyards, orchards, or row crops), the season (during summer growing season, harvest, or winter when plants are dormant), and if the land was in use or fallow. Damage to crops and land disturbance during construction would be a **low** impact because construction activities would be temporary and BPA would compensate landowners for crop loss during construction.

Livestock grazing and farming in the area may need to be temporarily restricted to avoid conflicts between livestock or farm equipment and construction activities. This would be a **low** impact because it would be temporary, and BPA would provide compensation for losses and would notify and coordinate with landowners regarding construction schedules. As with most land uses, disturbance during construction and vegetation removal could introduce or spread noxious weeds (see Chapter 17, Vegetation).

Open Space

The presence of construction workers, noise and dust from heavy equipment, helicopters, or rock blasting could temporarily limit access to recreational areas (forested or non-forested) within open space areas, increase traffic on roads that are also used to access recreational areas, and intrude on recreational experiences. These types of intrusions into recreational experiences would be temporary and a **low** impact. Likewise, these types of intrusions could affect wildlife and wildlife habitat within open space areas (see Chapter 18, Wildlife).

Where non-forested open space areas close to rural residences are being used for agricultural purposes (for example, small or large gardens), impacts from construction would also be temporary and **low**, for the reasons described above for impacts to agricultural lands.

Most open space areas potentially affected by the project are forested. During construction, these forested areas would be cleared within the right-of-way and for the substations and access roads. Additional danger trees would likely be removed in some areas (see Section 3.11, Vegetation Clearing). As described for timber production lands, landowners would be compensated for timber harvested from these areas. In forested open space areas where the existing use is for timber production by small landowners or if the forested open space is not being used for timber production but is being used for the enjoyment of the landowner, **no-to-low** impacts to land use would occur from construction. In both cases landowners would be compensated for all clearing (see Section 5.2.2.2, Operation and Maintenance, for long-term permanent impacts from clearing in open space).

5.2.2.2 Operation and Maintenance

Unauthorized Access

If a decision is made to build a new line, new and improved access roads and new right-of-way could create an avenue for unauthorized public access and use of public and private land. At a landowner's request, BPA would place gates at the entrance of access roads to prevent public access onto public and private land and the right-of-way. Even with gates, unauthorized access and use of the right-of-way and nearby land could occur.

In general, unauthorized public access and use of public and private land could cause new uses and activities that may be incompatible with existing land uses. These new uses and activities could cause increased soil erosion, fire danger, introduction of noxious weeds, and illegal dumping. Increased soil erosion could occur from unauthorized uses such as driving off-road vehicles in unauthorized areas and disturbing the soil, which can lead to soil erosion. Over time, unauthorized use of gravel or dirt roads near the project could also lead to similar accelerated deterioration of these roads (see Chapter 14, Geology and Soils). Fire danger can increase when unauthorized users build campfires, discard lit cigarettes, or if vehicle exhaust systems contact dry vegetation (see Chapter 10, Public Health and Safety). Noxious weeds can be introduced to an area when unauthorized vehicles inadvertently transport and spread noxious weed seeds into the project area and nearby lands. If these vehicles also disturb soil, the potential for the noxious weeds to become established in these disturbed areas increases (see Chapter 17, Vegetation).

Unauthorized access and use could also disturb vegetation, wildlife and their habitat, and cultural resources. Vegetation and wildlife habitat can be disturbed by unauthorized vehicles driving over and crushing or uprooting plants, and by any vegetation clearing from an unauthorized use (see Chapter 17, Vegetation). Wildlife can be disturbed or displaced by noise and noise can increase stress, disrupt normal foraging and reproductive habits, cause abandonment of unique habitat features, and increase energy expenditures (see Chapter 18, Wildlife). Known or previously undiscovered cultural resource sites can be disturbed and damaged by the unauthorized collection of artifacts or other cultural resources (see Chapter 13, Cultural Resources).

According to scoping comments and conversations with landowners, existing access roads and rights-of-way are providing opportunities for unauthorized access and use that may be incompatible with the existing land uses. The degree to which this would continue into the future is unknown. It is also unknown to what degree improved and new access roads or new rights-of-way would increase or create new opportunities for unauthorized access and use. Location and frequency of unauthorized access is hard to predict, it could be a one-time temporary occurrence or it could become permanent if access is hard to prevent. For these reasons, impacts could be **low-to-high**.

Urban/Suburban and Rural

BPA would negotiate and purchase easements for new right-of-way (transmission line and access roads) from landowners with affected properties. These easement documents would describe right-of-way use limitations for the underlying landowner. BPA does not permit activities or land uses in the right-of-way that are unsafe or might interfere with constructing, operating, or maintaining transmission facilities. These restrictions are developed in accordance with NESC requirements and are part of the legal rights BPA acquires for its transmission line easements (see Chapter 3, Project Components and Construction, Operation and Maintenance Activities and Chapter 10, Public Health and Safety).

Use limitation within the right-of-way would require keeping it clear of all structures, fire hazards, tall-growing vegetation (generally taller than 4 feet) and any other use that may interfere with the safe operation or maintenance of the line. Landowners would be prohibited from placing tall-growing vegetation, permanent structures, or outbuildings, including swimming pools, fences, and decks, within the new right-of-way, and would be required to remove these uses currently within existing rights-of-way, a **low-to-moderate** impact (see Section 5.2.2.1, Construction).

Permanent use limitations created by BPA acquiring new easements for right-of-way in an area where none have existed before would be a **high** impact. Where these new easements might create use limitations off of, but adjacent to, existing right-of-way (e.g., removing danger trees that are part of a landowner's landscaped yard or limiting an existing recreation use) or cause a stranded use of the property, impacts would be **low-to-high** depending on the existing use and whether that use could continue. The transmission line could create other possible issues for residents, such as impacts on views from homes, or concerns about property values and electric and magnetic field exposure (see Chapter 7, Visual Resources, Chapter 11, Socioeconomics, and Chapter 8, Electric and Magnetic Fields).

For new and existing rights-of-way, the area between towers and roads are generally compatible with urban/suburban and rural land uses such as trails, sports fields, and roads (often used as a trail) (see Section 5.2.2.1, Construction), and permanent impacts would be limited to the land under the tower or road (substations are not proposed within this land use). New or improved access roads in urban/suburban areas off the right-of-way are unlikely to affect future development in the surrounding area because this type of development is typically located near roads. For this reason, development of new access roads or improvement of existing roads in urban/suburban land uses would be a **moderate** impact. This same type of road development in rural land uses would be **moderate-to-high** depending on the type of existing or planned development in the vicinity of the existing or planned roads.

Twice each year helicopter flyover inspections would create temporary noise along the transmission line. Annual ground inspections of the line may be noticeable to landowners as crews drive on access roads and walk the right-of-way. Vegetation management activities would also require personnel to drive along access roads or walk the right-of-way to determine vegetation clearing needs. Cutting trees with chainsaws and removing debris would cause noise and dust. Equipment noise during repairs may be noticeable but would be infrequent. Maintenance impacts on uses within urban/suburban and rural areas would be **low** because disturbances would be temporary and mostly limited to noise, dust, managing vegetation, and a small amount of vehicle traffic.

Timber Production

Timber production areas crossed by new rights-of-way and access roads, or under towers and substations would be permanently affected because trees would be prevented from growing within these areas, curtailing growing and harvesting activities and future revenue potential. Danger trees or trees within a safety backline outside of the right-of-way (see Section 3.11, Vegetation Clearing) would also be removed. In some cases, depending on location and local forest practices, a right-of-way or new access road could permanently disrupt forest practices on both sides of the right-of-way or road. This could occur if timber harvest requires crossing the right-of-way with equipment (cranes, derricks, and booms) or trucks moving or hauling harvested timber across right-of-way. A right-of-way can also make certain timber stands inaccessible or economically infeasible to harvest (stranded use). Permanent land removal from timber production would be a **high** impact (see also Chapter 11, Socioeconomics for the economic effects of timber production losses).

Staging areas and conductor pulling areas outside the right-of-way cleared during construction could be re-planted and used for timber production after the line is operating, as long as these trees would not become danger trees. Since compensation would be provided for clearing during construction and clearing in these areas is temporary, **no-to-low** impacts would occur. Maintenance activities would have **no** impacts on uses within timber production areas outside of cleared areas because BPA would communicate scheduling in advance with landowners.

Agriculture

Agricultural activities can occur within the right-of-way under certain conditions and at appropriate locations. In general, cultivated crops that do not require structural support and do not grow higher than 4 feet at mature height may remain in the existing right-of-way and are allowed in the new right-of-way between the towers and roads. These might include vegetable crops, strawberries, mint, and other low-growing crops. However, orchards, tall-growing natural or planted vegetation used for landscaping, or windrows, and crops supported by trellises or stakes (e.g., grapes or cane berries) would likely not be allowed within the right-of-way, a **high** impact if they already exist or are planned for these areas. Farm vehicles and large equipment that do not extend more than 14 feet high, such as harvesting combines, cranes, derricks and booms, could be operated safely under the line where it passes over roads, driveways, parking lots, cultivated fields or grazing lands.

Crop cultivation within the right-of-way would be negotiated when a new easement is purchased for new right-of-way. On existing right-of-way, BPA would review existing easement and land use agreements to determine if existing crops are compatible with the new line. Stranded use of agricultural land could also be caused by a new right-of-way or construction of the project on existing right-of-way, a **high** impact depending on whether existing uses could continue.

Working with the landowner, BPA would try to locate access roads along fences or property lines for access across fields. Towers would create an obstacle for mechanical tilling, and if irrigation is used, it may need to be modified such that pipes maneuver between or around the towers. Because the areas under towers and roads would not be tilled, they could become sources of noxious weeds, creating a seed source for contaminating a field (see Chapter 17, Vegetation). BPA works closely with underlying landowners to minimize weed infestations.

Grazing tends to be compatible with transmission lines, because livestock would be able to graze within the right-of-way. Although towers and roads would remove that area of vegetation from grazing, livestock (and wildlife) could still maneuver around the towers and roads. Depending on the size of the original property, how much land is available for grazing and how the project may limit or eliminate the original grazing use, impacts would be **low-to-high**. In some cases, grazing could increase because trees would be permanently removed. During line maintenance, workers would ensure that gates are closed to prevent livestock from escaping.

Maintenance of the transmission line would temporarily disrupt land use through noise, truck traffic, and vegetation management activities (see Urban/Suburban and Rural), a **low** impact.

Open Space

Operation and maintenance of transmission lines and access roads could create or increase unauthorized access to undeveloped rural areas (see Unauthorized Access).

Forested and non-forested open space within existing and new rights-of-way, and where roads and substations are proposed would permanently change to non-forested open space, a **moderate-to-high** impact, depending on whether existing uses within that open space could still occur, are altered or limited, or permanently prohibited. Compatible uses within forested or non-forested open space, such as recreational activities, while temporarily impacted (see Section 5.2.2.1, Construction), could continue even after project facilities are constructed, a **moderate** impact. In forested open space being used for timber production activities by small landowners, the same **high** impact on these uses would occur as described in Timber Production. Any stranded uses caused by the project that permanently discontinues that use would likely be a **high** impact.

Maintenance of the transmission line would disrupt recreation through noise, dust, truck traffic, and vegetation clearing, or herbicide application (see Urban/Suburban and Rural). Overall, operation and maintenance impacts on open space would be **low.** Impacts would generally be temporary and limited to noise, dust and a small amount of vehicle traffic during maintenance.

5.2.2.3 Sundial Substation

Sundial Substation and its access road would remove about 25 to 50 acres (exact amount unknown until final design is complete) from Port of Portland ownership and the land would become BPA fee-owned property. In addition, some non-BPA transmission line and access road work would occur in the city of Fairview near this substation site.

Though the Port of Portland would be compensated for land acquired by BPA for the proposed project, this land would no longer be available to the Port for an industrial use development or for planned wetland mitigation, a **high** permanent impact.

BPA would purchase about 25 to 50 acres for each of the proposed substations and substation access roads, with exact acreage depending on the parcel selected and the final substation and access road design.

For purposes of the land use analysis, an estimated impact area was defined at each substation site to accommodate adjustments in substation and substation access road design and positioning that occur throughout the design process.

Because the site is within an existing industrial area, temporary noise, dust, and traffic impacts on existing land uses during construction would be **low**. Though the substation, access roads, and line changes would occur in mostly non-forested open space (40 acres; a portion is identified for Port of Portland wetland mitigation), the area is within an industrial complex with planned and existing industrial uses. Maintenance and operation of the substation and associated facilities would not be a change in planned use and would have **no** impact on existing and nearby land uses, which include a FedEx distribution center, a marine construction and repair company, a gravel company, a paper products company, an existing substation and transmission lines, and the Portland-Troutdale Airport.

5.2.3 Castle Rock Substation Sites

5.2.3.1 Casey Road

Impacts common to action alternatives are in Section 5.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

Casey Road Substation and its access road would remove about 25 to 50 acres (exact amount unknown until final design is complete) from WDNR ownership and the land would become BPA fee-owned property. This would be a **high** impact on land ownership though WDNR has large land holdings in the project area and in Washington in general.

The Casey Road site would permanently remove about 63 acres of WDNR land from mostly timber production use, causing a **high** impact. Final design of the substation would likely decrease the number of acres removed from timber production. The substation would be partially within the existing right-of-way and would not prevent access to surrounding timber production areas or create stranded uses. Target practice does occur at this site, an unauthorized use that would not be allowed to continue, a **moderate** impact.

5.2.3.2 Baxter Road

Baxter Road Substation and its access road would remove about 25 to 50 acres (exact amount unknown until final design is complete) from Sierra Pacific Industries ownership and the land would become BPA fee-owned property, a **high** impact on land ownership.

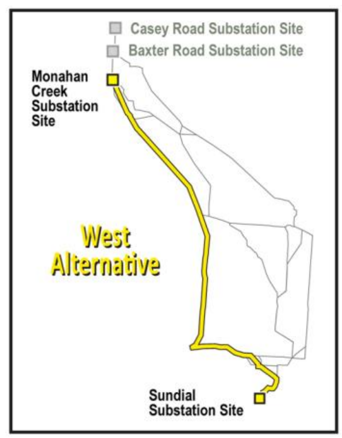
The Baxter Road site would remove about 47 acres of Sierra Pacific Industries land from mostly timber production, a permanent conversion of land use and a **high** impact. Final design of the substation would likely decrease the number of acres removed from timber production. The substation would be partially within the existing right-of-way and would not prevent access to surrounding timber production areas or create stranded uses.

5.2.3.3 Monahan Creek

Monahan Creek Substation and its access road would remove about 25 to 50 acres (exact amount unknown until final design is complete) from private ownership and the land would become BPA fee-owned property, a **high** impact on land ownership.

The Monahan Creek site would affect about 67 acres of mostly rural and open space lands used for livestock grazing and rural residences. Final design of the substation would likely decrease the amount of acres removed from grazing. Though the substation and associated facilities would be located to avoid residences and existing transmission facilities, it would permanently convert existing land uses to utility use, a **high** impact. The substation would remove a large area of land from grazing, and grazing might be unable to continue depending on the landowners' holdings. Temporary **moderate** impacts from construction would occur to nearby residents and to residents who use Delameter Road to commute because substation construction would be longer in duration (13 months) than construction of any particular portion of the transmission line, and construction would be closer to residents in the general area.

5.2.4 West Alternative



Of the action alternatives, the West Alternative would cross the most urban and suburban and agricultural land use. This alternative would be closer to I-5 than the other action alternatives and would parallel substantially more existing transmission lines, about 66 miles (almost 98 percent of the total distance). The West Alternative would cross the highest percentage (99 percent) of private land and would be located on only 1 percent public land. This alternative also would cross more areas with high density, multi- and single-family residential units, and would have the largest number of homes within various distances from the edge of the right-of-way (see Table 5-1). For the action alternatives, the number of homes at various distances from the edge of the right-of-way generally decreases from west to east (see Table 5-1).

Table 5-1 Numbers of Homes from the Edge of the Right-of-Way

Distance from Edge of Right-of-Way[1]	West Alternative	Central Alternative	East Alternative	Crossover Alternative
500 feet	3,032	327	286	657
300 feet	1,526	173	157	320
100 feet	323	26	25	59
50 feet	174	14	15	29

Notes:
1. Assuming a 150-foot-wide right-of-way.

5.2.4.1 Land Ownership

The West Alternative would require some new right-of-way for transmission lines and new and improved access roads. BPA would need to purchase easement rights for the new right-of-way. BPA would acquire new easements on up to 401 acres for the transmission line right-of-way, and new and improved access roads (see Table 5-2). Acreage amounts for new easements for improved roads would depend on whether BPA already owns easement rights on these roads. If BPA has existing rights on some of the improved roads, the new easement requirement would be less than 401 acres. Most land potentially requiring new easements in the West Alternative is privately held (391 acres) and about 10 acres is publicly owned (mostly WDNR).

Because most of the West Alternative would be built on existing right-of-way and use existing access roads, the West Alternative would require fewer new easements and have the least overall impact on landowners of the action alternatives. At the same time, there are more individual landowners who own smaller lots next to the existing right-of-way along the West Alternative than the other action alternatives. Portions of the line and roads built on existing easements would cause **low-to-moderate** impacts on landowners. The remaining portions that would require new right-of-way and easements that would restrict use would cause **high** impact on landowners.

5.2.4.2 Land Use

The West Alternative would use about 1,097 acres of existing right-of-way for about 66 miles (see Table 5-3; the 1,097 acres is the total of the acreages in the “Existing Right-of-Way” columns for each land use type for the West Alternative). About 127 acres of new right-of-way would be needed in certain areas along and adjacent to the existing right-of-way (see Table 5-2, Chapter 4, and Appendix B). The width of this new right-of-way would vary in these areas depending on how much existing right-of-way is available for the new line. Both towers and roads would be built within this new right-of-way. Most new right-of-way (104 acres) would be on open space lands likely being used for recreation by adjacent landowners and others who have enjoyed its natural and rural character since it is next to existing right-of-way that is not currently cleared of vegetation. Outside the new 150-foot right-of-way, an additional 131 acres would be affected on other, adjacent existing BPA rights-of-way where towers need to be removed or replaced and new and improved access roads are required. Over half of this acreage is open space, and the remaining is a mixture of urban/suburban, rural, timber production, and agricultural land.

Urban/Suburban

Urban/suburban land is about 7 percent of the area crossed by the West Alternative. This includes commercial, industrial, and residential areas.

About 2 acres of new right-of-way in urban/suburban areas would be needed for the new line, potentially causing a **high** impact on existing land uses because no tall vegetation, structures, or new development would be permitted within any new right-of-way. **Low-to-moderate** impacts would occur where existing uses would be compatible with project components (e.g., low-growing landscaping). New right-of-way could also affect planned development or use of property next to it, creating **no-to-high** impacts depending on whether a planned development complies with right-of-way restrictions, or an existing adjacent use becomes stranded. Restrictions would occur in few places (e.g., the northwest part of Segment 50).

Table 5-2 New Easements Required on Public and Private Land (Acres)[1,2]

Alternatives and Options	Private Land[3]			Public Land[4]			Total		
	New Transmission Line Right-of-Way	New Access Roads[5]	Improved Access Roads[5,6]	New Transmission Line Right-of-Way	New Access Roads[5]	Improved Access Roads[5,6]	New Transmission Line Right-of-Way	New Access Roads[5]	Improved Access Roads[5,6]
West Alternative	**119**	**102**	**170**	**8**	**1**	**1**	**127**	**103**	**171**
West Option 1	N/C	+2	-3	N/C	N/C	N/C	-	-	-
West Option 2	-64	-1	-10	+10	+<1	+2	-	-	-
West Option 3	-40	+11	+9	+6	+3	+1	-	-	-
Central Alternative	**861**	**125**	**516**	**427**	**39**	**144**	**1,287**	**165**	**661**
Central Option 1	+30	N/C	+10	+12	+5	+33	-	-	-
Central Option 2	-62	+14	-40	N/C	N/C	N/C	-	-	-
Central Option 3	-20	-4	-37	-86	+1	-9	-	-	-
East Alternative	**1,027**	**105**	**861**	**228**	**36**	**120**	**1,255**	**141**	**980**
East Option 1	-35	+4	-43	N/C	N/C	N/C	-	-	-
East Option 2	-32	-4	-146	+51	-11	-9	-	-	-
East Option 3	-12	N/C	-3	+21	-3	+6	-	-	-
Crossover Alternative	**456**	**92**	**424**	**316**	**41**	**92**	**772**	**133**	**515**
Crossover Option 1	+53	+<1	+7	N/C	N/C	N/C	-	-	-
Crossover Option 2	N/C	+4	+38	N/C	N/C	N/C	-	-	-
Crossover Option 3	+41	+5	+39	N/C	N/C	N/C	-	-	-

Notes:

N/C—No net change from the action alternative.

1. The value for each option represents the net change from the action alternative. It was calculated as the acres for the option minus the acres in the segments the option replaces.
2. Does not include area within existing transmission line right-of-way.
3. Private land includes parcels owned by large landowners, companies, and private individuals.
4. Public land includes state owned (including WDNR and local government).
5. New and improved access road easements (50 feet) outside of new and existing transmission line right-of-way.
6. All or a portion of improved access roads may have existing BPA easement rights.

Source: BLM 2009b

Table 5-3 Land Use (Acres)[1]

	Urban/Suburban			Rural			Timber Production[2]			Agriculture			Open Space[3]		
Alternatives and Options	Existing Right-of-Way[4]	New Right-of-Way[4]	Towers 5 and Access Roads[6]	Existing Right-of-Way	New Right-of-Way	Towers and Access Roads	Existing Right-of-Way	New Right-of-Way	Towers and Access Roads	Existing Right-of-Way	New Right-of-Way	Towers and Access Roads	Existing Right-of-Way	New Right-of-Way	Towers and Access Roads
West Alternative	**89**	**2**	**6**	**81**	**4**	**13**	**0**	**0**	**12**	**165**	**17**	**19**	**762**	**104**	**81**
West Option 1	N/C	N/C	N/C	-1	-<1	N/C	N/C	N/C	N/C	-2	-3	-1	+4	+4	+2
West Option 2	+<1	-<1	N/C	+11	-4	-<1	N/C	+10	+<1	+41	-11	-2	+31	-49	+9
West Option 3	N/C	-<1	N/C	+37	-4	N/C	N/C	+23	+9	+29	-15	-1	+76	-37	+5
Central Alternative	**8**	**13**	**2**	**20**	**7**	**6**	**0**	**974**	**240**	**23**	**12**	**6**	**66**	**281**	**108**
Central Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	+42	+10	N/C	N/C	N/C	+3	+<1	+10
Central Option 2	+2	-9	N/C	N/C	-<1	+3	N/C	-81	-9	+6	-10	N/C	+10	+38	-3
Central Option 3	N/C	-<1	N/C	N/C	+11	+5	N/C	-188	-19	N/C	+8	+<1	N/C	+63	-6
East Alternative	**8**	**12**	**2**	**20**	**10**	**12**	**0**	**1,020**	**319**	**23**	**12**	**11**	**66**	**201**	**132**
East Option 1	N/C	-8	-<1	N/C	+9	+2	N/C	-58	-9	N/C	-6	N/C	N/C	+29	+24
East Option 2	N/C	N/C	N/C	N/C	N/C	+<1	N/C	N/C	-51	N/C	N/C	-2	N/C	+18	-19
East Option 3	N/C	N/C	N/C	N/C	N/C	N/C	N/C	+22	+1	N/C	N/C	N/C	+10	-13	-2
Crossover Alternative	**20**	**3**	**2**	**59**	**3**	**10**	**0**	**627**	**160**	**39**	**3**	**9**	**453**	**136**	**105**
Crossover Option 1	+1	N/C	N/C	-9	+4	+<1	N/C	N/C	N/C	+39	+14	+2	+11	+34	+<1
Crossover Option 2	N/C	N/C	N/C	+15	N/C	+3	N/C	N/C	+4	N/C	N/C	N/C	+65	N/C	+11
Crossover Option 3	N/C	N/C	N/C	+15	N/C	+3	N/C	+18	+4	N/C	N/C	N/C	+21	+23	+12

Notes:
N/C—No net change from the action alternative.
1. The value of each option represents the net change from the action alternative. It was calculated as the acres in the option minus the acres in the segments the option replaces.
2. Includes all large landowners that do timber production (commercial timber companies, PacifiCorp, and WDNR.
3. Includes Open Space – Forest (all forested land outside of the Timber Production category) and Open Space – Non Forested.
4. Transmission line right-of-way (up to150 feet). Also includes portions of new or improved access roads within the right-of-way.
5. Includes removed, rebuilt, or new towers on existing BPA right-of-way but outside of the 150 feet needed for the new transmission line.
6. Includes all new and improved access roads outside of new and existing right-of-way. New access roads assume 30-foot wide disturbance to land use, existing access roads assume 20-foot wide disturbance to land use.
Sources: Herrera 2010, USGS 2011

About 89 acres of existing right-of-way in urban/suburban areas would be potentially affected by the new line (see Table 5-3). This is the greatest amount of urban/suburban land potentially affected by the action alternatives. This acreage is on existing BPA right-of-way next to existing BPA lines. Although this existing right-of-way is owned by BPA or encumbered with existing easements, it has been vacant for decades and, as such, accessed or used for recreation and other activities or uses common in urban/suburban areas. One of the largest uses of the existing right-of-way by adjacent landowners has been for trees and other ornamental landscaping in residential or rural neighborhoods. Some landscaped vegetation is quite mature and would need to be removed. Many encroachments (see Section 5.2.2.1, Construction) have been identified along existing BPA rights-of-way both north and east of BPA's Ross Substation in the greater Vancouver area and would need to be removed.

Where existing incompatible uses would need to be removed both within and adjacent to the existing right-of-way, impacts to land use would be **low-to-moderate**. These uses would include commercial and industrial activities within the urban/suburban land use through the Minnehaha area and closer to the Columbia River. These activities are occurring within the vacant right-of-way (whether or not legally allowed through existing easements or land use agreements) and would not be allowed to continue.

Due to limitations on development in the right-of-way, the project could restrict planned new development or use of property next to the existing and new rights-of-way, a **no-to-high** impact, depending on whether the development planned is in compliance with right-of-way restrictions or whether an existing use is stranded because of the addition of new right-of-way. The West Alternative requires little new right-of-way, so these new development restrictions would occur in few places (the northwest part of Segment 50 is one example). In areas of existing right-of-way, there would be no change to existing restrictions on development.

An additional 6 acres of urban/suburban land outside the 150-foot right-of-way for the new transmission line would be affected by new and improved access roads and by tower removal or construction on adjacent BPA right-of-way. New roads require new right-of-way, similar to the new transmission line, causing similar impacts to those already described. Unlike a new transmission line, a new road in urban/suburban land use could aid future development. Improved access roads already exist within existing land uses and are likely being used by landowners. **No** additional impacts would occur to land use. All existing tower removals or rebuilds on existing transmission lines would occur on existing right-of-way and would cause **no** additional impacts to land use.

Rural

Rural lands are about 7 percent of the land crossed by the West Alternative. This is the greatest amount of rural land crossed by the action alternatives.

About 4 acres of rural land would be crossed by new right-of-way, potentially causing a **high** impact on existing land uses because no tall vegetation, structures, or new development would be permitted within any new right-of-way. **No-to-high** impacts could occur on planned development or use of property adjacent to the new right-of-way, depending on whether development plans comply with right-of-way restrictions or whether an existing adjacent use is stranded because of the addition and placement of new right-of-way.

Where the new line would cross about 81 acres in existing right-of-way, impacts would be **low-to-moderate** because livestock grazing and most low-profile rural uses that do not interfere with safe operation of the line could continue. Similar to Urban/Suburban, recreation activities in rural areas, such as hunting or hiking, could continue. Where existing incompatible uses would need to be removed both within and adjacent to the existing right-of-way, impacts to land use would be **low-to-moderate**.

Although vegetation would need to be cleared from both existing and new rights-of-way (see Chapter 17, Vegetation) on rural land, these areas would remain rural in character after project construction and during operation and maintenance.

About 13 acres outside the new 150-foot right-of-way would be affected or changed from this use where tower removal or construction is required on adjacent BPA right-of-way, or where new and improved access roads are required.

New roads require new right-of-way, similar to the new transmission line, causing similar impacts to those already described. In general, access roads are common and compatible with rural land uses. They could also aid future development. Improved access roads already exist within existing land uses and are likely being used by landowners. **No** additional impacts would occur to land use. All existing tower removals or rebuilds on existing transmission lines would occur on existing right-of-way and would cause **no** additional impacts to land use.

Timber Production

Timber production lands are 1 percent of the land crossed by the West Alternative. New right-of-way would not be needed on timber production land.

The existing right-of-way crosses lands owned by Weyerhaeuser Company, Longview Fiber, and WDNR; all in the northern portion of the alternative. Within the existing right-of-way, these lands are not being used for timber production and would need to be cleared. Landowners would be compensated according to existing easement documents or land use agreements, a **no-to-low** impact. Likewise, removing danger trees outside of the 150-foot right-of-way would have **no-to-low** impacts since compensation would be given. These areas outside the right-of-way would be allowed to be replanted and remain productive into the future.

Another 12 acres of timber production lands would be affected or changed from this use by road improvements and some new roads outside of the existing right-of-way. Improved access roads already exist and any improvements to these roads would likely benefit the underlying landowner and timber production activities. New roads require new right-of-way, similar to the new transmission line, causing a **no-to-low** impact during construction because landowners would be compensated for timber removed, and a **high** impact during operation and maintenance because timber production could not continue in these areas or if the new road causes adjacent stranded use.

Agriculture

Agricultural lands are about 14 percent of the land that would be crossed by the West Alternative.

New right-of-way would restrict agricultural practices on about 17 acres of agricultural land, a **high** impact where certain agricultural activities could not continue because of height restrictions under the new transmission line (for example, Christmas tree, apple, and peach farming, and cultivation of some types of berries such as highbush blueberries [*Vaccinium corymbosum*]). Some agricultural uses, however, such as grazing and cultivation of hay/silage or other row crops less than 4 feet tall (that maintain 25 feet of clearance between the maximum sag of the transmission line and the mature height of the vegetation), would be allowed to continue within new right-of-way in the areas between towers and roads. Impacts in these areas would be **low-to-moderate** because uses may be temporarily restricted during construction but over the long term, these uses would be compatible with the project and could continue, even if somewhat altered.

About 165 acres of existing vacant right-of-way is in agricultural use. Some agricultural activities, mostly in Clark County north and east of Vancouver, would not be permitted to continue within the existing right-of-way (tall-growing crops like those mentioned above). Because BPA owns most of the existing right-of-way in this area, similar to an encroachment, the agricultural activities that interfere with the safe operation of the line would be removed, a **low-to-moderate** impact. Agricultural activities that do not interfere with the safe operation of the line would likely be allowed to continue.

Another 19 acres outside the new 150-foot right-of-way would be affected or changed by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way. New roads require new right-of-way, similar to the new transmission line, causing a **no-to-low** impact during construction because landowners would be compensated for damaged crops. A **high** impact would occur during operation and maintenance because agricultural activities could not continue, or, a new road could cause adjacent stranded use. Typically, in agricultural areas, access roads would be temporary or would be located along field edges to avoid existing crops. Improved access roads already exist and any improvements to these roads would likely benefit the underlying landowner and agricultural activities. All existing tower removals or rebuilds on existing transmission lines would occur on existing right-of-way and would cause **no** additional permanent impacts to agricultural land use.

The West Alternative would change both prime farmland and farmland of statewide importance to towers and roads on and off existing and new right-of-way. Towers and new and improved access roads would change about 61 acres of prime farmland and 79 acres of farmland of statewide importance, totaling about 16 percent of the area within the West Alternative with these state designations. However, only about 24 acres of the 139 acres with these designations are currently included in the agriculture land use, so the West Alternative would only remove about 3 percent of agricultural lands designated as prime farmland and farmland of statewide importance.

Open Space

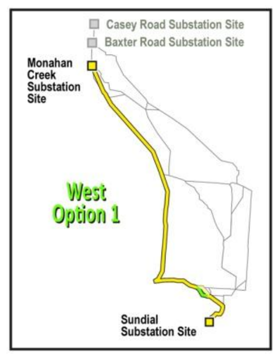
Open space lands are about 68 percent of the land crossed by the West Alternative. This is the greatest amount of open space among the action alternatives. Open space along the West Alternative includes forested areas (non-production and likely some in timber production by small landowners) and non-forested land. This open space also includes some designated recreation areas (see Chapter 6, Recreation).

New right-of-way would restrict the use of 104 acres of open space land. Another 762 acres of existing vacant right-of-way would be cleared; most has timber on it. In addition, 81 acres of open space outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA rights-of-way.

Impacts on all open space land use affected by the project would generally be **low-to-moderate** because most uses within open space lands would remain compatible with the project. There may be some areas along new right-of-way where small landowners are using lands for timber production. This use would not be able to continue, causing a **high** impact.

None of the open space along the West Alternative is part of a designated wilderness area or wildlife preserve, but a portion along segments 36, 36A, 36B, 40, 41, 45, 46, and 50 has recently been designated as a natural area by the Washington State Commissioner of Public Lands (see Sections 17.1.1.5, Herbaceous, and 17.1.2.1, WDNR Protected Areas). WDNR also owns a forest riparian conservation easement along Segment 9 that would likely be affected by clearing along the existing right-of-way and possibly off right-of-way for danger trees, a **moderate-to-high** impact depending on the exact location of the easement, and types of existing vegetation and extent of clearing needed.

5.2.4.3 West Option 1



West Option 1 would replace a portion of the alternative that follows existing right-of-way just east of Vancouver with an option that is farther west and closer to Vancouver. This portion of the alternative includes replacing one of the existing 230-kV lines with a new double-circuit 500-kV line. The existing 230-kV line and the new line would be placed on new 500-kV towers. West Option 1 would have a negligible decrease in private lands crossed by project components (see Table 5-2). The option would cross the same acreage of timber production land as the West Alternative. The option crosses 10 additional acres of open space land, about 2 fewer acres of urban/suburban and rural land, and 6 fewer acres of agricultural land (see Table 5-3). The option would reduce the prime farmland and farmland of statewide importance in agricultural use needed for the project by about 3 acres.

Impact levels on land ownership and land use would be the same as the West Alternative.

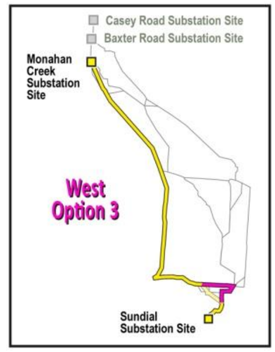
5.2.4.4 West Option 2

West Option 2 would replace a portion of the alternative in the rural residential areas north of Camas with an option farther to the east in the same area. West Option 2 would reduce private lands needed for project components by about 75 acres. A 12-acre section of public property on Segment 43 would be needed for new right-of-way and access road easements (see Table 5-2). The local school district has expressed interest in this land for a new school. The project would likely prohibit this use depending on design and placement of permanent buildings.

West Option 2 would add about 6 acres of urban/suburban and rural land, 11 acres of timber production land, and 28 acres of agricultural land to the area crossed by project components. The option would reduce the amount of open space cleared by about 9 acres (see Table 5-3). West Option 2 would increase the prime farmland and farmland of statewide importance in agricultural use needed for towers and roads by about 5 acres.

Impact levels on land ownership and land use would be the same as the West Alternative.

5.2.4.5 West Option 3

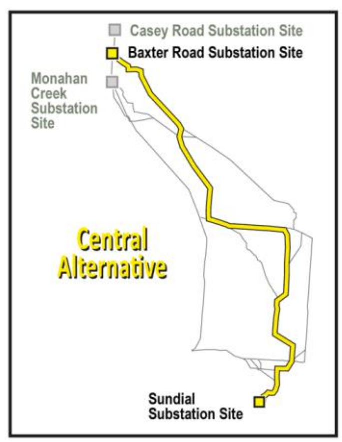


West Option 3 would replace a portion of the West Alternative in the rural residential areas north of Camas with a route crossing rural residential and rural areas farther east. The option would reduce private lands crossed by project components by 20 acres and increase the area of public lands needed for new right-of-way and access road easements by 10 acres along segments T and 49 (see Table 5-2).

West Option 3 crosses about 32 additional acres of urban/suburban and rural land, 32 acres of additional timber production land, 13 acres of additional agricultural land, and 44 acres of additional open space. This option would cross the greatest amount of urban/suburban and rural land of the options, and the greatest amounts of timber production and open space land (see Table 5-3). West Option 3 would increase the amount of prime farmland and farmland of statewide importance in agricultural use needed for the project by about 3 acres.

Impact levels on land ownership and land use would be the same as the West Alternative.

5.2.5 Central Alternative



The Central Alternative would parallel existing transmission lines for about 8 miles (about 10 percent of the alternative's total distance), but would require new right-of-way for the remaining approximately 69 miles of its total 77-mile length. Most urban and suburban areas crossed by the Central Alternative are near the northern and southern ends of this alternative, with mostly rural residential, forest, and agricultural areas in between. Of the action alternatives, the Central Alternative would cross the second highest amount of land being used for timber production. Most land (73 percent) is privately owned; WDNR (26 percent) and the city of Camas (1 percent) own the remainder. This alternative also would cross areas with high density, multi- and single-family residential units, and would have the third highest number of homes within various distances from the edge of the right-of-way (see Table 5-1).

5.2.5.1 Land Ownership

The Central Alternative would require new right-of-way for transmission lines and new and improved access roads. BPA would need to purchase easement rights for the new transmission line right-of-way and new and improved access roads. BPA would acquire new easements on up to 2,113 acres for these project elements (see Table 5-2). Acreage amounts for new easements for improved roads would depend on whether BPA already owns easement rights on these roads. If BPA has existing rights on some of the improved roads, the new easement requirement would be less than 2,113 acres.

Most land potentially subject to new easements in the Central Alternative is privately held (1,502 acres) by large landowners, including Sierra Pacific, Weyerhaeuser and Longview Timber. About 610 acres of public land (594 acres owned by WDNR and a small portion owned by the city of Camas) would also require easements. Portions of the line built on an existing easement would cause a **low-to-moderate** impact on landowners. The remaining portions that would require new right-of-way and easements restricting use would cause **high** impact on landowners.

5.2.5.2 Land Use

The Central Alternative would use about 117 acres of existing right-of-way for about 8 miles (see Table 5-3; the 117 acres is the total of the acreages in the “Existing Right-of-Way” columns for each land use type for the Central Alternative). In addition, about 1,287 acres of new 150-foot right-of-way would be needed for the new line and access roads that would be built within this right-of-way (see Table 5-2). New and improved access roads outside the 150-foot right-of-way for the new line and tower removal or construction on adjacent BPA right-of-way would affect an additional 362 acres. Most is open space or timber production land. The remaining is a mixture of urban/suburban, rural, and agricultural land.

Urban/Suburban

Urban/suburban lands are about 1 percent of the land crossed by the Central Alternative, which passes through commercial, industrial, and residential areas in Camas and Washougal.

About 13 acres of new right-of-way in urban/suburban areas would be needed for the project, with **low-to-moderate** impacts where existing uses would be compatible with project components (e.g., a garden or low-growing landscaped vegetation); in areas where existing development would not be permitted within new right-of-way, or where project components would not be compatible with existing uses (e.g., tall landscaped vegetation), impacts would be **high**. Restrictions on new development adjacent to new right-of-way would have **no-to-high** impacts, depending on whether a planned development is in compliance with right-of-way restrictions or whether an existing adjacent use is stranded because of the addition and placement of new right-of-way.

About 8 acres of existing urban/suburban right-of-way would be affected by the new line. This acreage is on existing BPA right-of-way next to existing BPA lines. Most is undeveloped or developed with industrial uses closer to the Columbia River. With a new line and roads, previous industrial uses within vacant existing right-of-way (whether or not legally allowed through existing easements or land use agreements), would not be allowed to continue, a **low-to-moderate** impact.

An additional 2 acres of urban/suburban land outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way. New roads require new right-of-way, similar to the new transmission line, causing similar impacts to those already described. Unlike a new transmission line, a new road in urban/suburban land use could aid future development. Improved access roads already exist within existing land uses and are likely being used by landowners. **No** additional impacts would occur to land use. All existing tower removals or rebuilds on existing transmission lines would occur on existing right-of-way and would cause **no** additional impacts to land use.

Rural

Rural lands are about 2 percent of the land crossed by the Central Alternative. Most is rural residential and is developed with low-density housing and related structures.

About 7 acres of rural land would be crossed by new right-of-way and about 20 acres near the Little Washougal River and northwest of the city of Washougal would be crossed by existing right-of-way. About 6 acres outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way.

Impacts on existing rural land uses and limitations on new development would be similar to the West Alternative.

Timber Production

Timber production lands are about 67 percent of the land crossed by the Central Alternative. Most is owned by large landowners such as Weyerhaeuser, Longview Timber, and WDNR.

About 974 acres of timber production land would be crossed by new right-of-way. During construction, trees would be removed and landowners would be compensated for the timber, a **no-to-low** impact. Over the long term, impacts would be **high** because timber production could not continue in the right-of-way. Also, placement of the new right-of-way could cause stranded uses for timber harvest. If danger trees need to be removed outside of the 150-foot right-of-way (see Section 3.11, Vegetation Clearing), a **no-to-low** impact would occur, since landowners would be compensated. After construction, these areas outside of the right-of-way would be allowed to be replanted and remain productive into the future.

Existing right-of-way does not cross timber production land.

About 240 acres outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent existing BPA right-of-way. Improved access roads already exist and any improvements to these roads would likely benefit the underlying landowner and timber production activities. New roads require new right-of-way, similar to the new transmission line, causing a **no-to-low** impact during construction because landowners would be compensated for timber removed, and a **high** impact during operation and maintenance because timber production could not continue in these areas or if the new road causes adjacent stranded use.

Agriculture

Agricultural lands are about 2 percent of the land that would be crossed by the Central Alternative.

About 12 acres would be crossed by new right-of-way, and about 23 acres of existing right-of-way in agricultural use would be affected mostly north of Castle Rock and south of the Little Washougal River. Some of these agricultural activities would not be permitted to continue within the existing right-of-way. Like an encroachment, these activities would be removed, a **low-to-moderate** impact within existing right-of-way and a **high** impact if on new right-of-way. Some agricultural uses, however, such as cultivation of hay/silage and other crops under 4 feet tall), or grazing, would continue within the right-of-way. Impacts in these areas would be **low-to-moderate** because these uses would be compatible with the project and could continue though somewhat altered by the project.

Where 6 acres outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way, impacts would be similar to that of the West Alternative, Agriculture.

The Central Alternative would change both prime farmland and farmland of statewide importance to towers and roads on and off existing and new right-of-way. Towers and new and improved access roads would change about 18 acres of prime farmland and 192 acres of farmland of statewide importance, totaling about 26 percent of the area within the Central Alternative with these state designations. However, only about 5 acres of the 210 acres are currently classified as agriculture, so the Central Alternative would only remove about 1 percent of agricultural lands designated as prime farmland and farmland of statewide importance.

Open Space

Open space lands are about 26 percent of the land crossed by the Central Alternative. Open space along the Central Alternative includes non-production forested areas (non-production and likely some production by small landowners) and non-forested land. Open space also includes some designated recreation areas such as the Yacolt Burn State Forest (see Chapter 6, Recreation).

New right-of-way would restrict about 281 acres of open space land, and 66 acres of existing right-of-way would be cleared, most now covered with timber. In addition, 108 acres outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on other adjacent, existing BPA right-of-way.

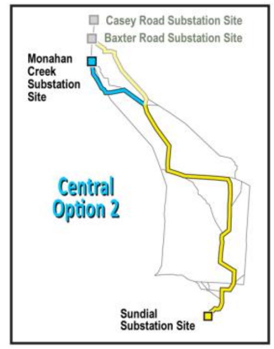
Impacts on all open space land use affected by the project would generally be **low-to-moderate** because most uses within open space lands would remain compatible with the project. There may be some areas along new right-of-way where small landowners are using lands for timber production. This use would not be able to continue, causing a **high** impact.

5.2.5.3 Central Option 1

Central Option 1 would begin at the Casey Road substation site and the transmission line would cross unpopulated forest production and open space land. The option would increase private lands needed for project components by 40 acres. About 50 acres of additional public property would be needed for new right-of-way easements (see Table 5-2). Central Option 1 would affect about 52 additional acres of timber production land and 14 additional acres of open space land. The option would not change the area of prime farmland and farmland of statewide importance in agricultural use needed for the project.

Impact levels to land ownership and land use would be the same as the Central Alternative.

5.2.5.4 Central Option 2

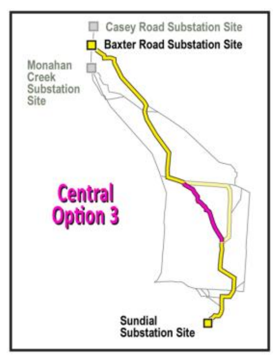


Central Option 2 would begin at the Monahan Creek substation site and would remove the portion of the Central Alternative crossing the Cowlitz River north of Castle Rock and running farther to the southeast. This option would add a new route running southeast from the Monahan Creek substation site through sparsely populated land, crossing the unincorporated community of West Side Highway next to SR 411, the Cowlitz River and I-5, and running through largely unpopulated land toward the east. This option would reduce new right-of-way easement needed on private land by 88 acres (see Table 5-2). There would be no net change in public land needed.

Central Option 2 would add about 2 acres of rural land and 45 acres of open space land to the area affected by the project, most in the outskirts of the city of Lexington. This option would reduce the amount of urban/suburban land crossed by the project by a little less than 7 acres, removing urban/suburban impacts north of Castle Rock, but adding impacts within Lexington and Ostrander. About 4 fewer acres of agricultural land and 90 fewer acres of timber production land would be affected (see Table 5-3). The option would decrease the area of prime farmland and farmland of statewide importance in agricultural use needed for the project by less than 1 acre.

Impact levels to land ownership and land use would be the same as the Central Alternative.

5.2.5.5 Central Option 3



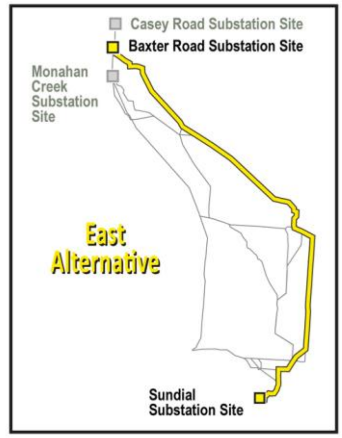
Central Option 3 would replace the Lewis River crossing near Ariel and a portion of the Central Alternative between Ariel and Venersborg, with a downstream river crossing and a new route running directly southeast from Ariel through rural residential areas toward Venersborg. This option would reduce new right-of-way easement needed on private land by 61 acres, and would decrease public land needed by 94 acres (see Table 5-2). Of the 94 acres, about 3 acres of public land at Moulton Falls Regional Park would be added north of the East Fork Lewis River on Segment 30.

Central Option 3 would add about 16 acres of impact on rural land west of Amboy and north of SR 503. About 9 acres of agricultural land and 57 acres of open space land would be added to the area affected by project components including an area set aside by WDNR for genetic reserves along Segment 30. Portions of this 40-acre plot are within the right-of-way and new and improved access roads (see Chapter 17, Vegetation). This option would reduce the amount of urban/suburban land crossed by almost 1 acre, and would clear about 207 fewer acres of timber production land in the eastern portion of the project area (see Table 5-3). Central

Option 3 would increase the area of prime farmland and farmland of statewide importance in agricultural use needed for the project by less than 1 acre.

Impact levels to land ownership and land use would be the same as the Central Alternative.

5.2.6 East Alternative



The East Alternative would parallel existing transmission lines for about 8 miles (almost 11 percent of the total distance), but would require new right-of-way for the remaining approximately 68 miles of its total 76-mile length. Similar to the Central Alternative, it passes through some urban and suburban areas near the beginning and end of its length, but there is a smaller amount of these areas and lower residential property densities due to a relatively greater amount of rural areas. Most land along the alternative is rural residential, agricultural, and forest land. Of the action alternatives, the East Alternative would cross the highest amount of land being used for timber production. About 85 percent of the land is privately owned, and WDNR (14 percent) and city and county governments (less than 1 percent) own the remaining land. The East Alternative would have the lowest number of homes within various distances from the edge of the right-of-way (see Table 5-1).

5.2.6.1 Land Ownership

The East Alternative would require new right-of-way for transmission lines and new and improved access roads. BPA would need to purchase easement rights for the new transmission line right-of-way and new and improved access roads. BPA would acquire new easements on up to 2,376 acres for these project elements (see Table 5-2). Acreage amounts for new easements for improved roads would depend on whether BPA already owns easement rights on these roads. If BPA has existing rights on some of the improved roads, the new easement requirement would be less than 2, 376 acres. Most land potentially subject to new easements in the East Alternative is privately held (1,993 acres). About 387 acres of public land would also be subject to easements; 358 acres are owned by WDNR. About 18 acres of a municipal watershed managed by the city of Camas (City of Camas Watershed) would be impacted by new easement. Portions of the line built on an existing easement would cause a **low-to-moderate** impact on landowners. The remaining portions that would require new right-of-way and easements restricting use would cause **high** impact on landowners.

5.2.6.2 Land Use

The East Alternative would use about 117 acres of existing right-of-way for about 8 miles (see Table 5-3; the 117 acres is the total of the acreages in "Existing Right-of-Way" columns for each land use type for the East Alternative). In addition, about 1,255 acres of new right-of-way would be needed for the alternative (see Table 5-2). Most of this new right-of-way (1,020 acres) would be on timber production lands. Outside the new 150-foot right-of-way, new and improved access roads and tower removal or construction on adjacent existing BPA right-of-way would affect an additional 476 acres. Most is open space or timber production land. The remaining is a mixture of urban/suburban, rural, and agricultural land.

Urban/Suburban

Urban/suburban lands are about 1 percent of the land crossed by the East Alternative. The alternative passes through commercial, industrial, and residential areas in or near Castle Rock, Camas, and Washougal. The East Alternative would require about 12 acres of new right-of-way in urban/suburban areas. About 8 acres of existing right-of-way would be affected by the new line. An additional 2 acres of urban/suburban land outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way. Impacts would be similar to the Central Alternative (see Central Alternative, Urban/Suburban).

Rural

Rural lands are about 2 percent of the land crossed by the East Alternative; most is low-density rural residential or undeveloped land.

About 10 acres of rural land would be crossed by new right-of-way, and about 20 acres of rural land on existing right-of-way would be crossed by the project. An additional 12 acres outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way.

Impacts on rural uses and limitations on development in areas of new and existing right-of-way would be similar to the West Alternative (see West Alternative, Rural).

Timber Production

Timber production lands are about 72 percent of the East Alternative, a higher percentage than any other action alternative. Similar to the Central Alternative, most of the land cleared by the East Alternative is timber production land owned by large landowners such as Weyerhaeuser and Longview Timber. About 1,020 acres of timber production land would be cleared for new right-of-way. Existing right-of-way does not cross timber production land. An additional 319 acres outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way.

Impacts on timber production and limitations on development, access, and potential for stranded use in areas of new and existing right-of-way would be similar to the Central Alternative (see Central Alternative, Timber Production).

Agriculture

Similar to the Central Alternative, agricultural lands make up about 3 percent of land crossed by the East Alternative. About 12 acres of agricultural land would be crossed by new right-of-way, and about 23 acres of existing right-of-way would be affected in the southern portion of the project area north of Washougal. An additional 11 acres outside the new 150-foot right-of-way would be affected or changed from this use by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way.

Impacts on agriculture, and limitations on development and to access would be similar to the Central Alternative (see Central Alternative, Agriculture).

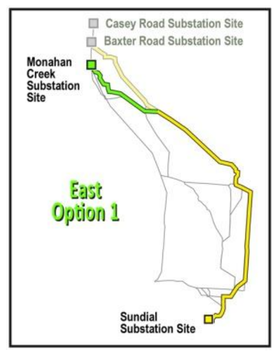
The East Alternative crosses both prime farmland and farmland of statewide importance. The towers and new and improved access roads would require about 19 acres of prime farmland and 211 acres of farmland of statewide importance, totaling about 41 percent of the area within the East Alternative with these state designations. This is the greatest amount of this type of land crossed of the action alternatives. However, only about 6 acres of the 230 acres are currently classified as agriculture, so the East Alternative would only remove about 1 percent of agricultural lands designated as prime farmland and farmland of statewide importance.

Open Space

Open space lands are about 22 percent of the land crossed by the East Alternative. Open space along the East Alternative includes non-production forested areas (non-production and likely some production by small landowners) and non-forested land. Open space also includes some designated recreation areas such as the Yacolt Burn State Forest (see Chapter 6, Recreation). New right-of-way required for the East Alternative would affect about 201 acres of open space land, and 132 acres outside the new 150-foot right-of-way would be affected or changed from open space use by new and improved access roads and by tower removal or construction on adjacent existing BPA right-of-way. In addition, 66 acres of existing right-of-way would be cleared.

Impacts to open space land would be similar to those discussed in the Central Alternative (see Central Alternative, Open Space).

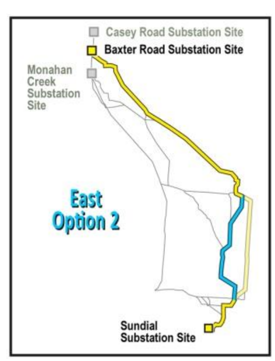
5.2.6.3 East Option 1



East Option 1 begins at the Monahan Creek substation site and would remove the portion of the East Alternative crossing the Cowlitz River north of Castle Rock. The option would use segments southeast of the Monahan Creek substation site that run through sparsely populated land, cross the Cowlitz River and I-5 and run through largely unpopulated land toward the east. The option would reduce the amount of private land needed for new right-of-way easements by 74 acres (see Table 5-2). There would be no net change for public land.

East Option 1 would affect an additional 11 acres of rural land and about 53 acres of open space land. The option would reduce the amount of urban/suburban land crossed by about 9 acres, agricultural land by about 6 acres, and timber production land by about 67 acres (see Table 5-3). The option would decrease the area of prime farmland and farmland of statewide importance in agriculture needed for the project by about 1 acre.

Impact levels to land ownership and land use would be the same as the East Alternative.



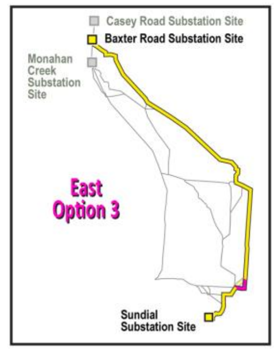
5.2.6.4 East Option 2

East Option 2 would replace a portion of the East Alternative between Yale and the rural residential areas north of Camas with a route farther to the west. The option would decrease private land needed for new right-of-way easement by 182 acres but would increase public land needed by 31 acres (see Table 5-2). The option would decrease impacts on the City of Camas Watershed by 8 acres.

East Option 2 crosses a similar amount of urban/suburban, rural, and open space land. Impacts on timber production land cleared by the project would be reduced by about 51 acres and a little over 2 fewer acres of agricultural land would be crossed (see Table 5-3). The option would reduce the area of prime farmland and farmland of statewide importance in agricultural use needed for the project by less than 1 acre.

Impact levels to land ownership and land use would be the same as the East Alternative.

5.2.6.5 East Option 3

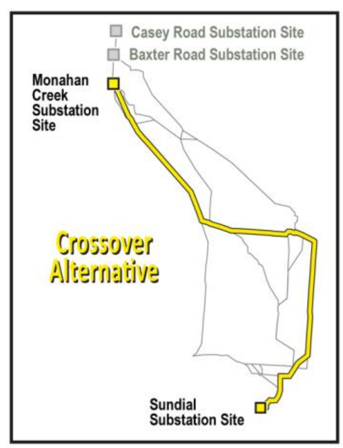


East Option 3 would replace a short portion of the alternative in unpopulated land with a new route through unpopulated land. The option would decrease the private land needed for new right-of-way by 15 acres, and would increase the WDNR land needed by 24 acres (see Table 5-2). The City of Camas Watershed would not be impacted by new right-of-way using this option.

East Option 3 crosses the same amount of urban/suburban, rural, and agricultural land as the East Alternative. The option would clear an additional 23 acres of timber production land. It would also cross about 5 fewer acres of open space land (see Table 5-3). This option would not change the area of prime farmland and farmland of statewide importance in agricultural use needed for the project.

Impact levels to land ownership and land use would be the same as the East Alternative.

5.2.7 Crossover Alternative



The Crossover Alternative would parallel existing transmission lines for about 33 miles (almost 45 percent of the total distance) and would require new right-of-way for the remaining approximately 41 miles of its total 74-mile length. Similar to the Central and East alternatives, it passes through some urban and suburban areas near the beginning and end of its length, but there is a smaller amount of these areas and lower residential property densities due to a relatively greater amount of rural areas. Most land along the alternative is rural residential, agricultural, and forest land. Of the action alternatives, the Crossover Alternative would cross the third highest amount of land being used for timber production. About 79 percent of the land is privately owned. The remaining land is owned by WDNR (20 percent) and city and county governments (less than 1 percent). The Crossover Alternative would have the second highest number of homes within various distances from the edge of the right-of-way (see Table 5-1).

5.2.7.1 Land Ownership

The Crossover Alternative would require new right-of-way for transmission lines and new and improved access roads. BPA would need to purchase easement rights for the new transmission line right-of-way and new and improved access roads. BPA would acquire new easements on up to 1,420 acres for these project elements (see Table 5-2). Acreage amounts for new easements for improved roads would depend on whether BPA already owns easement rights on these roads. If BPA has existing rights on some of the improved roads, the new easement required would be less than 1,420 acres. Most land potentially subject to new easements in the Central Alternative is privately held (972 acres), and 449 of the affected acres are publicly owned. About 422 acres of public land crossed by the project is on WDNR property and the remaining is on county land. Similar to the Central and East alternatives, most land potentially subject to new easements is timber production or open space land, including designated open space. Portions of the line built on an existing easement would cause a **low-to-moderate** impact on landowners. The remaining portions that would require new right-of-way and easements restricting use would cause **high** impact on landowners.

5.2.7.2 Land Use

The Crossover Alternative would use about 571 acres of existing right-of-way for about 33 miles (see Table 5-3; the 571 acres is the total of the acreages in the “Existing Right-of-Way” columns for each land use type for the Crossover Alternative). In addition, about 772 acres of new right-of-way would be needed for this alternative (see Table 5-2). Most new right-of-way (627 acres) would be on timber production lands (see Table 5-2). An additional 286 acres outside the 150-foot right-of-way for the new line would be affected by new and improved access roads, and by tower removal or construction on adjacent BPA right-of-way. The remaining land is a mixture of urban/suburban, rural, and agricultural land.

Urban/Suburban

Urban/suburban lands are about 1 percent of the area affected by the Crossover Alternative. Most of the urban/suburban land is residential and or developed with industrial uses areas near Lexington, Camas, and Washougal.

Almost 3 acres of new right-of-way would be needed, and about 20 acres of existing BPA vacant right-of-way would be affected by the new line. An additional 2 acres of urban/suburban land outside the 150-foot right-of-way for the new line would be affected by new and improved access roads, and by tower removal or construction on adjacent BPA right-of-way.

Impacts on urban/suburban land uses and limitations on development in areas of new and existing right-of-way would be similar to the West Alternative (see West Alternative, Urban/Suburban).

Rural

Rural lands are about 7 percent of the land crossed by the Crossover Alternative; most is low-density rural residential or undeveloped.

About 3 acres of rural land would be cleared for new right-of-way. About 59 acres of existing right-of-way would be cleared as needed, and would remain rural in character after project construction. About 10 acres outside the 150-foot right-of-way for the new line would be affected by new and improved access roads and by tower removal, or construction on adjacent BPA right-of-way.

Impacts on rural uses and limitations on development in areas of new and existing right-of-way would be similar to the West Alternative (see West Alternative, Rural).

Timber Production

Timber production lands are about 48 percent of the Crossover Alternative; most is owned by large landowners such as Weyerhaeuser, Longview Timber, and WDNR.

About 627 acres of timber production land would be cleared for new right-of-way. Existing right-of-way does not cross timber production land. About 160 acres outside the 150-foot right-of-way for the new line would be affected by new and improved access roads, and by tower removal or construction on adjacent BPA right-of-way.

Impacts on timber production and limitations on future timber harvest in those areas and on adjacent properties would be similar to the Central Alternative (see Central Alternative, Timber Production).

Agriculture

Agricultural lands are about 3 percent of the land crossed by the Crossover Alternative.

New right-of-way required for the Crossover Alternative would affect about 3 acres of agricultural land. About 39 acres of existing right-of-way would be affected. About 9 acres of agricultural land outside the 150-foot right-of-way for the new line would be affected by new and improved access roads, and by tower removal or construction on adjacent BPA right-of-way.

Impacts on agriculture, and limitations on development and to access would be similar to the Central Alternative (see Central Alternative, Agriculture).

The Crossover Alternative crosses both prime farmland and farmland of statewide importance. Towers and new and improved access roads would cover about 26 acres of prime farmland and 142 acres of farmland of statewide importance, totaling about 21.2 percent of the area within the Crossover Alternative with these state designations. However, only about 5 acres of the 168 acres are currently designated as agriculture, so the Crossover Alternative would only remove about 1 percent of agricultural lands designated as prime farmland and farmland of statewide importance.

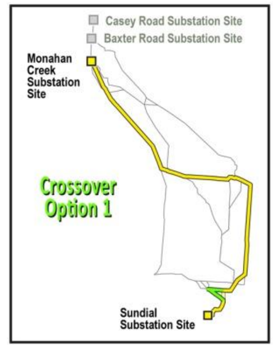
Open Space

Open space lands are about 43 percent of the land crossed by the Crossover Alternative. Open space along the Crossover Alternative includes non-production forested areas (non-production and likely some production by small landowners) and non-forested land. Open space also includes some designated recreation areas such as the Yacolt Burn State Forest (see Chapter 6**, Recreation**).

About 136 acres of open space land would be crossed by new right-of-way. About 453 acres of existing right-of-way in open spaced lands would be cleared as needed. About 105 acres outside the new 150-foot right-of-way would be affected by new and improved access roads, and by tower removal or construction on adjacent, existing BPA right-of-way.

Impacts to open space lands would be similar to those discussed in the Central Alternative (see Central Alternative, Open Space).

5.2.7.3 Crossover Option 1

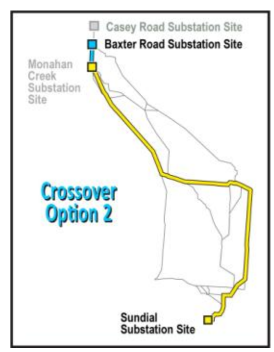


Crossover Option 1 would remove a portion of the alternative crossing north–south through rural residential areas north of Camas between NE Zeek Road and SE 23rd Street, and replace it with a route running west along an existing right-of-way until about NE 232nd Avenue, then southeast through open fields and more rural residential areas. The option would increase private land needed for right-of-way and access road easements by about 60 acres (see Table 5-2). There would be no change in public land required.

Crossover Option 1 would affect about an acre more of urban/suburban land, 55 more acres of agricultural land, and about 46 more acres of open space land near the Little Washougal River and north of Lacamas Lake. This option would not change the amount of timber production land cleared, and would reduce the amount of rural land crossed by about almost 4 acres (see Table 5-3). The option would increase the area of prime farmland and farmland of statewide importance in agricultural use needed by about 10 acres.

Impact levels to land ownership and land use would be the same as the Crossover Alternative.

5.2.7.4 Crossover Option 2

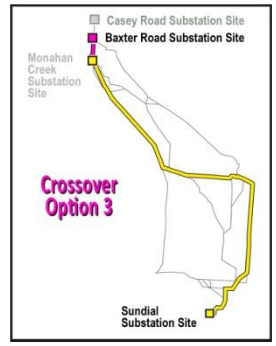


Crossover Option 2 would begin at the Baxter Road substation site and the new transmission line would cross sparsely populated land. The option would increase private land required for right-of-way and easements by about 42 acres (see Table 5-2).

Crossover Option 2 would add about 4 acres of timber production land and 76 acres of open space land to the area crossed, most near the Baxter Road substation site. There would be no change to the amount of urban/suburban or agricultural land crossed, but there would be a 18-acre increase in the amount of rural land crossed (see Table 5-3). The option would not change the area of prime farmland and farmland of statewide importance in agricultural use needed for the project.

Impact levels to land ownership and land use would be the same as the Crossover Alternative.

5.2.7.5 Crossover Option 3



Crossover Option 3 would begin at the Baxter Road substation site and the new transmission line would cross sparsely populated land and require some additional new right-of-way. The option would increase private land needed for new right-of-way and easements by about 85 acres (see Table 5-2).

Crossover Option 3 would add about 22 acres of timber production land and 56 acres of open space land to the area crossed, most near the Baxter Road substation site. There would be no change in the amount of urban/suburban or agricultural land crossed, and there would be a little over 15-acre increase of rural land crossed (see Table 5-3). The option would not change the area of prime farmland and farmland of statewide importance in agricultural use needed for the project.

Impact levels to land ownership and land use would be the same as the Crossover Alternative.

5.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2. The following additional land use mitigation measures have been identified to further reduce or eliminate adverse land use impacts by the action alternatives. If implemented, these measures would be completed before, during, or immediately after project construction, unless otherwise noted.

- Build new permanent access roads along the edges of clearings, pastures or small farms to minimize disturbance.
- Closely coordinate with and notify 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.
- Consider special agreements with rural landowners to allow growing ornamental and orchard trees or other crops that do not interfere with operation or maintenance of facilities on the right-of-way.
- Provide a schedule of construction activities to landowners that could be affected by clearing of and construction within the right-of-way.
- Work with private landowners and WDNR concerning a possible cooperative agreement to control unauthorized public access or use on private or public lands that could result from the project. The agreement could address various provisions related to unauthorized access, such as additional measures to be taken to discourage unauthorized use of right-of-way and access roads, periodic inspection for unauthorized access, and damages from unauthorized access.

5.2.9 Unavoidable Impacts

All existing land uses crossed by the new right-of-way that are inconsistent with right-of-way management and safety would be prohibited for the life of the project. All existing structures and activities currently located, or occurring, in the existing right-of-way to be used by the project that are not consistent with right-of-way management and safety would be removed or prohibited without compensation to the user.

New access roads would create a new land use that may be consistent with or similar to existing uses in urban and commercial areas, but may be inconsistent with residential or rural land uses, especially during construction. New or improved access roads could continue, increase, or create new opportunities for unauthorized access to, or use of, public or private land.

Operational maintenance and inspection activities would occur once or twice per year.

5.2.10 No Action Alternative

Under the No Action Alternative, the project would not be constructed and there would be **no** impact on land use. Similar land use activities would continue to occur in the project area including existing roads, substations and transmission lines and maintenance activities on those facilities. All other existing land uses would also continue to occur such as timber harvest, agriculture, recreation, and urban and rural development.

Chapter 6 Recreation

This chapter describes existing recreation resources in the project area, and how the project alternatives could affect these resources. Related information can be found in Chapter 5, Land and Chapter 7, Visual Resources. Economic values of recreation in the project area are discussed in Chapter 11, Socioeconomics.

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

6.1 Affected Environment

Recreation resources are found in both urban and rural portions of the project area within Cowlitz and Clark counties, Washington, and Multnomah County, Oregon. These resources include urban parks and greenways, developed facilities in rural areas such as campgrounds or trailheads, and undeveloped rural areas. Recreational activities within the three counties include boating, fishing, hunting, target practice, camping, hiking, swimming, picnicking, sports games, wildlife watching, ATV use, sightseeing, horseback riding, and mountain biking. These activities occur in dedicated areas such as parks and other developed recreation facilities, on motorized and non-motorized trails, and in dispersed areas such as open space (see Maps 6-1A through 6-1E).

Although these maps show recreation resources throughout the project area, for this analysis, a study area for recreation resources was identified to include a 2000-foot—wide corridor along the entire route of each action alternative, 1,000 feet on either side of the transmission line centerline. This study area includes all project facilities.

In the western and southern portions of the study area, recreation resources are closely spaced, urban, and generally more fragmented. In the eastern portion, recreation resources tend to be larger, more contiguous, and more rural. There are many recreation resources scattered throughout Cowlitz, Clark, and Multnomah counties outside of the study area (see Maps 6-1A through 6-1E).

Recreation resources within the study area are owned by public and private entities within Cowlitz, Clark, and Multnomah counties, and the cities of Castle Rock, Vancouver, Camas, Washougal, Fairview, and Troutdale. These resources are managed under the following plans:

- Cowlitz County Comprehensive Park Plan Update (Cowlitz County 2010b)
- Cowlitz Regional Trails Plan (Cowlitz-Wahkiakum Council of Governments (CWCOG) 2006)
- Vancouver-Clark Comprehensive Parks, Recreation and Open Space Plan (Vancouver-Clark Parks and Recreation Department 2007)
- Final Recreation Resource Management Plan, Lewis River Hydroelectric Projects Federal Energy Regulatory Commission (FERC) Project Nos. 935, 2071 and 2111 (EDAW, Inc. and PacifiCorp 2008)
- Western Yacolt Burn Forest Recreation Plan (WDNR 2010a)
- City of Troutdale, Parks Master Plan (City of Troutdale 2006)

- City of Camas; Park, Recreation and Open Space Comprehensive Plan (City of Camas 2007)
- City of Fairview Comprehensive Plan (City of Fairview 2004)
- City of Castle Rock and Castle Rock School District Park and Recreation Plan (CWCOG 2011a)
- Washington State Scenic and Recreational Highways Strategic Plan (Washington Department of Revenue 2010d)
- Portland-Vancouver Bi-State Trails System Plan (Intertwine Alliance 2010)
- Columbia River Gorge National Scenic Area Management Plan (Columbia River Gorge Scenic Area Management Plan 2007)

The remainder of this section describes existing recreation resources in the study area by general recreational category (see Table 6-1).

6.1.1 Parks and Recreation Facilities

Public recreation facilities in the study area are managed by public and private entities including Vancouver-Clark Parks, Cowlitz County, Washington State Department of Transportation (WSDOT), Washington State Department of Natural Resources (WDNR), and PacifiCorp.

Cowlitz County manages developed parks at 14 sites (**mini parks**, **neighborhood parks**, and **community parks**) in the rural areas of the county (Cowlitz County 2010a). Recreation areas within the southern part of the county are in developed areas (Castle Rock, Longview, Kelso, and the I-5 transportation corridor) and around lakes and rivers (Merwin, Yale, and Swift reservoirs; Cowlitz, Coweeman, Kalama, and Lewis rivers) (Cowlitz County 2010a). Riverside Park is along the Cowlitz River (see Table 6-1, Map 6-1A).

PacifiCorp provides public recreational opportunities along the Lewis River, below Merwin Dam and along the shores of Yale, Merwin, and Swift reservoirs. Recreation facilities begin at Island Access, about 2 miles east of Woodland, Washington on SR 503, and continue 45 miles upstream to Eagle Cliff Park at the east end of Swift Reservoir (PacifiCorp 2011). Parks and recreation facilities within the study area include Merwin Park (see Table 6-1, Map 6-1C).

The Vancouver-Clark Parks and Recreation Department (VCPRD) manages developed parks at 239 sites in Clark County and Vancouver (VCPRD 2007). The VCPRD also owns and manages a variety of recreation facilities, including sports fields, pools, gyms, community centers, a tennis center, skate parks, and off-leash dog park areas. Parks and recreation facilities in the study area include Pleasant Valley, Hazel Dell, East Minnehaha, Covington, Sifton, Goot, Walnut Grove, Green Mountain, Moulton Falls, Tenny Creek, and Oak parks; Sherwood Ridge and Sherwood Meadows open space/natural areas; Heritage Trail; and Washougal River Greenway (see Table 6-1; Maps 6-1D, 6-1E). Also in Clark County, the western portion of the Yacolt Burn State Forest (managed by WDNR and referred to in this chapter as the Western Yacolt Burn State Forest) provides opportunities for camping, hiking, hunting, fishing, horseback riding, off-road vehicle use, and mountain biking.

In Multnomah County, the 40-Mile Loop Land Trust manages the 40-Mile Loop Trail with the cities of Troutdale and Fairview, Multnomah County, and other local jurisdictions. In the study area, the 40-Mile Loop Trail includes planned trail segments in Troutdale and Fairview. In Fairview, the Metropolitan Service District (Metro), a regional government for the Portland metropolitan area, manages the Chinook Landing Marine Park, a public boating facility where Fairview plans to have a marine museum housed in the retired USS Ranger (see Table 6-2 for recreation areas planned or scheduled for improvements near the project).

Other facilities within the study area include public and private golf courses. Golf course facilities generally include amenities such as restaurants used to host events.

6.1.2 Sightseeing

Cowlitz and Clark counties have many natural environmental features that provide destinations for recreational activities. In the study area, these include views from the tops of mountains (e.g., Larch Mountain), views from lakes (e.g., Merwin and Yale), rivers (e.g., Lewis and Columbia), and waterfalls (Lucia and Moulton). Scenic drives include the Spirit Lake Memorial Highway, Northern Clark County Scenic Drive, Lewis and Clark Trail Scenic Byway, and Columbia River Gorge Scenic Byway (see Table 6-1). Spirit Lake Memorial Highway is a National Scenic Byway along SR 504 crossed by the Central and East alternatives. The Northern Clark County Scenic Drive, a 70-mile drive created by the Board of Clark County Commissioners, follows multiple roads through the county and is crossed by the West Alternative and Central Option 3. The Lewis and Clark Trail Scenic Byway and Columbia River Gorge Scenic Byway are Washington State Scenic Byways that follow SR 14 along the Columbia River and are crossed by all action alternatives.

6.1.3 Non-Motorized Trails

Non-motorized trails are used for walking, hiking, mountain biking, and horseback riding. Non-motorized trails within urban areas of Cowlitz, Clark, and Multnomah counties provide an on- and off-street network of recreation, transportation, and wildlife habitat viewing corridors. In the study area, non-motorized trails include Riverfront (East), Hazel Dell Park, Washington State University Vancouver Campus, Ellen Davis, Lacamas Heritage, Bells Mountain, and Lucia Falls/Moulton Falls trails, and trails within Riverside Park, East Fork Lewis River Greenway, and the Washougal River Greenway Park. Non-motorized trails also include a planned segment of the 40-Mile Loop Trail (see Tables 6-1, 6-2; Maps 6-1A, 6-1C, 6-1D, 6-1E). WDNR manages 35 miles of non-motorized trails within the Western Yacolt Burn State Forest including the Tarbell Trail (also known as Larch Mountain Trail), Jones Creek Trail, and Jones Creek Trail Connector A. The Silver Star Trail, within the Silver Star Scenic Area of the Gifford Pinchot National Forest, is outside of the study area and is not crossed by the action alternatives.

Table 6-1 Current Recreation Resources and Activities[1]

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Parks and Recreation Facilities					
Sherwood Ridge and Sherwood Meadows	Open space/natural areas managed for their natural value and low-impact recreational use.	Park/Recreation Facility	Vancouver-Clark Parks	Clark County, WA	West Alternative
Tenny Creek Park	An 8.25-acre park with playground areas, a 0.5-mile walking trail, a small skateboarding spot, benches, and picnic tables.	Park/Recreation Facility	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Pleasant Valley Park	A 40-acre community park next to Pleasant Valley Elementary and Middle Schools (14320 NE 50th Avenue). The park is partially developed and has asphalt and crushed rock trails, non-irrigated open grass areas, a gazebo, and access to Salmon Creek. Glenwood Little League and Prairie Soccer use the adjacent school site for league practices and games (VCPRD 2010).	Park/Recreation Facility	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Hazel Dell Park and Hazel Dell Park Trail	A 20-acre neighborhood park, one of the first built in Clark County. This park includes play equipment, picnic shelters, an open lawn area, and trails within the park.	Park/Recreation Facility; Non-Motorized Trail	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Covington Park	A 4.2-acre park on the east side of I-205 in the Maple Tree/Five Corners area. The park contains a walking/biking trail, a playground, a multi-use sports court, and picnic tables and benches.	Park/Recreation Facility	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Walnut Grove Park	A 3.7-acre park with a playground, basketball half court, 0.3-mile trail, picnic tables, and benches.	Park/Recreation Facility	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Sifton Park	A 5-acre park with a playground, 0.5-mile walking trail, basketball half court, picnic tables, and benches.	Park/Recreation Facility	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Green Mountain Park	A 460-acre undeveloped, regional park (VCPRD 2007).	Park/Recreation Facility	Vancouver-Clark Parks	Clark County, WA	West Options 2 and 3

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Green Meadows Golf Course	A private recreation facility that features golf, tennis, athletic, and social amenities. The golf course has programs and activities, and dining and entertainment areas.	Park/Recreation Facility	Private	Vancouver, WA	West Alternative
Camas Meadows Golf Club	A public recreation facility that includes an 18-hole golf course, driving range, and restaurant.	Park/Recreation Facility	Private	Camas, WA	West Options 1 and 3
Goot Park	A park with an adult softball field, half basketball court, playground equipment, picnic areas, and restrooms.	Park/Recreation Facility	City of Camas	Camas, WA	West, Central, East, Crossover Alternatives
Oak Park	A 1.8-acre community park with a half basketball court, playground equipment, picnic tables, and a barbecue area.	Park/Recreation Facility	City of Camas	Camas, WA	West, Central, East, Crossover Alternatives
Washougal River Greenway and Trail	The 86.7-acre greenway along the lower Washougal River provides shoreline access, picnic areas, fishing, and trails.	Park/Recreation Facility; Non-Motorized Trails	City of Camas	Clark County, WA	West, Central, East, Crossover Alternatives
Moulton Falls Park	A 387-acre regional park at the confluence of the East Fork Lewis River and Big Tree Creek with two waterfalls and an arch bridge more than 30 feet high. The Chelatchie Prairie Railroad excursion train also passes through the park. Areas of interest include volcanic rock formations from early lava flows, historic Indian meeting grounds, the Murphy Grade, a swing bridge on Big Tree Creek, and access to the Bells Mountain Trail.	Park/Recreation Facility	Vancouver-Clark Parks	Yacolt, WA	Central Option 3
Riverside Park	A 58-acre community park along the Cowlitz River. The park has baseball and soccer fields, trails and walking pathways, playground equipment, picnic areas, basketball courts, and tennis courts. The park is used for picnicking, recreational activities for children from the Lexington area, and for fitness walking. It does not have access for fishing or launching boats.	Park/Recreation Facility; Non-Motorized Trails	Cowlitz County	Cowlitz County, WA	East Option 1

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Castle Rock High School	A 107-acre school park that includes the North County Recreation Sports Complex. The park has sports fields and facilities for school-related recreational activities.	Park/Recreation Facility	City of Castle Rock	Castle Rock, WA	Central, East Alternatives
Sightseeing					
Spirit Lake Memorial Highway	A 54-mile National Scenic Byway along SR 504. The highway begins in Castle Rock at Mt. St. Helens Way and ends on Johnston Ridge, with a view of the Mt. St. Helens crater.	Sightseeing	WSDOT	Cowlitz County, WA	Central, East Alternatives
Northern Clark County Scenic Drive	A 70-mile drive created by the Board of Clark County Commissioners. The drive goes through Battle Ground, Yacolt, La Center, and Ridgefield. Several parks are along the route, including Lucia Falls, Moulton Falls, Whipple Creek and Daybreak parks. Historic sites include the Henry Heisson House, the Cedar Creek Grist Mill, Allen House, and the Cathlapotle Plankhouse.	Sightseeing	Clark County	Clark County, WA	West Alternative, Central Option 3
Lewis and Clark Trail Scenic Byway	The Lewis and Clark Trail Scenic Byway is 572 miles long in Washington and extends from Clarkston on the Idaho border to Cape Disappointment on the Pacific Coast. It is designated as a Washington State Scenic Byway. Washington SR 14, which would be crossed by the project, is part of this byway.	Sightseeing	WSDOT	Cowlitz and Clark counties, WA	West, Central, East, Crossover Alternatives
Columbia River Gorge Scenic Byway	The Columbia River Gorge Scenic Byway follows SR 14 for about 100 miles between Maryhill and Vancouver, Washington along the Columbia River. The scenic byway is designated as a Washington State Scenic Byway. All action alternatives cross SR 14. Scenic attractions near the project include Captain William Clark Park in Washougal, Washington. Lewis and Clark camped here for 6 days during their 1806 expedition.	Sightseeing	WSDOT	Clark County, WA	West, Central, East, Crossover Alternatives

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Non-Motorized Trails					
East Fork Lewis River Greenway	The greenway includes more than 1,000 acres of waterfront property along both banks of the East Fork Lewis River between Paradise Point State Park north of La Center and Daybreak Park north of Battle Ground. It is part of an interconnected, 10-mile greenway system. Most of the undeveloped greenway is open to non-motorized use.	Non-Motorized Trail	Vancouver-Clark Parks	Clark County, WA	West Alternative
Castle Rock Riverfront Trail (East)	The trail is a 1.5-mile lighted, paved multi-use trail extending from Lion's Pride Park north to just past the PH10 (A Street) bridge. Trail amenities include viewing areas, benches, and picnic tables.	Non-Motorized Trail	City of Castle Rock	Castle Rock, WA	Central, East Alternatives
Ellen Davis Trail	A 2.5-mile crushed rock trail that connects Discovery Loop Trail at Leverich Park with St. James Road. The trailhead is at Leverich Park. The trail follows Burnt Bridge Creek through the BPA Ross Complex and the Minnehaha Neighborhood. It is a multi-use trail open to hikers and cyclists.	Non-Motorized Trail	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Washington State University Vancouver Campus Trail	Walking paths, jogging paths, and interpretive trails surrounding Washington State University's Vancouver Campus.	Non-Motorized Trail	Washington State University	Vancouver, WA	West Alternative
Lacamas Heritage Trail	Lacamas Heritage Trail is a shared-use trail in East Clark County on the west side of Lacamas Lake and Lacamas Creek. It provides opportunities to view birds, rock formations, and waterfalls, and offers picnicking areas, extensive waterfront access, and a children's play center. Clark County and the City of Camas own interconnected trail sections.	Non-Motorized Trail	Vancouver-Clark Parks	Camas, WA	West Option 1

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Bells Mountain Trail	A primitive, 4-foot-wide shared-use trail serves hikers, mountain bikers, and equestrians. The trail can be accessed from Moulton Falls Park at the Hantwick Road Trailhead. The trail can also be accessed from the Cold Creek Day Use Area, which is operated by WDNR. Its highest point near the north end is about 1,500 feet. The trail passes through fir and alder forests with glimpses of Mt. St. Helens and Mt. Adams.	Non-Motorized Trail	Vancouver-Clark Parks	Clark County, WA	Central Alternative, East Option 2
Tarbell Trail (Larch Mountain Trail)	A 35-mile non-motorized loop trail system open to the public year-round. Parts of the trail have existed for more than 100 years and continue to be a popular destination trail system for non-motorized trail riders. Originally, the Tarbell trailhead, north of the forest, was used exclusively by equestrians and hikers; mountain bikers and other non-motorized recreationists also frequent the trailhead. The trail provides access to Larch Mountain and Cold Creek.	Non-Motorized Trail	WDNR	Washougal WA	East, Crossover Alternatives
Lucia Falls/ Moulton Falls Trail	A primitive, shared-use trail that connects Moulton Falls and Lucia Falls parks. Points of interest include three waterfalls, volcanic rock formations from early lava flows, and an arch bridge over 30 feet high.	Non-Motorized Trail	Vancouver-Clark Parks	Yacolt, WA	Central Option 3
40-Mile Loop Trail: Reynolds Trail	A 1.8-mile, paved non-motorized trail section on top of the levee in the Troutdale Reynolds Industrial Park. This trail is part of the 40-Mile Loop Trail system.	Non-Motorized Trail	40-Mile Loop Land Trust	Troutdale, OR	West, Central, East, Crossover Alternatives
40-Mile Loop Trail: Columbia River Trail Extension	A paved, non-motorized trail section connecting the Marine Drive portion of the 40-Mile Loop Trail and the Reynolds Trail. This section of the 40-Mile Loop Trail system is currently under construction.	Non-Motorized Trail	40-Mile Loop Land Trust	Troutdale, OR	West, Central, East, Crossover Alternatives

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Motorized Trails/Hunting					
Western Yacolt Burn State Forest	State forest area open to both motorized and non-motorized trail use, and hunting and fishing. Trails open to motorized use include the Jones Creek Trail and Jones Creek Trail Connector A. WDFW regulates hunting within this recreation area.	Motorized Trails/ Hunting	WDNR	Washougal, WA	Central, East, Crossover Alternatives; East Options 2 and 3
Jones Creek Trail/Jones Creek Trail Connector A	Fourteen miles of double-track motorcycle and all-terrain vehicle motorized trail open seasonally from May 1 to November 30. The trailhead is in the southern portion of the forest, linking to the designated motorized trail system.	Non-Motorized Trails	WDNR	Washougal, WA	East, Crossover Alternatives
Campgrounds/Water-Based Recreation					
Camp Currie	A camping resource for organized youth groups with a rustic lodge, covered outdoor mess hall, three Adirondack camp cabins, and multiple tent camp sites, 3 miles northwest of Camas.	Camping	Private	Camas, WA	West Alternative, West Option 1, Crossover Option 1
Merwin Park: Merwin Ramp, Speelyai Bay Park, and Cresap Bay boat launch	The largest recreation area on the Lewis River. The park is open year round and can accommodate up to 1,500 people. Recreational opportunities at the park include picnic areas, outdoor games, swimming, camping, and bank fishing.	Park/Recreation Facility; Water-Based Recreation	PacifiCorp	Ariel, WA	Central, Crossover Alternatives
Haapa Boat Launch	Boat launch that provides fishing and water access to the North Fork Lewis River about 5 miles east of Woodland. There are picnic areas, parking and restrooms in the vicinity.	Water-Based Recreation	Vancouver-Clark Parks	Woodland, WA	West Alternative
Marina Park	The marina provides moorage slips and docks, and picnic areas, restrooms, a walking path, and events such as concerts and fishing tournaments.	Park/Recreation Facility; Water-Based Recreation	Port of Camas-Washougal	Washougal, WA	West, Central, East, Crossover Alternatives

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Lower Columbia River Water Trail	A 146-mile water trail that provides paddling opportunities, including launching and landing sites, and information about paddling stewardship and safety.	Water-Based Recreation	Lower Columbia River Estuary Partnership	Bonneville Dam to the Pacific Ocean	West, Central, East, Crossover Alternatives
Al Helenburg Memorial Boat Launch	Boat launch that provides fishing and water access to the Cowlitz River just south of Castle Rock High School. There are picnic areas, parking, and restrooms in the vicinity.	Water-Based Recreation	City of Castle Rock	Castle Rock, WA	Central, East Alternatives

Notes:

1. Recreation resources and activities were identified with a "study area"; an area within approximately 1,000 feet of the project that includes the transmission line right-of-way, new and improved access roads, substation areas, and removed, rebuilt, and new towers on existing right-of-way.

Sources: City of Camas 2007, City of Fairview 2004, City of Troutdale 2006, Clark County 2011d, Cowlitz County 2010a, Cowlitz Wahkiakum Council of Governments 2006, EDAW Inc. and PacifiCorp 2008, Metro 2011, USGS 2009, VCPRD 2007, Washington State Tourism 2011, WDNR 2010a

Table 6-2 Planned Recreation Resources and Activities[1]

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Kelley Meadows Neighborhood Park (formerly East Minnehaha Park)	A 7.5-acre park that features trees, a wetland, and open lawns. Construction to further develop the park area was to begin in 2012 but has been delayed until further funding can be obtained.	Park/Recreation Facility	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Chelatchie Prairie Rail with Trail Project	A multi-use trail paralleling the 33-mile length of the county-owned Chelatchie Prairie Railroad	Non-Motorized Trail	Clark County	Burnt Bridge Creek Trail to Yale Bridge	West, Central, Crossover Alternatives; Central Option 3
40-Mile Loop: Reynolds Gap section	The Reynolds Gap is a planned segment of the 40-Mile Loop Trail in Troutdale, Oregon. The gap segment is about 6 miles long and would run through the Reynolds Industrial Park. The 40-Mile Loop Trail will ultimately connect to make an uninterrupted loop trail. The planned segment of the trail would be north of Sundial Substation.	Non-Motorized Trail	40-Mile Loop Land Trust	Troutdale, OR	West, Central, East, Crossover Alternatives
Canyon Creek Bridge	A 500-acre property at the intersection of Healy and Blevins roads. Development of a zip line tour facility with nine zip lines and three rope-bridge walkways is planned.	Recreation Facility	Private	Amboy, WA	East, Crossover Alternatives
USS Ranger, Chinook Landing Marine Park	A retired U.S. aircraft carrier proposed for development as an aircraft carrier museum, conference center, and event venue at the Chinook Landing Marine Park.	Marine Park/ Recreation Facility	Metro	Fairview, OR	West, Central, East, Crossover Alternatives

Notes:

1. Recreation resources and activities were identified with a "study area"; an area within approximately 1,000 feet of the project that includes the transmission line right-of-way, new and improved access roads, substation areas, and removed, rebuilt, and new towers on existing right-of-way.

Sources: 40-Mile Loop Land Trust 2011, Bungee Masters Inc. 2011, City of Fairview 2004, Vancouver-Clark Parks 2007

6.1.4 Motorized Trails

Motorized trails are trails open for use by four-wheel drive vehicles, ATVs, and motorcycles that can also be used for non-motorized recreation (WDNR 2010a). In the study area, the only trails formally open for motorized recreation are in the Western Yacolt Burn State Forest; these trails include the Jones Creek Trail and Jones Creek Trail Connector A (see Table 6-1; Maps 6-1D, 6-1E). Longview Timberlands LLC, Sierra Pacific Industries, and Weyerhaeuser Company do not allow motorized recreational activities on their lands (WDNR 2010a), although unauthorized motorized uses could occur. WDNR reports that a lack of nearby areas for motorized recreation has driven this use to the Western Yacolt Burn State Forest, which has seen an increase in undesignated (unauthorized) motorized trail use (WDNR 2010a).

6.1.5 Hunting

Washington Department of Fish and Wildlife (WDFW) regulates hunting and issues hunting permits, both on private lands and on lands managed by the WDNR. The following are current hunting seasons in the project area:

- Bear hunting from August to November
- Deer and elk hunting from September to December
- Elk hunting (rifle) season in the first half of November
- Turkey hunting from April to May, September to October, and November to December
- Pheasant hunting from September to October in Western Washington
- Rabbit hunting from September to March
- Grouse hunting from September to December (WDNR 2010a)

The Western Yacolt Burn State Forest is the largest WDNR-managed site in the study area open to hunting (see Table 6-1; Maps 6-1C, 6-1D, 6-1E). There are no other locations in Cowlitz or Clark counties where private landowners have entered into formal “Hunt by Written Permission” or “Feel Free to Hunt” agreements with WDFW to allow public access for hunting (WDFW 2009). Private landowners in the study area may have provided specific written permission to individual hunters, but none are registered with WDNR.

6.1.6 Campgrounds

Within the study area, opportunities for camping are limited. There is camping at Camp Currie (see Table 6-1; Maps 6-1D, 6-1E). Camping occurs in the Lewis River Recreation area (managed by PacifiCorp) at Cresap Bay Campground and in the Western Yacolt Burn Forest on WDNR land but these sites are outside the study area.

6.1.7 Water-Based Recreation

Water-based recreation in the study area includes fishing, boating, swimming, water skiing, jet skiing, kayaking, canoeing, parasailing, tubing, sailing, and rafting on lakes and rivers. There are more than 30 boat launch sites in southwest Washington for anglers, water skiers, jet skiers, and boaters. Public launches are available on the Cowlitz, Kalama, Lewis, and Columbia rivers, and at Yale and Swift reservoirs (Cowlitz County Tourism Bureau 2010). The Columbia, Cowlitz, Kalama, Toutle and Lewis rivers have runs of salmon and steelhead. Yale and Merwin lakes provide opportunities to fish for crappie, bluegill, trout, kokanee, tiger muskies, and bass (Cowlitz County Tourism Bureau 2010). These water resources also provide opportunities for kayaking, canoeing, and boating. Boats can be launched at the Haapa Boat Launch, Washougal River Greenway Park, Merwin Park, the Port of Camas-Washougal Marina and the Chinook Landing Marine Park in the City of Fairview in Oregon (see Table 6-1; Maps 6-1C, 6-1D, 6-1E).

6.1.8 Dispersed Recreation

Dispersed recreation takes place outside of developed recreation facilities, and may include fishing, target shooting, hiking, nature appreciation, and backpacking (WDNR 2010a). Opportunities for authorized dispersed recreational uses exist within the study area on WDNR lands, including the Western Yacolt Burn State Forest area. Unauthorized recreation activities can also occur in these areas. Unauthorized recreational uses known to occur include target shooting, which occurs near the Casey Road substation site, and off-highway vehicle use.

6.2 Environmental Consequences

General impacts that would occur for the action alternatives are discussed below, followed by impacts unique to each alternative.

6.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- Obstruct existing or planned dispersed recreational uses after project construction
- Alter or eliminate dedicated recreation opportunities after project construction

Impacts would be **moderate** where project activities would cause the following:

- Temporarily preclude or limit dispersed and dedicated recreational opportunities during peak use periods during project construction
- Permanently impact user experience of a recreation resource
- Create or encourage new unauthorized land uses along the right-of-way for recreational purposes, such as ATV use in unauthorized areas

Impacts would be **low** where project activities would cause the following:

- Temporarily preclude or limit dispersed and dedicated recreational opportunities during off-peak use periods during project construction
- Require relocation of dispersed recreational activities to an equal or better location after project construction
- Temporarily impact user experience of a recreation resource

No impact would occur to recreation areas or activities if there would not be any effect on the location or quality of recreation facilities and uses during and after construction.

6.2.2 Impacts Common to Action Alternatives

6.2.2.1 Construction

Both the Lewis and Clark Trail Scenic Byway and Columbia River Gorge Scenic Byway would be crossed at the same location on SR 14 by the action alternatives. Traffic could be slowed for brief periods during blasting near SR 14 (to protect cars from flying debris), or while the conductor is being strung across SR 14 by helicopter (see Chapter 12, Transportation). Temporary construction activity would create noise and dust, would increase traffic, and could delay access to sites or negatively change user experience at recreation sites. These would be **low** impacts because access to these scenic byways could be delayed but would not be limited or precluded, and because other impacts would be temporary.

The action alternatives would cross Oak Park in Camas, Washington and the Washougal River Greenway east of Camas in Clark County. During construction, access to these resources could be delayed or limited. Goot Park is just east of Segment 52 (common to all action alternatives) in Camas, and visitor experience of Goot Park could be affected by noise, dust, or visual intrusions. These impacts would be **low** if construction occurred during off-peak use periods, and **moderate** if conducted during peak use periods because impacts would be temporary and access would be limited. In addition, many parks in the surrounding area would be unaffected by the project and could provide additional recreation opportunities.

The Columbia River transmission line crossing would include in-water construction activities (see Chapter 3, Project Components). Temporary construction activities would introduce noise, dust, and visual intrusions from helicopters and barges into the scenic character at this crossing location, and could impact motorists' experience along SR-14 scenic drives and the experience of fishermen or boaters along and on the river. Users most likely affected would be those seeking nature appreciation and wildlife viewing experiences; both could be negatively affected by construction noise and visual intrusions. However, impacts from construction would be **low** because construction would be temporary and would not restrict access to scenic drives or in-water areas.

Construction could also have a positive effect on the recreational experience of some users. Construction of a large project such as this one, which includes in-water construction and helicopters, could be a point of interest or even attract additional users to parks or other areas that provide views of construction activities.

6.2.2.2 Operation and Maintenance

The project would create impacts if tower, substation, or road placement changed a recreational function by limiting the use or removing facilities such as picnic areas, boat ramps, trails, or access areas. However, most impacts on recreation would be **experiential** in the form of intrusions to the aesthetic character of the area from helicopter inspections of the line that would occur twice each year. These intrusions would occur at specific recreation sites and at larger, informal recreational areas such as the Lewis and Clark Trail Scenic Byway, Columbia River Gorge Scenic Byway, and the Columbia River. The project would also be visible to users of distant recreation sites outside the study area.

The action alternatives would parallel existing transmission lines in some areas and would cross non-motorized trails a few times within the Washougal River Greenway (see Maps 6-1D and 6-1E). The right-of-way for all action alternatives would bisect one 16-acre parcel of this park that contains the trails. The right-of-way would also run along the western edge of a 3.5-acre parcel of the park, and an improved access road (running east/west near Tower 52/8) would bisect the eastern portion of the parcel. About 0.3 acre of the park would be changed to towers and improved access roads. This would be a **moderate** impact because the project would follow existing transmission lines in some areas, would span the trails within the Washougal River Greenway, and there would be no towers within the 16-acre parcel split by the action alternatives. However, the presence of additional towers and conversion of a small portion of the park to tower footprints could affect the experience of visitors.

The action alternatives would be about 450 feet northwest of the Port of Camas-Washougal Marina (see Maps 6-1D and 6-1E). A new access road, located on the northwest corner of the property, would affect less than 0.1 acre of the marina (see Tables 6-3, 6-4, 6-5, and 6-6). This would be a **low** impact because the project would only convert a small corner of marina property into access roads, which would not affect user experience, and the transmission line would not span the marina or convert any of the Marina property to right-of-way or towers.

The action alternatives would remove and replace the existing two 230-kV transmission lines that cross the southern part of Oak Park with a new double-circuit 230-kV line. The new 500-kV line would parallel the replaced double-circuit line on the vacated right-of-way. Less than 0.1 acre of the park would be converted to new access roads (see Tables 6-3, 6-4, 6-5, and 6-6; Maps 6-1D and 6-1E). This would be a **low** impact because transmission lines already cross the park and the new line would be built within existing right-of-way. The new access road would affect the edge of the park, and this change to the park likely would not affect user experience.

New and improved access roads to and on right-of-way can provide increased access to forested areas of nearby parks and trails along the action alternatives. This could increase access for unauthorized hunting and ATV use on otherwise inaccessible lands causing a **moderate** impact to recreation areas. Signs and fencing may limit some potential impact.

6.2.2.3 Sundial Substation

There are no existing recreation resources within the Sundial site (see Map 6-1D) and **no** impacts on recreation from construction of the substation would occur. Part of the 40-Mile Loop Trail, called the Reynolds Gap, is planned to be constructed north of the site on top of the levee with a full view of the industrial complex. There is no schedule at this time to begin construction. The substation, new roads, and transmission lines would not be out of context with the existing industrial nature of the area. In addition, project components would not interfere with the levee or the future trail.

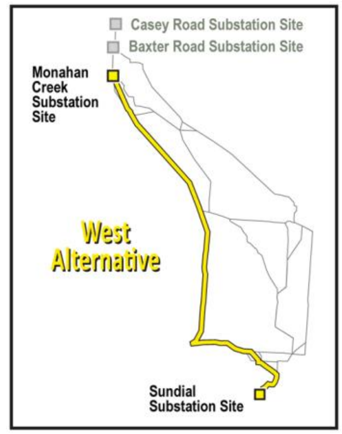
6.2.3 Castle Rock Substation Sites

There are no existing recreation resources within the Casey Road, Baxter Road, or Monahan Creek sites, so there would be **no** impacts at these sites (see Map 6-1A). There is known unauthorized dispersed recreation in the area of the Casey Road substation site; however, because this use is unauthorized, any changes to the availability of this use from construction of the substation would be a **low** impact.

Impacts common to action alternatives are in Section 6.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

6.2.4 West Alternative

6.2.4.1 Construction



During construction, about 5 acres of recreation facilities and less than 0.1 mile of trails would be temporarily disturbed. The disturbed area would include less than 0.1 acre of the East Fork Lewis River Greenway, almost 2 acres of the Green Meadows Golf Course, almost 3 acres of Camp Currie, and less than 1 acre of the Washougal River Greenway (see Maps 6-1A, 6-1C, 6-1D). Temporarily disturbed trails would include about 50 feet of the Ellen Davis Trail and 200 feet of the Washington State University Vancouver Campus Trail (see Map 6-1D). Temporary disturbance could include noise, dust, restricted access, and visual disturbances.

Construction would occur throughout the year. Summer months are peak use time for general recreation; peak use times for hunting vary by type of hunting (see Section 6.1.5, Hunting). The winter months are non-peak use times for all recreational uses. During peak use times, the West Alternative's temporary impacts on recreation resources would be **moderate**. During non-peak times, temporary impacts on these recreation resources would be **low**. Any temporary impacts on user experience from construction would be **low**. In addition, many parks in the surrounding area would be unaffected by the project and could provide additional recreation opportunities.

The West Alternative route would be near the Haapa Boat Launch; Pleasant Valley, Covington, Sifton, Goot, Tenny Creek, and Walnut Grove parks; Hazel Dell Park and Hazel Dell Park Trail; and Sherwood Ridge and Sherwood Meadows (see Tables 6-1, 6-2; Maps 6-1C, 6-1D, 6-1E). Construction activities could occasionally and temporarily disturb the quiet and scenic landscape at these recreation resources, but these resources would still be accessible. Because no project components would be within these resources and construction activities would be temporary, there would be **no-to-low** impact on these resources.

6.2.4.2 Operation and Maintenance

Required project facilities for the West Alternative would permanently occupy about 8.9 acres of recreation land. Of this total, 0.9 acre would be affected by towers, about 5.5 acres would be affected by new access roads, and about 2.5 acres would be affected by access road improvements (see Table 6-3). In addition, less than 0.3 miles of trails would be permanently crossed by new or improved access roads (see Table 6-3).

The West Alternative would follow existing right-of-way along the eastern edge of the East Fork Lewis River Greenway (see Map 6-1C). New access roads would affect about 3 acres within the greenway (see Table 6-3). No towers or improved access roads would be within the greenway. The new access roads and the transmission line would add an industrial, human-made element to the greenway and would have experiential impacts on recreationists (see Chapter 7, Visual Resources). The new roads would affect areas within the park that are managed for protection and enhancement of the natural environment. This would cause a **high** impact because it would permanently alter a dedicated recreation resource.

Table 6-3 West Alternative and Options—Permanent Impacts on Parks and Trails

Alternative and Options[1,2]	Recreation Resource	Towers[3]	New Access Roads[4]	Improved Access Roads[4]
West Alternative	Parks (acres)	Camp Currie (0.6), Green Meadows Golf Course (0.2), Washougal River Greenway (0.1)	Camp Currie (1.2), East Fork Lewis River Greenway (3.1), Green Meadows Golf Course (0.8), Port of Camas-Washougal Marina (<0.1), Oak Park (<0.1)	Camp Currie (0.3), Green Meadows Golf Course (1.9), Washougal River Greenway (0.2)
	Trails (miles)	--	Ellen Davis Trail (<0.1), Washington State University Vancouver Campus Trail (<0.1)	Washington State University Vancouver Campus Trail (<0.1)
West Option 1	Parks (acres)	Camas Meadows Golf Club (+0.2), Camp Currie (-0.2), Green Meadows Golf Course (-0.2)	Camas Meadows Golf Club (+0.1), Camp Currie (+0.5), Green Meadows Golf Course (-0.8)	Camp Currie (-0.3), Green Meadows Golf Course (-1.9), Camas Meadows Golf Club (+0.2)
	Trails (miles)	Lacamas Heritage Trail (+0.1)	Lacamas Heritage Trail (+0.3)	Lacamas Heritage Trail (+<0.1)
West Option 2	Parks (acres)	Green Mountain (+0.5), Camp Currie (-0.6), Green Meadows Golf Course (-0.2)	Green Mountain (+2.3), Camp Currie (-1.2), Green Meadows Golf Course (-0.8)	Green Mountain (+2.4), Camp Currie (-0.3), Green Meadows Golf Course (-1.9)
	Trails (miles)	N/C	N/C	N/C
West Option 3	Parks (acres)	Green Mountain (+0.5), Camp Currie (-0.6), Green Meadows Golf Course (-0.2)	Green Mountain (+0.9), Camp Currie (-1.2), Green Meadows Golf Course (-0.8)	Green Mountain (+2.4), Camp Currie (-0.3), Green Meadows Golf Course (-1.9)
	Trails (miles)	N/C	N/C	N/C

Notes:

N/C – No net change from the action alternative.

1. The value for each option represents the net change from the action alternative. It was calculated as the total impacted acres or miles added by the option minus the total impacted acres or miles in the segments the option replaces.
2. No permanent impacts would occur in substation areas.
3. Includes rebuilt and new towers.
4. Includes access roads within and outside of the 150-foot right-of-way.

Sources: Clark County 2011d, Cowlitz Wahkiakum Council of Governments 2006, Metro 2011, USGS, 2009

The West Alternative would cross the Northern Clark County Scenic Drive at Northeast Cedar Creek Road and at Northeast 259th Street (see Map 6-1C). The transmission route would be on existing right-of-way and parallel an existing line that already crosses the scenic drive. The additional visual intrusion from the new line would be minor and a motorists view of the crossing would be temporary, a **low** impact.

The existing right-of-way is on the eastern side of the Washington State University Vancouver Campus and crosses the Campus Trail multiple times (see Maps 6-1D and 6-1E). An improved access road would also follow part of the trail for over 300 feet. Less than 0.1 mile of the trail would be changed to new and improved access roads (see Table 6-3). Though the West Alternative would follow existing right-of-way and no towers would be in the trail, this would be a **high** impact because a small area (less than 0.1 mile) of the trail would be changed to new access roads. This would permanently alter this dedicated recreation resource.

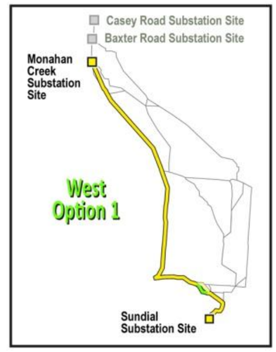
A small area of the Ellen Davis Trail would also be affected. The West Alternative would pass near this trail along the trail's north side. Less than 0.1 mile of the trail would be permanently changed to new access road where it would cross the trail near its eastern end. Although this is a small portion of the Ellen Davis Trail, the impact to this area would be **high** because it would permanently alter the recreation resource.

The West Alternative would cross the northern part of Kelley Meadows Neighborhood Park (formerly East Minnehaha Park) (see Maps 6-1D and 6-1E). No new towers, new access roads, or improved access roads would be within the park area. This 7.5-acre park is currently undeveloped and primarily consists of open lawn areas. Construction to develop the park area was scheduled to begin in 2012 but do to the continuing depressed economy construction has been delayed until further funds can be obtained (see Table 6-2). The final layout of the park is being developed, and this project could influence the final park design to avoid placing developed areas of the park within the right-of-way. This would be a **no-to-low** impact because there would be no towers or roads placed in the park area, the park does not currently contain large numbers of trees that would be removed, and the park layout is still being developed and could be coordinated with BPA.

The West Alternative would diagonally bisect the Green Meadows Golf Course, paralleling an existing transmission line through the golf course (see Maps 6-1D and 6-1E). Almost 3 acres of the golf course would be changed to towers, new access roads, and improved access roads (see Table 6-3). This would be a **moderate** impact because an existing transmission line bisects the golf course, and already affects the recreational experience of golfers. The West Alternative would follow the northeast boundary of Camp Currie (a portion of which is in existing right-of-way) (see Maps 6-1D and 6-1E). About 2 acres of the camp would be changed to towers, new access roads, and improved access roads (see Table 6-3). This would cause a **moderate** impact because the existing right-of-way is near the edge of the camp property and only separates about 5 acres of the northeast corner of the property from the rest of the camp.

The West Alternative route would be near the Haapa Boat Launch; Pleasant Valley, Covington, Sifton, Goot, Tenny Creek, and Walnut Grove parks; Hazel Dell Park and Hazel Dell Park Trail; and Sherwood Ridge and Sherwood Meadows (see Tables 6-1, 6-2; Maps 6-1C, 6-1D, 6-1E). The transmission line could visually intrude on the recreational experience of the park and trail users, but there are existing transmission lines that presently pass by these recreation areas and a new line would not be inconsistent with existing views. No towers or right-of-way would be within the parks, so there would be **no-to-low** impact on these resources.

6.2.4.3 West Option 1



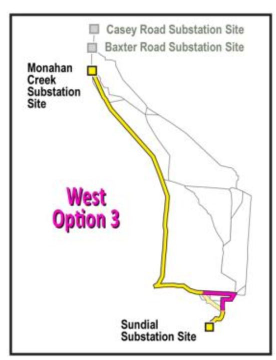
West Option 1 would replace a portion of the alternative that follows existing right-of-way just east of Vancouver with an option that is farther west and closer to Vancouver. Tower construction would temporarily disturb an additional 0.5 acre of parks, about 1.7 acres of the Camas Meadows Golf Club, and 0.8 acre of the Lacamas Heritage Trail. About 0.2 acre of Camp Currie and 1.7 acres of Green Meadows Golf Course would be unaffected (see Table 6-3 and Maps 6-1D and 6-1E). Temporary disturbance could include dust and noise, limited access, visual disturbance, or impacts on user experience. During peak use times (summer months and hunting season), construction of West Option 1 would cause temporary **moderate** impacts on the golf club, Camp Currie, and the Lacamas Heritage Trail, and **low** impacts during non-peak times. Any temporary impacts on user experience at these locations would be **low**.

West Option 1 would reduce the area permanently affected by towers by about 0.2 acre, and reduce the additional area of parks that would be affected by new and improved access roads by almost 2 acres (see Table 6-3). West Option 1's right-of-way would cross the northern part of Camas Meadows Golf Club instead of the Green Meadows Golf Course and follow the existing right-of-way east-west through Camp Currie instead of the eastern border of the camp (see Map 6-1D). West Option 1 would also add the Lacamas Heritage Trail to those crossed by improved access roads (see Table 6-3). No towers would be constructed within the trail, and the portion of the line crossing the trail would follow existing right-of-way. West Option 1 would reduce the total area of parks and increase the amount of trails that would be changed to towers and access roads. This option could create **moderate** permanent impacts on user experiences at the golf club, and Camp Currie.

6.2.4.4 West Option 2

West Option 2 would replace a portion of the alternative in the rural residential areas north of Camas with an option farther to the east in the same area. West Option 2 would reduce the temporary disturbance from tower construction by almost 2 acres. West Option 2 would increase the amount of land permanently converted to towers and access roads by about 5 acres within Green Mountain Park, but would eliminate permanent impacts within Camp Currie and Green Meadows Golf Course (see Table 6-3 and Map 6-1D). Impacts on Green Mountain Park would be **low** because the park is not heavily used and the option would follow existing right-of-way for most of its length.

6.2.4.5 West Option 3

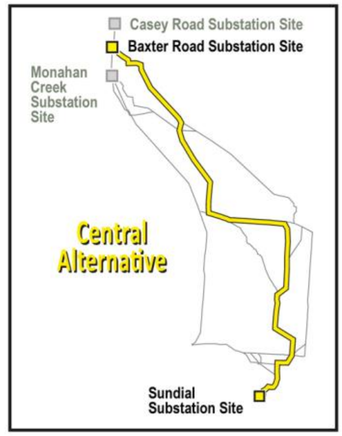


West Option 3 would replace a portion of the West Alternative in the rural residential areas north of Camas with a route crossing rural residential and rural areas farther east. West Option 3 would reduce the temporary disturbance to parks from tower construction by almost 2 acres. This option would permanently impact about 4 acres of land within Green Mountain Park, but would not impact Camp Currie or

Green Meadows Golf Course. Impacts on Green Mountain Park would remain **low** because the park is not heavily used and the option would follow existing right-of-way for most of its length.

6.2.5 Central Alternative

6.2.5.1 Construction



During construction, temporary impacts to recreation would occur on about 1 acre of the Washougal River Greenway; no temporary impacts would occur on the trails. Temporary disturbance could include noise, dust, restricted access, and visual disturbances.

Proposed new right-of-way would be near PacifiCorp's public recreation areas along the Lewis River (Merwin Park), Goot Park, and the Western Yacolt Burn Forest (see Table 6-1; Maps 6-1C, 6-1D, 6-1E). Construction activities could disturb the quiet and scenic landscape of the recreation areas, but the facilities would still be accessible, and no towers or right-of-way would be within the park. There would be **no-to-low** impact on these resources.

Construction would occur throughout the year. During peak use times (such as summer for general recreation, and hunting season for hunting uses), temporary impacts on recreation resources from construction of the Central Alternative would be **moderate**. During non-peak times (winter), temporary impacts on these recreation resources would be **low**. Any temporary impacts on user experience from construction would be **low**. In addition, many parks in the surrounding area would be unaffected by the project and could provide additional recreation opportunities.

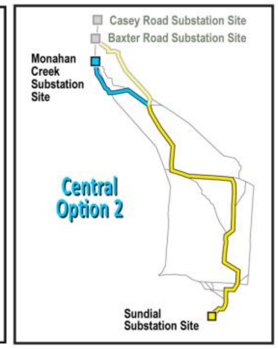
6.2.5.2 Operation and Maintenance

Required project facilities for the Central Alternative would permanently occupy about 0.5 acre of recreation land. Of this total, 0.1 acre would be affected by towers, about 0.2 acre would be affected by new access roads, and about 0.2 acre would be affected by existing access road improvement (see Table 6-4; impacts to the Washougal River Greenway, Port of Camas-Washougal Marina and Oak Park are discussed under 6.2.2, Impacts Common to Action Alternatives).

In addition, less than 0.2 mile of trails would be permanently crossed by improved access road. These would be the Riverfront Trail (East) and Bells Mountain Trail (see Table 6-4 and Map 6-1A). The roads would have a **low** impact on these trails because maintenance activities are infrequent and the chance of maintenance activities occurring during trail use is likely low. Where new right-of-way would also cross Bells Mountain Trail, it would add an industrial, human-made element to the trail that could negatively affect the experience of recreationists. This impact on user experience would be **moderate**.

Proposed right-of-way would cross the Spirit Lake Memorial Highway (SR 504). The project would be a visual intrusion into this drive's scenic views. This would be a **low** impact because the crossing is less than a mile from the SR 504 interchange with I-5 and is in more developed areas of the scenic drive. The transmission line could also visually intrude on the recreation experience of park and trail users where it is visible from Merwin Park, Goot Park, and the Western Yacolt Burn Forest. However, no towers or right-of-way would be within these parks, so **no-to-low** impacts on these resources would occur.

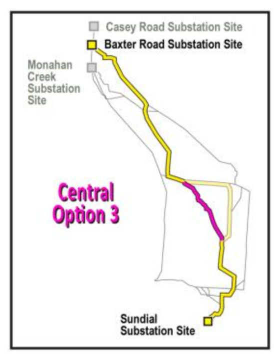
6.2.5.3 Central Options 1 and 2



Central Option 1 would begin at the Casey Road substation site and the transmission line would cross unpopulated forest production and open space land. Central Option 2 would begin at the Monahan Creek substation site and would remove the portion of the Central Alternative crossing the Cowlitz River north of Castle Rock and running farther to the southeast. This option would add a new route running southeast from the Monahan Creek substation site through sparsely populated land, crossing the unincorporated community of West Side Highway next to SR 411, the Cowlitz River and I-5, and running through largely unpopulated land toward the east.

Central Options 1 and 2 would have no additional impacts since there are no parks or trails along these options. In addition, there would be **no** impact on the Riverfront Trail (East) from access road improvements under Central Option 2 because it would not cross the trail. There would be **no** impact on the Spirit Lake Memorial Highway at SR 504 from visual intrusions by either option (see Table 6-4 and Map 6-1A) because they do not cross the highway. Unauthorized target shooting at the Casey Road substation site is discussed in Section 6.2.3, Castle Rock Substation Sites.

6.2.5.4 Central Option 3



Central Option 3 would replace the Lewis River crossing near Ariel and a portion of the Central Alternative between Ariel and Venersborg, with a downstream river crossing and a new route running directly southeast from Ariel through rural residential areas toward Venersborg. Central Option 3 would have **no** impact on Bells Mountain Trail or the recreation resources within the Western Yacolt Burn Forest because this option does not cross these resources. This option does not directly cross the recreation resources near PacifiCorp's public recreation areas along the Lewis River (Merwin Park), but construction activities could disturb the quiet and scenic landscape of the recreation area. Because facilities would still be accessible, and no towers or right-of-way would be within the park, there would be **no-to-low** impact on these resources.

Tower construction for Central Option 3 would temporarily disturb about 0.2 acre of Moulton Falls Park. Less than 0.1 acre of the park would be permanently changed by towers, and an additional 0.7 acre would be changed by new and improved access roads. Tower construction would temporarily disturb less than 0.1 mile of the Lucia Falls/Moulton Falls Trail (a wide paved trail); towers would permanently alter less than 0.1 mile of trail, and less than 0.1 mile of the trail would be converted to a new access road.

Table 6-4 Central Alternative and Options—Permanent Impacts on Parks and Trails

Alternative and Options[1,2]	Recreation Resource	Towers[3]	New Access Roads[4]	Improved Access Roads[4]
Central Alternative	Parks (acres)	Washougal River Greenway (0.1)	Port of Camas-Washougal Marina (<0.1), Oak Park (<0.1)	Washougal River Greenway (0.2)
	Trails (miles)	--	--	Bells Mountain Trail (<0.1), Riverfront Trail (East) (<0.1)
Central Option 1	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	N/C	N/C	N/C
Central Option 2	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	N/C	N/C	Riverfront Trail (East) (-<0.1)
Central Option 3	Parks (acres)	Moulton Falls (+<0.1)	Moulton Falls (+0.1)	Moulton Falls (+0.6)
	Trails (miles)	Lucia Falls / Moulton Falls Trail (+<0.1)	Lucia Falls / Moulton Falls Trail (+<0.1)	Bells Mountain Trail (-<0.1)

Notes:

N/C – No net change from the action alternative.

1. The value for each option represents the net change from the action alternative. It was calculated as the total impacted acres or miles added by the option minus the total impacted acres or miles in the segments the option replaces.
2. No permanent impacts would occur in substation areas.
3. Includes rebuilt and new towers.
4. Includes access roads within and outside of the 150-foot right-of-way.

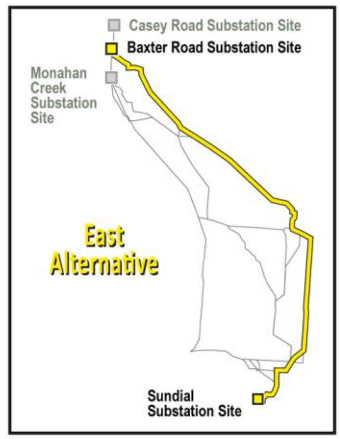
Sources: Clark County 2011d, Cowlitz Wahkiakum Council of Governments 2006, Metro 2011, USGS 2009

The route and access roads would require vegetation clearing for new right-of-way through the park. The project would visually intrude on the recreational experience of visitors to the park and trail. Impacts could be mitigated by repositioning the access road and tower away from the trail and minimizing vegetation removal near the trail as much as possible. A **high** impact would occur at Lucia Falls/Moulton Falls Trail because this recreation resource would be permanently altered.

Central Option 3 would also cross the Northern Clark County Scenic Drive at Northeast Cedar Creek Road and at Lucia Falls Road (see Table 6-4 and Map 6-1C). The project would be a visual intrusion into the drive's scenic views because, unlike the West Alternative, there is no existing right-of-way at these crossings. While motorist's views of cleared vegetation would be temporary and the transmission line would be high above the windshield view, the character of the drive at these locations would be different and permanent, a **moderate** impact.

6.2.6 East Alternative

6.2.6.1 Construction



Tower construction would temporarily disturb about 0.7 acre of the Washougal River Greenway and about 0.1 mile of the Tarbell Trail. Access to the Riverfront Trail (East) and the Jones Creek Trail might also be limited during construction where roads crossing the trails would be improved.

Construction would occur throughout the year, weather permitting. During peak use times (such as summer for general recreation, hunting season for hunting uses), temporary impacts on recreation resources would be **moderate**. During non-peak times (such as winter), temporary impacts on these resources would be **low**. Any temporary impacts on user experience from construction would be **low**. In addition, many parks in the surrounding area would be unaffected by the project and could provide additional recreation opportunities.

Similar to the Central Alternative, the East Alternative right-of-way would be near PacifiCorp's public recreation areas between Lake Merwin and Yale Lake, Goot Park, Larch Mountain Trail, and within the Western Yacolt Burn Forest (see Table 6-1; Maps 6-1C and 6-1D). Construction activities could disturb the quiet and scenic landscape of these recreation areas, but the facilities would still be accessible. No towers or right-of-way would be within these recreation areas, so **no-to-low** impacts on these resources would occur.

6.2.6.2 Operation and Maintenance

Required project facilities for the East Alternative would permanently occupy about 0.5 acre of recreation land. Of this total, 0.1 acre would be affected by towers, about 0.2 acre would be affected by new access roads, and 0.2 acre would be affected by improvement of existing access roads (see Table 6-5; impacts on the Washougal River Greenway, Port of Camas-Washougal Marina and Oak Park are discussed under 6.2.2, Impacts Common to Action Alternatives).

In addition, less than 0.6 mile of trails would be permanently crossed by towers, and new and improved access roads. Less than 0.1 mile of the Riverfront Trail would be converted to improved access road. Less than 0.1 mile of the Tarbell Trail would be converted to towers, and less than 0.5 mile of additional trail would be converted to new and improved access roads (see Table 6-5 and Maps 6-1C, 6-1D, 6-1E), a **high** impact since the trail would be permanently altered by the project. Impacts to the trail might be mitigated by adjusting locations of towers and roads or by moving portions of the trail. The impact on user experience would be **moderate** since the project would add an industrial, human-made element to views from the trail that could negatively affect the experience of recreationists.

Improved access roads would upgrade about 0.2 mile of the Jones Creek Trail (see Table 6-5; Maps 6-1D and 6-1E). This is a motorized trail, so the upgrades would add traffic to the trail and potentially improve the trail experience for ATV users by changing the road conditions (e.g., surface, width). The right-of-way would be west of the trail and could add an industrial, human-made element to the views from the trail that could negatively affect the experience of recreationists. The impact on user experience would be **moderate**.

The right-of-way for the East Alternative would cross the Tarbell Trail eight times, going through the middle of the trail's loop (see Map 6-1C). At the northern portion of the trail, five crossings would occur and the right-of-way would closely parallel the trail for about 1 mile. At the southern portion of the trail, three crossings would occur and the right-of-way would closely parallel the trail for about 1,500 feet. Less than 0.1 mile of the trail would be changed to towers and an additional 0.1 mile of the trail would be converted to new and improved access roads. The right-of-way, towers, and access roads would add an industrial, human-made element to the trail's views that could negatively impact the experience of recreationists. The access roads would also convert portions of a non-motorized trail to motorized uses, which may require moving parts of the trail. Because permanent alterations to the trail would be necessary, this would be a **moderate-to-high** impact. Visual and experiential impacts to the recreational user could be eliminated by relocating nearby sections of the trail away from the right-of-way.

Like the Central Alternative, the right-of-way would cross the Spirit Lake Memorial Highway (SR 504) and be a visual intrusion into the drives scenic views (see Section 6.2.5.2, Operation and Maintenance). This would be a **low** impact because the crossing is less than 1 mile from the SR 504 interchange with I-5 and is in more developed areas of the scenic drive. The transmission line could also visually intrude on the recreation experience at PacifiCorp's public recreation areas between Lake Merwin and Yale Lake, Goot Park, Larch Mountain Trail, and the Western Yacolt Burn Forest. However, no towers or right-of-way would be in these areas, so **no-to-low** impacts on these resources would occur. The Silver Star trailhead and trail system are inside the Silver Star Scenic Area of the Gifford Pinchot National Forest but outside the study area. The Silver Star trail climbs to the peak of Silver Star Mountain, about 2 miles east of the East Alternative. From the peak, the East Alternative would be visible to hikers and would visually intrude on scenic views of the area west of the peak. Because this could negatively impact user experiences, it would be a **moderate** impact.

Table 6-5 East Alternative and Options—Permanent Impacts on Parks and Trails

Alternative and Options[1,2]	Recreation Resource	Towers[3]	New Access Roads[4]	Improved Access Roads[4]
East Alternative	Parks (acres)	Washougal River Greenway (0.1)	Port of Camas-Washougal Marina (<0.1), Oak Park (<0.1)	Washougal River Greenway (0.2)
	Trails (miles)	Tarbell Trail (<0.1)	Tarbell Trail (0.1)	Jones Creek Trail (0.2), Riverfront Trail (East) (<0.1), Tarbell Trail (<0.1)
East Option 1	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	N/C	N/C	Riverfront Trail (East) (-<0.1)
East Option 2	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	Tarbell Trail (-<0.1)	Tarbell Trail (-0.1)	Bells Mountain Trail (+<0.1), Jones Creek Trail (-0.2), Tarbell Trail (-<0.1)
East Option 3	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	Jones Creek Trail (+<0.1)	Jones Creek Trail Connector A (+<0.1)	Jones Creek Trail Connector A (+0.3), Jones Creek Trail (-0.2)

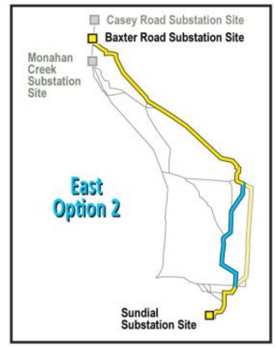
Notes:

N/C – No net change from the action alternative.

1. The value for each option represents the net change from the action alternative. It was calculated as the total impacted acres or miles added by the option minus the total impacted acres or miles in the segments the option replaces.
2. No permanent impacts would occur in substation areas.
3. Includes rebuilt and new towers.
4. Includes access roads within and outside of the 150-foot right-of-way.

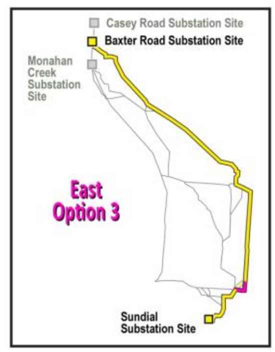
Sources: Clark County 2011d, Cowlitz Wahkiakum Council of Governments 2006, Metro 2011, USGS 2009

6.2.6.3 East Option 1



East Option 1 begins at the Monahan Creek substation site and would remove the portion of the East Alternative crossing the Cowlitz River north of Castle Rock. East Option 1 would use segments southeast of the Monahan Creek substation site that run through sparsely populated land, cross the Cowlitz River and I-5 and run through largely unpopulated land toward the east. East Option 1 would cause **no** impacts on the Riverfront Trail (East) or to the visual quality of the Spirit Lake Memorial Highway at SR 504 (see Table 6-5, Map 6-1A) because this option does not cross these resources. The East Option 1 route would be near Riverside Park (see Table 6-1, Map 6-1A), where the transmission line could visually intrude on the recreational experience of the park users, but there would be no change to access or to the park facility. This visual intrusion would be a **moderate** impact. Temporary impacts on user experience from construction dust and noise would be **low** at Riverside Park.

6.2.6.4 East Option 2



East Option 2 would replace a portion of the East Alternative between Yale and the rural residential areas north of Camas with a route farther to the west. East Option 2 would cross the Bells Mountain Trail, and part of the trail would also be changed to an improved access road (see Table 6-5, Map 6-1C). Construction and upgrades to the access road could cause noise, dust, and temporary limited access and use of the trail, which would be a **low** impact on Bells Mountain Trail user experience. Maintenance activities would have a **low** impact on the trail because these activities are infrequent. New right-of-way crossing Bells Mountain Trail would add an industrial, human-made element to the trail that could negatively affect the experience of recreationists. The impact on user experience would be **moderate**. East Option 2 would modify the route south of Yale Dam to go farther west and closer to the western edge of the Western Yacolt Burn State Forest. East Option 2 would not change impacts on the parks, but would eliminate direct or indirect impacts on Jones Creek Trail, Tarbell Trail, and Larch Mountain Trail (see Table 6-5, and Maps 6-1D and 6-1E) because this option does not cross these resources.

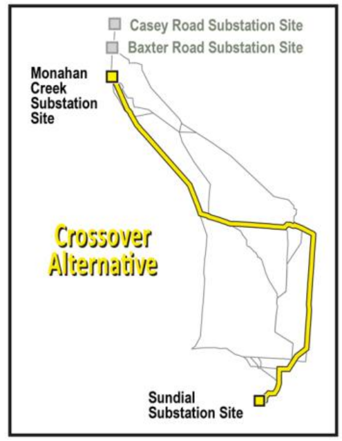
6.2.6.5 East Option 3

East Option 3 would replace a short portion of the alternative in unpopulated land with a new route through unpopulated land. East Option 3 would modify part of the route in the southern part of the Western Yacolt Burn State Forest. The right-of-way would cross the Jones Creek Trail and the Jones Creek Trail Connector A twice (see Maps 6-1D and 6-1E). Tower construction would temporarily disturb less than 0.1 mile of the Jones Creek Trail, with less than an additional 0.1 mile of the Jones Creek Trail converted to towers, a **low** impact (see Table 6-5). About 0.4 mile of Jones Creek Trail Connector A would be converted to new and improved access road (see Table 6-5). This option would eliminate impacts to a portion of Jones Creek Trail proposed to be used for an access road for the East Alternative (see Section 6.2.6.2, Operation and Maintenance) because it would not use that road and does not cross it. The

Jones Creek Trail and Jones Creek Trail Connector A are motorized trails; the upgrade to both trails would likely add traffic to the trails and potentially improve the trail experience for ATV users by changing the road conditions (e.g., surface, width). The right-of-way would cross the trails multiple times and would add an industrial, human-made element to the views from the trails that could negatively impact the experience of recreationists. This would be a **moderate** impact to these trails.

6.2.7 Crossover Alternative

6.2.7.1 Construction



There are no recreation resources along the northern portion of the Crossover Alternative.

Temporary impacts that would occur near PacifiCorp's public recreation areas along the Lewis River (Merwin Park) and Goot Park would be the same as those discussed for the Central Alternative because the portion of the Crossover Alternative where these resources are located is the same as the central portion of the Central Alternative.

Temporary impacts on the Washougal River Greenway, Tarbell Trail, and other parks and trails would be the same as those discussed for the East Alternative, because the portion of the Crossover Alternative where these resources are located is the same as the southern portion of the East Alternative.

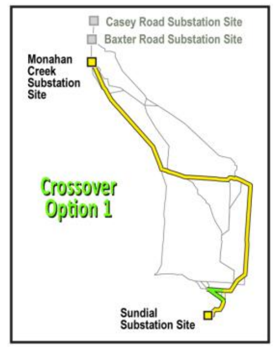
6.2.7.2 Operation and Maintenance

Required project facilities for the Crossover Alternative would permanently occupy about 0.5 acre of recreation land. Of this total, about 0.1 acre would be affected by towers, less than 0.2 acre would be affected by new access roads, and about 0.2 acre would be affected by improvement of existing access roads (see Table 6-6). In addition, less that 0.1 miles of trail would be affected by towers, and less than 0.4 miles would be affected by new and improved access roads.

Permanent impacts on the Washougal River Greenway, Tarbell Trail, and Jones Creek Trail would be the same as those discussed for the East Alternative (see Table 6-6). The Crossover Alternative would not impact the Riverfront Trail (East). The proposed right-of-way would be near PacifiCorp's public recreation areas along the Lewis River (Merwin Park), Goot Park, Larch Mountain Trail, and the Western Yacolt Burn Forest (see Table 6-1; Maps 6-1C, 6-1D, 6-1E). The transmission line could visually intrude on the recreational experience of the park and trail users and construction activities could disturb the quiet and scenic landscape of the recreation areas, but the facilities would still be accessible. No towers or right-of-way would be within these parks and this trail, so **no-to-low** impacts on these resources would occur. The Silver Star trailhead and trail system are inside the Silver Star Scenic Area of the Gifford Pinchot National Forest but outside the study area. The Silver Star trail climbs to the peak of Silver Star Mountain, about 2 miles east of the Crossover Alternative. From the peak, the Crossover Alternative would be visible to hikers and would visually intrude on scenic views of the area west of the peak. Because this could negatively impact user experiences, it would be a **moderate** impact.

Because the Crossover Alternative is close to trails and parks, the right-of-way would provide increased access to the forested areas of the parks and trails, primarily the western portion of the Yacolt Burn State Forest. This would cause increased access for hunting and ATV use on these otherwise inaccessible lands. The Yacolt Burn State Forest is open to motorized users during the summer, beginning on May 1 of each year, and closes in the fall when conditions become wet. Increased access to these areas by motorized users would be a positive impact during the summer months when motorized access is permitted. However, during the seasons when this area is closed to motorized users, improved access could allow unauthorized use, which would be a **moderate** impact. Signs, gates, and fencing may limit some potential impact.

6.2.7.3 Crossover Option 1



Crossover Option 1 would remove a portion of the alternative crossing north–south through rural residential areas north of Camas between NE Zeek Road and SE 23rd Street, and replace it with a route running west along an existing right-of-way until about NE 232nd Avenue, then southeast through open fields and more rural residential areas. Crossover Option 1 would modify part of the route north of Camas and Washougal. The right-of-way would follow part of the east boundary of Camp Currie (see Maps 6-1D and 6-1E). Tower construction would temporarily disturb about 1.5 acres of the camp. About 1.2 acres of the camp would be permanently converted to towers and new access roads (see Table 6-6). This would be a **moderate** impact on the camp because the right-of-way would follow existing right-of-way along the edge of the camp property.

6.2.7.4 Crossover Options 2 and 3

Crossover Options 2 and 3 would begin at the Baxter Road substation site and the new transmission line would cross sparsely populated land. Crossover Option 3 would require some additional new right-of-way. Crossover Options 2 and 3 would have no additional impacts since there are no parks or trails along either option.

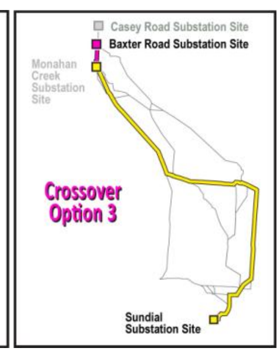


Table 6-6 Crossover Alternative and Options—Permanent Impacts on Parks and Trails

Alternative and Options[1,2]	Recreation Resource	Towers[3]	New Access Roads[4]	Improved Access Roads[4]
Crossover Alternative	Parks (acres)	Washougal River Greenway (0.1)	Port of Camas-Washougal Marina (<0.1), Oak Park (<0.1)	Washougal River Greenway (0.2)
	Trails (miles)	Tarbell Trail (<0.1)	Tarbell Trail (0.1)	Jones Creek Trail (0.2), Tarbell Trail (<0.1)
Crossover Option 1	Parks (acres)	Camp Currie (+0.3)	Camp Currie (+0.9)	N/C
	Trails (miles)	N/C	N/C	N/C
Crossover Option 2	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	N/C	N/C	N/C
Crossover Option 3	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	N/C	N/C	N/C

Notes:

N/C – No net change from the action alternative.

1. The value for each option represents the net change from the action alternative. It was calculated as the total impacted acres or miles added by the option minus the total impacted acres or miles in the segments the option replaces.
2. No permanent impacts would occur in substation areas.
3. Includes rebuilt and new towers.
4. Includes access roads within and outside of the 150-foot right-of-way.

Sources: Clark County 2011d, Cowlitz Wahkiakum Council of Governments 2006, Metro 2011, USGS, 2009

6.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2. The following additional mitigation measures have been identified to further reduce or eliminate adverse impacts on recreation by the action alternatives. If implemented, these measures would be completed before, during, or immediately after project construction unless otherwise noted.

- If desired by local governments or property owners, make sections of the right-of-way available for hiking and biking activities in selected areas.
- Coordinate with agencies managing recreation resources to inform the public about construction closures.
- Discuss locations of new towers, substations, and access roads with land managers and owners to avoid sensitive recreation areas.
- Place towers so that they would not be visible from nearby recreation areas where possible.
- Preserve existing vegetation (except weeds) 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 right-of-way crosses.
- Use techniques to re-vegetate cut and fill slopes on access roads and near tower locations.
- Minimize access road placement in highly sensitive recreation areas.
- Implement signage, gates, and fencing where necessary to prevent unauthorized access to previously inaccessible areas via the new right-of-way.

6.2.9 Unavoidable Impacts

Temporary construction activity (noise, dust, visual intrusions, traffic) would impact users' experiences at recreation sites and along the Columbia River and scenic drives. For all action alternatives, portions of a new transmission line would be introduced to areas where such infrastructure does not currently exist. Existing recreation areas at these locations would be altered by the placement of transmission towers, access roads, and right-of-way restrictions. Most permanent impacts on recreation would be experiential intrusions to the scenic character of the area from the transmission towers and lines (see Chapter 7, Visual Resources). These intrusions would occur at specific recreation sites and for general dispersed or informal recreational uses, such as the Lewis and Clark Trail Scenic Byway, Columbia River Gorge Scenic Byway, and the Columbia River.

6.2.10 No Action Alternative

Under the No Action Alternative, the project would not be constructed and there would be **no** impact on recreation. Authorized and unauthorized recreational activities would continue to occur in the project area. As the area continues to grow, more recreation resources may be developed. Dispersed recreation would likely continue to grow.