

Summary

This chapter summarizes the draft environmental impact statement (EIS) prepared for the I-5 Corridor Reinforcement Project:

- Purpose of and need for action
- Project overview, including the four proposed action alternatives and their optional route segments (“options”) and proposed new substations
- Affected environment and environmental impacts

S.1 Purpose of and Need for Action

S.1.1 Background

Bonneville Power Administration (BPA) is a federal agency within the U.S. Department of Energy that markets wholesale electric power generated by federal and private facilities to customers in the Pacific Northwest and nearby regions. To deliver this power, it operates and maintains more than 15,000 circuit miles of high-voltage transmission lines.

BPA has a statutory obligation to ensure it has sufficient capability to serve its customers through a safe and reliable transmission system. The Federal Columbia River Transmission Act directs BPA to construct improvements, additions, and replacements to its transmission system that the BPA Administrator determines are necessary to provide service to BPA’s customers, maintain electrical stability and reliability, and integrate new power sources (16 U.S.C. § 838b). If there is not enough available transmission capacity on the system to serve growing demand and accommodate new transmission requests, new transmission facilities may be proposed, subject to appropriate environmental review under the National Environmental Policy Act (NEPA).

S.1.2 Need for Action

Based on over a decade of studies, BPA has identified a need to increase the long-term electrical capacity and transfer capability of its 500-kV transmission system between the Castle Rock, Washington area and the Troutdale, Oregon area. This portion of BPA’s transmission system (known as the SOA, or South of Allston, path) serves, in part, the Portland, Oregon-Vancouver, Washington, metropolitan area (metro area). The SOA path is becoming more and more congested because of continually increasing loads in the metro area. The last major BPA high-voltage transmission line in the southwest Washington/northwest Oregon area was built over 40 years ago. Since then, the population in this area has more than doubled and electrical demand (load) has continued to increase.

In addition, power flow patterns on BPA’s transmission system are shifting and stressing the system in ways not originally envisioned. This has led to increased congestion on the SOA path in particular during the summer months because of a variety of factors including growing summer peak loads in the metro area, new generating plants interconnecting 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.

When the growing local summer peak load is combined with traditional high air conditioning loads in California and the Southwest, the probability that the SOA path will exceed its operating limit during the summer months increases. BPA's current analysis of load forecasts, transmission system configuration, summer operating conditions, and other factors that influence transmission system capacity indicates that the existing SOA path's capacity will likely be reached by spring 2021. 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.

In addition, Network Open Season (NOS) marketing processes conducted by BPA in 2008, 2009, 2010, and 2013, identified new firm transmission service requests to use the SOA path, which BPA is unable to accommodate because of a lack of available firm capacity on that path. Under its Open Access Transmission Tariff (OATT), BPA must investigate actions it could take, including adding infrastructure, to provide access to the transmission system in response to requests for service.

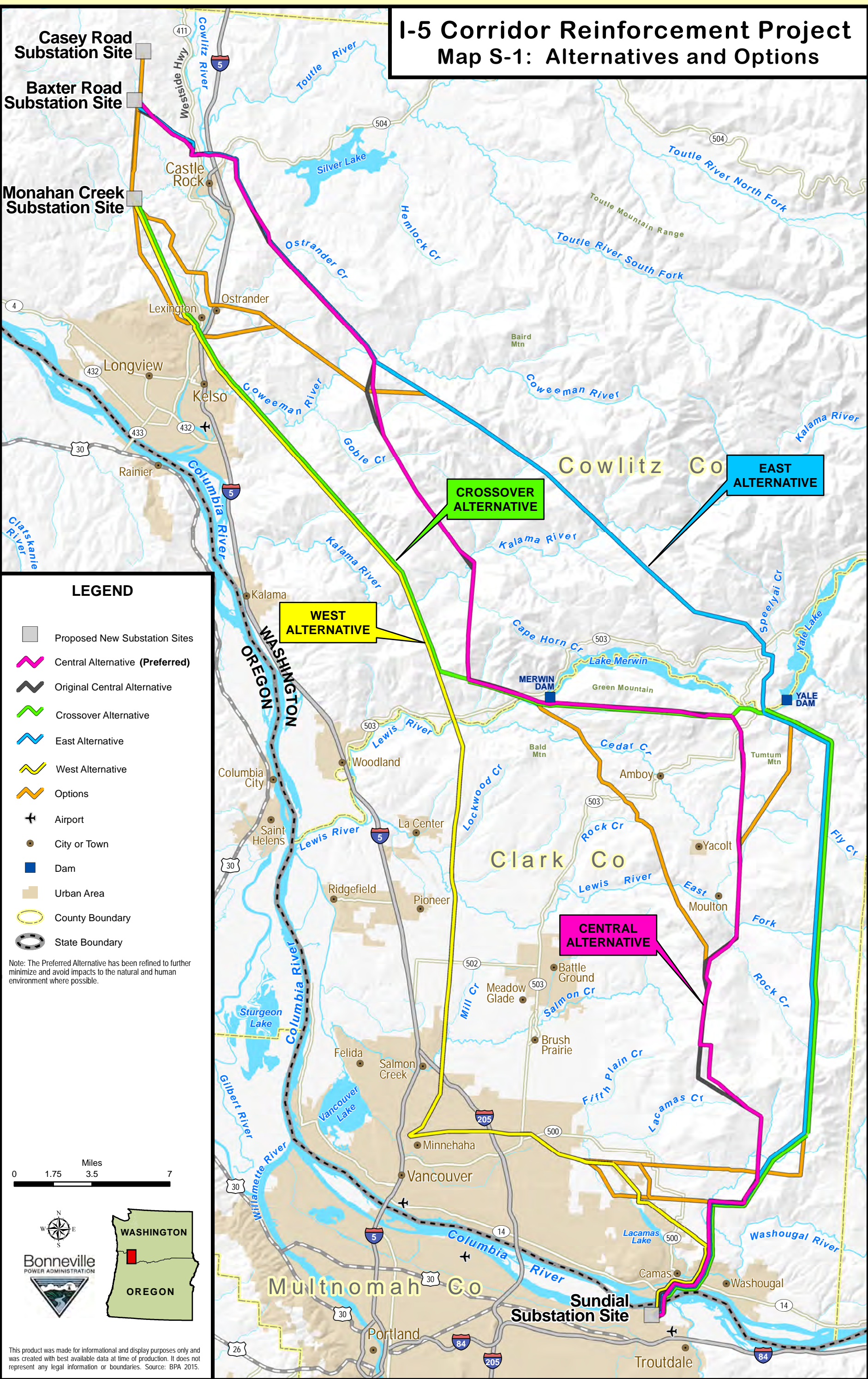
For many years, BPA has taken several steps to reduce congestion on the transmission system and maintain system reliability in the I-5 corridor without building new lines. BPA has upgraded existing facilities that affect the available capacity of the SOA path and initiated operating procedures to maximize the use of existing transmission line capacity in this area. However, these operational procedures do not create additional capacity on the system and cannot effectively mitigate the stresses on the system without causing other problems, such as needing to rapidly disconnect large amounts of generation and curtailing load (loss of power to many types of users of power) if replacement power cannot be found or delivered. In the future, preserving the reliability of the SOA path by using these operational procedures will become even more difficult and less effective because of the continually growing economy and population in the metro area and the increasing amount of industries relying on steady, uninterrupted power in the region.

Over the past several years, BPA also has been looking into the feasibility of using a variety of other non-wires measures – such as generation redispatch, energy efficiency and demand response – to help mitigate congestion and maintain reliability of the SOA path, potentially to the extent that construction of a transmission line could be significantly deferred or perhaps even indefinitely avoided. To date, however, BPA has been unable to identify any combination of non-wires measures that would address the reliability and congestion issues on the SOA path in the long-term and that are operationally, commercially, and economically feasible.

Nonetheless, BPA recognizes that non-wires technologies are evolving. BPA thus is continuing to separately investigate and evaluate the feasibility and cost-effectiveness of generation redispatch and other non-wires measures to help address reliability of the SOA path. These measures are being tested not only for their ability to “bridge the gap” between the project need date and the energization date for a new line, but also to explore whether they could realistically defer the project need, whether in the short term, or even for the long term or indefinitely.

Based on these considerations, BPA is proposing to build a 500-kilovolt (kV) lattice-steel-tower transmission line that would run from a new 500-kV substation near Castle Rock, Washington, to a new 500-kV substation near Troutdale, Oregon (see Map S-1). BPA is considering four action alternatives (transmission line routes, each with optional route variations), three sites for the

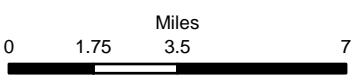
I-5 Corridor Reinforcement Project Map S-1: Alternatives and Options



LEGEND

- Proposed New Substation Sites
- Central Alternative (Preferred)
- Original Central Alternative
- Crossover Alternative
- East Alternative
- West Alternative
- Options
- Airport
- City or Town
- Dam
- Urban Area
- County Boundary
- State Boundary

Note: The Preferred Alternative has been refined to further minimize and avoid impacts to the natural and human environment where possible.



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Map S-1: Alternatives and Options

proposed substation near Castle Rock, and one site (with two options) for the proposed substation near Troutdale.

In meeting the need for action, BPA will attempt to achieve the following purposes: using ratepayer funds responsibly and efficiently, minimizing impacts to the natural and human environment, maintaining BPA transmission system reliability and performance, and helping BPA meet its statutory and contractual obligations, using ratepayer funds responsibly and efficiently, and minimizing impacts to the natural and human environment. (For summaries and comparisons of how each action alternative and option meets these criteria, see Tables 4-9, 4-10, and 4-11 in Chapter 4.)

In addition to service and reliability benefits, the project's additional capacity would benefit BPA's transmission system and customers in other ways. The proposed new line and substations would help redistribute the flow of power, which would increase the capacity of the overall system, and would also provide the transmission flexibility required to bring more renewable wind power from the east to population centers along the I-5 corridor. The project would also allow BPA to schedule outages on existing lines, which is necessary to perform critical maintenance but currently challenging to arrange.

S.1.3 Public Involvement

During the initial scoping period of this EIS (fall 2009), 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. Information about the project was publicized by publishing notices in the *Federal Register*, mailing information packets to more than 9,500 landowners and other interested groups or individuals in the project vicinity, holding six public open-house style meetings (attended by more than 2,500 people), establishing a project website, and placing ads in and sending press releases to local media. BPA invited comments through several methods, including online, through a dedicated voice-messaging system, comment forms mailed or faxed, and written and verbal comments collected at public scoping meetings. All comments received were posted on the project's website.

Based on comments from more than 7,000 people and additional studies of the transmission system, BPA refined the proposed transmission line routing alternatives. In late summer 2010, BPA hosted four additional public meetings to present updated project information, publicized by placing ads in and sending press releases to local media. In the period following (until release of the Draft EIS in November 2012), BPA staff met with property owners, neighborhood groups, community organizations, elected officials, Tribes, state agencies and other interest groups, and hosted additional public meetings. 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.

Release of the Draft EIS was publicized through direct notification of more than 13,000 landowners, other interested individuals, Tribes, elected officials, organizations, businesses, and agencies. BPA mailed or emailed a project update newsletter to the project mailing list, posted information on the project website, and sent press releases to or placed ads in local media. BPA invited comments via email, U.S. mail, faxes, voicemail or at one of six drop-in meetings (held in December 2012) or six public meetings (held in January-February, 2013). More than 662 communications were received before the comment period closed on

March 25, 2013, from which BPA identified and responded to 2,859 comments. (Comments and responses can be found in Volume 3 [3A through 3H].)

In June 2013, BPA notified all people on the project distribution list that a comment summary was available on the project website and that BPA would be attending multiple local fairs to provide project information and answer questions. For most of 2013 and 2014, project team members met with landowners along the Preferred Alternative (Central Alternative using Central Option 1) to further refine project design. In June 2014, BPA issued an updated map showing adjusted tower and access road locations that reduce impacts along the Preferred Alternative. As the Final EIS was getting closer to public release, BPA released a Project Update in April 2015 reminding the public of the project schedule and release of the Final EIS at the end of the year.

S.2 Project Overview

The proposed 500-kV transmission line would run from a new 500-kV substation near Castle Rock, Washington to a new 500-kV substation near Troutdale, Oregon, crossing through Cowlitz and Clark counties, Washington, and Multnomah County, Oregon. BPA is considering four routing alternatives for the transmission line: a West Alternative, Central Alternative, East Alternative and Crossover Alternative (see Map S-1). Each has three additional optional routes (“options”) that replace a portion of the alternative and each connects to a new substation (to be called Castle Rock Substation) at one of three sites: Monahan Creek, Baxter Road or Casey Road. All would end at a new Sundial Substation near Troutdale, which would be built west of Sundial Road on one of two lot options (Lot 11 Option or Lot 12 Option) within the Port of Portland’s industrial complex. All alternatives and options would cross the Columbia River.

The four action alternatives (including options) vary in length from about 67 to 80 miles, and cross mostly private property, some federal and state owned land, and municipal lands owned by cities, counties, and the Port of Portland. The West Alternative would be located in more urban and developed areas and would use mostly existing right-of-way, while the Central and East alternatives would be located in more rural and undeveloped areas on mostly new right-of-way. The Crossover Alternative would use a combination of existing and new right-of-way.

Project construction 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. In general, BPA needs a 150-foot wide right-of-way easement for a new 500-kV transmission line, and a 50-foot wide easement for new access roads. BPA would purchase fee ownership in up to about 100 acres for each new substation; exact acreage would depend on the site selected.

About 360 to 390 500-kV lattice steel towers would be constructed. These would primarily be single- and double-circuit towers, with some triple-circuit towers possible depending on the alternative or option selected. Typically, the single-circuit 500-kV towers are between 120 and 275 feet tall; double-circuit 230-kV towers are between 125-and 210-feet tall. Towers proposed for the Columbia River crossing would be up to 266-feet tall (500-kV towers) or 305-feet tall (230-kV double-circuit towers).

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. Roads would be built within the transmission line right-of-way as much as possible if terrain and land use allow. In

some areas, new roads would be required; in others, existing roads would be improved. Between 63 and 207 miles of new and improved roads would be required, depending on the alternative and/or option selected. In coordination with landowners, BPA installs gates at entrances to access roads to prevent public access to private lands and the transmission line right-of-way.

For all action alternatives, fiber optic cable would be installed on the towers to provide a communication link between the new substations and BPA's power system, and dispatchers and maintenance crews. Equipment changes would be made inside control houses at three BPA substations.

If a decision is made to build the project, construction would take about 5 years (up to 3 years for each substation). The transmission line and substations would be built by two or more construction contractors. A typical transmission line construction crew has 50-60 workers (70 to 100 at the peak of construction). A typical substation construction crew has 20-30 workers (40-50 at the peak of construction).

BPA is also considering a No Action Alternative and, as mentioned, is exploring the feasibility of non-wires solutions that could defer the need for the line.

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.

S.2.1 Proposed Action Alternatives

From north to south, each of the four action alternatives would begin at a new substation near Castle Rock and end at the proposed Sundial Substation in Oregon. (Proposed substation sites are summarized first below.) Each action alternative has three route options—where some line segments are replaced with different ones—to provide routing flexibility in certain locations.

S.2.1.1 Substations

Each of the project's substations would be built on a large parcel purchased by BPA. They would not be used to transform voltages and so would not have transformers. Instead they would operate as switching stations and would have equipment for controlling power flow only. Each substation would include a control house and equipment inside a fenced substation yard, with a 10-foot-wide gravel buffer outside the fence.

- **Castle Rock Substation (three possible options):**
 - Casey Road site. This site is 2 miles west of Westside Highway, northwest of Castle Rock and, like the other two, adjacent to several BPA 500- and 230-kV transmission lines. The site would use 13.4 acres of Washington Department of Natural Resources-managed (WDNR) property in a cleared, hilly area. A 2.5-acre detention pond would be built north of the substation to collect and filter substation water runoff. West of the detention pond, an area would be set aside for spoils from site excavation. About 3.2 miles of new road and 0.3 mile of improved road would be needed to access the site from Westside Highway.

BPA would purchase in fee 100 acres for this site, which is part of the Preferred Alternative.

- Baxter Road site. This site is located 4 miles north of the Monahan Creek substation site, 4 miles west of Westside Highway, northwest of Castle Rock, and adjacent to several BPA transmission lines. The 17-acre site is Sierra Pacific Industries-owned forest land surrounded by forested wetlands. A 2.5-acre detention pond would be built just south of the site. About 2 miles of existing road would be improved for access.
- Monahan Creek site. This site is near the intersection of Monahan and Delameter roads 3.5 miles west of Castle Rock. Currently privately owned grazing land located among rural residences, the 14.4-acre site is next to several BPA transmission lines. A 2.25-acre detention pond would be built at the intersection of Delameter, Garlock, and Otter roads. About 0.1 mile of new road would be built for access from Delameter Road.
- **Sundial Substation (two possible options).** The project would end at one of two lots located along Sundial Road, within the Troutdale Reynolds Industrial Park located about 1 mile north of Interstate-84 in Troutdale, Oregon. Lots 11 and 12 are part of a light-industrial complex owned by the Port of Portland. BPA’s existing Troutdale Substation is east of the two lots and Sundial Road. Non-BPA substations are east of Lot 12 and north of Lot 11. Several BPA and non-BPA transmission lines run in or near the lots.

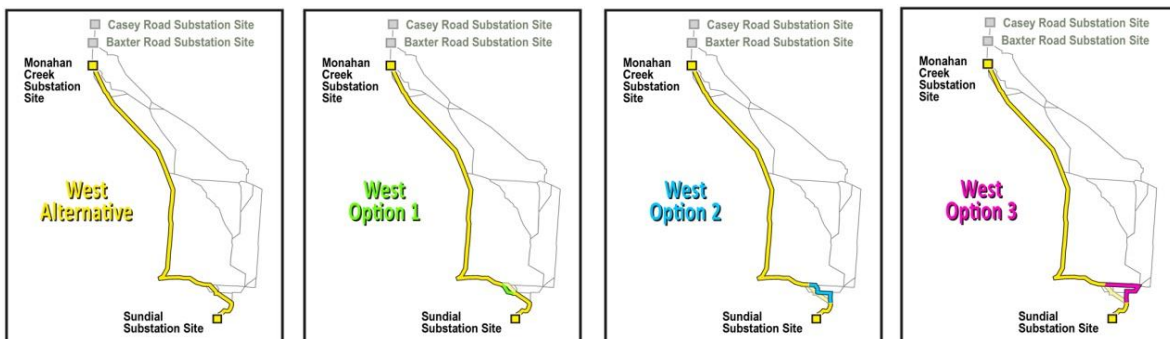
Of the two options, Lot 11 is the preferred option. Lot 11 is 22.3 acres, of which 13 acres would be used for the substation. It would require a new access road about 0.25 mile long from Sundial Road and new spur roads to access new towers. No detention pond is required. Lot 12 is 40.1 acres, of which the substation would use 17.3 acres. It would be accessed by about 0.5 mile of new road and also include new spur roads to towers.

S.2.1.2 Transmission Line Alternatives and Options

The transmission line alternatives and options use a combination of existing and new rights-of-way. The alternatives and options cross through varying proportions of different land uses. Specific route segments included in each alternative and its options are listed in Chapter 2.

West Alternative and Options

The West Alternative begins at the Monahan Creek substation site west of Castle Rock and runs 67.5 miles southeast to the Sundial Substation site in Oregon. The options add slightly to the



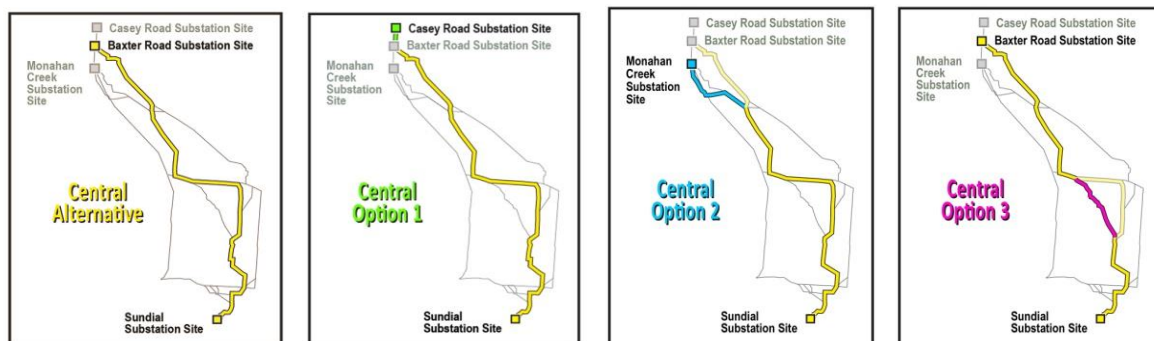
net length: West Option 1, +0.1 mile; West Option 2, +1.6 miles; West Option 3, +5.6 miles. About 63 miles of new and improved access roads would be required.

Most of the West Alternative (98 percent) uses existing BPA right-of-way (paralleling existing lines) which crosses the highest proportion (17 percent) of populated area among the action alternatives—about 7 percent urban/suburban and 10 percent rural. It crosses the northeast tip of the Longview/Kelso urban area and several miles of the Vancouver urban area farther south; most of the rural area crossed is undeveloped. Beyond the right-of-way—from the right-of-way edge out to 1,000 feet on either side of the line—the West Alternative would cross near a greater percentage of property zoned for residential use than the other alternatives: about 46 percent is zoned residential

The West Alternative would cost about \$385 million based on a 2012 estimate and 2012 dollars. 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. For the West Alternative and all other action alternatives, using any of the options identified for the alternative would have about the same estimated cost as identified for the alternative. For example, the West Alternative using West Option 1 would have about the same estimated cost as the West Alternative.

Central Alternative and Options

The Central Alternative begins at the Baxter Road substation site northwest of Castle Rock and immediately heads east, crossing north of Castle Rock before running south and east to the Sundial Substation site, a total of about 78.2 miles. The options vary the net length only slightly: Central Option 1 (part of the Preferred Alternative, begins at the Casey Road substation site), +2.2 miles; Central Option 2 (begins at Monahan Creek substation site), -2.3 mile; Central Option 3, -5.8 miles. About 160 miles of new and improved access roads would be required.



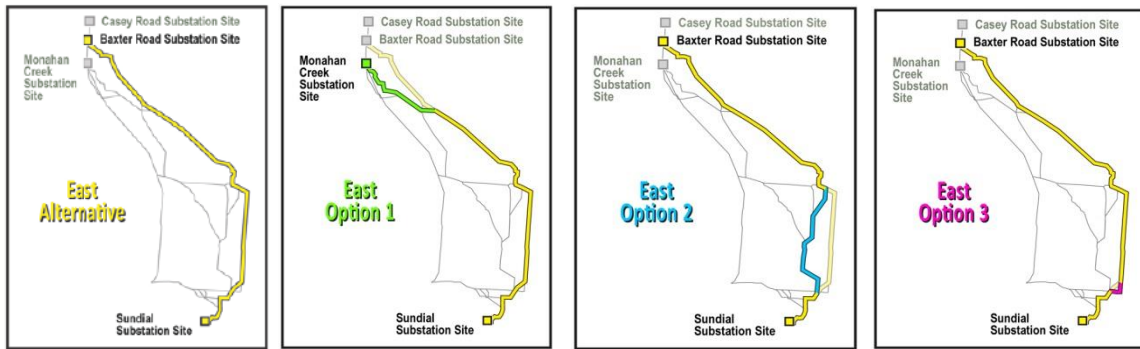
The Central Alternative would primarily use new right-of-way (about 90 percent) that would run mostly through forest land (around 90 percent of land use crossed). Only 3 percent of the land crossed by the right-of-way would be populated—1 percent urban/suburban, primarily north of Castle Rock, and 2 percent rural (exception: Central Option 2 would cross 4 percent rural land). About 14 percent of the land beyond the right-of-way (out to 1,000 feet on both sides) of the Central Alternative is zoned for residential use.

In 2012, it was estimated that this alternative would cost about \$459 million in 2012 dollars. This estimate was updated in 2015 to about \$750 million based on 2015 dollars. This updated estimated cost information is available because, since 2012, BPA has continued to refine various

aspects of the Central Alternative using Central Option 1, as the agency's Preferred Alternative. This has led to more detailed cost information about this alternative. Though the potential costs of the other alternatives have not been expressly updated in this EIS, it can be reasonably assumed that the incremental increase from 2012 to 2015 in estimated cost of each of the other alternatives would be roughly proportionally similar to the increase identified for the Central Alternative.

East Alternative and Options

Like the Central Alternative, the East Alternative begins at the Baxter Road substation site and heads east, crossing north of Castle Rock, but then continues farther east before turning south around Yale Dam to proceed to the Sundial Substation site, a total of 75.5 miles. The options vary net length slightly: East Option 1 (begins at Monahan Creek substation site, crossing south of Castle Rock), -1.8 miles; East Option 2, +1 mile; East Option 3, +1.1 miles. About 207 miles of new and improved access roads would be required.



The East Alternative would primarily use new right-of-way (about 90 percent) that would run through predominantly forest land (around 90 percent of land use crossed). Only 3 percent of the land crossed by the right-of-way would be populated—about 1 percent urban/suburban, primarily near Castle Rock, and 2 percent rural (exception: East Option 1 would cross 4 percent rural land). About 7 percent of the land beyond the right-of-way (out to 1,000 feet) of the East Alternative is zoned for residential use. Estimated cost is \$489 million (2012 estimate and dollars).

Crossover Alternative and Options

The Crossover Alternative begins at the Monahan Creek substation site west of Castle Rock and runs 74 miles to the Sundial Substation site. The options add slightly to net length: Crossover



Option 1, +5.2 mile; Crossover Option 2 (begins at Baxter Road substation site), +4.3 miles; Crossover Option 3 (begins at Baxter Road substation site), +4.2 miles. About 127 miles of new and improved access roads would be required.

Though the Crossover Alternative shares a portion of the West Alternative's northern route, running along existing right-of-way, it turns east above the Lewis River and south below Yale Dam, requiring about 55 percent new right-of-way that would mostly cross forest land (about 76 percent). About 8 percent of the land crossed by the right-of-way would be populated—about 1 percent urban/suburban, primarily in Longview, and 7 percent rural. About 14 percent of the land beyond the right-of-way (out to 1,000 feet) of the Crossover Alternative is zoned for residential use. Estimated cost is \$442 million (2012 estimate and dollars).

S.2.2 No Action Alternative

Under the No *Action* Alternative, BPA would not build the proposed I-5 project, including the new 500-kV transmission line and substations and upgrades at 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 operational procedures to maximize use of existing capacity, transmission system congestion along this path would be expected to increase, making it difficult for BPA to preserve system reliability and risking unplanned outages. 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.

S.3 Environmental Impacts

Construction and installation of lattice-steel towers, new access roads and new substations, and related counterpoise installation, pulling/tensioning sites, helicopter fly yards, danger tree removal, and staging areas, would have temporary and permanent impacts on area resources. Construction would require heavy vehicles, helicopters, and equipment such as cranes and bulldozers and would create dust, noise and potential traffic delays that could temporarily disturb local residents, motorists, wildlife, and the natural environment. Permanent impacts would include removing some land from current uses or restricting its future uses and clearing vegetation and trees, which could cause soil compaction and erosion and disturb habitat for fish and wildlife. The transmission line would span the area's major rivers and streams, but some fish-bearing streams and wetlands would be affected by vegetation clearing, access road crossings and tower sites. Besides these physical impacts, some new towers and roads would be visible and could affect scenic views near residential, rural residential, or recreation areas.

This section summarizes the proposed project's environmental impacts on natural resources in the area. Impacts unique to each proposed substation, alternative, and option are summarized following a brief look at common impacts (e.g., ones that would occur regardless of action alternative or option selected). Impact levels and assessment methodology are defined in each resource chapter. For comparison purposes, these impacts have been compiled in Tables 4-10 and 4-11 in Chapter 4. Mitigation measures to lessen impacts are incorporated in the project's design (see Table 3-2 in Chapter 3); additional recommended measures are listed at the end of each resource chapter.

S.3.1 Land

S.3.1.1 Affected Environment

For project analysis purposes, the project area includes lands at and near proposed project facilities in Cowlitz and Clark counties, Washington, and Multnomah County, Oregon. This includes unincorporated portions of these counties and the cities 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. Land potentially affected by the project is predominately privately owned, with some public ownership scattered throughout. Private land includes small parcels or holdings by individual landowners, and large parcel or holdings owned by PacifiCorp and private commercial timber companies such as Weyerhaeuser Columbia Timberlands LLC, Sierra Pacific Industries, and Weyerhaeuser Company. Public landowners include federal and state agencies and city and county governments. Public agencies that own or manage lands directly crossed by the project include WDNR, the city of Camas, and the Port of Portland.

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). Cowlitz County has large areas of mostly forested open space and timber production, with some scattered agriculture and rural residential land. Clark County also has large areas of forested open space and timber production, but more agriculture and rural residences. Higher density urban/suburban areas occur in and around the cities of Kelso and Longview to the north and in the greater Portland-Vancouver metro area to the south, which includes land in Multnomah County. Some action alternatives also cross low-density suburban residential areas.

West Alternative and Options

This alternative, the closest to I-5, would pass through the cities of Kelso, Vancouver, Camas, Washougal, Troutdale, and Fairview; the Longview urbanized area; the urban growth boundaries of Vancouver and Washougal; and the Portland metro area. In some areas, it would cross unincorporated land with rural, agricultural and open space uses, but it would cross significantly more urban/suburban areas (including residential, commercial and industrial uses) than the other action alternatives. However, it would occupy substantially more existing transmission line right-of-way (66 miles, almost 98 percent of the total distance) than the other action alternatives. More than half of the land within the existing right-of-way (64 percent) is privately-owned. BPA owns another 30 percent within its existing right-of-way and the remaining is managed by WDNR (1 percent) or other public entities (5 percent).

Central Alternative and Options

This alternative would pass through the cities of Camas, Washougal, Troutdale, and Fairview, as well as unincorporated land, crossing less urban/suburban land (mostly near the northern and southern ends) and more rural, agricultural, forested open space, and timber production land than the West Alternative. The alternative parallels existing lines for about 8 miles (10 percent of its total distance), requiring mostly new right-of-way. Most land crossed is privately owned (71 percent); WDNR (27 percent) and the city of Camas (2 percent) manage or own the remainder.

East Alternative and Options

Similar to the Central Alternative, this alternative would pass through the cities of Camas, Washougal, Troutdale, and Fairview, as well as unincorporated land, crossing less urban/suburban land (mostly near the northern and southern ends) and more rural, agricultural, forested open space, and timber production land than the West Alternative. The alternative parallels existing lines for about 8 miles (11 percent of its total distance), requiring mostly new right-of-way. Most land crossed is privately owned (85 percent); WDNR (14 percent) and city and county governments (less than 1 percent) manage or own the remainder.

Crossover Alternative and Options

This alternative would pass through the cities of Kelso, Camas, Washougal, Troutdale and Fairview; the Longview urbanized area; and unincorporated land. It crosses less urban/suburban, agricultural, and open space land, more timber land, and about the same amount of rural land as the West Alternative. The alternative parallels existing lines for about 33 miles, 45 percent of its total distance. Most land crossed is privately owned (79 percent); WDNR (20 percent) and city and county governments (less than 1 percent) manage or own the remainder.

S.3.1.2 Impacts Common to Action Alternatives

During the project's 5-year construction period, everyday activities in urban/suburban and rural areas could be interrupted for one or two weeks at a time (longer periods if near substation construction) by construction workers; noise and dust from heavy equipment, helicopters, or rock blasting; and by land access restrictions for safety and security. For developed urban/suburban and rural land uses, construction activities would predominantly have temporary **low** impacts for a few weeks, with the exception of permanent **low-to-moderate** impacts on landowners who may be required to remove encroachments (buildings, vehicles, fences, etc.) within rights-of-way.

For timber production land use, construction would have temporary **no-to-low** impacts because, though trees would need to be cleared within or near the line's right-of-way, construction staging areas, helicopter fly yards, and conductor pulling and tensioning sites, BPA would coordinate with harvest schedules and landowners would be compensated for trees cleared earlier than planned. Similarly, construction would have temporary **low** impacts on agricultural land uses because landowners would be compensated for any crop losses caused by clearing and BPA contractors would coordinate with farmers to minimize disruption to grazing or other farm activities. Where open space throughout the project area is used for recreation or by adjacent rural residents for agriculture (e.g., gardens), the intrusion by construction activities could have temporary **low** impacts; elsewhere, where open spaces are used for timber production, construction would have **no-to-low** impacts for the reasons cited above.

Once constructed, the line, access roads and substations would permanently remove land from use or limit land uses and activities within the right-of-way. BPA would negotiate and purchase easements for new right-of-way from landowners with affected properties. These easement documents would describe right-of-way use limitations for the underlying landowner. In urban/suburban and rural areas, permanent use limitations by the line would have permanent **low-to-moderate** impacts on landowners. Where BPA would acquire new easements for right-of-way where none have previously existed, there could be some permanent **high** impacts.

Likewise, permanent impacts could be **low-to-high** where new line easements create use limitations off (but adjacent to) existing right-of-way, depending on whether that use could continue or if the easement would cause “stranded uses” of the property. New and improved access roads would have **moderate** impacts in urban/suburban areas, where they are usually compatible uses, but potential **moderate-to-high** impacts in rural areas, depending on existing or planned development. If unauthorized users gain access to the new (line or road) easements, impacts could be **low-to-high**, depending on land use and proximity of houses.

In timber production areas, conversion of land to new rights-of-way could have permanent **high** impacts on some landowners, despite compensation, due to permanent disruption of forest practices, such as making certain timber stands inaccessible or economically infeasible to harvest (stranded use). Outside the right-of-way, where staging areas, helicopter fly yards, danger tree, and conductor pulling and tensioning areas would need to be cleared during construction, landowners could later replant, causing temporary **no-to-low** impacts on timber production uses.

Agricultural uses can continue within rights-of-way under certain conditions. In general, compatible cultivated crops may remain in existing right-of-way or be allowed in new right-of-way under the transmission line between towers and roads. However, orchards and other incompatible natural or planted vegetation would likely not be allowed within the right-of-way, a **high** permanent impact if they already exist or are planned for these areas. Where agricultural land may be stranded due to the project, the permanent impact would also be **high**. Livestock grazing is usually allowed to continue within rights-of-way, although the line and roads could have **low-to-high** impacts on grazing depending on the size of the property, amount of grazing land and any limitations posed by the project.

Permanent conversion of forested open spaces to non-forested open space (utility use) would have **moderate-to-high** impacts. Impacts on compatible open space activities, such as recreation, would be **moderate** because these could continue. In forested open spaces being used for timber production, the same **high** impacts could occur as described above for timber production.

For all land-uses, there would be temporary **no-to-low** impacts from operation and maintenance activities (traffic, noise, dust and vegetation management) in and around rights-of-way and substations.

Sundial Substation Site. Because the site (Lot 11 or 12) would be within the Port of Portland’s Troutdale Reynolds Industrial Park, temporary construction impacts of the substation and access road (including spur roads) would be **low**. Similarly, there would be a **low** permanent impact on land use and ownership, because both lots are currently for sale and intended for industrial use. Operation and maintenance activities would have **no** impact on the industrial park and nearby uses.

S.3.1.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

Regardless of the substation site, BPA would purchase in fee ownership up to 100 acres, having a **high** impact on landownership. Landowners or managers affected would be WDNR (Casey Road site), Sierra Pacific (Baxter Road site) or some private residents (Monahan Creek site).

Impacts on land use would also be **high** on any site. The Casey Road site would remove about 100 acres of land from mostly timber production use; the Baxter Road site would remove about 47 acres from mostly timber production, and the Monahan Creek site would affect up to 67 acres of mostly rural and open space lands used for grazing and rural residences. Final substation design could reduce acreage impacts.

Due to the proximity of residences to the Monahan Creek site, construction could have temporary **moderate** impacts on nearby residents or commuters who use Delameter Road because substation construction could take up to 3 years, depending on site conditions.

West Alternative

Because this alternative would cross more urban/suburban areas than the other action alternatives (7 percent vs. 1 percent), it passes through the greatest quantity of areas with high densities of multi- and single-family residential units per acre and the highest number of homes within 500 feet of the edge of right-of-way (more than 3,000). However, it does so on predominantly existing right-of-way, requiring only about 401 acres of new easements for transmission line right-of-way, and new and improved roads (less if BPA already owns easement rights on some roads). The West Alternative would cross the lowest percentage (64 percent) of private land compared to the other alternatives because 30 percent of the land for this alternative is already owned by BPA within the existing right-of-way. Of the remaining (publicly held) acreage, WDNR manages 1 percent and 5 percent is owned and/or managed by other public entities.

The West Alternative would occupy about 1,097 acres of existing right-of-way and require about 127 acres of additional new right-of-way along and adjacent to existing right-of-way. About 104 acres (82 percent) of this new right-of-way would be on open space land. Outside the new right-of-way, an additional 131 acres (including 81 acres of open space) on adjacent existing BPA rights-of-way would be affected by project-related activities, such as removing or replacing existing towers or establishing new or improved roads of-way edge.

As for all action alternatives, portions of the line or roads built on existing easements would cause **low-to-moderate** impacts on adjacent landowners; in areas requiring new right-of-way and subsequent easements restricting use, impact on landowners would be **high**. Because the West Alternative would occupy 98 percent existing right-of-way and has a larger proportion of existing access roads, it would have the least overall impact on landowners of the action alternatives. At the same time, the existing easement and access roads either cross or are adjacent to more private land held by a large number of small landowners.

The West Alternative would have the following permanent impacts on land uses:

Urban/suburban (7 percent of area crossed, most of the action alternatives)—potential **high** impacts on existing land uses within 2 acres of new right-of-way due to clearing and use restrictions, although the acreage affected is small and impacts would be **low-to-moderate** where existing uses are compatible (e.g., low-growing landscaping). Restrictions on new development adjacent to new right-of-way would have **no-to-high** impact, depending on development plans. Impacts by new roads built outside the new right-of-way (on other existing BPA rights-of-way) would be similar to those of the transmission line (**no-to-high**) while improved roads and related project activities occurring outside the the right-of-way would have **no** impacts because roads are compatible uses within urban/suburban areas and could aid

future development. In total, new and improved roads and project activities occurring on other existing BPA rights-of-way would affect 6 acres. **Low-to-moderate** impacts would occur in a larger area of urban/suburban land (about 89 acres) on existing right-of-way where, because it has long been vacant, some adjacent landowners have installed ornamental landscaping or structures (residential or commercial/industrial) that would have to be removed.

Rural (7 percent of area crossed, most of the action alternatives)—potential **high** impacts within 4 acres of new right-of-way due to clearing and land use restrictions. Restrictions by new line right-of-way and new roads on adjacent new development could have **no-to-high** impacts. **Low-to-moderate** impacts on 81 acres of existing right-of-way because, despite initial vegetation clearing and removal of incompatible uses, most recreation, livestock grazing and low-profile rural uses could continue. Improved access roads already exist within existing land uses and are likely being used by landowners; they would have **no** additional impacts on land use. Roads and other off-right-of-way project activities would affect 13 rural acres total.

Timber production (1 percent of area crossed, least of the action alternatives)—**no** impact by new right-of-way since none crosses timber production land. About 12 acres outside the new right-of-way would be converted to new or improved roads, having **no-to-low** impacts initially because landowners would be compensated for timber removed, but permanent **high** impacts because forest production could not continue. Where the line crosses 5 acres in existing right-of-way, the land is not being used for timber production; removal of existing vegetation within the right-of-way and of danger trees outside the right-of-way, would have **no-to-low** impacts because landowners would be compensated and replanting would be allowed in certain areas.

Agriculture (14 percent of area crossed, most of the action alternatives)—**high** impact within 17 acres of new rights-of-way where incompatible agricultural activities could not continue or encroachments would have to be removed but **low-to-moderate** impact where grazing and compatible agricultural activities could continue between towers and roads on new right-of-way. For the same reason, impacts would be **low-to-moderate** within about 165 acres of existing vacant right-of-way used for agriculture. Where 19 acres outside new right-of-way would be affected by new and improved access roads and other project activities; new roads would have **no-to-low** impacts initially because landowners would be compensated for damaged crops, but permanent **high** impacts because agricultural activities could not continue or a portion of land could be stranded. Improved roads and tower removals or rebuilds, which would occur on existing right-of-way, would have **no** impact. Less than 2 percent of agricultural land removed is designated as prime farmland and farmland of statewide importance.

Open space (68 percent of area crossed, most of the action alternatives)—**low-to-moderate** impacts within 104 acres of new rights-of-way, on 81 acres of land outside new rights-of-way needed for new and improved access roads and other project-related activities, and within about 762 acres of existing vacant right-of-way, most with timber that would require clearing. None of the open space along the West Alternative is part of a designated wilderness area or wildlife preserve, but a portion is managed by WDNR as a natural area preserve and natural resource conservation area. WDNR also manages a forest riparian 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 potential **high** impact.

(Note: all options would have the same overall land ownership and land use impacts as the alternative, but in different locations.)

- **West Option 1:** Negligible decrease in private lands impacted and no change in public lands impacted. Would affect slightly less (-2 acres) rural land, the same acreage of urban/suburban and timber production land, less (-6 acres) agricultural land, and more (+10 acres) open space land. Would impact 3 fewer acres of prime farmland and farmland of statewide importance.
- **West Option 2:** Decrease in private lands (-75 acres) but increase in public lands (+12 acres) required. Would affect more (+6 acres) rural land, more (+11 acres) timber production land, more (+28 acres) agricultural land, less (-9 acres) open space land, and the same amount of urban/suburban land. Would impact 2 more acres of prime farmland and farmland of statewide importance.
- **West Option 3:** Decrease in private lands (-20 acres) but increase in public lands (+10 acres) required. Would affect more (+32 acres) urban/suburban and rural land, more (+32 acres) timber production land, more (+13 acres) agricultural land, and more (+44 acres) open space land—the largest acreage totals for all land uses except agricultural that would be impacted by any option. Would impact about 3 fewer acres of prime farmland and farmland of statewide importance.

Central Alternative

BPA would need to acquire up to 2,019 acres of new easements for transmission line right-of-way and new and improved roads. Most land subject to new easements is privately held (1,447 acres, or 71 percent) by large landowners, including Sierra Pacific, Weyerhaeuser, and Weyerhaeuser Columbia Timberlands. About 572 acres of public land would also be subject to easements, of which 556 acres is managed by WDNR. There would be **low-to-moderate** impacts on landowners adjacent to existing easements and **high** impacts on landowners adjacent to new right-of-way and easements restricting use.

Because the Central Alternative would follow existing right-of-way for only 8 miles, it would need about 1,269 acres of new right-of-way for both towers and roads—the most of the action alternatives. About 988 acres (78 percent) would be on timber production land, the second highest amount among the action alternatives. An additional 336 acres (including 237 acres of timber production) would be affected by road construction and project-related activities off the proposed right-of-way or on existing right-of-way. Densities of residential units near its right-of-way are similar to the West Alternative and in some cases higher, although a much smaller number (318) of homes are within 500 feet of the right-of-way edge.

During construction, there would be temporary impacts on about 40 acres of land used for 45 pulling and tensioning sites beyond the right-of-way. Thirty of these sites would be on timber production land. If tree clearing is required, temporary impacts would be **low-to-moderate**. Temporary access roads would affect about 3 acres of various land uses, a **low** impact because existing uses could resume. Removal of up to 2,000 danger trees would have temporary **no-to-low** impacts.

The Central Alternative would have the following permanent impacts on land uses:

Urban/suburban (1 percent of area crossed)—**low-to-moderate** impact within 11 acres of new right-of-way where existing uses (e.g., a garden or low-growing landscape) would be compatible with the project, but **high** impact where incompatible uses would require clearing and be restricted. An additional 2 acres of urban/suburban land outside the new right-of-way would be

affected by new and improved roads or other project activities, with the same impacts as the West Alternative (**no-to-high** impacts by new roads; **no** impacts by improved roads and other activities). Within 14 acres of existing urban/suburban right-of-way, impacts would be **low-to-moderate** due to required removal of obstructions and continuing restrictions.

Rural (2 percent of area crossed)—would require 6 acres for new right-of-way, cross 20 acres within existing right-of-way, and affect 5 acres outside of the right-of-way for roads and other project activities, with impacts similar to the West Alternative.

Timber production (67 percent of area crossed)—initial **no-to-low** impact within 988 acres of new rights-of-way and on 237 acres required for new and improved roads and other components off the right-of-way, because timber producers would be compensated, but permanent **high** impact because timber production could not continue and new right-of-way could strand some timber land. Where danger trees would need to be removed outside the right-of-way, there would be **no-to-low** impact because landowners would be compensated and replanting would be allowed.

Agriculture (2 percent of area crossed)—**high** impact within 5 acres of new rights-of-way, where certain agricultural activities could not continue or encroachments would have to be removed; **low-to-moderate** impact where low-profile agricultural activities could continue between towers and roads. Likewise, there would be a **low-to-moderate** impact within about 23 acres of existing vacant right-of-way used for agriculture. Where 7 acres outside new right-of-way would be affected by new and improved access roads and other project activities, impacts would be similar to that of the West Alternative (**low-to-moderate** initially; **high** permanently.) Less than 1 percent of agricultural land removed is designated as prime farmland and farmland of statewide importance.

Open space (25 percent of area crossed)—**low-to-moderate** impact within 259 acres of new rights-of-way, on 85 acres of land outside new rights-of-way needed for new and improved access roads and other project-related activities, and within about 87 acres of existing vacant right-of-way because, while forested areas would require clearing, most uses within open space lands would remain compatible with the project, although somewhat altered. Where small landowners are using lands for timber production within proposed new right-of-way, the use would not be able to continue, a **high** impact.

(Note: all options would have the same overall land ownership and land use impacts as the alternative, just in different locations.)

- **Central Option 1:** Increase in private lands (+26 acres) and public lands (+44 acres) required. Would affect more (+58 acres) timber production land and more (+27 acres) open space land, with no change in acreage under other uses. No change in acreage of prime farmland and farmland of statewide importance.
- **Central Option 2:** Decrease in private lands (-88 acres) but no change in public lands required. Would affect less (-7 acres) urban/suburban land, more (+2 acres) rural land, less (-90 acres) timber production land, less (-4 acres) agricultural land, and more (+45 acres) open space land. Would reduce impacts on prime farmland and farmland of statewide importance by less than 1 acre.
- **Central Option 3:** Decrease in private lands (-61 acres) and public lands (-94) required (although 3 additional acres of public land at Moulton Falls Regional Park would be

impacted). Would affect marginally less (<1 acre) urban/suburban land, more (+16 acres) rural land, less (-207 acres) timber production land, more (+9 acres) agricultural land, and more (+57 acres) open space land, including a portion of a WDNR-managed genetic reserve. Would impact slightly more (less than 1 acre) of prime farmland and farmland of statewide importance.

East Alternative

BPA would need to acquire up to 2,376 acres of new easements for transmission line right-of-way and new and improved roads. Most land subject to new easements is privately held (1,993 acres, or 85 percent). About 387 acres of public land would also be subject to easements, of which 358 acres are managed by WDNR and 18 acres managed by the city of Camas (City of Camas Watershed). There would be **low-to-moderate** impacts on landowners adjacent to existing easements and **high** impacts on landowners adjacent to new right-of-way and easements restricting use.

Similar to the Central Alternative, the East Alternative would follow existing right-of-way for about 8 miles, needing about 1,255 acres of new right-of-way for both towers and roads, of which about 1,020 acres (81 percent) would be on timber production land. An additional 476 acres (including 319 acres of timber production) would be affected by project-related activities off the proposed right-of-way or on existing right-of-way. Among the action alternatives, the East Alternative has the fewest homes (286) within 500 feet of the right-of-way edge.

The East Alternative would have the following permanent impacts on land uses:

Urban/suburban (1 percent of area crossed)—would require 12 acres of new right-of-way, use 8 acres of existing right-of-way and affect 2 acres off the right-of-way for roads and other activities, with impacts similar to the Central Alternative.

Rural (2 percent of area crossed)—would require 10 acres for new right-of-way, cross 20 acres within existing right-of-way and affect 12 acres outside of the right-of-way. Impacts similar to the West Alternative.

Timber production (72 percent of area crossed, most of the action alternatives)—would require 1,020 acres of new right-of-way (no existing right-of-way could cross this land use) and affect 319 acres off the right-of-way, with impacts similar to the Central Alternative.

Agriculture (3 percent of area crossed)—would require about 12 acres for new right-of-way, use about 23 acres of existing vacant right-of-way and affect 11 acres outside the right-of-way, with impacts similar to the Central Alternative. About 3 percent of agricultural land removed is designated as prime farmland and farmland of statewide importance.

Open space (22 percent of area crossed)—would require about 201 acres for new right-of-way, use 66 acres of existing vacant right-of-way and affect 132 acres of land outside the right-of-way. Impacts similar to the Central Alternative – **low-to-moderate** in most cases, with potential **high** impacts where incompatible uses would have to discontinue.

(Note: all options would have the same overall land ownership and land use impacts as the alternative, just in different locations.)

- **East Option 1:** Decrease in private lands (-74 acres) but no change in public lands required. Would affect less (-9 acres) urban/suburban land, more (+11 acres) rural land, less (-67 acres) timber production land, less (-6 acres) agricultural land, and more (+53 acres) open space land. Would impact 1 fewer acre of prime farmland and farmland of statewide importance.
- **East Option 2:** Decrease in private lands (-182 acres) but increase in public lands (+31 acres) required, although 8 fewer acres in the City of Camas Watershed would be impacted. Would affect less (-51 acres) timber production land and less (-2 acre) agricultural land, with marginal or no change in acreage in other land use categories. Would impact slightly less (less than 1 acre) prime farmland and farmland of statewide importance.
- **East Option 3:** Decrease in private lands (-15 acres) but increase in public (WDNR-managed) lands (+24 acres) required; the City of Camas Watershed would not be impacted by new easements under this option. Would affect more (+23 acres) timber production land and less (-5 acres) open space land, with no change in acreage in other land use categories. No change in acreage of prime farmland and farmland of statewide importance.

Crossover Alternative

BPA would need to acquire up to 1,420 acres of new easements for transmission line right-of-way, and new and improved roads. Most land subject to new easements is privately held (972 acres, or 79 percent). About 449 acres of public land would also be subject to easements, of which 422 acres (20 percent) are managed by WDNR. There would be **low-to-moderate** impacts on landowners adjacent to existing easements and **high** impacts on landowners adjacent to new right-of-way and easements restricting use.

Because the Crossover Alternative would follow existing right-of-way for about 33 miles, it would need about 772 acres of new right-of-way for towers and roads, of which about 627 acres (81 percent) would be on timber production land. An additional 286 acres (including 160 acres of timber production) would be affected by project-related activities off the proposed right-of-way or on existing right-of-way. The alternative's right-of-way would cross within 500 feet of 657 homes—less than the West Alternative because it does not pass through the highly urban/suburban areas on the south, but more than the Central and East alternatives because it does pass through the more urban/suburban areas of Kelso and Longview.

The Crossover Alternative would have the following permanent impacts on land uses:

Urban/suburban (1 percent of area crossed)—would require about 3 acres for new right-of-way, use 20 acres of existing right-of-way and affect 2 acres outside the right-of-way, with impacts similar to the West Alternative.

Rural (7 percent of area crossed)—would require 3 acres for new right-of-way, use 59 acres of existing right-of-way, and affect 10 acres outside of the right-of-way. Impacts similar to West Alternative.

Timber production (48 percent of area crossed)—would require about 627 acres of new right-of-way (existing BPA right-of-way does not cross this land use) and affect 160 acres off the right-of-way, with impacts similar to the Central Alternative.

Agriculture (3 percent of area crossed)—would require 3 acres for new right-of-way, use 39 acres of existing vacant right-of-way and affect 9 acres outside the right-of-way. Impacts similar to the Central Alternative. About 3 percent of agricultural land removed is designated as prime farmland and farmland of statewide importance.

Open space (43 percent of area crossed)—would require about 136 acres for new right-of-way, use 453 acres of existing vacant right-of-way and affect 105 acres of land outside the right-of-way, with primarily **low-to-moderate** impacts similar to the Central Alternative. Would also likely affect a WDNR-managed forest riparian easement along Segment 9, a potential **high** impact.

(Note: all options would have the same overall land ownership and land use impacts as the alternative, just in different locations.)

- **Crossover Option 1:** Increase in private lands (+60 acres) but no change in public lands required. Would affect less (-4 acres) rural land, more (+55 acres) agricultural land, and more (+46 acres) open space land (near the Little Washougal River and north of Lacamas Lake); marginal or no change in urban/suburban and timber production acreage. Would impact 11 more acres of prime farmland and farmland of statewide importance.
- **Crossover Option 2:** Increase in private lands (+42 acres) but no change in public lands required. Would affect more (+18 acres) rural land, more (+4 acres) timber production land, and more (+76 acres) open space land (most near the Baxter Road substation site); no change in urban/suburban or agricultural acreage. No change in acreage of prime farmland and farmland of statewide importance.
- **Crossover Option 3:** Increase in private lands (+85 acres) but no change in public lands required. Would affect more (+18 acres) rural land, more (+22 acres) timber production land, and more (+56 acres) open space land (most near the Baxter Road substation site); no change in urban/suburban or agricultural acreage. No change in acreage of prime farmland and farmland of statewide importance.

S.3.2 Recreation

S.3.2.1 Affected Environment

Recreation resources in the project area include urban parks and greenways, developed facilities in rural areas such as campgrounds or trails (motorized and non-motorized), and undeveloped rural and open space areas used for dispersed recreation. Recreational activities within the three counties (Cowlitz and Clark counties in Washington and Multnomah County in Oregon) include boating, fishing, hunting, target practice, camping, hiking, swimming, picnicking, sports games, sightseeing and wildlife watching, horseback riding, all terrain vehicle (ATV) use, and mountain biking.

Cowlitz County manages developed parks at 14 sites in rural areas and other recreation areas in developed areas and around lakes and rivers. The Vancouver-Clark Parks and Recreation Department (VCPRD) manages developed parks at 239 sites in Clark County and Vancouver, and a variety of recreation facilities from sports fields and pools to gyms and community centers. Also in Clark County, the western portion of the Yacont Burn State Forest (managed by WDNR) provides opportunities for camping, hiking, hunting and other outdoor activities. PacifiCorp

provides public recreational opportunities along the Lewis River, below Merwin Dam and along the shores of Yale, Merwin and Swift reservoirs.

In Multnomah County, the 40-Mile Loop Land Trust manages the 40-Mile Loop Trail within the cities of Troutdale and Fairview, Multnomah County, and other local jurisdictions. 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. Other facilities within the study area include public and private golf courses.

For this EIS, recreation resources existing or planned within 1,000 feet either side of the transmission line were analyzed for impacts.

S.3.2.2 Impacts Common to Action Alternatives

All action alternatives would cross the following recreation resources: Oak Park in Camas, Washington, the Washougal River Greenway east of Camas, the Lewis and Clark Trail Scenic Byway and Columbia River Gorge Scenic Byway on SR 14, and the Columbia River. Goot Park in Camas would not be crossed, but is just east of the action alternatives. Temporary construction impacts (noise, dust, visual intrusion, access delays or restrictions) to these resources would generally be **low**. If construction takes place during peak use periods, temporary impacts on the parks and the greenway could be **moderate**. There could also be temporary **low-to-moderate** impacts on dispersed recreation, including fishing, kayaking and canoeing, on both public and private lands during construction.

Operation and maintenance of the line, which would involve twice annual helicopter inspections and occasional use of access roads by maintenance crews, would have **no-to-low** impacts due to infrequency and the small portion of recreational property permanently affected by towers or access roads under all action alternatives. Overall experiential impacts to recreation resources would be **moderate** because, while the presence of the new facilities would be permanent, transmission lines, roads and clearings are already present in the environment and most would be viewed from a distance. This includes **moderate** impacts within the Washougal River Greenway and Oak Park, due to taller towers that would be built in existing rights-of-way and new access roads (common to all action alternatives). New and improved access roads elsewhere in the project area could encourage unauthorized access of some lands, with localized **moderate** impacts where signs and fencing could not prevent it.

Sundial Substation Site. **No** impact: there are no existing recreation resources within the site.

S.3.2.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

There would be **no** impacts on recreation by building the Castle Rock Substation on the Monahan or Baxter Creek sites. Locating the substation on the Casey Road site, however, could have a **low** impact on authorized or unauthorized dispersed recreation; target shooting occurs in this area and could be affected by limited access to the site.

West Alternative

During project construction, about 5 acres of recreation facilities and less than 0.1 mile of trails would be temporarily disturbed, creating a **low** temporary impact during non-peak periods and **moderate** temporary impact during peak use periods. Facilities affected would include the East Fork Lewis River Greenway, Green Mountain Golf Course, Camp Currie, and the Washougal River Greenway. Construction could occasionally disturb visitors at other nearby recreation resources, but at most would have temporary **low** impacts.

The West Alternative would permanently occupy about 8.5 acres of recreation land: just under 1 acre for towers and about 7.5 acres for new or improved access roads. In addition, new/improved roads would permanently cross about 0.15 mile of trails. (This includes acreage affected in Washougal River Greenway and Oak Park, for which impacts are discussed under common recreation impacts above.) This is the highest amount of recreational acreage impacted by any alternative. Impacts would be **high** on the East Fork Lewis River Greenway, where new access roads would affect about 3 acres; on Washington State University's Vancouver Campus, where a portion (less than 0.1 mile) of the Campus Trail would be converted to new and improved access roads; and on the Ellen Davis Trail, where less than 0.1 mile would be converted to new access road. Impacts would be **moderate** on 3 acres of the Green Mountain Golf Course and 2 acres of Camp Currie where project towers and roads would be placed alongside existing rights-of-way. Impacts would be **low** in the Port of Camas-Washougal Marina, where less than 0.1 acre would be crossed by an access road. There would be **no-to-low** impacts on remaining parks, campgrounds and trails crossed or in the vicinity, including on Northern Clark County Scenic Drive, which is crossed in existing right-of-way.

- **West Option 1:** About 3 more acres impacted by construction; same **low** or **moderate** temporary impacts, depending non-peak/peak usage of resources, as the alternative. Avoids permanent impacts within Green Mountain Golf Course (-2.9 acres), but shifts permanent impacts to Camas Meadows Golf Club (+0.5 acre). Impacts about 0.5 mile more of the Lacamas Heritage Trail, and the same amount of acreage in Camp Currie as the alternative, but within the camp instead of along the eastern border. Impact would be **moderate** on these facilities. Net reduction in permanent impacts on parks (primarily golf courses) of about 2 acres, but net increase in permanent impacts on trails of less than 0.5 mile.
- **West Option 2:** About 2 fewer acres impacted by construction; same temporary impacts as alternative. Avoids permanent impacts within Green Mountain Golf Course (-2.9 acres) and Camp Currie (-2.1 acres). Additional permanent impacts on 5.2 acres within Green Mountain Park; however, impact would be **low**. Net increase in permanent impacts of about 0.2 acre.
- **West Option 3:** About 2 fewer acres impacted by construction; same temporary impacts as alternative. Avoids permanent impacts within Green Mountain Golf Course and Camp Currie, like West Option 2. Additional permanent impacts on 3.8 acres within Green Mountain Park; impact would be **low**. Net decrease in permanent impacts of about 1.2 acres.

Central Alternative

During project construction, about 1 acre of recreation facilities would be temporarily disturbed (in the Washougal River Greenway). 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. No towers or right-of-way are proposed within the parks. WDNR-managed trails that could be affected by construction activities include the Tarbell, Larch Mountain, Jones Creek, and Bells Mountain trails. Impacts on all affected areas would be **low** during non-peak periods and **moderate** during peak use periods. About 0.2 mile of temporary access roads in Oak Park and Washougal River Greenway, removal of danger trees outside the right-of-way, and a pulling and tensioning site outside and next to the right-of-way on the Port of Camas-Washougal Marina property would cause temporary construction impacts. These would be **low-to-moderate** in these recreational areas because they are short-term; all affected land would be restored and trees would be allowed to grow back.

The Central Alternative would permanently occupy about 0.5 acre of recreation land: 0.1 acre for towers and slightly more than 0.4 acre of land for new access roads. (This includes acreage affected in Washougal River Greenway, Goot Park and Oak Park, for which impacts are discussed under common recreation impacts above.) In addition, Bells Mountain Trail and the Washougal River Greenway Trail would be affected by improved access roads (less than 0.1 mile each), a **low** impact; where new right-of-way would cross Bells Mountain Trail, it would have a **moderate** impact. This is the smallest amount of recreation acreage directly affected by any action alternative.

The alternative would cross the scenic Spirit Lake Memorial Highway (SR 504), but at a developed location, a **low** impact. It would also be visible to recreationists at Merwin Park, Goot Park and the Western Yacolt Burn, but no components would be placed within these areas, causing **no-to-low** impacts.

- **Central Option 1:** No change in impacts on recreational land. Avoids crossing the Spirit Lake Memorial Highway.
- **Central Option 2:** No change in impacts on recreational land. Avoids crossing the Spirit Lake Memorial Highway.
- **Central Option 3:** Avoids direct impacts on Bells Mountain Trail and visual impacts on PacifiCorp's public recreation areas along the Lewis River (Merwin Park) and the Western Yacolt Burn. Additional temporary and permanent impacts (0.2 and just over 0.7 acres, respectively) in Moulton Falls Park; permanent impact would be **high**. Crosses the Northern Clark County Scenic Tour at NE Cedar Creek Road and Lucia Falls Road, a **moderate** impact. Net increase in permanent impacts of about 0.7 acre of park and net decrease in impacts on less than 0.1 mile of trail.

East Alternative

During project construction, about 0.7 acre of the Washougal River Greenway and 0.1 mile of the WDNR-managed Tarbell Trail would be temporarily disturbed, creating a **low** impact during non-peak periods and **moderate** impact during peak use periods. Similar to the Central Alternative, the East Alternative's right-of-way would be near PacifiCorp's public recreation areas along the Lewis River (Merwin Park), Goot Park, and the Western Yacolt Burn. WDNR-managed trails in the Western Yacolt Burn that could be affected by temporary construction activities include the Larch Mountain, Jones Creek, and Bells Mountain trails. However, visual intrusions and any temporary closures would be short-lived, causing **no-to-low** impacts on these facilities.

The East Alternative would permanently occupy slightly more than 0.3 acre of recreation land: about 0.1 acre for towers, and just over 0.2 acre of land for new or improved roads. (This includes acreage affected in Washougal River Greenway and Oak Park, for which impacts are discussed under common recreation impacts above.) Impacts would be **low** in the Port of Camas-Washougal Marina, where less than 0.1 acre would be crossed by an access road

In addition, about 0.3 mile of trails would be permanently crossed by the line, or by new or improved access roads. Trails impacted by the alternative include the Larch Mountain and Sandy River Greenway trails (less than 0.1 mile each for new access road), the Washougal River Greenway and Riverfront (East) trails (less than 0.1 mile for improved access road each), Tarbell Trail (less than 0.2 mile for access roads; less than 0.1 mile for towers), Jones Creek Trail (less than 0.1 mile for improved road), and Riverfront Trail (East) (less than 0.1 mile for improved road). Impact on the Tarbell Trail, which is crossed eight times and paralleled for about 1 mile, would be **moderate-to-high**. Because of permanent alterations, impacts would also be **moderate-to-high** on the Larch Mountain Trail, the Sandy River and Washougal River Greenway trails, and the Riverfront (East) Trail. Impact on the Jones Creek Trail would be **moderate**.

Similar to the Central Alternative, the East Alternative would cross the scenic Spirit Lake Memorial Highway (SR 504) and would be visible to recreationists between Merwin and Yale lakes, Goot Park, Larch Mountain Trail and the Western Yacolt Burn, but would have **no-to-low** impacts. Hikers along the Silver Star Trail on Silver Star Mountain, about 2 miles east of the alternative, could experience a **moderate** impact from visual intrusion.

- **East Option 1:** Same temporary impacts as alternative. Would avoid permanent impacts on the Riverfront Trail (East) and avoid crossing Spirit Lake Memorial Highway. Right-of-way would be near Riverside Park, creating a **moderate** visual impact. Net reduction in permanent impacts on trails of less than 0.1 mile.
- **East Option 2:** Same temporary and permanent impacts on parks. Would avoid permanent impacts on Tarbell, Larch Mountain and Jones Creek trails. Additional **low** temporary and **moderate** permanent impacts on less than 0.1 mile of Bells Mountain Trail. Would modify the route south of Yale Dam to go farther west and closer to the western edge of the Western Yacolt Burn. Net reduction in permanent impacts on trails of less than 0.4 mile.
- **East Option 3:** Same temporary and permanent impacts on parks. Additional temporary and permanent impacts on less than 0.3 mile of Jones Creek Trail for access roads, with the same **moderate** permanent impact as the alternative. Net increase in permanent impacts on trails of less than 0.3 mile.

Crossover Alternative

There are no recreation resources along the northern portion. Temporary and permanent impacts on the Washougal River Greenway, Tarbell Trail, Jones Creek Trail, Port of Camas-Washougal Marina and other parks and trails (such as near PacifiCorp's public recreation areas) would be the same as those discussed for the East Alternative, because the Crossover Alternative shares the East Alternative's right-of-way through its southern portion, where these resources are located. This alternative would not impact Riverfront Trail (East). Similar to the Central and East alternatives, it would be visible to recreationists at Merwin Park, Goot Park, Larch Mountain Trail and the Western Yacolt Burn, but would have **no-to-low** impacts on these facilities. Would permanently occupy about 0.5 acre of recreation land: 0.1 acre for towers and

less than 0.4 acre for new and improved access roads. Less than 0.6 mile of trail would be crossed by the line or new or improved roads.

- **Crossover Option 1:** About 1.5 additional acres temporarily impacted and 1.2 acres permanently impacted, all within Camp Currie. This would have a **moderate** impact on the camp. Net increase in permanent impacts of 1.2 acres.
- **Crossover Options 2 and 3:** No change in impacts.

S.3.3 Visual Resources

S.3.3.1 Affected Environment

The action alternatives would cross five regions with similar types, quality, and quantity of environmental resources. From north to south, these regions are identified as the Willapa Hills, Cowlitz/Chehalis Foothills, Western Cascades Lowlands and Valleys, Valley Foothills, and Portland/Vancouver Basin.

Scenic quality assessments of areas crossed by the action alternatives were based on the Bureau of Land Management's Visual Resource Management system, which takes into consideration landforms, vegetation, water, color and modifications (e.g., buildings or roads) on one scale, and viewer sensitivity on another.

Substations

The three potential Castle Rock Substation sites are considered to have low scenic quality. The Casey Road site contains visual landscape common to the region (forest), is partially logged and is adjacent to an existing transmission corridor, resulting in low scenic quality. Given its location in a relatively remote area with no nearby residential or recreational uses, viewer sensitivity is also low, for an overall landscape rating of low. The Baxter Road site, in the same remote area as the Casey Road site, is in a small topographical depression surrounded by vegetation and adjacent to a transmission corridor. Scenic quality and viewer sensitivity are similar at both sites (low), which share the same overall landscape rating of low. The Monahan Creek site contains visual landscape common to the region (grazing land), has limited visibility and is adjacent to a transmission corridor, resulting in low scenic quality. Due to nearby rural residences and an adjacent rural road, viewer sensitivity is medium. Overall landscape rating is low.

The Sundial Substation site's two optional lots, located in an industrial park, are in an area of low scenic quality. Despite their location in a populated area with a high amount of use, there is low public interest in the lots themselves, resulting in medium viewer sensitivity. Overall landscape rating is low.

West Alternative and Options

Originating in the Willapa Hills (as all action alternatives do), the West Alternative would pass through rolling vegetated hills and rural and residential areas before entering the communities of West Side Highway and Kelso, where it would pass through many more residential areas. The hills become larger and the population less dense where it would enter the Western Cascades Lowlands and Valleys. After crossing the East Fork Lewis River, the alternative would enter the Portland/Vancouver Basin. Based on a standardized assessment of landscape features, the West Alternative would cross through areas with generally low scenic quality. However, the

alternative would pass relatively close to residential areas for most of its length and these viewers can have high levels of viewer sensitivity. The combination of low scenic quality and high viewer sensitivity gives the West Alternative and options an overall medium landscape rating.

Central Alternative and Options

Northwest of the Cowlitz River, the Central Alternative would pass through landscape similar to the West Alternative (rolling vegetated hills and rural and residential areas), but in an area north of Castle Rock. East of the Cowlitz River, the Central Alternative would cross the Cowlitz/Chehalis Foothills area and then enter the Western Cascades Lowlands and Valleys. After crossing the Lewis River, the alternative would enter the Portland/Vancouver Basin. General scenic quality is low. The area between the Cowlitz and Lewis rivers is sparsely populated and has limited use, with generally low viewer sensitivity. Pockets of greater sensitivity exist where the alternative would cross the Lewis River (west of Lake Merwin through Ariel). Where the alternative would pass near rural residences around Castle Rock to the north, and Amboy, Yacolt and Camas to the south, viewers could have medium sensitivity. Overall viewer sensitivity is medium, resulting in an overall landscape rating of low.

East Alternative and Options

The East Alternative's northernmost segment is the same as the Central Alternative's. It would pass by some rural and residential areas north of Castle Rock, cross the Cowlitz River and pass through the Cowlitz/Chehalis Foothills before entering the Western Cascades Lowlands and Valleys. It would then cross the Lewis River farther east, between Lake Merwin and Yale Lake, before entering the Portland/Vancouver Basin. General scenic quality is low. Except for the area nearest Castle Rock (with medium viewer sensitivity), most of the alternative's northern portion has low viewer sensitivity because there are few homes and roads and low levels of use. For the rest of its route, viewer sensitivity ranges from low to high depending on proximity to residents, motorists or recreationists, with greater sensitivities along Lewis River Road and near Ariel, Lake Merwin, and Camas. Overall viewer sensitivity is medium, resulting in an overall landscape rating of low.

Crossover Alternative and Options

The Crossover Alternative shares its northern portion with the West Alternative, its middle portion with the Central Alternative, and its southern portion (south of Lake Merwin and Yale Lake) with the East Alternative. General scenic quality is low. Viewer sensitivity ranges from low to high depending on the number of nearby residents, motorists and recreation opportunities. Overall viewer sensitivity is medium, resulting in an overall landscape rating of low.

S.3.3.2 Impacts Common to Action Alternatives

During construction of the towers, access roads, and substations, there would be temporary changes in scenery due to helicopters, trucks, and heavy equipment operating in the area. Construction crews would work in localized areas of the transmission line right-of-way and at the substations, and would be visible primarily to nearby viewers or those with a direct line of sight. Installation of towers and conductor stringing by helicopter would be visible from a greater distance. However, construction of any action alternative would create a temporary **low**

visual impact because activities would only take place at any one location for a few weeks at a time. At substation sites, construction activities would occur over a longer period, but impacts would still generally be **low** since the Baxter and Casey sites are remote and the Sundial site is in an industrial complex. Temporary impacts at the Monahan site may be higher for residents living adjacent or close to the site, or for motorists who use Delameter Road.

When construction is completed, the project's towers, conductors, access roads, rights-of-way clearing and substations would cause permanent visual changes in the landscape. The project's new towers would range from 50 to 140 feet taller than existing BPA structures in the area, making them more visible, particularly where they break the skyline. Impacts on viewers could be **low-to-high**, depending on many factors, including surrounding land uses, topography, vegetation, distance and weather conditions. New access roads' visual impacts could be limited to localized areas or, where built on steep slopes, be seen from a distance. Maintenance activities would have **no-to-low** temporary impacts on views.

Sundial Substation Site. **Low** visual impact: the two lots are near many existing transmission lines and three existing substations in an industrial park.

S.3.3.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

Low impacts. The Casey Road and Baxter Road sites are in remote areas with low scenic quality adjacent to four transmission lines. Though the Monahan Creek site, also adjacent to a transmission corridor, would likely be visible to a few surrounding residents and local motorists, it would otherwise have limited visibility.

West Alternative

With a low scenic quality rating but high viewer sensitivity, the West Alternative would have a **moderate** impact on visual resources for most of its length, with localized areas of **moderate-to-high** impacts on residences near the Longview/Kelso area (including the West Side Highway neighborhood), east of Vancouver, through the Camas and Washougal area; and on some parks (the East Fork Lewis River Greenway and Pleasant Valley Park), river crossings (Kalama, Lewis, East Fork Lewis), and natural areas (Lacamas Prairie NAP/NRCA). It would travel primarily in existing right-of-way where transmission lines already have affected views, but new towers would be taller than existing towers.

- **West Option 1:** Same overall impact as the alternative. Would reduce impacts on some residents (in NE 48th Circle) 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 (including NE Stoney Meadows Dr. and NE Goodwin Rd.).
- **West Options 2 and 3:** Slightly higher overall impact. Would avoid impacts on the Green Mountain Golf Course, but have potentially **high** impacts on a greater number of residents and Green Mountain Park to the east due to required new right-of-way and longer line length. Both options would have higher visual impacts on residents along NE 48th Circle. West Option 2 would also impact residents along NE Zeek Rd. and NE 28th St.

Central Alternative

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 (the Cowlitz River and SR 504), Ariel, the Lewis River, Lake Merwin, Camas and Washougal (where there are parks, greenspaces and natural areas, and residences close to the right-of-way).

- **Central Option 1:** 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.
- **Central Option 2:** Slightly higher overall impact. 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 except for the unincorporated community of West Side Highway adjacent to SR 411, where it would have potentially high visual impacts. The Monahan Creek substation site would also have a slightly higher impact on viewer sensitivity (medium) than the other substation sites.
- **Central Option 3:** Slightly higher overall impact. Would move the Lewis River crossing near Ariel farther downstream through a visually sensitive area (including Lake Merwin) that attracts recreational users and would take a direct southeast route toward Venersborg on new right-of-way through more populated (rural residential) areas.

East Alternative

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 Castle Rock (the Cowlitz River and SR 504) to the north, the Lewis River, Camas and Washougal (where there are nearby residents, parks and greenspaces to the south), and the Western Yacolt Burn.

- **East Option 1:** Slightly higher overall impact. 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. The Monahan Creek substation site would also have a slightly higher impact on viewer sensitivity (medium) than the other substation sites.
- **East Options 2 and 3:** Same overall impact as the alternative. East Option 2 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. East Option 3 would replace a very short route segment north of Camas crossing through unpopulated land.

Crossover Alternative

While this alternative would share its northern portion with the West Alternative, which would have localized **moderate** impacts on some viewers (such as those in the West Side Highway neighborhood and through the Camas and Washougal area), the rest of its route passes through sparsely populated or unpopulated land where it would be highly visible in only a few areas,

such as around Ariel, the Lewis River and Lake Merwin. Consequently, the alternative would have a **low-to-moderate** visual impact along most of its length.

- **Crossover Option 1:** Slightly higher overall impact. 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 natural areas, open fields and more rural residential areas. This would remove visual impacts around NE Zeek Rd. and NE Blair Rd., but introduce impacts on residences around NE 267th Ave., where taller towers could dominate surroundings.
- **Crossover Options 2 and 3:** Slightly lower overall impact. 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). Both options would travel through sparsely populated land, but Option 3 would require additional right-of-way parallel to an existing line.

S.3.4 Electric and Magnetic Fields

S.3.4.1 Affected Environment

Existing electric and magnetic fields (EMF) vary widely throughout the project area, depending on proximity to electronic devices or electrical lines and intervening landscape or walls. In general, existing EMF levels are higher in developed areas where electrical lines and buildings with electrical wiring, electrical equipment, and appliances are present. Throughout a home, for example, average electric field levels can range from 5 to 60 volts per meter (V/m)—the highest measurement next to a running household appliance. Outdoor electric field levels in publicly accessible places can range from 1 V/m to 12 kilovolts per meter (kV/m), with the higher field measurements present near high-voltage transmission lines of 500 kV or more. Magnetic field levels are typically less than 2 milligauss (mG) in homes and range from less than a milligauss to about 1 gauss (G) outdoors in publicly accessible places.

During foul weather, a strong electric field at the surface of wet transmission line conductors can cause corona, which creates audible noise and can cause electromagnetic interference affecting AM radio or broadcast television signals. Corona likely occurs periodically along existing lines in the project area.

S.3.4.2 Impacts Common to Action Alternatives

Impacts from EMF generated by a new transmission line would be similar for each action alternative and option. Construction standards, grounding requirements and right-of-way restrictions would minimize the potential for electric fields to cause nuisance shocks for anyone near the right-of-way, causing **no-to-low** impact. Likewise, new transmission lines are configured to reduce EMF and minimize electromagnetic interference that could affect older audio and video equipment. If interference occurs, BPA has a mitigation program to correct it. EMF from the line could, however, affect older models of pacemakers. Pacemaker wearers are advised to limit their exposure to electric fields of 1 kV/m or less and to magnetic fields of 1,000 mG or less. Electric fields from the proposed 500-kV line would generally meet these guidelines beyond about 35 feet from the edge of the rights-of-way. Wearers of pacemakers and similar medical-assist devices are discouraged from unshielded right-of-way use.

An increase in public exposure to magnetic fields could occur if the project causes field level increases and if residences or other structures draw people to these areas. However, decades of scientific studies are inconclusive as to whether magnetic fields can potentially cause health effects and so impacts are unknown.

At the *edge* of the right-of-way, electric field levels (length-weighted averages) for the action alternatives would range from 0.6 to 2.4 kV/m (2.3 kV/m on new right-of-way) under both extreme (maximum) and normal (average) operating conditions. This would meet BPA's guidelines of 2.5 kV/m. The highest electric fields allowed, which would occur *on* the right-of-way (on new or existing right-of-way) directly under the line under extreme operating conditions (e.g., high temperatures, heavy electrical load), would range from 8.8 to 9 kV/m, meeting BPA's 9 kV/m guideline. (Generally, the public only accesses rights-of-way where lines cross roads or parking lots. At those locations, BPA requires lower fields. Where lines cross trails, the standard limit applies.) Under normal conditions, using length-weighted averages, electric field levels on the right-of-way would range from 5.3 to 5.8 kV/m. These electric field levels would be comparable to or less than those from existing 500-kV lines in the area and elsewhere.

Magnetic field levels (using length-weighted averages) on existing right-of-way for the action alternatives would be comparable to those from existing 500-kV lines in the area and elsewhere:

- At the *edge* of the right-of-way, under normal (average) conditions, field levels would range from 6 to 15 mG (12 mG on new right-of-way).
- At the *edge* of the right-of-way, under extreme (e.g., high temperatures, heavy electrical load) conditions, field levels would range from 26 to 59 mG (48 mG on new right-of-way).
- *On* the right-of-way, under normal (average) conditions, field levels would range from 28 to 68 mG (35 mG on new right-of-way).
- *On* the right-of-way, under extreme conditions (e.g., high temperatures, heavy electrical load), field levels could range from 139 to 276 mG (184 mG on new right-of-way).

Based on land uses and zoning along the action alternatives, a greater number of people would live near or pass by the West Alternative—and potentially pass through fields from the new line—than the other action alternatives.

EMF levels at the perimeter of the substations' yards, regardless of site, would reflect fields generated by the new 500-kV line. The magnitudes and impacts would be similar to those for the transmission line alone. Within a few hundred feet, field levels would dissipate to normal surrounding levels.

S.3.5 Noise

S.3.5.1 Affected Environment

Throughout the project area, noise levels can vary widely. Typical noise levels may be intermittently high in urban areas such as Longview and Vancouver, Washington, particularly near industrial and commercial uses and highways, but consistently low or moderate elsewhere, depending on suburban and rural population, wind levels, aircraft traffic, and recreation, forest,

or agricultural activities. In some areas, existing transmission lines may contribute to this noise, particularly those of higher voltage (345-kV or higher) built before 1978, when noise limits were not yet established. Foul weather may induce corona and corona-generated noise (see Section S.3.4.1, Affected Environment). Foul weather can vary along the route between 26 and 34 percent, on average, according to the National Climatic Data Center (based on 2005-2013 data). Other privately-collected data show that the rate is between 32 and 51 percent.

Some existing substations in the project area may contribute noise as well, mainly caused by transformer equipment that creates a hum or the infrequent sound of opening and closing circuit breakers.

S.3.5.2 Impacts Common to Action Alternatives

Construction of the transmission line, substations, and access roads would involve the use of heavy equipment and helicopters and generate temporary noise that could affect nearby individuals. Although project construction would occur over 30 months, most transmission line construction activities would last only days or a few weeks at any one location, having an overall **low-to-moderate** impact. Noise impacts from construction of the 500-kV substations, which could take up to 3 years, would occur at the substation locations the entire time, although potentially loud equipment would not be used during all phases of construction. Residents near substation sites, particularly near the Monahan Creek substation site, may experience **moderate-to-high** noise impacts over a longer period. Where blasting may be required in rocky areas, there would be temporary and infrequent **high** noise impacts.

Once operating, average potential corona noise levels on existing right-of-way for the alternatives are estimated to range from 47 to 48 decibels on the A-weighted scale (dBA) at the edge of the right-of-way during foul weather. Where an alternative would occupy new rights-of-way (i.e., areas with no existing transmission lines), audible noise levels at the edge would be 47 dBA. This level would drop about 3 dBA for every doubling of distance away from the line.

Though the alternatives and most options could increase potential corona noise by 2 to 8 dBA on existing right-of-way (Crossover Option 1 corona noise levels increase by 10 dBA), they would meet BPA's 50 dBA design criteria and statutory noise limits established in Oregon and Washington. Three options (Central Option 1 and Crossover Options 2 and 3) where older lines would remain on the right-of-way would exceed the 50 dBA criterion but would meet a second criterion—falling within a maximum 3 dBA increase. All alternatives and options (except for Crossover Option 2 at 56 dBA) would also meet the U.S. Environmental Protection Agency's 55 dBA guideline for noise at the edge of right-of-way during foul weather. During fair weather, audible noise at the edge of the right-of-way would be about 20 dBA lower if corona were present at all.

For all alternatives and options, transmission line operations would have **no-to-low** noise impacts. The West Alternative would cross through slightly more urban, suburban, and rural development areas than the other action alternatives (17 percent vs. 3-8 percent), but would still have no-to-low impacts on affected individuals. Occasional maintenance activities such as twice annual helicopter patrols, periodic repairs by field crews, and vegetation maintenance would have infrequent, temporary **low** impacts—except when loud equipment like chainsaws may be required, causing a temporary **moderate** impact.

The new substations would meet BPA's 50 dBA design criteria at the station perimeters and all state noise limits and federal guidelines. Audible noise levels at the proposed substations would predominantly reflect foul weather corona noise from incoming and outgoing transmission lines and so be similar to levels discussed above, creating **no-to-low** impacts. Maintenance impacts would also be similar.

S.3.6 Health and Safety

S.3.6.1 Affected Environment

Transmission facilities provide electricity for heating, lighting, and other services essential for public health and safety. At the same time, if not constructed, operated, and maintained properly, these same facilities could pose health and safety risks such as electrocution, fire, collision hazards for aircraft and watercraft, exposure to toxic and hazardous substances, including herbicides, and attractive targets for vandalism or sabotage. BPA designs and maintains its facilities to meet safety requirements to prevent or reduce these risks. Meeting these requirements includes maintaining proper clearances between transmission lines and the ground, roadways and treetops, and preventing inappropriate use of rights-of-way. All Federal Aviation Administration (FAA) requirements for lighting or marking towers and conductors are followed.

Three documented hazardous waste and contaminated sites are located in the project area: the BPA Ross Complex, which the West Alternative would cross within existing right-of-way and where an existing access road would be improved; the International Paper Co. Mill and Solid Waste Site, which the Central Alternative would cross on new right-of-way; and the Reynolds Metals site, where the two proposed lots for the Sundial Substation are located and which all alternatives and options would cross to connect to the substation.

S.3.6.2 Impacts Common to Action Alternatives

All construction activities would be guided by site- and task-specific safety plans prepared by BPA and its contractors. During construction, there would be **no** health and safety impacts on members of the general public, who would not be allowed in construction areas. By following all safety requirements and implementing mitigation measures, construction activities would have temporary **low** impacts on worker health and safety. Similarly, **no-to-low** impacts would occur from toxic and hazardous substances because of the small quantities generated during construction, strict adherence to all regulations, the unlikely occurrence of spills, and required quick response to hazardous wastes that may be discovered. Construction on known contaminated sites would also have **low** impacts (see individual discussions under the affected action alternatives or substations).

Construction vehicles would be equipped with fire suppression equipment and construction activities would be coordinated with local fire agencies, with special care taken during fire danger advisories. Because BPA and its contractors would use proper precautions and be aware of conditions during construction, potential fire impacts would be **low**. Increased traffic during construction would have a temporary **low** impact on transportation safety.

Once the line is operating, BPA would restrict access to or uses of rights-of-way to prevent unsafe activities, keeping long-term health and safety impacts **low**. The general public would not be allowed in areas where maintenance activities are occurring, ensuring **no** impacts;

maintenance activities would have temporary **low** impacts on worker health and safety. Maintenance vehicles would travel infrequently on area roads, with **low** long-term impact on transportation safety. BPA would require the line to meet or exceed nationally required clearance standards and maintenance activities would include vegetation management to maintain these clearances. BPA works with landowners to maintain vegetation on the right-of-way using a variety of methods including herbicides. To avoid impacts to domestic water supply wells and other domestic water sources, BPA would strictly follow the guidelines set forth in its Transmission System Vegetation Management Program including maintaining adequate buffers and herbicide-free zones around any potential water sources and work with existing landowners to accommodate their concerns and needs. Impacts would be **low**.

Maintenance would be conducted by vehicles and personnel equipped with fire safety equipment. For these reasons, long-term fire impacts would be **low**. The public would have limited access to the right-of-way and access roads, ensuring that unauthorized access and risks of fire or trash dumping are minimized and have a **low** impact.

Some equipment at the new substations may contain diesel and oil. Any oil-containing equipment would be designed with proper containment and spill control devices, and a spill response plan would be in place, ensuring **no-to-low** long-term impacts from toxic or hazardous substance during operations.

By following all FAA requirements for lighting or marking towers and conductors, impacts on aircraft safety would be **low-to-moderate**. There would be **no-to-low** safety impacts on commercial and recreational river traffic because the project would avoid placing structures within the navigable portion of the Columbia River.

Vandalism and theft at BPA facilities has occurred in the past and will likely continue. Depending on the damage, these acts can cause fires, pose electrocution risks to nearby persons and utility or maintenance staff, or disrupt power. BPA inspects transmission lines twice annually by helicopter and once annually from the ground, repairing damage as required. The overall impact of theft or vandalism would be **low-to-moderate**. If acts of sabotage or terrorism occur, these could create temporary **high** impacts.

If an extreme weather event, such as high winds or icing, were to occur in the area occupied by the new transmission line, there could be a public safety risk from a falling tower. However, BPA designs its towers and lines to withstand high winds and added loads from falling trees or ice. Also, the line's location within a cleared right-of-way helps to reduce risk of damage to nearby residences or other buildings. Because the new line would create known but rare risks to public health and safety during such weather events, the overall impact would be **moderate**.

Sundial Substation Site. The substation site, as well as the end of Segment 52 (shared by all alternatives) south of the Columbia River, and connector lines between the substation and BPA's existing Troutdale Substation, would be constructed within three areas of the previously contaminated Reynolds Metals site. However, impacts to public health and safety would be **low** because special care would be taken during excavation for the substation and towers, information about known contaminants on site is available, most contaminated debris and soil has been removed, and existing health risk levels are considered acceptable by the EPA and Oregon Department of Environmental Quality (ODEQ).

S.3.6.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

The three sites would have no additional health and safety impacts beyond the common impacts discussed above.

West Alternative and Options

About 600 feet of access road would need to be improved within one of the “control areas” of BPA’s Ross Complex. Control areas reduce the potential for hazardous substance exposure by restricting access or usage. To avoid disturbing the soil, BPA would add rock to the existing road surface, but not blade the existing road, and would not allow temporary tower disturbance areas to interfere with the site. By preserving the “cap” on this site, project construction and maintenance activities would have **no** hazardous substance impacts at the complex.

Central Alternative and Options

A portion of Segment 28, east of Amboy and Yacolt and one tower would be located on the far western edge of the former International Paper Co. Mill site. This location is likely not within areas potentially contaminated by prior paper mill operations. Hazardous substance impacts at this location would be **low** because previous assessments indicated limited contamination, the contaminated soils have been removed, and the proposed route largely avoids areas of the mill site where historic operations occurred. In any case, the site would be investigated further and risks would be mitigated if the Central Alternative is selected for construction. Where the Central Alternative shares Segment 52 (crossing the Reynolds Metals site) with other alternatives, it would also have a **low** hazardous substance impact.

East and Crossover Alternatives and Options

Same general health and safety impacts as those common to all action alternatives.

S.3.7 Socioeconomics

S.3.7.1 Affected Environment

Socioeconomic conditions and resources include population and housing, employment and income, public services, utilities and infrastructure, government revenue, property values, and land-generated income from agricultural and private timber production. The project could also affect existing quality of life and other community values.

Population and Housing. About 1.28 million people live in Cowlitz, Clark, and Multnomah counties, in communities ranging from concentrated urbanized areas to sparsely populated rural areas. The population of the cities and towns in the project area range from about 1,600 in Yacolt to about 164,000 in Vancouver. Temporary housing, including rental housing, hotel/motel accommodations, campgrounds and RV parks, are plentiful in the Portland-Vancouver metro area and in Kelso and Longview, Washington, but are more limited in the communities in the eastern portions of the project area.

Employment and Income. In 2013, more than 3.3 million people were employed in the Seattle-Tacoma-Olympia and Portland-Vancouver-Beaverton metropolitan areas. Government, wholesale and retail trades employ the greatest numbers (14 percent each), followed by health care and manufacturing (9 percent each); professional services, construction, and accommodation and food sectors (7 percent each); and real estate, finance and insurance, arts, entertainment and recreation, and farm sectors (5 percent each). The annual unemployment rate in the metropolitan areas ranged from 4.9 to 8.6 percent in 2014. Average per-capita income across the metropolitan areas ranged from \$36,000 to \$55,000 in 2013, and combined personal income totaled about \$315 billion. Average per capita income in 2013 was about \$40,500 in Clark County and about \$36,000 in Cowlitz County.

Public Services and Infrastructure. Fire protection is provided by municipal fire departments, rural fire districts, and the WDNR (for state lands). Police protection is provided by state police, sheriff's deputies and municipal police departments. Other public services include water and sewer, provided by local municipalities.

Government Revenue. State, county, and local governments rely on taxes and other revenue sources to fund public services and programs. These include retail sales and use taxes (Washington only), income taxes (Oregon only), business and occupation taxes (Washington), timber harvest taxes (Washington), property taxes and lodging taxes. Land held in trust by WDNR provides revenue to separate trusts managed for various public services, including schools.

Property Values. The assessed value of real property was about \$8 billion in Cowlitz County, \$39 billion in Clark County, and \$61 billion in Multnomah County in 2013. Due to market adjustments from the 2009 recession, the market value of property throughout the Pacific Northwest has generally trended downward.

Agricultural Production. Agricultural land comprises about 10 percent of the total land area in Cowlitz, Clark, and Multnomah counties, of which about 39 percent is harvested cropland. In 2012, agricultural crops in the three counties produced about \$148 million in revenues. Farmland also provides open space and other amenities important to residents and visitors.

Private Timber Production. Private timber production occurs on about 47 percent of the total land area in Cowlitz, Clark, and Multnomah counties. Private timberland owners harvested about 263 million board feet of timber from about 4,500 acres in the three counties in 2013, accounting for about 75 percent of the total timber harvest in these counties. Stumpage values for softwood timber in the Pacific Northwest in 2014 averaged about \$350 per thousand board feet.

Community Values. Many people who live in the project area identify the rural character of the landscape, close-knit communities, high-quality public services, and distance from higher density development as defining the quality of life they enjoy. Individuals enjoy benefits from the natural environment surrounding their homes and other amenities, such as scenic views, solitude and quiet, a sense of safety, and a sense of privacy—all of which can directly contribute to property values. Visitors also enjoy these benefits; recreation and tourism is an important part of the project area's economy. Travel-related spending in the three counties ranged from about \$142 million in Cowlitz County in 2009 (adjusted to 2014 dollars) to about \$3.4 billion in Multnomah County in 2014. The reliable supply of electricity also contributes to the area's

quality of life and stability of the economy, although it comes with public health and safety risks, such as concerns about EMF.

Environmental Justice. Federal agencies must determine if their activities could have disproportionately high, adverse effects on minority and low-income populations.

- **Minorities:** Based on a study of 2010 Census tracts, the project would cross some areas (3 out of 78 aggregated block groups studied) in Washington with minority populations more than 50 percent higher than the county's minority population. The three tracts would be crossed by the West Alternative and/or Crossover Alternative. However, the most areas crossed had lower minority populations than the surrounding counties and state as a whole. In Oregon (Multnomah County), the project would cross areas with a higher aggregate minority population than the county or state, but the percentage of minorities is not 50 percent higher.
- **Low-income:** Although only 5 out of 43 Census tracts crossed by the project reported low-income populations in 2013, median incomes within those tracts were higher than the respective county incomes and poverty rates in those tracts were lower than that of the surrounding county (and states). Of those five tracts, four are near the West or Crossover alternatives, or both, and one (in Kelso) would be crossed by all action alternatives.

S.3.7.2 Impacts Common to Action Alternatives

Population and Housing. There would be a short-term *increase* in population and demand for housing during construction but **no** long-term impact because existing BPA staff would operate and maintain project facilities.

Employment and Income. Construction activities would create a short-term *increase* in employment (about 200 jobs). Short-term *increases* in income are estimated to be about 0.13 percent of total personal income in the project area, with short-term benefits to local businesses when workers spend wages on products and services, although these impacts would be too small to be discernible. There would be **no** long-term impact on employment or income, but by improving the reliability of electricity delivery in the region, the project would encourage businesses who need high-quality power to locate and invest in the area, which could provide jobs.

Public Services and Infrastructure. If a serious accident were to occur during construction or operations, demands on emergency medical, police or fire services would be temporary and localized, potentially causing a short-term *decrease* in availability of services elsewhere. Water used during construction would only be obtained from a permitted source and would not displace existing water requirements by municipalities. Water and wastewater treatment for Sundial Substation would be coordinated with the city of Troutdale. There would be **no** impacts on public service providers and infrastructure most of the time and only temporary **low** impacts if project workers should require them during a fire or accident.

Government Revenue. Short-term *increases* in government revenue would result from taxes on direct and indirect project-related spending (by contractors) during construction, and from the harvest of privately owned timber in and near the new right-of-way, access roads and substation sites. Additional short-term *increases* in revenue to state trusts would occur if the project requires the harvest of timber from trust lands that otherwise would not be harvested until

later. Some of the timber-related increase would be offset if state and private timberland managers decided to reduce harvest on other lands. Overall, there would be **no** adverse impact on tax revenues in the three counties during project construction. However, the project would cause long-term **decreases** in government revenue by diminishing the property tax base (BPA fee-owned property would be permanently removed from tax rolls), reducing future timber-related revenue from state trust lands, and decreasing future revenue from taxes on private timber harvests and some agricultural products. Revenue impacts differ for each action alternative and substation site and are summarized in more detail below. In general, revenue decreases could have **high** impacts on Cowlitz or Clark counties in some years.

Property Values. The value of some residential properties near the line could **decrease** slightly in the short-term, depending on many variables. The project is expected to have **no** appreciably measurable impacts on long-term residential property values. Some timberland would be less valuable if taken out of production; however, BPA compensates owners of property it acquires in fee or from which it secures an easement.

Agricultural Production. Construction of towers and access roads would permanently remove land from agricultural production. Operation of the new line may permanently remove the ability of landowners to grow incompatible crops on the right-of-way. The project would create short-term **decreases** in agricultural revenue on lands directly affected by the project, and possibly long-term **decreases** if such production were prohibited. Revenue impacts differ for each action alternative and are summarized below. Line repairs may also cause temporary crop damage; BPA would assess and pay for the damage. Overall, the project would likely have **no** impact on the overall supply and price of crops in the regional agricultural markets, although there could be **low** impacts on farmers who produce products for niche markets.

Private and Public Non-WDNR Timber Production. The project may create short-term **increases** in timber production revenues where clearing would require harvesting immediately, but this could create long-term **decreases** because of restrictions on replanting in the right-of-way. Revenue impacts differ for each action alternative and substation site and are summarized below. Overall, the project would likely have **no** long-term impact on the price of timber in regional markets.

Community Values. The project could cause short-term **decreases** in the value of amenities, such as peace and quiet, for residents that would be affected by increased noise, traffic, and other aspects of construction. It could cause long-term **decreases** in the value of amenities, such as being close to forested open space, for residents of properties near the transmission line or substations. If any construction workers are injured, they could experience short- or long-term **decreases** in well-being (health and safety), as could any person who believes the project could expose them to higher risks from EMF or electrocution. Short- and long-term **decreases** in recreational values could result if the project diminishes visual aesthetics, but it could also provide long-term **increases** where access roads would enhance accessibility or visibility. The project would provide long-term **increases** in transmission system reliability.

Environmental Justice. Because none of the action alternatives crosses population areas with disproportionately high minority or low-income populations, impact levels were not evaluated. However, during the public scoping process, BPA considered all input from persons or groups regardless of race, income status or other social/economic characteristics to ensure fair treatment of minority and low-income residents.

Sundial Substation Site. BPA plans to purchase both Lots 11 and 12 within the Troutdale Reynolds Industrial Park from the Port of Portland at market value. This could cause **increases** or **decreases** in revenue for the Port, depending on its effect on the value of remaining lots in the industrial park. If BPA displaces a potential private landowner who would pay property taxes, this could create a long-term **decrease** in revenue for Multnomah County, a **moderate** impact.

S.3.7.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

Casey Road site. BPA would purchase in fee ownership in the Casey Road site and access road property from the state of Washington through WDNR. Timber harvested during construction would create a short-term **increase** of about \$282,035 in revenues from state trust lands. Converting the property permanently to a substation would cause a long-term **decrease** in state trust revenue from forgone future harvests currently valued at \$220,344. Loss of future property tax revenues could have a **moderate** impact on Cowlitz County.

Baxter Road site. BPA would purchase in fee ownership in the Baxter Road site and access road property from Sierra Pacific Industries. Timber harvested during construction would create short-term **increases** in revenues of about \$127,718 for Sierra Pacific and in timber-harvest tax revenues of \$5,000 for Cowlitz County and \$1,300 for the state of Washington. Converting the property permanently to a substation and access road would cause long-term **decreases** in revenues of about \$354,771 for Sierra Pacific, \$14,000 for Cowlitz County and \$3,500 for the state. Loss of timber tax revenues and foregone property taxes could have a **moderate** impact on Cowlitz County. There would be **no** impact on market prices for timber.

Monahan Creek site. BPA would purchase in fee ownership of the Monahan Creek site and access road property from multiple landowners. Trees cover portions of the property; other portions are used for grazing. Loss of future property tax revenues could have a **low** impact on Cowlitz County.

West Alternative and Options

During construction, there could be the following short-term impacts (+ or – signs for Options indicate the net change from the action alternative):

- increases in timber-harvest revenues on state trust lands (West Alternative and Options 1 and 2, \$4,096; Option 3, +\$59,713);
- increases in timber-harvest tax revenues (West Alternative and Options 1 and 2, \$24,932; Option 3, +\$7,933);
- increases in private and non-WDNR public timber production revenues (West Alternative and Option 1, \$499,592; Option 2, +\$220; Option 3, +\$158,666);
- and decreases in agricultural production

Short-term and long-term socioeconomic impacts would include increases or decreases in certain revenues, as summarized here. Where increases are compared among alternatives and options, a plus sign (+) means a larger increase and a minus sign (-) means a smaller increase. Where decreases are compared among alternatives and options, (+) means a larger decrease and (-) means a smaller decrease.

revenues (West Alternative, \$458,800; Option 1, +\$90; Option 2, +\$400; Option 3, +\$200).

Over the life of the project, there would be the following long-term impacts:

- decreases in trust revenues from forgone timber harvests (West Alternative and Options 1 and 2, \$3,200; Option 3, +\$46,651)—**moderate** impacts on Cowlitz County;
- decreases in timber-harvest tax revenues (West Alternative and Options 1 and 2, \$69,257; Option 3, +\$22,037)—**moderate** impacts on Cowlitz County;
- decreases in private and non-WDNR public timber production revenues (West Alternative and Option 1, \$1.4 million; Option 2, +\$611; Option 3, +\$440,740)—**no** impact on regional prices;
- and decreases in agricultural production revenues (West Alternative, \$4.5 million; Option 1, +\$1,500; Option 2, +\$133,100; Option 3, +\$262,100). For all options, if landowners stop growing crops in the right-of-way due to restrictions, there could be an additional long-term decrease in revenue of about \$20.5 million. These changes in agricultural production would have **no** impact on regional prices but potential **low-to-moderate** impacts on local prices.

When annualized, these increases and decreases would be minor (in some cases, a fraction of a percent) relative to annual revenues in each category, although impacts could be proportionally greater on individual landowners.

Central Alternative and Options

During construction, there could be the following short-term impacts:

- increases in timber-harvest revenues on state trust lands (Central Alternative and Option 2, \$3.3 million; Option 1, +\$421,588; Option 3, -\$705,414);
- increases in timber-harvest taxes (Central Alternative, \$137,974; Option 1, -\$3,142; Option 2, -\$10,529; Option 3, -\$16,825);
- increases in private and non-WDNR public timber production revenues (Central Alternative, \$2.8 million; Option 1, -\$62,850; Option 2, -\$210,587; Option 3, -\$336,502);
- and decreases in agricultural production revenues (Central Alternative and Option 1, \$2,700; Option 2, +\$800; Option 3, +\$35,900).

Over the life of the project, there would be the following long-term impacts:

- decreases in trust revenues from forgone timber harvests (Central Alternative and Option 2, \$2.6 million; Option 1, +\$329,372; Option 3, -\$551,115)—potential **high** impacts on Cowlitz or Clark counties;
- decreases in timber-harvest tax revenues (Central Alternative, \$383,261; Option 1, -\$8,729; Option 2, -\$29,248; Option 3, -\$46,736)—potential **high** impacts on Cowlitz or Clark counties;

- decreases in private and non-WDNR public timber production revenues (Central Alternative, \$7.7 million; Option 1, -\$174,582; Option 2, -\$584,964; Option 3, -\$934,727)—**no** impact on regional prices;
- and decreases in agricultural production revenues (Central Alternative and Option 1, \$334,400; Option 2, -\$100; Option 3, +\$556,700). For Central Option 3 only, if landowners stop growing crops in the right-of-way due to restrictions, there could be an additional long-term decrease in revenue of about \$1.3 million. These changes in agricultural production would have **no** impact on regional prices but potential **low-to-moderate** impact on local prices.

Similar to the West Alternative, these revenue impacts would be small relative to annual totals, although impacts could be proportionally greater on individual landowners.

East Alternative and Options

During construction, there would be the following short-term impacts:

- increases in timber-harvest revenues on state trust lands (East Alternative and Option 1, \$1.6 million; Option 2, +\$627,066; Option 3, +\$383,913);
- increases in timber-harvest taxes (East Alternative, \$172,174; Option 1, -\$11,782; Option 2, -\$11,608; Option 3, -\$1,746);
- increases in private and non-WDNR public timber production revenues (East Alternative, \$3.6 million; Option 1, -\$235,643; Option 2, -\$304,960; Option 3, -\$164,135,740);
- and decreases in agricultural production revenues (East Alternative and Options 2 and 3, \$22,000; Option 1, +\$400).

Over the life of the project, there would be the following long-term impacts:

- decreases in trust revenues from forgone timber harvests (East Alternative and Option 1, \$1.2 million; Option 2, +\$489,905; Option 3, +\$299,938)—potential **moderate** impacts on Cowlitz or Clark counties;
- decreases in timber-harvest tax revenues (East Alternative, \$478,260; Option 1, -\$32,728; Option 2, -\$32,245; Option 3, -\$4,851)—potential **moderate** impacts on Cowlitz or Clark counties;
- decreases in private and non-WDNR public timber production revenues (East Alternative, \$9.7 million; Option 1, -\$654,564; Option 2, -\$701,776; Option 3, -\$197,963)—**no** impact on regional prices;
- and decreases in agricultural production revenues (East Alternative and Options 2 and 3, \$287,200; Option 1, +1,440)—**no** impact on regional prices but potential **low-to-moderate** impact on local prices.

As with the other action alternatives, these revenue impacts would be small relative to annual totals, but impacts could be proportionally greater on individual landowners.

Crossover Alternative and Options

During construction, there would be the following short-term impacts:

- increases in timber-harvest revenues on state trust lands (Crossover Alternative and all options, \$2.3 million);
- increases in timber-harvest taxes (Crossover Alternative and Option 1, \$91,868; Option 2, +\$7,654; Option 3, +\$13,179);
- increases in private and non-WDNR public timber production revenues (Crossover Alternative and Option 1, \$2 million; Option 2, +\$153,081; Option 3, +\$263,577);
- and decreases in agricultural production revenues (Crossover Alternative and Options 2 and 3, \$26,000; Option 1, +\$2,500).

Over the life of the project, there would be the following long-term impacts:

- decreases in trust revenues from forgone timber harvests (Crossover Alternative and all options, \$1.8 million)—potential **moderate** impacts on Cowlitz or Clark counties;
- decreases in timber-harvest tax revenues (Crossover Alternative and Option 1, \$255,190; Option 2, +\$21,261; Option 3, +\$36,608)—potential **moderate** impacts on Cowlitz or Clark counties;
- decreases in private and non-WDNR public timber production revenues (Crossover Alternative and Option 1, \$5.2 million; Option 2, +\$425,225; Option 3, +\$732,158)—**no** impact on regional prices;
- and decreases in agricultural production revenues (Crossover Alternative and Options 2 and 3, \$110,000; Option 1, +11,900)—**no** impact on regional prices but potential **low-to-moderate** impact on local prices.

As with the other action alternatives, these revenue impacts would be small relative to annual totals, but impacts could be proportionally greater on individual landowners.

S.3.8 Transportation

S.3.8.1 Affected Environment

The transportation system includes public highways and roads, private logging and other private local roads, public transit, railroads, public and private airports and airstrips, and marine traffic. Regional highways include I-5, I-205 and I-84; state highways (all in Washington) include SR 14, SR 411 (West Side Highway), SR 500, SR 502 and SR 503. Interconnecting the highways are hundreds of county and city roads. Public transit is provided by the Cowlitz Transit Authority (Community Urban Bus Service [CUBS]) and Clark County Public Transportation Benefit Authority (C-TRAN).

Rail lines operating in the area include Burlington Northern Sante Fe, Lewis and Clark Railroad and Amtrak; Union Pacific operates close to the project area near Troutdale. Airports located in and near the area include Portland International Airport (PDX), which also operates Portland-Troutdale Airport located southeast of the proposed Sundial Substation site; Southwest Washington Regional Airport in Cowlitz County; and Pearson Field and Grove Field airports in Clark County. There are also several private airstrips and heliports operating throughout the area.

General marine traffic occurs on the Columbia River at the proposed transmission line crossing north of Troutdale. While large cargo ships do not travel through this area, tugs, barges and

recreational boaters use this stretch of the river. Recreational boating also occurs on Yale Lake and Lake Merwin to the northwest. Some small float planes also use local lakes and rivers.

S.3.8.2 Impacts Common to Action Alternatives

Construction of the line, including transport of construction equipment and supplies, commuting by project workers, improvements made to county roads and development of BPA access roads, would temporarily and intermittently increase traffic and cause potential delays along the transportation corridors in the project area, including I-5, I-205, I-84, SR 14, SR 500, SR 503 and SR 411. The project would add an estimated 45 trucks per day, or about 4,500 driven miles per day on highways, state routes and local roads—a temporary **moderate** impact on traffic volume. Traffic delays due to increased truck traffic, blasting (to protect cars from flying debris) and conductor-stringing across roadways (by helicopter or caterpillar pull) would also have temporary **moderate** impacts. BPA contractors would be required to follow all legal size and load limits on state and county roads and to repair any damage to existing roads caused by the project, having an expected **low** impact on existing road conditions.

Construction activities would have **no-to-low** impacts on public transit services because any temporary service disruptions needed would be coordinated with the applicable transit agency before construction. Crossings of railroads would be timed to avoid interrupting freight or passenger trains, and if necessary, appropriate coordination and crossing permits would be obtained from the affected railroad operator. Project construction would have **no-to-low** impact on rail.

Any project structure 200 feet or taller or within a certain distance of an airport will require pre-approval by the FAA, which may require appropriate lighting and marking. Because some towers close to airports are proposed to be over 200 feet, the project could create **no-to-low** impacts on airports.

One Columbia River crossing tower would need to be placed within the river (outside the river channel); boaters would be diverted from construction activities. **No-to-low** impact on river traffic would occur from these temporary diversions.

Once the line is operating, project-related traffic on area roads would be minimal and infrequent. Maintenance traffic would normally involve a few maintenance vehicles along the right-of-way several times a year and helicopters flying overhead twice a year. Even if larger vehicles such as cranes are periodically required to repair the line and cause minor traffic delays, the project would have **no-to-low** long-term impacts on roads. For the same reasons, line operations and maintenance would have **no-to-low** impact on public transit and rail. Conformance to FAA standards would ensure the line has **no** impact on nearby airport operations. Where the project would cross any navigable streams or rivers, including the Columbia River, conductors would be high enough to allow boaters to pass underneath unhindered, with **no** impact on marine traffic. At most, any recreational boats or marine traffic present during in-water maintenance activities would be temporarily diverted away, resulting in **no-to-low** impact.

Sundial Substation Site. Construction at either lot would periodically disrupt local motorists and existing truck traffic and workers in the larger industrial park for up to 3 years, a **moderate** impact. Maintenance activities would occur infrequently, having **no-to-low** impacts on traffic and roads in the industrial complex.

S.3.8.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

The Casey Road site is relatively remote and a new road would be built to access the substation site from Casey Road and West Side Highway (SR411). Improvements would be made to Casey Road, which is used regularly by a few local homeowners, but otherwise used infrequently by the public and logging trucks. Construction and maintenance traffic could temporarily delay these users, but would have a **low** impact because logging companies could arrange trips around the construction schedule and maintenance traffic would be infrequent. Construction vehicles using Casey Road and the West Side Highway could interrupt or slow traffic for long periods as fill material is transported to the substation site, a **moderate** impact on these roadways.

The Baxter Road site is also relatively remote, but could occasionally delay residential homeowners along Beebe Road (off of West Side Highway) as well as logging trucks, a **low** impact during construction.

The Monahan Creek site is less remote, but would require much less access road work. Intermittent traffic delays on Delameter Road, possible detours, and temporary increased traffic would cause **moderate** short-term impacts. Maintenance of the unmanned substation, regardless of site chosen, would have **no-to-low** impact on surrounding traffic and roads.

All Action Alternatives and Options

The four action alternatives and their options would have the same overall impacts on traffic and roadways: there would be **low-to-moderate** impacts during construction due to intermittent traffic disruptions and **no-to-low** impacts during operation and maintenance of the line. The only differences among them are locations of roads affected and the number of new and improved access roads required, both inside and outside the right-of-way.

Because the West Alternative would cross a more developed area, road construction may temporarily affect more motorists; at the same time, a larger network of roads would partially mitigate these impacts. The West Alternative also requires the fewest miles of new and improved roads outside of existing or proposed right-of-way of any action alternative. The other alternatives would cross more rural areas with fewer existing roadways and require a much higher number of new and improved access roads outside existing/proposed right-of-way. However, there would also be less traffic subject to disruption in these areas.

Once built, new and improved roads built within rights-of-way would have **no** impacts on the transportation system because they would not be public, although they could encourage trespassing. Those 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), having **no-to-low** long-term impact due to infrequent maintenance activities. The East Alternative would have the highest mileage of new or improved roads outside the right-of-way (21 miles new, 161 miles improved). The next highest would be the Central Alternative (14 miles new, 113 miles improved), followed by the Crossover Alternative (19 miles new, 78 miles improved). The West Alternative, because it would be built primarily within existing right-of-way with an extensive access road system, would only require 10 new and 20 improved

miles of road outside the right-of-way. Options for the action alternatives would vary these totals only slightly.

S.3.9 Cultural Resources

S.3.9.1 Affected Environment

The project is within three physiographic regions primarily in Washington, with a small portion in Oregon: the Willapa Hills, Southern Cascades, and the Portland Basin. The project extends through lands traditionally inhabited by two Native American groups, the Cowlitz and the Chinook, and occasionally visited by the Klickitat. Most of the project area is within the traditional territory of the Cowlitz, who had winter villages along the Cowlitz River. The southern end of the project is within the traditional territory of the Chinookan group known as the Multnomah. Their territory extended just south of the mouth of the Kalama River to the vicinity of the Sandy River. The Chinook maintained villages on or near the Columbia River between the mouths of the Cowlitz and Washougal Rivers. Later, Europeans established posts in this area, such as Fort Vancouver, and created settlements south of the Columbia River and in areas along the Cowlitz, Skookumchuck rivers in southwestern Washington, and along the Deschutes River in central Oregon.

Background research initially identified 39 archaeological resources previously documented in the project area (0.5 mile on either side of the transmission line centerline of all action alternatives, including existing and proposed rights-of-way and varying acreage for the four substation sites. This includes 33 resources recorded in the Washington Department of Archaeology and Historic Preservation (DAHP) database and six identified in previous survey reports but not officially recorded. The 39 archaeological resources consist of 17 pre-contact sites, 17 historic sites, and five mixed sites (both pre-contact and historic materials present). The pre-contact sites include four village locations, 10 lithic scatter sites, and three isolated artifact sites. The 17 recorded historic sites include two farmstead sites, two abandoned roads, five cemeteries, two grave markers, one debris scatter, one mine, one rock feature site, one aircraft crash site, one hydroelectric site, and one site with irrigation system remnants.

In addition to the archaeological resources, background research identified 16 previously recorded historic resources (structures or objects with potential for listing in the National Registry of Historic Places [NRHP]) within the project area, including BPA's transmission network. There are also 27 locations classified as ethnographic cultural resources that may be eligible traditional cultural properties (TCPs).

A recent pedestrian survey was also conducted within 250 feet of each side of the centerline of existing and proposed right-of-way to be occupied by the Preferred Alternative (Central Alternative using Central Option 1) and within 25 feet of either side of new and improved roads outside the transmission right-of-way. This survey identified 11 new archaeological resource sites, including 5 prehistoric and 6 historic. These newly identified sites have not yet been evaluated for listing. An additional historic resource survey within 0.5 mile of either side of the Preferred Alternative's centerline found 893 additional historic resources. The majority, 803, are located outside the right-of-way and not eligible for NRHP listing. However, 26 of 60 located within the right-of-way could be eligible for listing.

S.3.9.2 Impacts Common to Action Alternatives

Because the project transects areas where humans have lived for 10,000 years, construction of the line could potentially disturb cultural sites. It would also introduce visual elements that could alter the character of sensitive cultural resources. However, towers and access roads would be sited to avoid known sensitive areas whenever possible and trained cultural resource monitors would be consulted during construction to ensure unidentified sites are not inadvertently impacted. Where certain segments of older BPA transmission lines may be removed and older substations are modified, the project could impact historically significant BPA facilities. Operations and maintenance of the line would not directly affect cultural resources.

For the Draft EIS, comparison of potential impacts by the alternatives and options was made based on the Washington Statewide Predictive Model. Using the model and knowledge of existing cultural resource sites, each individual route segment within the alternatives and options was given a cultural sensitivity “score.” This score reflects both the number and significance of known cultural resources within each route segment, as well as the probability of encountering previously undiscovered cultural resources. The appropriate route segment scores were then added together to provide a total score for each alternative and option. Each total incorporates impacts from building the line, access roads and relevant substation. BPA completed an on-the-ground survey of cultural resources on the Preferred Alternative (Central Alternative using Central Option 1) where permission to enter property was granted. BPA is now consulting with appropriate entities to better identify and minimize impacts to potentially affected resources.

Based on this methodology, all action alternatives and options would have potential **moderate-to-high** impacts on cultural resources in the project area, but primarily in different locations.

Sundial Substation Site. Cultural sensitivity score of 25. **Moderate** impact because the site has a high probability for disturbing historic resources due to BPA’s 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. More recent studies identified 12 historic resources and 1 isolated archaeological find; this does not change potential impacts.

S.3.9.3 Impacts Unique to Action Alternatives

Castle Rock Area Substations

The Casey Road site has the lowest cultural sensitivity score of 15. The Monahan Creek and Baxter Road sites each have a higher score of 24, likely due to their proximity to creeks. All three substation sites are in remote areas that have been previously logged and are next to existing transmission lines that may have disturbed archaeological resources previously. However, logging activities and the existing transmission lines may contribute to a higher possibility that historic resources are present (i.e., historic transmission lines and logging camps). Construction of a substation at any of the three sites would have a **moderate** impact because of the adjacent historic BPA transmission lines.

West Alternative and Options

Highest cultural sensitivity score among the alternatives (498), likely because it would cross some large population centers—primarily in its southern half—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. Potential **moderate-to-high** impacts on cultural resources. (The options may lower or boost sensitivity scores, but overall impacts are the same as the alternative.)

- **West Option 1:** Slightly **higher** sensitivity score (+21). Would remove three segments with known resources, but two of three replacement segments would also have resources. Segments 40 and 46 have an historic road and grave marker, among other resources.
- **West Option 2:** **Higher** score (+53). Would remove four segments where towers could impact resources, but add four more sensitive segments that also have resources at tower sites (segments 36, 36a, 37, 43), including a village and ethnographic prairie.
- **West Option 3:** **Higher** score (+42) because it would remove four segments where towers could impact resources, but add three more sensitive segments (36, 36a, 37) that also have resources at tower sites.

Central Alternative and Options

Second lowest cultural 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. Potentially **moderate-to-high** impacts on cultural resources, including those identified in recent surveys along the Preferred Alternative. (The options may alter sensitivity scores, but overall impacts are the same as the alternative.)

- **Central Option 1:** Slightly **higher** sensitivity score (+12). Would add Segment A, which has the same trail at a tower location as segments B and F.
- **Central Option 2:** **Higher** score (+51). Would remove two segments where towers could impact resources, but add three more sensitive segments with resources at tower sites (1, 4, 5), including a village site and ethnographic site likely to contain burials.
- **Central Option 3:** **Lower** score (-26). Would replace one segment with another (30) that has less impact on an ethnographic trail.

East Alternative and Options

Lowest cultural 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 and lithic scatters. Potentially **moderate-to-high** impacts on cultural resources. (The options may alter sensitivity scores, but overall impacts are the same as the alternative.)

- **East Option 1:** Slightly **higher** sensitivity score (+11). Would remove two segments where towers would impact resources, but one (3) of four replacement segments (3, 7, 11, J) has a known village site that may be affected by tower locations.
- **East Option 2: Higher** score (+31). 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.
- **East Option 3:** Nearly the **same** impact as the alternative (-5). Would replace one segment with another, which contains no known sites at proposed tower locations.

Crossover Alternative and Options

Second highest cultural 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, villages sites and lithic scatters. Potentially **moderate-to-high** impacts on cultural resources. (The options may alter sensitivity scores, but overall impacts are the same as the alternative.)

- **Crossover Option 1: Higher** score (+57). Would remove one segment and add three segments (47, 48, 50), two of which (47, 50) have towers located where they could impact ethnographic prairies and a village site.
- **Crossover Option 2: Higher** score (+35), because one (C) of two replacement segments (C, E) has a tower located where it could affect an historic military road.
- **Crossover Option 3: Higher** score (+34), because two replacement segments (D, E) have towers located where they could affect the same historic military road as Option 2.

S.3.10 Geology and Soils

S.3.10.1 Affected Environment

The project area is within three physiographic regions: the Willapa Hills, South Cascades, and Portland Basin. The northern portions of the action alternatives and the three Castle Rock area substation sites are within the Willapa Hills region. Remaining portions of the Central, East, and Crossover alternatives, and the portion of the West Alternative between the Cowlitz and Lewis rivers, are within the South Cascades region. Topography of these two regions is mostly rolling to steep hills or relatively level terrain in the floodplains of major rivers, such as the Cowlitz River. South of the Lewis River, most of the West Alternative is within the Portland Basin, which is mostly flat or nearly flat terrain. Elevation in the project area ranges from 25 to 3,311 feet above sea level.

In the Willapa Hills and South Cascades regions, igneous rock is covered by varying depths of clay-rich soils weathered from the underlying bedrock. The Portland Basin is mostly filled with sediment (sand, clay and gravel) deposited by ice age floods. In all three regions, some sediments are derived from volcanic eruptions and mudflows from Mt. St. Helens and Mt. Hood,

such as near the Cowlitz and Kalama rivers and eastern portions of the Lewis River, and at the Sundial Substation site. Where the transmission line would cross these areas, it would be potentially subject to additional mudflows or ash fall from future volcanic eruption. Other geologic deposits include glacial till, glacial outwash, alluvium at river crossings, and lake and wetland deposits.

Soils in the area generally support agriculture, forest production, urban and rural development, and natural functions such as wetlands and aquifer recharge. Erosion risk varies by topography and soil makeup. Most soils in the northern (north of the Lewis River) and eastern portions of the project area have a severe soil erosion potential. A few small areas south of Lake Merwin, along the East Fork Lewis River, and south of Rock Creek along the East Alternative are also rated severe. The portion of the West Alternative from the Lewis River to the Columbia River is on flatter terrain, with most soils rated as having a low or moderate soil erosion potential.

Most soils in the project area are susceptible to compaction. Areas with low resistance to compaction occur along the northern portions of the action alternatives, the middle portion of the West Alternative and the southern portions of the Central, East, and Crossover alternatives. Areas with moderate resistance occur along the Cowlitz and Lewis rivers, between Lake Merwin and Yale Dam, and south near Amboy. Less than 1 percent of the soils within the project area have a high resistance to soil compaction.

The action alternatives and options cross known landslides and relatively steep slopes that may be susceptible to landslides. In general, mapped landslides and steep slopes are found in the northern (north of the Lewis River) and eastern portions of the project within the Willapa Hills and South Cascades regions of Washington. The risk of landslides is low in the relatively flat Portland Basin along the southern portion of the West Alternative.

About 480 earthquakes of less than magnitude 3 have occurred within 60 miles of the project area since 1973. Earthquakes measured as magnitude 3 are common in the project area and earthquakes in the 3.2 to 3.4 range are common in the Kelso area. Four earthquakes between magnitudes 5.2 and 6.9 occurred between 1949 and 2001. Only one fault considered active within the past 1.6 million years is crossed by one action alternative—the Lacamas Lake Fault, believed to have last ruptured between 10,000 and 100,000 years ago, is crossed by the southern portion of the West Alternative. Although quiet for centuries and not in the project area, the fault along the Cascadia Subduction Zone is expected to cause a very large earthquake (magnitude 9.0 or higher) that would be felt in the project area and across the Northwest. Because most of the land crossed by the action alternatives is underlain by bedrock, liquefaction (extreme movement of loose, saturated sediment during earthquakes) is unlikely except within the Cowlitz, Coweeman, Lewis, East Fork Lewis and Columbia River valleys, which have moderate-to-high liquefaction susceptibility.

S.3.10.2 Impacts Common to Action Alternatives

Transmission lines and access roads would generally be sited (and all substations would be sited) to avoid unstable (landslide) locations. Where unavoidable, engineers and geologists would survey locations by foot to select the best tower and road locations. Similarly, tower sites in geologic fault zones would be evaluated for surface ruptures and relocated if necessary. All facilities would be built to applicable seismic standards. In the few areas (about 42-43 acres for each alternative) where soil is susceptible to liquefaction, the low potential for major seismic activity reduces the likelihood of this affecting towers. Where possible, project facilities would

also be sited to avoid areas where volcanic mudflows could travel, although ash fall could not be avoided.

Excavation for project facilities and removal of vegetation along rights-of-way would affect soils by causing erosion and compaction. Impacts would be greatest during and immediately after construction, before vegetation becomes re-established or disturbed soil has been covered (e.g., by gravel), and on steeper slopes. By following best management practices, erosion impacts during construction would be kept **low-to-moderate** where soil is moderately (or moderately to severely) susceptible to erosion and **low** where erosion potential is slight. Infrequent operations and maintenance activities would have **low** erosion impacts.

By keeping construction equipment and vehicles on access roads and within approved construction footprints, temporary soil compaction impacts would be **moderate**. By taking mitigation measures after construction, long-term compaction impacts on soils not under roads, towers and substations would be **low**. However, soil under these facilities would be permanently compacted and removed from use; the project would have long-term **high** compaction impacts in these areas.

Sundial Substation Site. Temporary and permanent **low** erosion impacts because the site (either lot) is very flat and has only a slight erosion-hazard potential. Long-term **high** impacts on soil compaction under the substation, but temporary **moderate** and long-term **low** compaction impacts on soil compaction beyond the substation footprint (due to mitigation measures).

S.3.10.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

The Casey Road, Baxter Road and Monahan Creek sites have the same impacts. Due to the sites' underlying geology, they are unlikely to be subject to liquefaction during earthquakes. No mapped landslides are within the sites, but soils are considered to have moderate-to-severe (Monahan) or severe (Casey, Baxter) erosion potential. However, with mitigation, erosion impacts would be temporarily **low-to-moderate** during construction and **low** when the substation is operating. Soil compaction impacts would be permanent and **high** directly under the substation; in the adjacent disturbance area, compaction impacts would be **moderate** during construction and, following mitigation measures, **low** in the long-term.

West Alternative and Options

The northern portion of the West Alternative (north of the Lewis River) is within potentially landslide-susceptible terrain and crosses mapped landslides. Where these would be unavoidable, towers and roads would be built to appropriate design standards, taking into account soil stability. In this same northern portion, the alternative would disturb about 211 acres of soil with severe erosion potential, the least of the action alternatives. Mitigation measures would keep erosion impacts during construction **low-to-moderate** in these areas. Along the rest of the alternative, erosion impacts during construction would be **moderate** where erosion potential is moderate and, south of the Lewis River, **low** where erosion potential is slight. Long-term erosion impacts from operations and maintenance would be **low** (same for all action alternatives). Soils along this alternative have generally low-to-moderate resistance to soil compaction. There would be a long-term **high** impact on about 238 acres of soil that would

be permanently compacted under towers and roads; temporary compaction impacts elsewhere during construction would be **moderate** and long-term impacts elsewhere, **low**.

- **West Option 1:** Same erosion impacts (**low**) as the route segments it replaces and same compaction impacts (**high** under towers and roads; **low** elsewhere). Would cross slightly less soil (-5 acres) with severe erosion potential, but slightly more (+1 acre) with low resistance to compaction.
- **West Option 2:** Slightly more **low-to-moderate** erosion impacts because it would cross slightly more soil (+12 acres) on steeper slopes with moderate-to-severe erosion potential. Would compact slightly more (+8 acres) soil with low resistance.
- **West Option 3:** More **low-to-moderate** erosion impacts because it would cross a mapped landslide area near Matney Creek and about 20 percent more soil (+44 acres) with severe erosion potential. Would compact slightly more (+13 acres) soil with low resistance.

Central Alternative and Options

Most of the Central Alternative is within potentially landslide-susceptible terrain and would cross several mapped landslides; towers and roads unable to avoid these would be built to appropriate design standards. The alternative would disturb about 551 acres of soil with severe erosion hazard, the second-highest among the action alternatives. Same erosion impacts during construction as the West Alternative (**low-to-moderate** with mitigation), as well as along the rest of the alternative. **Low** long-term erosion impacts. 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. There would be a long-term **high** impact on about 206 acres of soil that would be permanently compacted under towers and roads; temporary compaction impacts elsewhere during construction would be **moderate** and long-term impacts elsewhere, **low**.

- **Central Option 1:** More **low-to-moderate** erosion impacts because it would cross more soil (+27 acres) with severe erosion potential near Castle Rock. Would compact slightly more (+3 acres) soil with low resistance.
- **Central Option 2:** Would have **low-to-moderate** erosion impacts where it would cross a mapped landslide near Longview and soil with severe erosion potential near Lexington, but would cross less (-38 acres) of this soil type overall. Would compact more (+31 acres) soil with low-to-moderate resistance.
- **Central Option 3:** Would have a **low-to-moderate** erosion impacts where it would cross mapped landslide areas near Amboy and the East Fork Lewis River and soil with moderate-to-severe erosion potential southeast of Amboy, but would cross less (-31 acres) of this soil type overall. Would compact slightly less (-3 acres) soil with moderate resistance.

East Alternative and Options

Proposed along the most remote and rugged route of the action alternatives, most of the East Alternative would cross potentially landslide-susceptible terrain. It would cross several mapped landslides; towers and roads unable to avoid these would be built to appropriate design standards. The alternative would disturb about 664 acres of soil with severe erosion hazard, the

highest among the action alternatives. Same erosion impacts during construction as the Central Alternative (**low-to-moderate** with mitigation) along its entire route. **Low** long-term erosion impacts. 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. There would be a long-term **high** impact on about 235 acres of soil that would be permanently compacted under towers and roads; temporary compaction impacts elsewhere during construction would be **moderate** and long-term impacts elsewhere, **low**.

- **East Option 1:** Would have **low-to-moderate** impacts where it would cross mapped landslide areas near the Cowlitz River and soil with severe erosion potential near Lexington, but would cross less (-47 acres) of this soil type overall. Would compact more (+28 acres) soil with low resistance.
- **East Option 2:** Would have **low-to-moderate** impacts where it would cross mapped landslide areas along Salmon Creek and soil with severe erosion potential south of Yale Dam and east of Amboy, but would cross nearly 10 percent less (-60 acres) of this soil type overall. Would compact slightly less (-4 acres) soil with low-to-moderate resistance.
- **East Option 3:** Would have **low-to-moderate** impacts where it would cross soil with severe erosion potential east of the upper reaches of the Washougal River, but would cross only slightly more (+3 acres) of this soil type total. Would compact slightly less (-2 acres) soil with low resistance.

Crossover Alternative and Options

Most of the Crossover Alternative is within potentially landslide-susceptible terrain and would cross several mapped landslides; towers and roads unable to avoid these would be built to appropriate design standards. The alternative would disturb about 478 acres of soil with severe erosion hazard, mostly located along its middle and lower portions. Mitigation would keep erosion impacts during construction **low-to-moderate** in these areas and along the rest of the route; long-term erosion impacts would be **low**. 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. There would be a long-term **high** impact on about 253 acres of soil that would be permanently compacted under towers and roads; temporary compaction impacts elsewhere during construction would be **moderate** and long-term impacts elsewhere, **low**.

- **Crossover Option 1:** Would cross slightly less soil (-3 acres) with severe erosion potential; same **low-to-moderate** impacts. Would compact more (+14 acres) soil with low resistance.
- **Crossover Option 2:** More **low-to-moderate** erosion impacts because it would cross about 14 percent more soil (+67 acres) with severe erosion potential near Castle Rock. Would compact less (-14 acres) soil with low resistance.
- **Crossover Option 3:** More **low-to-moderate** erosion impacts because it would cross about 12 percent more soil (+59 acres) with severe erosion potential near Castle Rock. Would compact less (-19 acres) soil with low resistance.

S.3.11 Water

S.3.11.1 Affected Environment

Watersheds: The action alternatives would cross the Columbia River and three major watersheds in Washington: the Cowlitz, Lewis, and Salmon/Washougal. In Cowlitz County, the major sub-watersheds crossed include the Lacamas, Delameter, Lower Cowlitz, Ostrander, Lower Coweeman, Upper Coweeman, Lower Kalama, Middle Kalama, Cathlapotle, Lake Merwin, and Cougar. In Clark County, the major sub-watersheds crossed include the Yacolt, Cedar Creek, Chelatchie Creek, Canyon Creek, Fly Creek, Vancouver, Horseshoe Falls, Lacamas Lake, Rock Creek, Little Washougal, West Fork Washougal, and Mount Zion. In Oregon, the project crosses the Columbia River and two watersheds, the eastern end of the Columbia Slough-Frontal Columbia River watershed and the western edge of the Beaver Creek-Sandy River watershed. Both are sub-watersheds of the Lower Willamette watershed in Multnomah County. Watershed conditions vary among and within these sub-watersheds.

Riparian buffers: The action alternatives would cross forested and non-forested riparian buffers. Forested buffers containing conifers, common at higher elevations, provide the most stream shade; hardwood riparian buffers, most common at lower elevations, provide somewhat less shade. Non-forested riparian buffers, found mostly on developed and agricultural land and in existing transmission line corridors, provide little or no stream shade. Riparian buffer widths range from 50 to 150 feet in Cowlitz County and from 50 to 250 feet in Clark County, depending on stream flow (perennial or seasonal) and the presence or absence of fish.

Floodplains: In Washington, the action alternatives would cross 16 100-year floodplains of the following waterbodies: Leckler Creek, Cowlitz River, Coweeman River, Kalama River, Little Kalama River, Lewis River, tributary to Chelatchie Creek, East Fork Lewis River, Salmon Creek, Burnt Bridge Creek, Little Washougal River, Washougal River, Lacamas Creek, Ostrander Creek, Speelyai Creek, and Canyon Creek. The project would also cross the 100-year floodplain of the Columbia River in Washington and Oregon; it would not cross any other Oregon floodplains.

Surface water: In addition to the above rivers and streams, the action alternatives cross many perennial, intermittent and ephemeral streams. Thirteen rivers and streams crossed are listed as impaired in Washington: Arkansas Creek, Monahan Creek, Delameter Creek, Ostrander Creek, South Fork of Ostrander Creek, Coweeman River, Riley Creek, Lockwood Creek, Mason Creek, East Fork of Lewis River, Salmon Creek, Dwyer Creek, and Lacamas Creek. Most are listed for elevated water temperature. Riley and Lacamas creeks are listed for elevated levels of fecal coliform, and Lacamas and Dwyer creeks are listed for low levels of dissolved oxygen. No impaired streams in Oregon would be crossed. Some surface water is used as drinking water: the city of Camas supplements its drinking water with water from two creeks and several landowners along the action alternatives use similar diversion dams for some or all of their drinking water.

Groundwater: Many aquifers serve domestic, municipal, commercial, agricultural and industrial customers throughout the project area. The Troutdale Aquifer in the southwestern portion of the project area is the only sole source aquifer, providing about 99 percent of available drinking water to Clark County. To protect groundwater, there are designated Critical Aquifer Recharge Areas (CARAs) and wellhead protection areas throughout the project area.

S.3.11.2 Impacts Common to Action Alternatives

Transmission line, access road and substation construction would disturb soil, temporarily or permanently clear vegetation and create hardened surfaces that could affect waterways, riparian buffers, floodplains and groundwater. Soil disturbance and vegetation removal could cause erosion and increased sediment delivery to streams, and new roads could increase surface runoff. Vegetation removal could also increase stream temperatures. Common impacts would include:

Watersheds: Low-to-high impacts from increased sediment delivery. Between 100 and 1,000 acres of vegetation would be cleared (depending on the action alternative) across 160,000-240,000 acres of watershed, representing a potential runoff and sediment delivery increase of less than 1 percent. With implementation of erosion control measures, long-term impacts on watershed function would generally be **low**, with some localized **high** impacts possible on steeper terrain or soil with high erodibility.

Riparian buffers and surface water quality: Low-to-high localized impacts (at the point where line or road right-of-way would cross a stream) on stream temperatures where riparian vegetation would be removed along fish-bearing or impaired streams. Highest impacts would occur where existing vegetation provides effective shade for stream cooling. **No** impact at existing right-of-way crossings or new crossings requiring little or no vegetation removal. Erosion control measures would minimize sediment delivery; no streams crossed are listed as impaired for turbidity. Except for one tower built on Lone Reef in the Columbia River, towers would be built outside waterways. However, where new access roads would cross waterways, including intermittent tributaries and drainages, culverts or bridges would be installed. With erosion control measures, impacts from tower and road construction in or near waterways would be **low**. Due to BPA's fueling and storage procedures, there would be **no-to-low** impacts from contamination by fuels or other hazardous materials during construction.

Floodplains: Low impact. Towers, substations, and access roads would be sited to avoid floodplains. Where unavoidable, towers constructed in a floodplain would be designed to allow water flow around tower legs. Access roads in floodplains would be built to existing grade.

Groundwater: No impact. Some municipal and domestic water rights and wells are likely within 0.125 mile of the action alternatives. Wells and surface water diversions potentially disturbed would be relocated or project activities would be adjusted to avoid them; mitigation measures would be implemented during tower and substation excavations to minimize potential contamination from fuels or other hazardous materials.

Once the line and substations are operating, use of access roads would continue to produce sediment throughout the life of the project. However, vehicle use of these roads would be infrequent (typically once a year) and all road drainage BMPs would be followed; long-term sediment impacts would be **low**. Maintaining riparian vegetation clearances along transmission line rights-of-way could potentially cause long-term, localized increases in water temperature, a **low-to-high** surface water quality impact depending on the stream's impairment status. BPA works with landowners to maintain vegetation on the right-of-way using a variety of methods including herbicides. Herbicide use would be restricted to areas outside appropriate buffers (164-foot no-spray buffers around well head locations), creating **no-to-low** temporary, localized impacts on waterways or groundwater.

Sundial Substation Site. **No** impact from increased runoff and erosion, loss of riparian vegetation, or contamination of surface water and groundwater because the site (either lot) is not near any water bodies except the Columbia River and storm water runoff would not be discharged into the river. **No** impact on floodplains because the site is outside the Columbia's 100-year floodplain. Wells within 1 mile of the Sundial site reach into the Troutdale Aquifer. Impacts to groundwater would be **moderate** if contamination from herbicides occurs because of the aquifer's moderate depth and high permeability; mitigation measures would be taken to avoid this. Construction dewatering (if required) would likely have **no** long-term impact on existing wells because there would be limited drawdown away from the dewatering site.

S.3.11.3 Impacts Unique to Action Alternatives

Castle Rock Area Substations

The substation at the Casey Road site would be built over one intermittent, non-fishbearing stream that flows east to a tributary of Rock Creek. Rock Creek is located about 1,800 feet north of the proposed substation. Although direct impacts on the intermittent stream may occur, subsurface water would likely continue to flow to nearby streams. Indirect impacts (e.g., sedimentation) could occur to Rock Creek, the tributary to Rock Creek, and another intermittent stream to the west of the stockpile site, however, stream channels would not be affected and water would continue to flow. Construction would have **low** impacts on surface water quality from potential added turbidity, **no** impact on stream temperatures because riparian vegetation has already been cleared along intermittent streams and no clearing would occur along other streams, and **no** impact on floodplains. Risk of groundwater contamination would be **low** because of moderate-to-deep, bedrock-sealed wells within 1 mile of the site and low soil permeability; construction dewatering (if required) would have **no** long-term impact on existing wells. During substation operation, storm water runoff would be discharged to a detention pond north of the site and released from the bottom of the pond to flow over land before reaching Rock Creek. Impacts on surface water quality from operations would be **low**.

Construction on the Baxter Road site would also have **low** impacts on surface water turbidity; most streams would be avoided and erosion control measures would minimize impacts to streams that flow to Baxter Creek. It would have **no** impact on stream temperatures because no riparian vegetation would be cleared, and **no** impact on floodplains. Same impacts as the Casey Road site on groundwater (**low** risk of groundwater contamination, **no** long-term impact on existing wells from construction dewatering). Similar to the Casey Road site, storm water runoff would be discharged to an on-site detention pond and released to flow over land before reaching Baker Creek, causing **low** impacts on surface water quality during substation operation.

Construction on the Monahan Creek site would have **low** impacts on surface water turbidity; nearby Monahan and Delameter creeks are 450-500 feet away and separated from the substation site by roads. Although both creeks are listed as impaired for elevated temperatures, there would be **no** impact on stream temperatures because no riparian vegetation would be cleared. About 1,100 square feet of the site is within the 100-year floodplain of Monahan Creek, but the substation would have **no-to-low** impact on floodplains. Same impacts as the two other sites on groundwater (**low** risk of groundwater contamination, **no** long-term impact on existing wells from construction dewatering). Similar to the other two sites, storm water runoff would be discharged to a detention pond (south of the site) and released to flow over land before reaching Delameter Creek, causing **low** impacts on surface water quality during substation operation.

West Alternative and Options

The West Alternative would have the fewest new river, stream, and creek crossings by the transmission line right-of-way and new access roads outside of the right-of-way (about 219 crossings). Transmission line clearing and road construction would result in about 1,285 acres of potential soil disturbance that could contribute sediment to streams, the least of the action alternatives because most of this alternative occupies existing right-of-way where clearing has already occurred. It would cause the smallest increase in runoff (0.09 percent) but the greatest increase in sediment delivery to streams (0.25 percent) because it would cross more erodible terrain. However, this would occur across a watershed area of about 161,000 acres. Isolated actions could cause **high** impacts on some streams, but long-term changes in watershed conditions would generally be minor and cause small changes in existing watershed functions. Impacts would be **low**.

Riparian vegetation would be cleared at 47 forested crossings of fish-bearing streams, the least among the action alternatives. Most crossings (28) would occur where the existing shade level is already low and provides limited stream cooling; impacts would be **low**. Nineteen crossings would occur where existing shade level does provide effective stream cooling and where shade loss is more likely to result in temperature increases; impacts at these locations would be **high**. This is the fewest number of high riparian impacts among the alternatives.

The West Alternative would cross five streams listed as impaired: Riley Creek for fecal coliform and Lockwood Creek, East Fork Lewis River, Mason Creek and Salmon Creek for elevated temperature. However, riparian vegetation has already been removed at these crossings, which would have **no** impacts on stream temperature or fecal coliform levels; the crossings would have **low** impacts on stream turbidity (caused by erosion). Thirty-one towers (triple the amount of the other action alternatives) would be constructed within the 100-year floodplains of the Lewis River (1), East Fork Lewis River (6), Burnt Bridge Creek (4), Lacamas Creek (8), Leckler Creek (1), Coweeman River (2), and Columbia River (9). Six miles of access road would be constructed or improved within floodplains, about 5 miles more than the other action alternatives. However impacts on floodplains would still be **low** (see common impacts section). The alternative would cross about 20 miles of wellhead protection areas, about two to three times more than the other action alternatives, but still have **no** long-term impacts on groundwater (see common impacts section).

The West Alternative's options would have the same overall water impacts, with the following minor differences in specific areas:

- **West Option 1:** Would cross 2 additional impaired streams where vegetation has already been removed, having **no** impacts on stream temperatures or fecal coliform levels and **low** impacts on stream turbidity. Net additions of 10 towers and 2 miles of access roads in floodplains, still a **low** impact.
- **West Option 2:** Would avoid clearing vegetation with "high shade function" along one creek. Net addition of one tower and marginally less roadway construction (-0.8 mile) in floodplains.
- **West Option 3:** Would clear vegetation with "high shade function" along one additional creek. Net addition of two towers and marginally less roadway construction (-0.7 mile) in floodplains.

Central Alternative and Options

The Central Alternative would have about 266 new river, stream, and creek crossings by the transmission line right-of-way and new access roads outside of the right-of-way. Transmission line clearing and road construction would result in about 1,503 acres of potential soil disturbance that could contribute sediment to streams, the most of the action alternatives because most of this alternative occupies new right-of-way that must be cleared. It would cause relatively moderate increases in runoff (0.59 percent) and sediment delivery to streams (0.15 percent) because it would require clearing moderate levels of mature conifer vegetation but cross less erodible terrain. This would occur across a watershed area of about 218,000 acres. Isolated actions could cause **high** impacts on some streams, but long-term changes in watershed conditions would generally be minor and cause small changes in existing watershed functions. Impacts would be **low**, same as the West Alternative (and other action alternatives).

Riparian vegetation would be cleared at 69 forested crossings of fish-bearing streams, the greatest among the action alternatives. Twenty crossings would occur where the existing shade level is already low; impacts would be **low**. Most crossings (49) would occur where existing shade level does provide effective stream cooling; impacts at these locations would be **high**. This is the greatest number of high riparian impacts among the alternatives.

The Central Alternative would cross two rivers listed as impaired, the East Fork Lewis and Coweeman rivers. Riparian vegetation removed at these crossings could cause river temperatures to increase, a **high** impact. Through appropriate erosion control measures, potential increases in turbidity would be minimized, a **low** impact. Eleven towers would be built within the 100-year floodplains of a tributary to Chelatchie Creek (1), the Cowlitz River (2), and the Columbia River (8). About 1 mile of new or improved access roads would also be built in floodplains, but overall impacts would be **low**. From 1 to 4 miles of wellhead protection areas would be crossed, same as the East Alternative and less than the other two action alternatives, having **no** long-term impacts.

The Central Alternative's options would have the same overall water impacts, with the following minor differences in specific areas:

- **Central Option 1:** Would clear vegetation with "high shade function" along one additional creek.
- **Central Option 2:** Would avoid crossing the East Fork Lewis River and avoid clearing vegetation with "high shade function" along nine creeks. One less tower and marginally less roadway construction (-0.1 mile) in floodplains.
- **Central Option 3:** Would avoid crossing the Coweeman River and avoid clearing vegetation with "high shade function" along two creeks. Same number of towers and marginally more roadway construction (+0.2 mile) in floodplains.

East Alternative and Options

The East Alternative would have about 277 new river, stream, and creek crossings by the transmission line right-of-way and new access roads outside of the right-of-way. Transmission line clearing and road construction would result in about 1,455 acres of potential soil disturbance that could contribute sediment to streams, the second most of the action

alternatives because, like the Central Alternative, most of this alternative occupies new right-of-way that must be cleared. It would cause the most increase in runoff (1.03 percent) because it requires clearing the greatest amount of mature vegetation, but would cause nearly no increase in sediment delivery to streams because it would cross the least erodible terrain. This would occur across a watershed area of about 209,000 acres. Isolated actions could cause **high** impacts on some streams, but long-term changes in watershed conditions would generally be minor and cause small changes in existing watershed functions. Impacts would be **low**, same as the other action alternatives.

Riparian vegetation would be cleared at 52 forested crossings of fish-bearing streams. Seventeen crossings would occur where the existing shade level is already low; impacts would be **low**. Most crossings (35) would occur where existing shade level does provide effective stream cooling; impacts at these locations would be **high**. This is the second greatest number of high riparian impacts among the alternatives.

The East Alternative would cross the same two impaired rivers as the Central Alternative, the East Fork Lewis and Coweeman rivers, and have the same potential **high** impacts on river temperatures, but **low** impacts from turbidity. Ten towers would be built within the 100-year floodplains of the Cowlitz River (1) and the Columbia River (9). About 1 mile of new or improved access roads would be built in floodplains. It would cross about 6 miles of wellhead protection areas, same as the Central Alternative.

The East Alternative's options would have the same overall water impacts, with the following minor differences in specific areas:

- **East Option 1:** Would cross two additional impaired streams, Ostrander Creek and the South Fork Ostrander Creek, but avoid clearing vegetation with "high shade function" along 11 creeks. One less tower and marginally less roadway construction (-0.1 mile) in floodplains.
- **East Options 2 and 3:** Both would clear vegetation with "high shade function" along additional creeks (five and four, respectively).

Crossover Alternative and Options

The Crossover Alternative would have about 297 new river, stream, and creek crossings by the transmission line right-of-way and new access roads outside of the right-of-way, the most of the action alternatives. Transmission line clearing and road construction would result in about 1,422 acres of potential soil disturbance that could contribute sediment to streams. It would cause relatively moderate increases in runoff (0.47 percent) and sediment delivery to streams (0.17 percent) because it crosses a mix of mature and immature vegetation, and both high and low erodible terrain. This would occur across a watershed area of about 184,000 acres. Isolated actions could cause **high** impacts on some streams, but long-term changes in watershed conditions would generally be minor and cause small changes in existing watershed functions. Impacts would be **low**, same as the West Alternative (and other action alternatives).

Riparian vegetation would be cleared at 55 forested crossings of fish-bearing streams. Twenty-three crossings would occur where the existing shade level is already low; impacts would be **low**. Most crossings (32) would occur where existing shade level does provide effective stream cooling; impacts at these locations would be **high**.

The Crossover Alternative would cross one river listed as impaired, the East Fork Lewis River, with potential **high** impacts on that river's temperature and **low** impacts from turbidity. Twelve towers would be built within the 100-year floodplains of Leckler Creek (1), Coweeman River (2), and the Columbia River (9). Nearly 2 miles of new or improved access roads would be built in floodplains. It would cross just under 10 miles of wellhead protection areas.

The Crossover Alternative's options would have the same overall water impacts, with the following minor differences in specific areas:

- **Crossover Option 1:** Would clear vegetation with "high shade function" along one additional creek.
- **Crossover Options 2 and 3:** Both would cross two additional impaired streams, Arkansas and Monahan creeks, having **low** impacts because vegetation has already been cleared. Crossover Option 3 would also require clearing vegetation with "high shade function" along one additional creek.

S.3.12 Wetlands

S.3.12.1 Affected Environment

Both forested and non-forested wetlands occur within the project's study area (a 1,000-foot corridor, 500-feet either side of the transmission line). These include mixed coniferous and deciduous-forested wetlands, scrub-shrub wetlands, emergent wetlands and aquatic bed wetlands. Wetlands can be found on lands managed for timber harvest and agriculture, within rural areas, and on land within suburban and urban development primarily on the north and south sides of the Columbia River, including the cities of Longview, Vancouver, and Camas in Washington, and Fairview and Troutdale in Oregon. Quality varies from relatively undisturbed wetlands with a high diversity of native plants that offer high-quality habitat, to smaller disturbed wetlands in active agricultural fields or interspersed throughout developed areas. Both Washington and Oregon have rating systems to determine the quality of wetland functions and several federal, state and local statutes exist to protect wetlands.

Wetlands also have buffers surrounding them that provide protection of wetland functions, including providing habitat for a variety of wetland-dependent or upland wildlife and plant species. Cowlitz and Clark counties and Washington State's Department of Ecology specify minimum buffer widths for wetlands, depending on their functions and values and surrounding land uses. Multnomah County in Oregon makes similar buffer width determinations.

S.3.12.2 Impacts Common to Action Alternatives

Towers, access roads and substations are generally sited to avoid wetlands. However, there would be some impacts where footings, roads or substations cannot avoid wetlands or where the line must span wetlands. Direct construction impacts would include vegetation removal (for right-of-way and towers, access roads, substations, and danger trees outside of the right-of-way), placement of fill, soil compaction, and contamination from accidental spills or oil from construction vehicles and equipment. Long-term indirect impacts would include habitat fragmentation and the introduction of invasive non-native or noxious weed species. Where unavoidable, filling of medium- or high-quality wetlands for tower footings and access roads would be a long-term **high** impact; fill placed in low-quality wetlands would be a **moderate**

impact. Clearing trees and shrubs along rights-of-way and new access roads from medium- or high-quality forested and scrub-shrub wetlands and wetland buffers would also have long-term **high** impacts.

During construction, soil disturbance and compaction would have temporary **moderate-to-high** impacts on medium- or high-quality wetlands and **low** impacts on low-quality wetlands. Short-term wetland habitat fragmentation would also occur. Removal of danger trees next to rights-of-way would create **low-to-moderate** impacts depending on the number removed at a specific wetland site and the wetland's quality. Some of the clearing, grading and filling required for pulling and tensioning sites adjacent to and outside of the right-of-way may occur in wetlands, causing a **low-to-high** impact depending on the quality of the wetland and if trees are allowed to regrow (for sites located outside the right-of-way). **No** impacts would occur from staging areas and helicopter fly yards, which would not be placed in wetlands.

During operation and maintenance of the line and access roads, vegetation maintenance activities such as vegetation clearing or herbicide application for noxious weed control would periodically be required. If herbicide application is required, appropriate buffers would be used to keep herbicides out of wetlands. Use of access roads for structure maintenance during wet periods would indirectly affect wetlands by introducing sediment, potentially affecting water quality. Best management practices would be implemented to reduce the potential for sediment; impacts from maintenance activities would be **low-to-moderate**. Wetlands or wetland buffers near substations could receive dust or sediment and contaminants in surface runoff from the substation yard and roads. Exposure to these contaminants would be infrequent, temporary, and a **low** impact.

Sundial Substation Site. There would be no impacts on wetlands if Lot 11 is selected for the substation, as none exist on the site. Construction on Lot 12 could have a **high** impact on about 11 acres of emergent wetlands that would be filled. Although these wetlands are located in an industrial setting, they are of medium quality and functions such as water quality improvement and bird, amphibian, reptile, and aquatic invertebrate habitat would be lost.

S.3.12.3 Impacts Unique to Action Alternatives

Castle Rock Area Substations

The Casey Road site would have **no-to-low** impacts on wetlands 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). The Baxter Road site would have a **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. The Monahan Creek site would have **no** impacts on wetlands.

West Alternative and Options

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 31 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 Lake (**high**

impact, and a **moderate** impact from potential noxious weed introduction); 14 towers near Camas where the line would cross the Columbia River and south of the river (**low-to-high** impact, same for all action alternatives).

- **West 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.
- **West Options 2 and 3:** Would require clearing fewer (-11 acres and -7 acres, respectively) 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 options 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 (for both options) and along Matney Creek (for West Option 3) would have **moderate-to-high** impacts.

Central Alternative and Options

Right-of-way clearing would affect about 17 acres of forested wetlands and 17 acres of scrub-shrub wetlands (both **high** impacts). Fill for tower footings (and access roads) would impact an additional 2 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; nine towers near Camas where the line would cross the Columbia River and south of the river (**low-to-high** impact).

- **Central Option 1:** Would require clearing more (+1 acre) 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 have a net reduction in fill (<1 acre) in forested and non-forested wetlands.
- **Central Option 2:** Would require clearing more (+5 acres) forested wetlands (but -1 acre scrub-shrub wetlands) and filling slightly more (+1 acre) forested and non-forested wetlands for four towers where the option would cross into Lexington near the Cowlitz River, a **high** impact.
- **Central Option 3:** 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.

East Alternative and Options

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 and south of the river (**low-to-high** impact).

- **East Option 1:** 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.
- **East Option 2:** Would require clearing fewer (-3 acres) forested and shrub-scrub 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.
- **East Option 3:** Would require clearing slightly more (+1 acre) forested wetlands and fewer (-1 acre) shrub-scrub wetlands, and filling slightly less (-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.

Crossover Alternative and Options

Right-of-way clearing would affect about 53 acres of forested wetlands and 35 acres of shrub-scrub 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.

- **Crossover Option 1:** Would require clearing more (+9 acres) forested and shrub-scrub wetlands and filling more (+2 acres) forested and non-forested wetlands—**high** impacts—within the same wetlands described for West Option 3.
- **Crossover Options 2 and 3:** Would require clearing more (+4 acres and +5 acres, respectively) forested and shrub-scrub wetlands and filling more (+<1 acre) forested and non-forested wetlands near Baxter Creek—a **high** impact. Two to three towers with roads would be placed in or near wetlands between the Baxter Road and Monahan Creek substation sites.

S.3.13 Vegetation

S.3.13.1 Affected Environment

The project area is in the Western Hemlock Forest Vegetation Zone, which is dominated by western hemlock, Douglas-fir, and western red cedar. The southern portion of the project area transitions into the Interior (Willamette) Valley Vegetation Zone. Other plant community types include remnant patches of wet and dry prairie; Oregon white oak woodlands; and riparian woodlands dominated by black cottonwood and willow. Wetland plant communities are common, especially near rivers and streams and where hydric soils occur in lowland and floodplain areas. Vegetation has been disturbed and altered by urbanization, forestry, and agriculture, causing habitat fragmentation, but higher quality plant communities still exist throughout the project area. The decline of some species has prompted their protection as threatened or endangered species under state or federal laws.

Seven general vegetation types were documented within 1,500 feet either side of the rights-of-way (the study area): mature forest, forest, production forest, shrubland, herbaceous (non-woody), rural landscaped, and urban/suburban landscaped. There are also some pockets of state-designated special-status plant habitats and special-status plant species with federal or state protection (none were identified within 1 mile of the project in Oregon). Noxious weeds also exist, and would be documented and mapped for the selected route before construction to identify appropriate control measures.

Mature forest is typically dominated by coniferous trees over 80-years old with a diameter at breast height (dbh) exceeding 21 inches and includes old-growth forest (more than 200-years-old, more than 32 inches dbh) and mature forested wetlands. Tree species are predominantly conifers, but some deciduous species may be present. Oregon white oak dominates in a few areas. Mature forest is uncommon in the study area, but can be found in riparian areas where timber harvest has been limited and in areas near Yale Lake and Lake Merwin. It covers about 2 percent of the study area along the West Alternative, 1 percent of the Central and East alternatives, and 3 percent of the Crossover Alternative.

Forest is defined as a stand with at least 30 percent areal cover by trees younger than 80-years old and with less than 21-inch dbh, and includes forested wetlands. Forest stands may be dominated by conifers or have a mixture of coniferous and deciduous species, and have a more diverse understory than other forest types. Forest, both in small fragmented and larger stands, can be found throughout the study area, but is most prevalent around the Cowlitz River and southwest of Lake Merwin. It covers about 31 percent of the study area along the West Alternative, 24 percent of the Central Alternative, 16 percent of the East Alternative, and 27 percent of the Crossover Alternative.

Production forest (forest routinely harvested for wood products), dominated by Douglas-fir and western hemlock, is most concentrated in the study area's central portion, north and southeast of Lake Merwin and Yale Dam. It covers only about 10 percent of the study area along the West Alternative, but is the most common vegetation type along the other three action alternatives, covering 63 percent of the study area along the Central Alternative; 73 percent of the East Alternative, and 50 percent of the Crossover Alternative.

Shrubland is defined as having at least 30 percent areal cover by shrubs and tree saplings, and includes scrub-shrub wetlands. In the study area, shrublands are scattered throughout the forest and production forest habitats and are often connected to herbaceous habitat. Shrublands cover about 7 percent of the study area along the West Alternative, 2 percent of the Central and East alternatives, and 4 percent of the Crossover Alternative.

Herbaceous vegetation includes pasture and cropland, and native upland and wetland prairie. More than 99 percent of southwestern Washington prairies have been converted to pasture, cropland or other non-native uses. Scattered throughout forest and forest production areas, this vegetation type is more concentrated along the Cowlitz River and southwest of Lake Merwin. Herbaceous vegetation is more common along the West Alternative, providing about 21 percent of the cover within its study area. The remaining action alternatives have very little—about 4 percent for the Central Alternative, 3 percent for the East Alternative and 5 percent for the Crossover Alternative.

Rural landscaped vegetation includes that found in rural areas, such as in pastures or cultivated fields on small farms or around low-density residential development. It is highly fragmented

and may include vegetation from the other categories. Rural landscaped vegetation is located primarily along the Cowlitz River, southwest of Lake Merwin, and in and around Castle Rock, Longview-Kelso, and parts of Vancouver, Camas, and Washougal. It covers about 12 percent of the study area along the West Alternative, 4 percent of the Central Alternative, 3 percent of the East Alternative, and 7 percent of the Crossover Alternative.

Urban/suburban landscaped vegetation includes that found in mid- to high-density development, including residential, commercial and industrial. In the study area, it occurs primarily in the north and south portions, near Castle Rock, the Longview-Kelso metro area, and Vancouver. It covers about 18 percent of the study area along the West Alternative, 3 percent of the Central and East alternatives, and 4 percent of the Crossover Alternative.

Special-status plant habitats are naturally occurring plant communities that are rare or have limited distribution. They may be designated as preserves, conservation areas, priority habits, or priority ecosystems by one of several Washington agencies. **Special-status species** are native species identified by federal or state authorities as having low or declining populations that could put them at risk at state, national and/or global levels. Occurrences of special-status habitats and species within 1 mile either side of the transmission line include the following:

- Lacamas Prairie Natural Area Preserve and Natural Resource Conservation Area (NAP/NRCA) east of Vancouver and northwest of Washougal (portions owned by Washington state), which would be crossed by the West Alternative and options and Crossover Option 1 (and is currently crossed by existing BPA transmission lines).
- A WDNR-managed forest riparian easement within the right-of-way along Segment 9 of the West and Crossover alternatives.
- WDNR-managed research plots partially within the right-of-way and proposed routes for access roads along Segment 30 of Central Option 3.
- Three priority ecosystems identified by the Washington Natural Heritage Program (WNHP): Oregon white oak woodlands (documented along the southern portion of all action alternatives in or near the Lacamas Prairie NAP/NRCA, but crossed only by the West Alternative and its options); one tufted hairgrass/California oatgrass ecosystem (in the study area of the West Alternative and its options, and Crossover Option 1); and one North Pacific herbaceous bald and bluff community (within the study area of the West Alternative, West Option 1 and Crossover Option 1, but not crossed). Six other herbaceous balds not documented by WNHP but identified by WDFW are found within the study area of several alternatives and options, but only one—on Larch Mountain—is directly crossed by the East and Crossover alternatives and East Option 2. An additional eight priority ecosystems are known to occur in the project area but were not found.
- Twenty-four federal and/or Washington state (listed or potential) special-status plant species, which have current documented occurrences along at least one action alternative in relatively small patches ranging from 2 to 75 square feet. No Oregon special-status species are documented although suitable habitat may be present. Likewise, no federally designated critical habitats are within the project area.

Noxious weeds are those that can damage cultivated or natural vegetation, livestock or other resources. They include species such as Himalayan blackberry, non-native thistles, and scotch broom. Noxious weeds can be found throughout the project area along roadsides, within

existing utility corridors, and in other disturbed areas. They are regulated at the state level in both Washington and Oregon, and controlled through county programs.

S.3.13.2 Impacts Common to Action Alternatives

Project construction would require some vegetation to be permanently removed under towers, new access roads, substations, and around improved access roads. New access roads would fragment plant habitat, creating greater edge exposure to weeds or disease, reducing genetic diversity, and negatively affecting plant community recovery. Removal of danger trees or trees in pulling and tensioning sites and helicopter fly yards would extend these effects beyond the right-of-way into adjacent forest or other habitats; these changes could be temporary or permanent depending on what is removed and whether it would be allowed to grow back.

While project components would be sited to avoid sensitive vegetation resources as much as possible, there could be **high** permanent impacts where special-status habitats or high-quality native habitats (include mature forest) would require removal. Likewise, impacts would be **moderate-to-high** on documented special-status species, **moderate** on forests (where trees would not be allowed to regrow), **low** on production forest and shrublands and **no-to-low** on herbaceous, rural landscaped and urban/suburban landscaped vegetation. Construction activities such as digging and vegetation crushing would have temporary **no-to-low** impacts on vegetation where mitigation measures would ensure adequate restoration. If sensitive plant communities are permanently altered by these activities, however, impacts could be higher. The spread of weeds could cause **low-to-high** impacts, depending on the weed species. Permanent impacts on vegetation in staging areas, which are normally already highly disturbed, would be **no-to-low**.

When the transmission line is operational, maintenance in rights-of-way and along access roads would generally have temporary and infrequent **low** impacts on vegetation. Impacts would be higher if brushing, mowing or grading inadvertently harmed special-status species (**moderate-to-high** impacts) or if emergency repairs required heavy equipment to travel off the designated access road, causing vegetation damage and compacted soils (**low-to-high** impact). If maintenance activities spread noxious weeds, this could be a **low-to-high** impact, depending on weed status. Activities that introduced invasive weeds to or otherwise damaged special-status plant habitats would have **high** impacts.

Sundial Substation Site. There would be **no** impact on vegetation by construction on Lot 11 because it was recently graded and filled by the Port of Portland. **Low-to-moderate** impacts would occur from construction of the substation and a 0.5 mile access road on Lot 12 because up to 40 acres of low-to-moderate quality herbaceous vegetation would be removed, including 11 acres of disturbed, medium-functioning herbaceous emergent wetlands.

S.3.13.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

Development of the Casey Road site would have **low** impacts on already disturbed vegetation. About 28 acres of production forest, 7 acres of shrubland and 1 acre of rural landscape would be permanently removed. The Baxter Road site would have **low** impacts, requiring removal of predominantly (nearly all 47 acres) previously harvested production forest. The Monahan Creek site, requiring permanent removal of about 67 acres of vegetation, would have predominantly

low impacts on 46 acres of rural landscaped vegetation, 18 acres of production forest and 1 acre of shrubland, but potentially **high** impact on 2 acres of mature forest. This site could also have **moderate-to-high** impacts on a state-listed special-status species, western wahoo, given documented occurrences near the site.

West Alternative and Options

Right-of-way clearing, and tower, road and substation construction would have **high** permanent impacts on 27 acres of mature forest; **moderate** impacts on 345 acres of forest; **low** permanent impacts on 366 acres of shrubland, 106 acres of herbaceous vegetation and 13 acres of production forest; and **no-to-low** impacts on 241 acres of rural and urban/suburban landscape. It would have **no** impact on 342 acres of herbaceous vegetation crossed by right-of-way that would not require clearing.

The West Alternative would potentially have **high** impacts on some currently documented special-status plant habitats and species. Where the line crosses 33 acres of the Lacamas Prairie NAP/NRCA and new access roads, it would require removal of 2 acres of Oregon white oak woodlands and clearing of an additional 11 acres. Where the right-of-way would cross a WDNR-managed Forest Riparian Easement, it would require tree removal. Right-of-way clearing and/or towers and roads construction would have a **high** impact on about 0.08 acre of federally-listed Bradshaw's lomatium and **moderate-to-high** impacts on three additional state-listed special-status species, small-flowered trillium (4.3 acres), dense sedge (1 acre) and Nuttall's quillwort (0.5 acre), depending on whether these activities contribute to the need for federal listing. In addition, four other state-listed special-status species are documented in the study area; if affected, impacts could be **high** on Oregon coyote-thistle and **moderate-to-high** on Hall's aster, tall bugbane and western wahoo.

The West options would have the same overall impacts on vegetation as the alternative, with these slight variations affecting certain habitats or species:

- **West Option 1:** Added **moderate-to-high** and **high** impacts on special-status habitats and species. Right-of-way would cross more (+28 acres) of the Lacamas Prairie NAP/NRCA, and towers and roads would remove more (+6 acres) of this special-status habitat, added **high** impacts where trees (particularly +1 acre of Oregon white oak) would be removed. Added **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, but relatively little (+/- <10 acres) or no change in acreage and impacts on other vegetation types.
- **West Option 2:** Would disturb less (-18 acres) of the Lacamas Prairie NAP/NRCA and avoid an Oregon white oak woodland, reducing or eliminating **high** impacts in these areas. Would also avoid documented populations of dense sedge, having fewer **moderate-to-high** impacts. However, it would clear more (+5 acres) mature forest, an added **high** impact. Would have fewer **moderate** impacts on forest land (-9 acres), but affect more (+11 acres) production forest (a **low** impact) than the alternative; little or no change in impacts on other vegetation types.
- **West Option 3:** Same as West Option 2, except requires clearing of slightly less (+3 acres total) mature forest land, having less **high** impacts on this vegetation type.

Would have added **moderate** impacts on forest land (+31 acres) and added **low** impacts on production forest (+33 acres), shrubland (+28 acres) and rural landscape (+32 acres); little or no change in impacts on other vegetation types.

Central Alternative and Options

Right-of-way clearing, and tower, road and substation construction would have **low** permanent impacts on 1,273 acres of production forest (the predominant vegetation type) requiring removal. About 245 acres of forest would be disturbed, a **moderate** impact, and 10 acres of mature forest, a **high** impact. There would be **low** impacts on 105 acres of shrubland and 39 acres of permanently cleared herbaceous vegetation. There would be **no** impact on 56 acres of herbaceous vegetation that would not require clearing in the right-of-way, and **no-to-low** impacts on 124 acres of rural and urban/suburban landscape. There are no known special-status plant habitats potentially affected by the Central Alternative. Right-of-way clearing and towers and access roads could remove or alter habitats with current documented occurrences of six special-status species: small-flowered trillium (4.3 acres), a **moderate-to-high** impact; hairy-stemmed checker-mallow (1 acre) and small patches of tall bugbane, western wahoo, dense sedge, and Torrey's peavine, **low-to-moderate** impacts (some species may actually benefit from clearing). In addition, one other special-status species is likely to occur; if affected, impact could be **moderate** on soft-leaved willow.

Additional plant surveys were conducted in 2014 and 2015 along this route to further identify habitats suitable for state- and federally-listed plant species and federal species of concern, as well as priority habitats. Surveys confirmed additional vegetation clearing required by 45 pulling and tensioning sites and removal of up to 2,000 danger trees would have **low** impacts because the clearing would occur mostly on already-disturbed timber production land and the sites could be replanted. Temporary access roads, mostly needed in the Camas and Washougal areas, would remove or compact low-growing vegetation from about 3 acres, but areas would be restored, a **low** impact.

The Central options would have the same overall impacts on vegetation as the alternative, with these slight variations affecting certain habitats or species:

- **Central Option 1:** Would impact more production forest (+40 acres) and shrubland (+20 acres) than the alternative (both **low** impacts); little or no change in impacts on other vegetation types. Same or similar impacts on special-status plant habitats and species.
- **Central Option 2:** Would have added **high** impacts on mature forest (+7 acres), added **moderate** impacts on forest land (+60 acres), and added **low** impacts on rural landscape (+47 acres), but fewer **low** impacts on production forest (-136 acres); little or no change in impacts on other vegetation types. Same or similar impacts on special-status plant habitats and species.
- **Central Option 3:** Would have added **high** impacts on mature forest (+3 acres), added **moderate** impacts on forest land (+57 acres), added **low** impacts on rural landscape (+16 acres), but fewer **low** impacts on production forest (-208 acres); little or no change in impacts on other vegetation types. Could also impact a WDNR special-status plant habitat, which could be a **moderate-to-high** impact, but would also avoid a hairy-stemmed checker-mallow site, having fewer **high** impacts on this species.

East Alternative and Options

Right-of-way clearing, and tower, road and substation construction would have **low** permanent impacts on 1,386 acres of production forest (the predominant vegetation type) requiring removal. About 214 acres of forest would be disturbed, a **moderate** impact, and 13 acres of mature forest, a **high** impact. There would be **low** impacts on 89 acres of shrubland and 65 acres of permanently cleared herbaceous vegetation. There would be **no** impact on 54 acres of herbaceous vegetation with rights-of-way that would not require clearing, and **no-to-low** impacts on 99 acres of rural and urban/suburban landscape. One special-status plant habitat—a potential North Pacific herbaceous bald and bluff priority ecosystem—could be affected along along its edge by Segment O, a potential **low** impact. Right-of-way clearing, and towers and access roads could remove or alter habitats with documented occurrences of one special-status species: small-flowered trillium (4.3 acres)—a **moderate-to-high** impact because this could contribute to the need for federal listing. In addition, two other special-status species are likely to occur; if affected, impacts could be **moderate** on soft-leaved willow or tall bugbane.

The East options would have the same overall impacts on vegetation as the alternative, with these slight variations affecting certain habitats or species:

- **East Option 1:** Would have added **high** impacts on mature forest (+7 acres), added **moderate** impacts on forest (+34 acres), added **low** impacts on rural landscape (+55 acres), and fewer **low** impacts on production forest (-114 acres) than the alternative; little or no change in impacts on other vegetation types.
- **East Option 2:** Would impact less mature forest (-8 acres), but have added **moderate** impacts on forest (+22 acres). Would also have fewer **low** impacts on production forest (-50 acres) and shrubland (-14 acres); little or no change in impacts on other vegetation types.
- **East Option 3:** Would have fewer **moderate** impacts on forest (-9 acres) but have added **low** impacts on production forest (+23 acres); little or no change in impacts on other vegetation types.

Crossover Alternative and Options

Right-of-way clearing and tower, road and substation construction would have **low** permanent impacts on 787 acres of production forest (the predominant vegetation type) requiring removal. About 315 acres of forest would be disturbed, a **moderate** impact, and 45 acres of mature forest, a **high** impact. There would be **low** impacts on 274 acres of shrubland and 63 acres of permanently cleared herbaceous vegetation. There would be **no** impact on 88 acres of herbaceous vegetation within rights-of-way that would not require clearing, and **no-to-low** impacts on 147 acres of rural and urban/suburban landscape. Similar to the West Alternative, where the right-of-way would cross a WDNR Forest Riparian Easement and require tree removal, there would be a potential **high** impact. Similar to the East Alternative, one special-status plant habitat—a potential North Pacific herbaceous bald and bluff priority ecosystem – could be affected along Segment O, a potential **high** impact. Also like the East Alternative, one special-status species could be affected: small-flowered trillium (4.3 acres)—a **moderate-to-high** impact if this hastens federal listing. In addition, two other special-status species are likely to occur; if affected, impacts could be **moderate** on tall bugbane and **moderate-to-high** on bolandra.

The Crossover options would have the same overall impacts on vegetation as the alternative, with these slight variations affecting certain habitats or species:

- **Crossover Option 1:** Could disturb 8 acres of the Lacamas Prairie NAP/NRCA, a **high** impact, but would not affect any known WNHP priority ecosystems in this area. Would have added **moderate** impacts on forest (+17 acres) and added **low** impacts on shrubland (+19 acres); little or no change in impacts on other vegetation types.
- **Crossover Option 2:** Would have added **low** impacts on production forest (+52 acres) and shrubland (+67 acres), but fewer **moderate** impacts on forest land (-13 acres); little or no change in impacts on other vegetation types.
- **Crossover Option 3:** Would have added **moderate** impacts on forest land (+14 acres) and added **low** impacts on production forest (+69 acres) and shrubland (+18 acres); little or no change in impacts on other vegetation types.

S.3.14 Wildlife

S.3.14.1 Affected Environment

Wildlife species that would be affected by the project include those that occur in mixed conifer/hardwood forest (forest and production forest), shrublands, open habitat, and urban/suburban habitats. In addition, wildlife using special-status habitats (summarized later in this section) would also be affected. To assess project impacts, general habitats within 1,500 feet either side of the action alternatives' centerline and special-status wildlife habitats within 1 mile either side of the centerline (the study area) were evaluated.

Forest wildlife. Forest habitats in the study area are generally 60 years old with a mix of conifers and hardwoods, but conifers dominating. They occur throughout the study area but are concentrated around the Cowlitz River and southwest of Lake Merwin. Mature forest, Oregon white oak woodlands, forested freshwater wetlands, riparian areas, herbaceous balds and caves—all considered WDFW priority habitats—may occur within this general wildlife habitat. Small and large stands of forest cover about 33 percent of the study area along the West Alternative, 25 percent of the Central Alternative, 17 percent of the East Alternative, and 30 percent of the Crossover Alternative. Common wildlife species found in forests include mammals such as coyotes, black bear, rabbits, squirrels, chipmunks, and Columbian black-tailed deer, and a variety of year-round and migratory bird species. Twenty-three special-status species could also be found in study area forests, and additional ones in mature forests; however, only 13 have documented occurrences in the study area. (Specific special-status species that could be impacted by the project are identified later in this Summary chapter.)

Production forest wildlife. Production forest is similar to forest habitat but can have less species diversity due to frequent disturbance and a different vegetation mix. This habitat type occurs throughout the study area, being somewhat less concentrated to the south and southwest of Lake Merwin. It is the most common vegetation type in the study area along three of the action alternatives: 63 percent of the Central Alternative, 73 percent of the East Alternative, and 50 percent of the Crossover Alternative. It comprises only 10 percent of the habitat along the West Alternative. The Casey Road and Baxter Road substation sites are also in production forest. Production forest is considered lower quality wildlife habitat than forest, but the same special-status species and habitats could occur in either. Sixteen special-status species

have been documented in the study area's production forests—most associated with WDFW priority habitats, including forested riparian areas, cliffs and talus, slopes and caves.

Shrubland wildlife. Shrublands include areas dominated by shrubs or tree saplings and typically occur in existing rights-of-way, on recently harvested production forest, and in fallow fields. Shrublands may include WDFW priority habitats, including freshwater (scrub-shrub) wetlands, riparian areas, herbaceous balds, and caves. In the study area, shrublands are mixed with forests and production forests and often connected to open habitats, with less concentration in the Vancouver area. The least occurring habitat type along the action alternatives, shrubland covers about 7 percent of the study area along the West Alternative, 2 percent of the Central and East alternatives, and 4 percent of the Crossover Alternative. One acre of the Monahan Creek substation site is in shrubland. Most shrubland in the study area is highly disturbed and dominated by weedy plant species, which can reduce wildlife habitat diversity. It can attract substantial numbers of birds and many of the same mammals as forest habitat. Nine special-status species may be found; however, only four have been documented.

Open habitat wildlife. Open habitats are non-forested areas dominated by herbaceous plants. They may include WDFW priority habitats but are frequently disturbed by cultivation, mowing and grazing, and low-density residential and farm-related development. Because of this disturbance, they are dominated by weedy plant species that can reduce wildlife habitat diversity. Interspersed throughout the study area, open habitats are somewhat more concentrated along the Cowlitz River, southwest of Lake Merwin, and in Castle Rock, Longview-Kelso and Vancouver. Open habitats are more common along the West Alternative than the more forested Central, East, and Crossover alternatives. About 33 percent of the study area along the West Alternative crosses open habitat, compared to 8 percent of the Central Alternative, 6 percent of the East Alternative and 12 percent of the Crossover Alternative. Open habitat also comprises most of the habitat at the Monahan Creek substation site. Many species that use open habitats are habitat generalists and can include some of the same birds and mammals attracted to other habitats, as well as small prey mammals and raptors. Sixteen special-status species may be found in this habitat; 10 have been documented.

Wildlife in urban/suburban habitat. Urban and suburban habitats are a mix of natural and developed environments that support a relatively low diversity and density of wildlife species. However, they can include small areas of WDFW priority habitats. Urban/suburban habitats occur primarily in the northern and southern portions of the study area, in and around Castle Rock, the Longview-Kelso metro area and Vancouver. More urban/suburban habitat occurs in the study area along the West Alternative, which is closer to population centers: 18 percent vs. 3-4 percent for the other three alternatives. The Sundial Substation site is also in an urban/suburban habitat. Many wildlife species thrive in high-density inner city areas, where the built environment provide holes, crevices, and ledges for birds and small mammals. Wildlife species in both urban and suburban areas are habitat generalists and frequently are non-natives, such as opossum. Undeveloped patches in suburban areas next to rural areas may serve as wildlife corridors. Only one special-status species has been documented in this habitat, along the West Alternative.

Special-status wildlife habitats include WDFW priority habitats and Oregon Department of Fish and Wildlife (ODFW) strategy habitats. WDFW defines priority habitats as those “with unique or significant value to a diverse assemblage of species.” Those found along the action alternatives include two locations of Oregon white oak woodlands (where 7 of 10 potential special-status species have been documented), herbaceous balds (no special-status species documented),

westside prairie (8 of 13 potential species documented), old-growth/mature forest (9 of 13 potential species documented), freshwater wetlands and fresh deepwater (16 of 45 potential species documented), riparian areas (20 of 31 potential species documented), caves (three of seven potential species documented), snag-rich areas (four documented talus and cliffs (three of seven potential species documented), and biodiversity areas and corridors (which provide habitat for a many different special-status species) .

In Oregon, strategy habitats are native habitats considered conservation priorities due to high losses in the past and the risk of future losses, and are categorized from 1 (highest) through 6 for their quality and importance to wildlife. Oregon strategy habitats in the project area include wetland and riparian habitats, most of which are highly disturbed and would likely be considered categories 5 or 6. This includes the primarily herbaceous emergent wetlands around the Sundial Substation site. The ODFW Sandy River Conservation Opportunity Area (COA), which may contain higher quality habitat, is 0.25 mile east of the proposed transmission line right-of-way and 0.5 mile east of the Sundial Substation site, and would not be affected.

Special-status wildlife species include those protected under the federal Endangered Species Act as threatened, endangered, or proposed species; those listed by the USFWS as candidate species or species of concern; and those listed for protection by the states of Oregon and Washington. Special-status species also include WDFW priority (non-listed) species and specific wildlife groups, such as waterfowl. Suitable habitat occurs along the action alternatives for one federally endangered species (Columbian white-tailed deer), although it is not likely found in the study area, and three federally threatened species (northern spotted owl , marbled murrelet and yellow-billed cuckoo). Northern spotted owl nesting territories have been documented as occurring within 1 mile of all action alternatives. The eastern portion of the Western Washington Coast Range Conservation Zone for marbled murrelet (marbled murrelet conservation zone) is crossed by all action alternatives and the three Castle Rock substation sites and there is a documented occurrence 3 miles northeast of the Casey Road substation. However, the project's distance from the coast makes it unlikely marbled murrelet would be found in the small patches of mature forest that occur in the project's northwest portion. Foraging habitat for the yellow-billed cuckoo occurs along all action alternatives, the largest near where the alternatives cross the Columbia River. Although the species was detected three times in the nearby Sandy River Delta in recent years, there are no documented occurrences within the study area. None of the action alternatives is within federally designated critical habitat for these federally listed species.

Sixty-one other special-status species have the potential to occur in the study area, of which 27 have documented occurrences. These include bald and golden eagles, great blue herons, osprey, mammals such as Columbian black-tailed deer, elk and Townsend's big-eared bat, and various amphibians and reptiles.

S.3.14.2 Impacts Common to Action Alternatives

Project construction would reduce or alter native forest and forest production habitats, shrubland, open habitats, urban/suburban habitats, and certain WDFW priority habitats. Right-of-way clearing would permanently remove all trees and incompatible shrubs, which would eliminate breeding, roosting, nesting, and foraging characteristics of forested habitats and alter the composition of wildlife within and along the edge of rights-of-way, substations and access roads. Habitat fragmentation would also occur. Permanent impacts on wildlife would be **low-to-high** in WDFW priority habitats, forested riparian areas and forested freshwater

wetlands, depending on their habitat value and species present. (Three WDFW priority habitats would be affected by all action alternatives: riparian areas, wetlands, and old growth/mature forest. No Oregon strategy habitats would be impacted.) Right-of-way clearing impacts would generally be **low** in forest, production forest, shrubland, open habitat and other habitat areas, with **no** impacts on wildlife species that are habitat generalists (including listed species of deer and elk). Some species would benefit from the clearing.

Where towers, access roads and substations would be built, wildlife habitat would be permanently cleared, removing protective cover and decreasing prey populations and edible vegetation, but enhancing habitat for raptors (providing additional perches and nest sites). Consequently, potential mortality impacts would be **moderate** on small mammals and reptiles. Tower, road and substation construction would otherwise have **low-to-high** impacts on other wildlife, depending on species present (**low** impacts in most areas).

Project construction could also temporarily displace or elevate stress levels for many nearby wildlife species, as well as harm individual animals. Stress from noise and construction activities, including damaged habitat, could temporarily disrupt foraging, breeding, and other normal activities, a **low** temporary impact on most mobile species (e.g., birds and mammals, including the federally endangered Columbian white-tailed deer). Invertebrates, reptiles, and amphibians are not highly mobile and could disproportionately experience decreased reproduction, injury, and mortality—temporary **low-to-high** impacts depending on a species' status. Special-status species that are less mobile or actively breeding would have a greater likelihood of experiencing **moderate** impacts (although construction is usually scheduled around breeding seasons).

Right-of-way clearing impacts on two federally threatened species, specifically, would be **low** (marbled murrelet, yellow-billed cuckoo) and **low-to-moderate** (northern spotted owl). Twenty to 28 other special-status species (documented within 1 mile of all action alternatives) could be impacted.

Once built, the new transmission line could pose obstacles to birds in flight and cause fatalities. Of primary concern are riparian areas where the action alternatives would cross over the Cowlitz, Coweeman, Kalama, Lewis, East Fork Lewis, and the Columbia rivers, and in larger wetland areas. However, BPA routinely installs bird diverters on overhead ground wires spanning open water and in other high bird use areas. Impacts (risk of added bird collisions) would be **low** along most of the transmission line, but potentially **low-to-moderate** where the line is near water bodies or other areas of high bird use, and **moderate** where the line parallels existing lines of a different height.

Typical operation and maintenance activities would have **low** temporary impacts on most wildlife except where there is mortality, in which case the impact would be **moderate** (if mortality would contribute to a need for federal listing, the impact would be **high**).

Sundial Substation Site. Both Lots 11 and 12 are within an industrial park where wildlife habitat has been degraded by prior construction and commercial/industrial activities. Impacts on wildlife from the permanent loss of low value habitat would be **low** on most wildlife. Lot 11 was recently graded by the Port of Portland. Where 11 acres of medium-function, primarily emergent wetland habitat would need to be filled on Lot 12, less mobile species could experience injury or mortality, a **low-to-moderate** impact. If western pond turtles or western

painted turtles are present (they are documented within 1 mile, but unlikely on site), construction could have a **moderate- to-high** impact on these declining species.

S.3.14.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

All three sites are in the northern portion of a marbled murrelet conservation zone and are located near potential northern spotted owl habitat. Two sites would remove potential northern spotted owl habitat, but all sites could generate noise and visual disturbance during construction that could affect owls or murrelets, if present. The three sites are also within the winter range of the Willapa Roosevelt elk herd, a WDFW priority area. About 47-68 acres of this priority habitat would be removed, depending on the site selected; this would be a **low** impact based on the elk's secure population and the proportionally small WDFW priority area affected. No special-status species are documented within 1 mile of the sites.

Development of the Casey Road site would permanently remove about 28 acres of production forest, 7 acres of shrubland and 1 acre of open habitat—having a **low** impact on most wildlife, including the marbled murrelet (no suitable habitat present) and northern spotted owl (poor surrounding habitat). At the Baxter Road site, where 47 acres of production forest would be cleared, wildlife impacts would be similar to the Casey Road site. Impacts on a small section (less than 1 acre) of scrub-shrub wetland, a WDFW priority habitat, could be **low-to-high** depending on the wetland's habitat value and the wildlife it supports. There would be **no** impact on the marbled murrelet and **low** impact on northern spotted owls.

The Monahan Creek site would require clearing 46 acres of open habitat, 18 acres of production forest, 1 acre of shrubland and about 2 acres of mature forest. Wildlife impacts in all areas other than mature forest would be similar to the Casey Road site. Removing mature forest would have a potentially **high** impact on wildlife due to its importance as a WDFW priority habitat. While this habitat can provide suitable nesting for bald eagles and marbled murrelet, removal would have a **low** impact on both species because there are no documented occurrences, the amount of mature forest affected is small, and its inland location (affecting murrelets) and surrounding habitat (affecting eagles) make it unlikely the species would be present.

West Alternative and Options

Because 65 miles of the 68-mile-long West Alternative parallels existing transmission lines on existing right-of-way, it would not create new fragmentation, although it could expand existing fragmentation where the right-of-way would need to be widened, 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.

Where the line crosses 17 miles of forest, 18 miles of shrubland, 5 miles of open habitat and 5 miles of urban/suburban habitats, construction disturbance and habitat loss or alteration would have **low** impacts on most wildlife. Potential mortality impacts (such as on prey species of raptors or bird/transmission line collisions) would generally be **moderate**. Impacts would be the same (low from habitat loss; moderate on mortality risks) on most wildlife where towers, roads and substations would occupy 171 acres of open habitat and clearing for right-of-way, towers, roads and substations would affect 372 acres of forest, 13 acres of production forest,

366 acres of shrubland (only 59 acres permanently removed; 307 acres would be altered by right-of-way), and 97 acres of urban/suburban habitat. Wildlife using shrublands would benefit from the creation of 308 acres of new habitat where forests would be cleared and low-level plants allowed to grow.

The alternative would remove or alter the following WDFW priority habitats, with these impacts: 214 acres of riparian habitat, **low-to-high** impacts; 61 acres of biodiversity areas and corridors, **high** impact; 303 acres of forested, scrub-shrub, and emergent freshwater wetlands, **low-to-high** impacts (**moderate-to-high** impacts on the Coweeman Wetlands, given its habitat value; **low-to-high** impacts from increased bird collision risk in wetlands); 20 acres of mature forest, **high** impact; 41 acres of westside prairie in the Lacamas Prairie NAP/NRCA, **high** impact (and potentially more bird mortality from collisions with transmission lines); and less than 6 acres of the Sifton/Lacamas Oregon White Oak and Washougal Oak woodlands, **high** impact. In addition, the alternative could have impacts on several priority habitats within 1 mile: **low** impact on an unnamed cave serving as a bat hibernaculum, **high** impact on a snag-rich area (due to its scarcity), and **low-to-moderate** impacts on the Lacamas Lake WDFW herbaceous bald priority habit.

Impacts on special-status species would be: **low** on the marbled murrelet because, although project activities would clear 377 acres of forest in a marbled murrelet conservation zone, at most, only 27 acres of this conservation zone is old-growth/mature forest and potentially suitable habitat; **moderate** on the northern spotted owl (the alternative runs within 0.4 mile of a northern spotted owl circle) from loss of potential nesting habitat (27 acres of old-growth/mature forest); **moderate** on bald eagles where the alternative crosses through two WDFW bald eagle priority areas, requiring 13 acres of tree habitat to be cleared; **low** on the yellow-billed cuckoo, given that potential habitat is generally low quality; **low** on elk and Columbian black-tailed deer, based on the species' secure populations and the small proportion of WDFW priority habitat permanently affected (same impact for all alternatives, but differences in acreage affected); and **low-to-moderate** or **moderate** impacts on other special-status species documented within 1 mile of the alternative (exceptions: western pond turtle and western painted turtle—**moderate-to-high** impacts).

The West Alternative options would have slightly different impacts on wildlife near the Lacamas Prairie NAP/NRCA, but with the same overall impacts as the alternative.

- **West Option 1:** Would remove or alter more freshwater wetlands (+33 acres), riparian habitat (+6 acres), and westside prairie (+34 acres). Would remove more WDFW wood duck priority areas (+7 acres, a **moderate** impact), but remove or alter fewer (-13 acres) biodiversity areas and corridors, avoiding the Columbian black-tailed deer population in this area.
- **West Options 2 and 3:** Would remove or alter more mature forest (about +5 and +3 acres, respectively) and habitat within a biodiversity area and corridor that supports Columbian black-tailed deer (+15 and +16 acres, respectively), but fewer freshwater wetlands (-20 and -14 acres) and fewer Oregon White Oak Woodlands (about -2 acres each, although still a **high** impact). West Option 2 would alter slightly less riparian habitat (-2 acres) and forest (-4 acres) while West Option 3 would alter more of both(+1 acre riparian habit, +34 acres forest).

Central Alternative and Options

Requiring mostly new right-of-way, the 77-mile 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).

Where it would cross 55 miles of production forest, 12 miles of forest, 2 miles of open habitat, 4 miles of shrubland, and 1 mile of urban/suburban habitat, construction disturbance and habitat loss or alteration would have **low** impacts on most wildlife. Potential mortality impacts along these areas would be the same or less than the West Alternative (due to lower collision risks for birds). Habitat and mortality impacts would also be the same on most wildlife (**low** from habitat loss; **moderate** on mortality risks) where towers, roads and substations would occupy 61 acres of open habitat and clearing for right-of-way, towers, roads and substations would affect 1,273 acres of production forest, 255 acres of forest, 105 acres of shrubland (37 acres permanently removed; 68 acres altered by right-of-way), and 27 acres of urban/suburban habitat. Wildlife using shrublands would benefit from the creation of 1,131 acres of new habitat due to tree clearing.

The alternative would remove or alter the following WDFW priority habitats, with these impacts: 197 acres of riparian habitat, **low-to-high** impacts (**low-to-moderate** impacts from bird collisions with the line); less than 4 acres of biodiversity areas and corridors, **high** impact; 47 acres of forested, scrub-shrub, and emergent freshwater wetlands, **low-to-high** impacts (**low-to-moderate** impacts from bird collisions); 10 acres of mature forest, **high** impact; and 1 acre of Washougal Oaks Woodland (Oregon white oak woodlands), **high** impact. In addition, the alternative would cross within 1 mile of a herbaceous bald priority habitat, but would have **no** impact. The alternative would avoid impacts on snag-rich priority areas.

Impacts on special-status species would be: **low** on the marbled murrelet where 1 acre of marginal marbled murrelet suitable habitat would be removed for project activities; **moderate** on the northern spotted owl from the loss of 34 acres of suitable habitat (production forest) within a northern spotted owl circle and passage within 1 mile of two additional circles; **low** on the yellow-billed cuckoo because of the removal of small patches of potential foraging habitat; **moderate** on bald eagles where the alternative would cross within 1 mile of three WDFW bald eagle priority areas and seven documented occurrences of nests, and requires clearing of 5 acres of habitat; **low** on elk; and **low-to-moderate** or **moderate** on all but one remaining special-status species documented within 1 mile of the alternative (**moderate-to-high** on western pond turtle).

The Central Alternative options would have slightly different impacts on some wildlife, but the same overall impacts as the alternative.

- **Central Option 1:** Would alter or remove more WDFW Roosevelt Elk Winter Range Priority Area (+78 acres). An access road would cross riparian habitat within 1 mile of two documented occurrences of Dunn's salamander, a potential **moderate** impact.
- **Central Option 2:** Would remove more mature forest (+8 acres), forest (+68 acres), wetlands (+9 acres) and riparian habitat (+4 acres).
- **Central Option 3:** Would remove more mature forest (+3 acres) and forest (+60 acres), but would alter less wetland habitat (-4 acres) and riparian habitat (-12 acres). Would cross a forested riparian area within 1 mile of a WDFW cavity-nesting duck priority area,

a **moderate** impact, but avoid two of the five documented occurrences of Cascade torrent salamander, one of three documented occurrences of western pond turtle (the one occurrence in Washington), and the one documented occurrence of Vaux's swift.

East Alternative and Options

Like the Central Alternative, the 76-mile East Alternative would require mostly new right-of-way, which would increase habitat fragmentation primarily in forested habitats but also reduce the collision risk for birds because most of the new line would not parallel existing lines.

Where it would cross 56 miles of production forest, 10 miles of forest, 5 miles of open habitat, 2 miles of shrubland, and 1 mile of urban/suburban habitat, construction disturbance and habitat loss or alteration would have **low** impacts on most wildlife. Potential mortality impacts along these areas would be the same as the Central Alternative. Habitat and mortality impacts would also be the same (**low** and **moderate**, respectively) on most wildlife where towers, roads and substations would occupy 114 acres of open habitat, and clearing for right-of-way, towers, roads and substations would affect 1,386 acres of production forest, 227 acres of forest, 89 acres of shrubland (55 acres permanently removed; 34 acres altered by right-of-way), and 22 acres of urban/suburban habitat. Wildlife using shrublands would benefit from the creation of 1,134 acres of new habitat due to tree clearing.

The alternative would remove or alter the following WDFW priority habitats, with these impacts: 225 acres of riparian habitat, **low-to-high** impacts (**low-to-moderate** impacts from bird collisions with the line); 10 acres of biodiversity areas and corridors, **high** impact; 122 acres of forested, scrub-shrub and emergent freshwater wetlands, **low-to-high** impacts (**high** impact where parts of the Fraser Creek Wetland would be altered and removed; **low-to-moderate** impacts from bird collisions within wetlands); 45 acres of the WDFW Rock Creek Snag-Rich Area priority habitat near Yale Dam, **high** impact; 14 acres of mature forest, **high** impact; 1 acre of the Washougal Oaks Woodland, **high** impact; 1 acre of talus, **high** impact; 1 acre of the Larch Mountain SDFW herbaceous bald priority habitat, **low** impact; and less than 1 acre along the edge of a WDFW cave-rich priority area in production forest, **low** impact.

Impacts on special-status species would be: **low** on the marbled murrelet because, although project activities would clear 424 acres of forest in a marbled murrelet conservation zone, at most, only 13 acres of this conservation zone is old-growth/mature forest and potentially suitable habitat; **moderate** on the northern spotted owl from loss of 306 acres of habitat (mostly production forest) within four northern spotted owl circles and removal of 13 acres of mature forest, including trees within the WDFW Rock Creek Snag-Rich priority habitat near the western edge of a USFWS northern spotted owl Conservation Support Area; **low** on the yellow-billed cuckoo because of the removal of small patches of potential foraging habitat; **moderate** on bald eagles where the alternative crosses within 1 mile of six documented nests and four WDFW bald eagle priority areas, including the Yale Tailrace Foraging Area, where 37 acres of trees would be removed; **low** on elk and Columbian black-tailed deer; and **low-to-moderate** or **moderate** on all but one remaining special-status species documented within 1 mile of the alternative (**moderate-to-high** on western pond turtle).

The East Alternative options would have slightly different impacts on some wildlife, but the same overall impacts as the alternative.

- **East Option 1:** Would remove more freshwater wetlands (+25 acres), old-growth/mature forest (+8 acres), and forest (+42 acres), and remove or alter less riparian habitat (-5 acres). 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 2 additional bald eagle nests. It would also impact more potential foraging habitat for yellow-billed cuckoo along the Coweeman River.
- **East Option 2:** Would remove or alter more riparian habitat (+9) but fewer freshwater wetlands (-6 acres), mature forest (-9 acres), and habitat from northern spotted owl circles (-71 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 a golden eagle nest, 3 of the 5 occurrences of coastal tailed frog, 1 occurrence of Cascades frog, and 3 of the 6 occurrences of Cascade torrent salamander. Would remove less WDFW Columbian black-tailed deer priority area (-12 acres).
- **East Option 3:** Would remove less wetlands habitat (-2 acres) but more riparian habitat (+7 acres).

Crossover Alternative and Options

The 74-mile 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 greater collision risks to birds along the northern portion. Where it would cross 35 miles of production forest, 14 miles of forest, 9 miles of open habitat, 12 miles of shrubland, and 1 mile of urban/suburban habitat, construction disturbance and habitat loss or alteration would have **low** impacts on most wildlife. Potential mortality impacts along these areas would be similar to the West Alternative. Habitat and mortality impacts would also be the same (**low** and **moderate**, respectively) on most wildlife where towers, roads and substations would occupy 126 acres of open habitat, and clearing for right-of-way, towers, roads and substations would affect 787 acres of production forest, 360 acres of forest, 274 acres of shrubland (66 acres permanently removed; 208 acres altered by right-of-way), and 21 acres of urban/suburban habitat. Wildlife using shrublands would benefit from the creation of 864 acres of new habitat due to tree clearing.

The alternative would remove or alter the following WDFW priority habitats, with these impacts: 225 acres of riparian habitat, **low-to-high** impacts (**low-to-moderate** impacts from bird collisions in the southern portion); 10 acres of biodiversity areas and corridors, **high** impact; 153 acres of freshwater wetlands, **low-to-high** impacts (**low-to-moderate** impacts from bird collisions in the southern portion); and 38 acres of mature forest, **high** impact. The Crossover Alternative's impacts on the following would be the same as the East Alternative: 1 acre of the Washougal Oaks Woodland, **high** impact; 1 acre of talus, **high** impact; 1 acre of the Larch Mountain SDFW herbaceous bald priority habitat, **low** impact; and less than 1 acre along the edge of a WDFW cave-rich priority area in production forest, **low** impact.

Impacts on special-status species would be: **low** on the marbled murrelet because, although project activities would clear 377 acres of forest in a marbled murrelet conservation zone, at most, only 45 acres of this conservation zone is old-growth/mature forest and potentially suitable habitat; **moderate** on the northern spotted owl from loss of 71 acres of habitat within a northern spotted owl circle and crossing within 1 mile of three others, and loss of 45 acres of

old-growth/mature forest; **low** on the yellow-billed cuckoo due to loss of a small amount of potential foraging habitat; **moderate** on bald eagles where the alternative crosses through three WDFW bald eagle priority areas—the Cowlitz Bald Eagle Feeding Habitat, the Lewis River Winter Eagle Habitat, and the Yale Tailrace Foraging Area—and within 1 mile of 10 documented bald eagle nests, removing 31 acres of trees; **low** on elk and Columbian black-tailed deer; and **low-to-moderate** or **moderate** on all but one remaining special-status species documented within 1 mile of the alternative (**moderate-to-high** on western pond turtle).

The Crossover Alternative options would have slightly different impacts on some wildlife, but the same overall impacts as the alternative.

- **Crossover Option 1:** Would alter more riparian habitat (+14 acres) and remove or alter more freshwater wetland habitat (+14 acres) and more westside prairie (+8 acres). Would come within 1 mile of a WDFW wood duck priority area and a documented occurrence of slender-billed white-breasted nuthatch that is avoided by the Crossover Alternative, and would cross within 1 mile of two WDFW biodiversity areas: the Green Mountain Biodiversity Area and the Camas Biodiversity Area. None of these areas would be directly crossed, having a **low-to-moderate** impact.
- **Crossover Options 2 and 3:** Would remove more riparian habitat (+8 and +10 acres, respectively) and more wetlands habitat (+4 each). Would alter more WDFW Roosevelt Elk Winter Range Priority Areas (+70 and +66 acres).

S.3.15 Fish

S.3.15.1 Affected Environment

The project area includes rivers and streams that provide diverse habitat for anadromous fish species (such as salmon) and resident fish species (such as bull trout). Fish-bearing streams include the Columbia River and its Washington tributaries, including the Lower Cowlitz, Coweeman, Kalama, Lower North Fork Lewis, Upper North Fork Lewis, East Fork Lewis and Washougal rivers, and Salmon Creek.

Some of these Columbia River tributaries, and creeks that feed into them, provide habitat for special-status fish species (listed or candidates for listing as threatened or endangered on the federal level, or listed as species of concern on either federal or state levels). Special-status fish species present in tributaries include: Lower Columbia River coho, Chinook and steelhead; Columbia River chum; Eulachon (smelt); and Pacific and river lamprey. Some special-status species are also known to migrate through the Columbia River where the action alternatives would cross. These include Snake River sockeye and Chinook, Upper Columbia River Chinook and steelhead, and Middle Columbia River steelhead. In addition, coastal cutthroat trout uses the Columbia River for migration and is listed in Oregon.

Other fish species native to the project area include rainbow and cutthroat trout, largescale, bridgelip, mountain sucker, mountain whitefish, longnose and speckled dace, and northern pikeminnow. Nonnative species include large and small mouth bass, brook trout, crappie, bluegill, and brown bullhead.

S.3.15.2 Impacts Common to Action Alternatives

Clearing for transmission line rights-of-way, substations, danger trees, temporary and permanent access roads, pulling and tensioning sites and helicopter fly yards, and construction of towers, substations and access roads across or near fish-bearing streams would cause increased surface runoff and release sediment that could cause direct impacts on water quality, fish habitat and fish. However, vegetation clearing (of 100 to 1,000 acres, depending on the action alternative) would occur across a watershed area of about 160,000-240,000 acres, causing increased runoff and sediment delivery rates of less than 1 percent—an overall **low** impact. While short-term, localized **high** impacts could occur, BPA would use erosion control measures to minimize the amount of sediment that would reach streams.

As discussed in the Water section, vegetation removal would also remove shade and cause stream temperature increases. It could also reduce the amount of large woody debris entering streams, which is important to fish habitat. Forested vegetation would be cleared along about 2-3 miles of fish-bearing streams. Impacts on streamside shade and large woody debris potential would be **low-to-high**, depending on the quality of riparian vegetation removed. At existing right-of-way crossings where vegetation has already been removed and kept clear, there would be **no** impact on stream shade or woody debris potential. Removal of danger trees in riparian zones could have temporary **low-to-moderate** impacts, but trees could grow back. Similarly, impacts on fish from temporary access roads, pulling/tensioning sites and fly yards would be short-term and **low**.

Construction activities could potentially impact projects to improve fish passage and habitat that have been completed or are planned in the lower Columbia River basin. These impacts could be **moderate-to-high**, depending on the proximity of permanent right-of-way to restoration sites. Also, construction within floodplains has the potential to impact fish by changing floodplain dynamics and stream channel adjustments. However, given the minor amount of construction in floodplains, overall impacts on fish from floodplain changes would be **low**. Where culverts or bridges would require replacement or rebuilding to allow project construction, there would be a net benefit to fish from improved habitat and passage.

BPA would require fuel to be stored and vehicle refueling to occur at least 100 feet from any surface waters. With spill containment and clean-up procedures in place, the risk of accidental spills would be minimized and any occurring would be temporary and limited to small areas, with a potential **moderate** impact on fish.

Collectively, these changes have the potential to affect ESA-listed and other fish species. Action alternatives crossing more high-value fish streams pose more risk. However, analyses indicate none of the alternatives and options would pose substantial risk to ESA-listed salmonids (and therefore, to other fish and aquatic species). Based on the Integrated Fish Impact index, which identifies the percentage by which affect fish populations are liked to be reduced by project-related habitat changes, the net effect on anadromous fish populations for any alternative would be less than 0.2 percent, a **low** impact.

Once the line and substations are operating, maintenance staff would normally use established roads near rivers and streams unless an emergency required going off-road, which could cause temporary erosion. There would be **no** long-term sediment impacts on streams or fish. Continued vegetation maintenance along streams would prevent regrowth of forested riparian vegetation, maintaining less shade and woody debris potential and having **low-to-high**

long-term impacts on fish. Vegetation maintenance could also affect floodplain function, but this impact would be **low**. Careful use of appropriate herbicides and adherence to stream buffers would minimize impacts on fish. Any adverse effects would have temporary and localized **no-to-low** impacts on fish.

Sundial Substation Site. **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.

S.3.15.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

All sites would have **no-to-low** impacts on fish. None is within floodplains, but each is in the vicinity of some creeks. The Casey Road 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. The Baxter Road 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 three non-fish-bearing streams only, with no vegetation removal along Baxter Creek. The Monahan Creek 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 these creeks.

As noted in the Common Impacts section, watershed impacts – increased runoff and sediment delivery to streams and fish habitats caused by the project – are the same (low) for all action alternatives and options. Specific percentages for potential runoff and sediment delivery can be found in the earlier Water summary section. Remaining water impacts – on riparian function, floodplains, and ESA-listed fish – are also common for all alternatives and options, but specifics (such as number of high-impact stream crossings, acreage affected or Integrated Fish Index rankings) differ and are summarized in this section.

West Alternative and Options

Riparian vegetation would be cleared at 47 forested crossings of fish-bearing streams. In addition to 19 crossings where loss of shade would have potential **high** impacts on stream temperatures and fish, there would also be **high** impacts at 10 crossings from loss of large woody debris potential. (These can both occur at the same crossing, but are considered separate high impacts.) This is the least amount of high impacts among the action alternatives. About 12.6 acres of vegetation at fish-bearing streams that would be cleared is in floodplains, with 18 acres of floodplain impacted in total (by right-of-way clearing, roads and towers), the highest of the action alternatives. However, 86 percent of the total floodplain area has already been cleared; additional impacts to fish from project-related floodplain impacts by the alternative would be **low**.

The West Alternative has the lowest impacts on ESA-listed and general fish populations (about 0.11 percent), because many stream crossings are in existing right-of-way that has already been altered. Because little clearing of highly functioning riparian vegetation would be required, the alternative would not pose a substantial risk to listed species; overall fish impacts would be **low**.

Permanent changes in habitat conditions would occur at six crossings on or adjacent to fish habitat enhancement projects on the North Fork Lewis River, Lockwood Creek, Salmon Creek,

and the Washougal River, having a **high** impact because benefits would be negated or compromised. Clearing could also partially offset benefits from nearby restoration projects at seven crossings, with potential **moderate** impacts. Four crossings could possibly affect extensive (non-site specific) restoration projects; impacts would be **moderate-to-high**.

- **West Option 1:** Same overall impacts as the alternative.
- **West Option 2:** Same overall impacts as the alternative. Would affect one less stream with high shade function (-1). Would have more crossings partially offsetting fish restoration benefits ((+2) and impacting extensive restoration projects (+2).
- **West Option 3:** 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). Would have more crossings partially offsetting fish restoration benefits (+2) and affecting extensive restoration projects (+3).

Central Alternative and Options

Riparian vegetation would be cleared at 68 forested crossings of fish-bearing streams. In addition to 49 crossings where loss of shade would have potential **high** impacts on stream temperatures and fish, there would also be **high** impacts at 45 crossings from loss of large woody debris potential. This is the greatest number of high riparian function impacts among the action alternatives. About 8.1 acres of vegetation at fish-bearing streams that would be cleared is in floodplains, with 9.2 acres of floodplain impacted in total (by right-of-way clearing, roads and towers), among the lowest of the action alternatives. Because the total amount of floodplain area impacted is small and existing floodplains are already impaired, additional impacts to fish from project-related floodplain impacts by the alternative would be **low**.

The Central Alternative's impacts on ESA-listed and general fish species falls between the East and Crossover alternatives; its net affect on anadromous fish populations would be about 0.15 percent based on the Integrated Fish Impacts index. Some clearing of highly functioning riparian vegetation would be required, but the alternative would not pose a substantial risk to listed species. Overall fish impacts would be **low**.

Permanent changes in habitat conditions would occur at three crossings on or adjacent to fish habitat enhancement projects on the Washougal River and North Fork Goble Creek, having a **high** impact because benefits would be negated or compromised. Clearing could also partially offset benefits from nearby restoration projects at 11 crossings, with potential **moderate** impacts. Seven crossings could possibly affect extensive restoration projects; impacts would be **moderate-to-high**.

During construction, there would be temporary impacts from clearing about 40 acres of land for 45 pulling and tensioning sites, none in riparian areas. Impacts would be temporary and **low**, with sites restored to their pre-construction conditions as much as possible. Some 2,000 danger trees could require removal, more than half on pre-disturbed timberland. Impacts on fish would be similar to that of other rights-of-way clearing. Temporary access roads, mostly needed in the Camas and Washougal areas, would disturb about 0.6 acre. Impacts to fish would be **low** because of the small number of acres involved and the developed nature of the area.

- **Central Option 1:** Same overall impacts as the alternative. Would cross one more stream with high shade function and high potential for large woody debris. Would have an additional crossing reducing benefits gained by restoration activities (+1).
- **Central Option 2:** 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). Would have an additional crossing potentially negating fish restoration benefits (+1), but fewer crossings reducing benefits gained by restoration activities (-6) or affecting extensive restoration projects (-1).
- **Central Option 3:** 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). One additional crossing would affect extensive restoration projects (+1).

East Alternative and Options

Riparian vegetation would be cleared at 52 forested crossings of fish-bearing streams. In addition to 35 crossings where loss of shade would have potential **high** impacts on stream temperatures and fish, there would be additional **high** impacts at 38 crossings from loss of large woody debris potential. This is the second greatest number of high impacts on riparian function among the action alternatives. About 9.8 acres of vegetation at fish-bearing streams that would be cleared is in floodplains, with 10.9 acres of floodplain impacted in total (by right-of-way clearing, roads and towers). Because the total amount of floodplain area impacted is small and existing floodplains are already impaired, additional impacts to fish from project-related floodplain impacts by the alternative would be **low**.

The East Alternative has among the highest impacts on ESA-listed and general fish populations (about 0.19 percent), based on the Integrated Fish Impacts index, because although the number of stream crossings is relatively low, many crossings would require substantial clearing of relatively high-functioning riparian vegetation. However, the alternative would not pose a substantial risk to listed species and the net effect on fish would still be small; overall fish impacts would be **low**.

Permanent changes in habitat conditions would occur at three crossings on or adjacent to fish habitat enhancement projects on the East Fork Lewis River and the Washougal River, having a **high** impact because benefits would be negated or compromised. Clearing could also partially offset benefits from nearby restoration projects at nine crossings, with potential **moderate** impacts. Five crossings could possibly affect extensive restoration projects; impacts would be **moderate-to-high**.

- **East Option 1:** 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). Would have one additional crossing that could negate fish restoration benefits (+1), but fewer crossings that partially offset benefits (-6) or affect extensive restoration projects (-1).
- **East Option 2:** Same overall impacts as the alternative. Would have more crossings that affect streams with high shade function (+5) and high potential for large woody debris (+6). Would have fewer crossings that could negate fish restoration benefits (-1), partially offset benefits (-1), or affect extensive restoration projects (-1).

- **East Option 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). Would have one additional crossing partially offsetting fish restoration benefits (+1), but one less crossing affecting extensive restoration projects (-1).

Crossover Alternative and Options

Riparian vegetation would be cleared at 55 forested crossings of fish-bearing streams. In addition to 32 crossings where loss of shade would have potential **high** impacts on stream temperatures and fish, there would be additional **high** impacts at 31 crossings from loss of large woody debris potential. About 7.3 acres of vegetation at fish-bearing streams that would be cleared is in floodplains, with 9 acres of floodplain impacted in total (by right-of-way clearing, roads and towers), least of the action alternatives. A large amount of existing right-of-way in floodplains has already been cleared. Because the total amount of floodplain area impacted is small and existing floodplains are already impaired, additional impacts to fish from project-related floodplain impacts by the alternative would be **low**.

The Crossover Alternative has the greatest potential impacts on ESA-listed and general fish populations (about 0.2 percent), based on the Integrated Fish Impacts index, because it would cross a greater number of productive anadromous fish-bearing streams and more highly functioning riparian vegetation would be cleared. However, given that only a fraction of potential fish production would be affected, the alternative would not pose a substantial risk to listed species; overall fish impacts would be **low**.

Permanent changes in habitat conditions would occur at three crossings on or adjacent to fish habitat enhancement projects on the East Fork Lewis River and the Washougal River, having a **high** impact because benefits would be negated or compromised. Clearing could also partially offset benefits from nearby restoration projects at seven crossings, with potential **moderate** impacts. Five crossings could possibly affect extensive restoration projects; impacts would be **moderate-to-high**.

- **Crossover Option 1:** Same overall impacts as the alternative. Would affect one more stream with high shade function.
- **Crossover Option 2:** Same overall impacts as the alternative. One additional crossing could partially offset the benefits of fish restoration projects(+1).
- **Crossover Option 3:** 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). One additional crossing could partially offset the benefits of fish restoration projects (+1).

S.3.16 Climate

S.3.16.1 Affected Environment

Temperatures and precipitation differ throughout the project area depending on location and elevation. The eastern portions of the project area get about 71 inches of snow and more than 85 inches of rain each year. Where the line would run at higher elevations in the western foothills of the Cascade Range (portions of the East and Crossover alternatives would be above 3,000 feet), it would be exposed to high winds, more prevalent heavy fog conditions, and

frequent temperatures below 32°F during winter. Western portions of the project area are lower (less than 200 feet) and have a more moderate climate. About 46 inches of rain and less than 5 inches of snow occur each year, with only a few days of subfreezing temperatures. The lower elevations typically have fewer heavy fog days and lower winds.

S.3.16.2 Impacts Common to Action Alternatives

Climate could be directly affected by long-term, large-scale changes in physical parameters such as transpiration (loss of water vapor from parts of plants), albedo (solar reflectivity of the earth's surface), or changes in topography and atmospheric composition. At most, the project would affect these parameters over extremely small areas. **No** impact on climate would occur from the action alternatives.

Climate, specifically certain weather conditions (wind, rain, ice, fog), could have a direct effect on construction as well as ongoing operation and maintenance activities, such as preventing construction equipment from accessing right-of-way, degrading access roads or icing (and stressing) conductors. However, these impacts would be **low** because transmission facilities would be engineered for climate conditions in the project area. Also, construction and maintenance activities would be scheduled to take advantage of favorable seasonal weather conditions, if possible.

S.3.17 Air Quality

S.3.17.1 Affected Environment

The airsheds in the project area are regulated by the Southwest Clean Air Agency (SWCAA) in Washington and the Department of Environmental Quality (ODEQ) in Oregon. Both agencies operate monitoring stations throughout their respective jurisdictional areas. Based on data collected, the action alternatives are within airsheds that are in “attainment or unclassified” for the national ambient air quality standards (NAAQS) for all pollutants, which include carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead, and particulate matter (PM). The Portland, Oregon, and Vancouver, Washington, areas are considered “maintenance areas” for carbon monoxide, meaning that, at one time, they were classified as “non-attainment” but now comply with the NAAQS (since 1996).

Portions of the West Alternative, Segment 52 and the Sundial Substation site are in the Portland-Vancouver metro area where there are more industrial sources of air pollution and higher traffic congestion. Longview, Washington is the second most populated portion of the project area (it is crossed by the West and Crossover alternatives and Central Option 2), experiencing moderate amounts of traffic and possible sources of air pollution from timber yards. For the remaining portions of the action alternatives, the landscape is rural with few or no sources of industrial air pollution. Local air pollutant emissions in the rural areas are limited primarily to windblown dust from agricultural or logging operations and tailpipe emissions from traffic along highways and local roads.

S.3.17.2 Impacts Common to Action Alternatives

Construction of the transmission line, substations and access roads would generate a temporary increase in some pollutants, such as particulate matter from fugitive dust and added exhaust emissions. However, because construction activities would be localized and short-lived, air

quality impacts would be **low**. Maintenance of these facilities would generate infrequent fugitive dust and exhaust emissions when maintenance vehicles travel access roads, creating **low** impacts. During transmission line operations, high electric fields cause a breakdown of air at the surface of the conductors called corona, which can produce small amounts of ozone and nitrogen oxides. There would be **no** impact to regional air quality from corona because the amount of pollutants emitted would be small, temporary and not detectable above background levels.

S.3.18 Greenhouse Gases

S.3.18.1 Affected Environment

Greenhouse gases (GHGs) are chemical compounds found in the earth's atmosphere that absorb and trap infrared radiation as heat. Global atmospheric GHG concentrations are a product of continuous emission (release) and removal (storage) of GHGs over time. In the natural environment, this release and storage is largely cyclical. Human activities such as deforestation, soil disturbance, and burning of fossil fuels disrupt the natural cycle by increasing the GHG emission rate over the storage rate, which causes a net increase of GHGs in the atmosphere. The resulting retention and build-up of heat in the atmosphere increases temperatures, which causes warming of the planet through a greenhouse-like effect and a host of problems stemming from melting arctic sea ice and changes in hydrology (e.g., smaller snow packs in mountains) to extreme weather events and changes in growing seasons. All of these changes could have a ripple effect on agricultural production, human health, public infrastructure, water supplies, hydropower generation, and terrestrial, aquatic, and marine ecosystems throughout the project area (and globally).

To lessen BPA's system contribution to GHG emissions, BPA developed a climate change roadmap in 2008 which identified measuring BPA's overall GHG emissions as a key starting point to managing its overall GHG footprint. As a result BPA has completed and published GHG inventories for 2009, 2010, 2011, and 2012 to track emissions and quantify the value of potential remedies for reducing them. In 2012, BPA's system-wide direct emissions totaled 88,524 metric tons of carbon dioxide equivalent (CO₂e). These direct emissions were calculated from the use of vehicles, air transportation, building operation and transmission line operation.

S.3.18.2 Impacts Common to Action Alternatives

Direct GHG emissions from non-generating utility projects such as this proposed project are primarily limited to vehicle and equipment emissions, and impacts to GHG concentrations from these are typically very low compared to emissions from significant industrial combustion sources and other regional sources.

During the 60-month construction period, the use of gasoline- and diesel-powered vehicles and equipment could contribute 60,571 metric tons of CO₂e emissions. That would be about 18,586 CO₂e metric tons per year, roughly the equivalent of operating 3,913 passenger vehicles annually. Operations and maintenance activities would emit fewer GHGs; when averaged over the operational life of the project (50 years), the result is annualized emissions of about 7,831 metric tons of CO₂e, or the equivalent of operating 1,649 passenger vehicles a year, a **low** impact.

Because trees serve as temporary carbon reservoirs, permanent conversion of forested areas for rights-of-way and access roads would likely also contribute to higher GHG concentrations in the environment. Estimated sequestration losses for the action alternatives range between 226,803 and 813,464 metric tons CO₂e, considered a **moderate** impact. The Preferred Alternative would create the highest sequestration loss.

S.3.19 Cumulative Impacts

Cumulative impacts are environmental impacts that result from the incremental impact of an action, such as one of the proposed action alternatives, when added to other past, present and reasonably foreseeable future actions.

Past actions that have affected natural and human resources in the project area include conversion of native prairie and floodplains to agriculture and pasture; timber clearing and harvest; settlements followed by residential, commercial and urban development (specifically in the Portland/Vancouver and Longview/Kelso metro areas, and including the many small towns and communities in Clark, Cowlitz and Multnomah counties); railroad, highway and road construction; establishment of ports and airports; development of power generation resources (including hydroelectric dams and coal- and natural gas-fired plants); and installation of transmission and distribution lines and related facilities.

Currently and in the reasonably foreseeable future, many of these activities will continue and grow. New development will continue as population growth and demand for resources increase. The regional road and highway system will likely expand as commercial and residential development encroaches into what are now rural areas. Utility infrastructure such as natural gas pipelines, electrical transmission and distribution lines, telecommunications, and cell towers will continue to develop. Marine terminals, ports, and commercial/industrial districts will be further developed to meet market demands for products and services. If a decision is made to build one of the action alternatives, the selected alternative would add to these impacts with construction and operation of additional transmission line facilities and the new substations.

The I-5 project's incremental contribution to potential cumulative impacts on resources would vary as follows:

Land: Minor incremental contribution to cumulative land use and ownership impacts from introduction of new utility facilities and removal of forested, agricultural and other uses permanently for right-of-way, towers and access roads. East Alternative would contribute the greatest potential impact; West Alternative the least.

Recreation: Minor incremental contribution, primarily affecting dispersed recreation, where the project would introduce a developed utility feature to a more natural landscape. Central and East alternatives would contribute the greatest potential impact; West Alternative the least.

Visual Resources: Minor incremental contributions where the West and Crossover alternatives would use existing right-of-way (more viewers, but more existing development); relatively high potential contributions by the Central, East and Crossover alternatives where they would run in newly cleared right-of-way in previously undeveloped areas.

Electric and Magnet Fields: Incremental increase in EMF along new right-of-way; incremental increase or decrease along existing right-of-way depending on the presence of another line and configuration of both lines.

Noise: Short-term adverse incremental contributions during construction at any given location along the line or at substation sites; minor incremental contributions from corona-generated noise when the line is operating.

Public Health and Safety: Minor incremental contributions possible during construction, from increased traffic and risks of electrocution, fire, toxic material spills and tree felling. The line would be designed to minimize the potential for safety issues once operating.

Socioeconomics: Small beneficial incremental contributions from project-related expenditures, employment, construction-related earnings, temporary lodging and work-crew spending in local communities. Minor incremental contributions to cumulative impacts on property values. No incremental contributions to public services or facilities.

Transportation: Temporary, but potentially significant, incremental contributions during construction from construction vehicles and traffic changes (lane closures, detours); temporary minor incremental contributions during semi-annual maintenance and infrequent repair activities; minor beneficial incremental contributions from new or improved access roads, particularly along the Central and East alternatives.

Cultural Resources: Adverse incremental contributions during construction and from intrusion on historic viewsheds.

Geology and Soils: Minor incremental contributions to cumulative soil erosion and compaction impacts (most would occur during construction and be temporary); no incremental contribution to landslide risk.

Water: Minor incremental contributions from runoff and sediment delivery to streams and decreased riparian shade along streams. The West Alternative has the smallest potential contribution because it has the fewest stream crossings; the East, Central, and Crossover alternatives have more because of new right-of-way.

Wetlands: Potential high incremental contributions by the West Alternative, which affects the greatest acreage of wetlands, but many of these are of low quality. The Central Alternative would have the least incremental contribution to cumulative impacts on wetlands, affecting the least acreage, but some of these wetlands are of higher quality. The East and Crossover Alternatives would have incremental contributions somewhere in between these two alternatives.

Vegetation: Incremental contributions where the project would clear forests and other native plant habitats (West Alternative would clear the least forest; East and Central alternatives the most); possible adverse incremental contributions to cumulative impacts on special-status plant habitat and species.

Wildlife: Incremental contributions from permanent loss of general wildlife habitat and WDFW priority habitat. The West and Crossover alternatives would contribute more to cumulative impacts on bird species and WDFW priority habitats; the Central and East alternatives would contribute more to cumulative impacts on general wildlife habitat (most of which is lower value

production forest). Possible adverse incremental contributions to cumulative impacts on special-status species.

Fish: Adverse incremental contributions where the alternatives would require clearing along fish-bearing streams and reduce riparian functions (the Central Alternative crosses the most fish-bearing streams; the West Alternative the least). Negligible contributions to cumulative impacts on fish from floodplain incursions and erosion (sediment delivery to streams).

Air Quality: Temporary local incremental contributions during construction from dust or construction vehicle emissions; no incremental contributions from operation or maintenance of the line.

Greenhouse Gases: Negligible incremental contributions.

Climate: No cumulative impacts.