State Environmental Policy Act Draft Programmatic Environmental Impact Statement

For Utility-Scale Solar Energy Facilities in Washington State

Shorelands and Environmental Assistance Program

Washington State Department of Ecology

Olympia, Washington

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State of Washington

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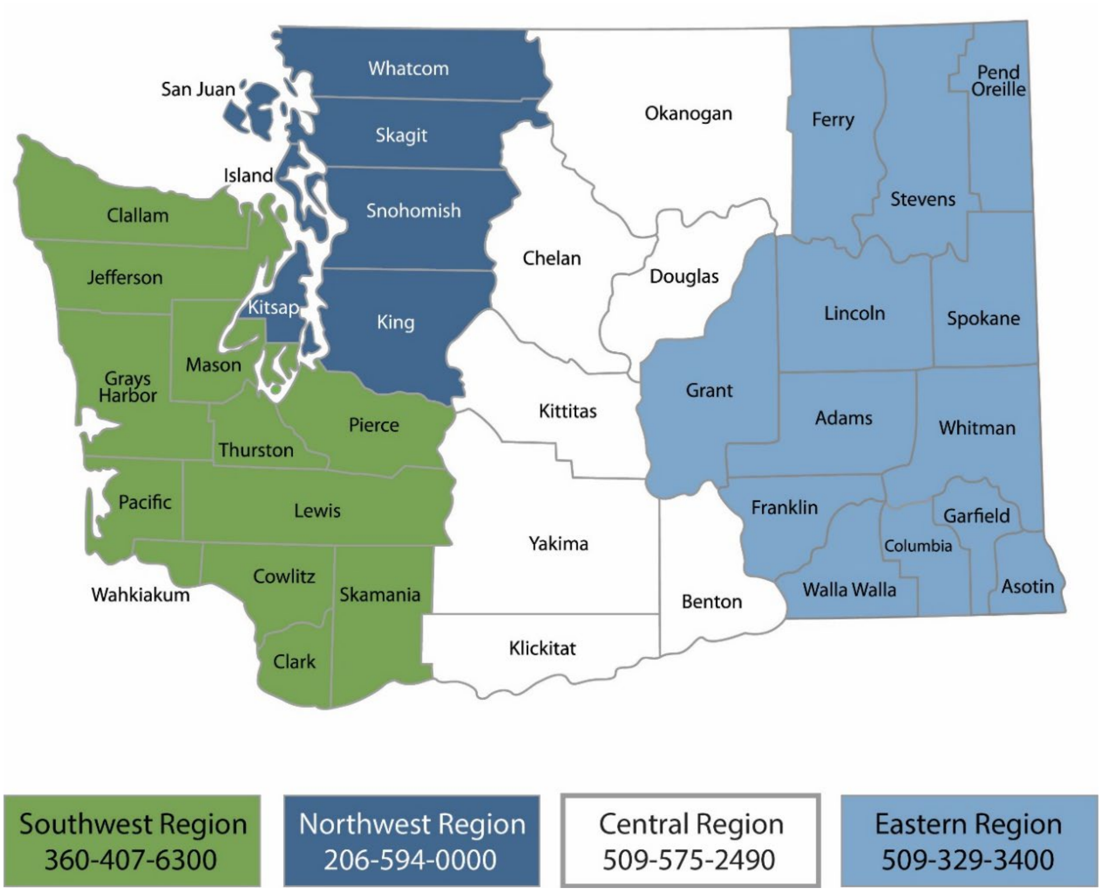
[1] https://climate.wa.gov/
[2] www.ecology.wa.gov/contact

Department of Ecology's Regional Offices

Map of Counties Served



Region	Counties served	Mailing Address	Phone
Southwest	Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Mason, Lewis, Pacific, Pierce, Skamania, Thurston, Wahkiakum	PO Box 47775 Olympia, WA 98504	360-407-6300
Northwest	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom	PO Box 330316 Shoreline, WA 98133	206-594-0000
Central	Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima	1250 W Alder St Union Gap, WA 98903	509-575-2490
Eastern	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman	4601 N Monroe Spokane, WA 99205	509-329-3400
Headquarters	Across Washington	PO Box 46700 Olympia, WA 98504	360-407-6000

Fact Sheet

Title

Programmatic Environmental Impact Statement on Utility-Scale Solar Energy Facilities in Washington State

Brief description of proposal

The Washington State Legislature directed the Washington State Department of Ecology (Ecology) to prepare a nonproject environmental review of utility-scale solar energy facilities in Washington by June 30, 2025. Revised Code of Washington (RCW) 43.21C.535[3] requires Ecology to assess and disclose the probable significant adverse environmental impacts and related mitigation measures for utility-scale solar energy facilities. Ecology prepared this Draft Programmatic Environmental Impact Statement (PEIS) to evaluate potential impacts and mitigation at a broad level. This Draft PEIS was prepared in compliance with the Washington State Environmental Policy Act (SEPA).[4]

The PEIS is intended to:

- Support the state's transition to clean energy while protecting the environment, Tribal rights and resources, and local communities.
- Identify the range of probable significant adverse environmental impacts utility-scale solar energy projects can pose.
- Provide information about facility siting and design that may be used to help avoid or minimize adverse environmental impacts for proposed projects.
- Identify general potential mitigation measures for impacts.
- Provide information for lead agencies to consider when conducting environmental reviews for utility-scale solar energy projects.

The PEIS evaluated the following types of utility-scale solar energy facilities as well as a No Action Alternative:

- **Utility-scale solar facilities (Alternatives 1 and 2):** solar energy facilities capable of generating between 20 and 1,200 megawatts of energy on sites between 200 to 12,000 acres in size.
- **Utility-scale solar facilities with battery energy storage systems (Alternative 3):** facilities that also include one or two battery energy storage systems, each capable of storing up to 500 megawatts of energy.

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[3] https://app.leg.wa.gov/RCW/default.aspx?cite=43.21C.535
[4] https://apps.leg.wa.gov/wac/default.aspx?cite=197-11

- **Utility-scale solar facilities that include agricultural uses (Alternative 4):** dual-use facilities where agriculture would occur during facility operations and may include raising or modifying the solar panels to allow for agricultural land use.
- **No Action Alternative:** city, county, and state agencies would continue to conduct environmental review and permitting for utility-scale solar facilities under existing state and local laws on a project-by-project basis without using this PEIS as a reference.

Location

The geographic scope for the solar PEIS includes areas throughout the State of Washington where utility-scale solar facilities are likely to be developed based on available solar energy, the topographic slope, and proximity to transmission lines.

Proposed date of implementation

The Final PEIS will be issued by the legislatively mandated date of June 30, 2025.

Responsible official contact

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Required permits, licenses, and approvals

Numerous regulations, plans, and laws guided or influenced the development of this PEIS. Because this is a programmatic EIS for a nonproject action, and the specific nature of projects that would be proposed is not yet known, it is not possible to present a complete list of permits, licenses, and approvals that could be required for future facilities.

Implementation of the types of utility-scale energy facilities evaluated in the PEIS would require compliance with regulations, rules, and plans at federal, state, and local levels. Examples of those that could be associated with utility-scale solar energy facilities include:

Federal

- Bald and Golden Eagle Protection Act
- Clean Water Act Section 404 Permit

- Compensatory Mitigation for Losses of Aquatic Resources; Final Rule 33 (*Code of Federal Regulations* Parts 325 and 332 and 40 *Code of Federal Regulations* Part 230)
- Determination of No Hazard to Air Navigation Approval
- Endangered Species Act
- Fish and Wildlife Coordination Act
- Magnuson-Stevens Fishery Conservation and Management Act
- Migratory Bird Treaty Act
- National Environmental Policy Act
- National Forest Management Act
- National Historic Preservation Act, Section 106
- National Oceanic and Atmospheric Administration Radar Operations Center Approval
- U.S. Department of Defense Clearance for Radar Interference
- U.S. Department of Transportation Act of 1966 Section 4(f) Review

State

- Aquatic Use Authorization (Washington State Aquatic Lands Act)
- Archaeological Excavation and Removal Permit
- Clean Air Act Prevention of Significant Deterioration Permit
- Clean Water Act National Pollutant Discharge Elimination System (NPDES) permits
- Clean Water Act Section 401 Water Quality Certification
- Coastal Zone Management Act Consistency
- State Waste Discharge Permit
- State Environmental Policy Act
- Surface Mining Reclamation Permit
- Washington Forest Practices Act
- Washington State Department of Labor and Industries electrical permits
- Washington State Department of Transportation permits
- Washington State Growth Management Act
- Washington State Hydraulic Code
- Washington State Water Pollution Control Act
- Washington State Shoreline Management Act
- Water Right Permit

Local

- Air quality permits
- Blasting permits
- Construction permits (right-of-way, access, grading, building, mechanical, and electrical permits)
- Critical areas ordinances
- Floodplain development permits
- Shoreline permits
- Zoning ordinances and other land use requirements

Authors and principal contributors

This document has been prepared under the direction of Ecology. All chapters and appendices have been prepared for and approved by Ecology. Key authors and principal contributors to the PEIS analyses are listed below:

- Washington State Department of Ecology
- Washington Department of Fish and Wildlife
- Washington State Department of Natural Resources
- Washington State Department of Archaeology and Historic Preservation
- Washington State Department of Transportation
- State of Washington Energy Facility Site Evaluation Council
- Anchor QEA
- Environmental Science Associates
- Hammerschlag LLC

Date of Draft PEIS issuance

12:00 p.m., September 25, 2024

Date comments are due

11:59 p.m., October 28, 2024

Public comment and hearings on the Draft PEIS

A 33-day public comment period is being conducted from 12:00 p.m., September 25 through 11:59 p.m., October 28, 2024. Comments should focus on the substance of the Draft PEIS and be as specific as possible. Comments on the Draft PEIS received during the comment period will be addressed in the Final PEIS, which is planned to be issued by June 30, 2025. Comments may be submitted in the following ways:

By mail:

Clean Energy Coordination
Department of Ecology
PO Box 47709
Olympia, WA 98504-7709

Online:

Complete a comment form[5]

[5] https://ecology.wa.gov/regulations-permits/sepa/clean-energy/programmatic-eis

In person at a public hearing:

October 15, 2024, starting at 4:00 p.m.
Ecology Central Region Office
1250 West Alder Street
Union Gap, WA 98903

October 16, 2024, starting at 1:00 p.m.
Red Lion Hotel Pasco Airport & Conference Center
2525 North 20th Avenue
Pasco, WA 99301

Virtually at a public hearing:

October 22, 2024, starting at 10:00 a.m.
Information and links to register at https://ecology.wa.gov/regulations-permits/sepa/clean-energy/programmatic-eis

Timing of additional environmental review

A Final PEIS will be completed by June 30, 2025. The PEIS considers potential impacts from general types of solar energy facilities; it is not site-specific or for a specific project. Implementation of the types of utility-scale energy facilities evaluated in the PEIS would require additional, more detailed, project-level environmental review prior to implementation.

RCW 43.21C.538 requires SEPA lead agencies to consider the solar PEIS for any utility-scale solar projects. Agencies must use the information in the PEIS, along with other publicly available information and site-specific details, to support their evaluation of proposed actions, alternatives, environmental impacts, or mitigation for a proposed project. Potential impacts not addressed in the PEIS will need to be evaluated in the project-level environmental review.

Document availability

The Draft PEIS is posted on the following websites:

- SEPA Register website[6]
- Ecology's programmatic EIS website[7]

This document is also available at the following locations:

Ecology Headquarters
300 Desmond Drive SE
Lacey, WA 98503

[6] https://apps.ecology.wa.gov/separ/Main/SEPA
[7] https://ecology.wa.gov/regulations-permits/sepa/clean-energy/programmatic-eis

Ecology Central Region Office
1250 West Alder Street
Union Gap, WA 98903

Location of background materials

The PEIS and associated resource reports developed specifically for this environmental review are available on Ecology's programmatic EIS website.[8]

Cost of copy of PEIS

To obtain a CD or printed copy of the Draft PEIS (for the cost of production), follow the instructions provided on the Ecology "Publications & Forms" webpage.[9]

[8] https://ecology.wa.gov/regulations-permits/sepa/clean-energy/programmatic-eis
[9] https://ecology.wa.gov/footer-pages/online-tools-publications/publications-forms

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State of Washington

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Appendix N. Public Services and Utilities Resource Report

Appendix O. Tribal Rights, Interests, and Resources Report

Appendix P. Environmental Justice Resource Report

Appendix Q. Cumulative Impacts Report

Acronyms and Abbreviations List

AC	alternating current
BESS	battery energy storage system
BLM	Bureau of Land Management
BMP	best management practice
CCA	Climate Commitment Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	Compatible Energy Siting Assessment
CETA	Clean Energy Transformation Act
CO_2e	carbon dioxide equivalent
CSZ	Cascadia Subduction Zone
DAHP	Washington State Department of Archaeological and Historic Preservation
dBA	A-weighted decibel
DC	direct current
DNR	Washington State Department of Natural Resources
DOC	Washington Department of Commerce
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EDNA	environmental designation for noise abatement
EFSEC	State of Washington Energy Facility Site Evaluation Council
EHS	environmental health and safety
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FTA	Federal Transit Administration
GHG	greenhouse gas
GHI	global horizontal irradiance
GMA	Growth Management Act
HVAC	heating, ventilation, and air conditioning
kV	kilovolt
kWh	kilowatt-hour
$kWh/m^2/day$	kilowatt-hour per square meter per day
LCA	life-cycle assessment
MW	megawatt
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration/Act
PEIS	Programmatic Environmental Impact Statement

PV	photovoltaic
RCW	Revised Code of Washington
RFFA	reasonably foreseeable future action
ROW	right-of-way
SEPA	State Environmental Policy Act
SMP	Shoreline Management Plan
SPCC	Spill Prevention, Control, and Countermeasure
TCP	Traditional Cultural Property
UGA	urban growth area
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation

Crosswalk with PEIS for Utility-Scale Onshore Wind Energy

Two Programmatic Environmental Impact Statements (PEISs) are being released at the same time, one for utility-scale solar energy facilities and one for utility-scale onshore wind energy facilities. This crosswalk identifies the areas with substantial differences between the documents.

Section	Utility-Scale Solar Energy PEIS (this document)	Utility-Scale Onshore Wind Energy PEIS
1: Introduction and Background	• Different summary of types of facilities and geographic areas evaluated	• Different summary of types of facilities and geographic areas evaluated
2: Utility-Scale Solar/Onshore Wind Energy Facilities	• Descriptions of typical components and phases of utility-scale solar energy facilities • Some differences in alternatives considered but not carried forward	• Description of typical components and phases of utility-scale onshore wind energy facilities • Some differences in alternatives considered but not carried forward
3: Study Area	• Description and map depicting scope of study for utility-scale solar energy facilities	• Description and map depicting scope of study for utility-scale onshore wind energy facilities
4: Affected Environment, Potential Impacts, and Mitigation (Introduction)	• No substantial differences	• No substantial differences
4.1 Tribal rights, interests, and resources	• Differences in specific impact drivers associated with facilities	• Larger study area includes consideration of additional geographic regions and steeper sloped/more mountainous areas • Differences in specific impact drivers associated with facilities
4.2 Environmental justice and overburdened communities	• No substantial differences	• No substantial differences
4.3 Earth	• Some differences in actions to avoid and reduce impacts	• Larger study area includes consideration of different affected environment areas (e.g., overlap with tsunami inundation zones and additional faults) • Differences in landslide and erosion risks from potential for facilities to be on steeper slopes • Some differences in actions to avoid and reduce impacts

Section	Utility-Scale Solar Energy PEIS (this document)	Utility-Scale Onshore Wind Energy PEIS
4.4 Air quality and greenhouse gases	• Different specific air emission estimates • Differences in the estimates for greenhouse gas life-cycle assessments	• Different specific air emission estimates • Includes evaluation of air quality for repowering facilities instead of decommissioning • Differences in the estimates for greenhouse gas life-cycle assessments
4.5 Water resources	• Differences in which WRIAs and aquifers the study area overlaps • Different impacts related to impervious surfaces • Includes potential water use for washing solar panels	• Differences in which WRIAs and aquifers the study area overlaps • Different impacts related to impervious surfaces
4.6 Biological resources	• Differences in specific impact drivers associated with facilities • Some differences in actions to avoid and reduce impacts	• Larger study area includes consideration of additional ecoregions, marine and nearshore habitats and species, and estuarine wetlands • Differences in specific impact drivers associated with facilities • Some differences in actions to avoid and reduce impacts
4.7 Energy or natural resources	• Different specific energy and natural resource use estimates and resulting different ranges of potential impacts • Some differences in actions to avoid and reduce impacts	• Includes the potential for facilities to affect adjacent wind resource availability • Different specific energy and natural resource use estimates and resulting different ranges of potential impacts • Some differences in actions to avoid and reduce impacts
4.8 Environmental health and safety	• Some differences in specific hazardous materials, health and safety hazards, and wildfire risks • Some differences in actions to avoid and reduce impacts	• Some differences in specific hazardous materials, health and safety hazards, and wildfire risks • Some differences in actions to avoid and reduce impacts
4.9 Noise and vibration	• Differences in the types of facility noise-and vibration-generating activities • Some differences in actions to avoid and reduce impacts	• Differences in the types of facility noise-and vibration-generating activities • Larger distance at which potential impacts from facilities could occur • Some differences in actions to avoid and reduce impacts

Section	Utility-Scale Solar Energy PEIS (this document)	Utility-Scale Onshore Wind Energy PEIS
4.10 Land use	• Additional agricultural information in affected environment from Least-Conflict Solar Siting Study for the Columbia Plateau • Some differences in actions to avoid and reduce impacts	• Decommissioning considers potential impacts from repowering wind facilities • Some differences in actions to avoid and reduce impacts
4.11 Aesthetics/ visual quality	• Different specific visual quality, light, and glare conditions associated with facilities, and resulting different ranges of potential impacts • Some differences in actions to avoid and reduce impacts	• Different specific visual quality, light, and glare conditions associated with facilities, and resulting different ranges of potential impacts • Some differences in actions to avoid and reduce impacts
4.12 Recreation	• No substantial differences	• No substantial differences
4.13 Historic and cultural resources	• Differences in specific impact drivers associated with facilities	• Larger study area includes consideration of additional geographic regions • Differences in specific impact drivers associated with facilities
4.14 Transportation	• Differences in construction impacts from transportation of facility components • Some differences in actions to avoid and reduce impacts	• Differences in construction impacts from transportation of facility components • Some differences in actions to avoid and reduce impacts
4.15 Public services and utilities	• Differences in specific impacts on public service and utility providers • Some differences in actions to avoid and reduce impacts	• Potential for significant adverse impacts on fire response related to turbines • Potential for significant adverse impacts on solid waste and recycling during decommissioning or repowering • Some differences in actions to avoid and reduce impacts
5: Cumulative Impacts	• Some differences in cumulative impacts on biological resources, noise and vibration, aesthetics/visual quality, and public services and utilities	• Some differences in cumulative impacts on biological resources, noise and vibration, aesthetics/visual quality, and public services and utilities
6: Consultation and Coordination	• No substantial differences	• No substantial differences
7: Permits and Approvals	• No substantial differences	• No substantial differences
8: List of Preparers and Contributors	• No substantial differences	• No substantial differences
9: Distribution List	• No substantial differences	• No substantial differences

1 Introduction and Background

1.1 PEIS overview

This Washington State Environmental Policy Act (SEPA) Programmatic Environmental Impact Statement (PEIS) was prepared to evaluate utility-scale solar energy facilities in Washington state. A PEIS is a type of nonproject environmental review used for planning; it is not an evaluation of a specific project. This PEIS considers potentially significant adverse environmental impacts at a broad level. It analyzes general types of facilities—but not individual projects—to identify probable significant adverse environmental impacts and possible ways to avoid, minimize, or mitigate those impacts.

The PEIS is intended to:

- Support the state's transition to clean energy while protecting the environment, Tribal rights and resources, and local communities.
- Identify the range of probable significant adverse environmental impacts utility-scale solar energy projects can pose.
- Provide information about facility siting and design that may be used to help avoid or minimize adverse environmental impacts for proposed facilities.
- Identify general potential mitigation measures for impacts.
- Provide information for lead agencies to consider when conducting environmental reviews for utility-scale solar energy facilities.

The PEIS does not approve, authorize, limit, or exclude facilities on a site-specific basis.

Environmental Review Terminology

Lead agency: Agency responsible for preparing the environmental review under state law. The Washington State Department of Ecology (Ecology) is the lead agency for this PEIS.

State Environmental Policy Act (SEPA): Washington State law intended to ensure that environmental values are considered early and during decision-making actions by state and local agencies.

Programmatic Environmental Impact Statement (PEIS): Fact-based nonproject environmental review used for planning. It is not an evaluation of a specific project. A PEIS considers potentially significant adverse environmental impacts at a broad level as well as possible ways to avoid, minimize, or mitigate those impacts. Local, state, and federal agencies may use PEISs in order to help evaluate proposed actions, alternatives, environmental impacts, or mitigation for proposed projects.

1.2 Background and history

The Washington State Legislature directed the Washington State Department of Ecology (Ecology) to prepare nonproject environmental reviews of utility-scale onshore wind energy facilities, utility-scale solar energy facilities, and green electrolytic and renewable hydrogen facilities in Washington by June 30, 2025. The reviews are being prepared pursuant to SEPA.

This Draft PEIS focuses on utility-scale solar energy facilities. A separate Draft PEIS was prepared for utility-scale onshore wind energy facilities. Solar and onshore wind environmental reviews are being developed at the same time, so this report includes a crosswalk for comparison purposes in the previous section. A PEIS that focuses on green electrolytic and renewable hydrogen facilities is being developed separately and is not discussed further in this document. Information on all three processes is available on Ecology's webpage for clean energy PEISs.[10]

Ecology developed this PEIS to analyze potential impacts and mitigation at a broad level. The agency issued a Determination of Significance and opened an extended comment period on the scope of the PEIS on utility-scale solar facilities in Washington state on September 27, 2023. The PEIS was prepared under Revised Code of Washington (RCW) 43.21C.030(2)(c) per Chapter 197-11 Washington Administrative Code (WAC) procedures. The Determination of Significance and Scoping Notice for the PEIS initiated Ecology's environmental review process. Scoping helps determine the focus of the PEIS evaluation by seeking input from Tribes, agencies, members of the public, and interested parties on the contents of the PEIS. More information about the scoping process is available in Appendix A, Scoping Summary Report.

1.3 Types of solar facilities evaluated (alternatives)

The PEIS focuses on utility-scale solar energy facilities as directed by the Washington State Legislature. As used in this PEIS, utility-scale means a facility capable of providing at least 20 megawatts (MW) of electricity directly to the state's electrical grid. Ecology published the Scoping Document[11] in September 2023 that included information on possible types of facilities that could be analyzed in the PEIS. To identify the types of facilities to be studied in this PEIS, Ecology considered the comments received during scoping.

Facility types that did not meet definitions of the utility-scale solar energy facilities to be analyzed in the legislative direction were eliminated from further consideration and are discussed in Section 2.8. For example, distributed solar, community solar, and home rooftop solar systems are not utility-scale facilities and are not evaluated in the PEIS. Fossil-fuel energy facilities and other clean energy facilities are considered in the cumulative impact analysis.

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[10] https://ecology.wa.gov/regulations-permits/sepa/clean-energy/programmatic-eis
[11] https://fortress.wa.gov/ecy/ezshare/sea/Clean Energy Coordination/Solar_ScopingDocument_PEIS_PublicFinal_092723corrected.pdf

After consideration of comments and input received during scoping, Ecology identified four types of utility-scale solar energy facilities and a No Action Alternative to be evaluated in this PEIS. The facility types are as follows, and detailed descriptions are in Chapter 2:

- **Utility-scale solar facilities:** solar energy facilities capable of generating between 20 and 1,200 MW of energy on sites between 200 to 12,000 acres in size.
- **Solar facilities with battery energy storage systems:** facilities that also include one or two battery energy storage systems (BESSs), each capable of storing up to 500 MW of energy.
- **Solar facilities that include agricultural uses:** dual-use facilities where agriculture would occur during facility operations and may include raising or modifying the solar panels to allow for agricultural land use.

Because the analysis in the resource reports (Appendices B through Q) showed potential impacts from small to medium utility-scale facilities are similar in most cases to impacts from large utility-scale facilities, these types of facilities (alternatives) have been combined in the Draft PEIS. This is to improve readability of the document. The resource reports included in Appendices B through Q contain the full analysis of impacts, separated for each type of facility.

1.4 PEIS scope of analysis

Ecology considered the potential for impacts from these types of facilities, as well as comments received during scoping, to determine the scope of the Draft PEIS. The PEIS focuses on probable significant adverse impacts, with some information provided on other impacts. This is reflected in the level of detail provided for resources in the sections and appendices, with more information provided for potentially significant impacts. The introduction to Section 4 has more information on the types of impacts considered.

RCW 43.21C.535[12] states that “the scope of a nonproject environmental review shall be limited to the probable, significant adverse environmental impacts in geographic areas that are suitable for the applicable clean energy type.” Based on this legislative direction, and considering comments received during scoping, the study area was developed.

Ecology identified the following assumptions in determining the geographic area for analysis. It is important to note that this map does not show where a facility may or may not be sited, it is for impact analysis only. Facilities may be proposed within or outside of the geographic scope of study.

- Areas with a global horizontal irradiance (GHI) of 3.5 kilowatt-hours per square meter per day (kWh/m^2/day) or greater
- Flat to moderately sloped ground surfaces with 15% or less slopes

[12] https://app.leg.wa.gov/RCW/default.aspx?cite=43.21C.535

- Areas within 25 miles of existing transmission lines that can handle the energy generation of utility-scale facilities (230 kilovolt [kV] or greater lines).
- An area in eastern Washington with existing utility-scale solar energy facilities that does not meet the criteria above was included in the study area because the area has sufficient solar energy availability and other potentially favorable characteristics for utility-scale developments.

Figure 1-1 shows the solar study area. More information on the study area is provided in Chapter 3.

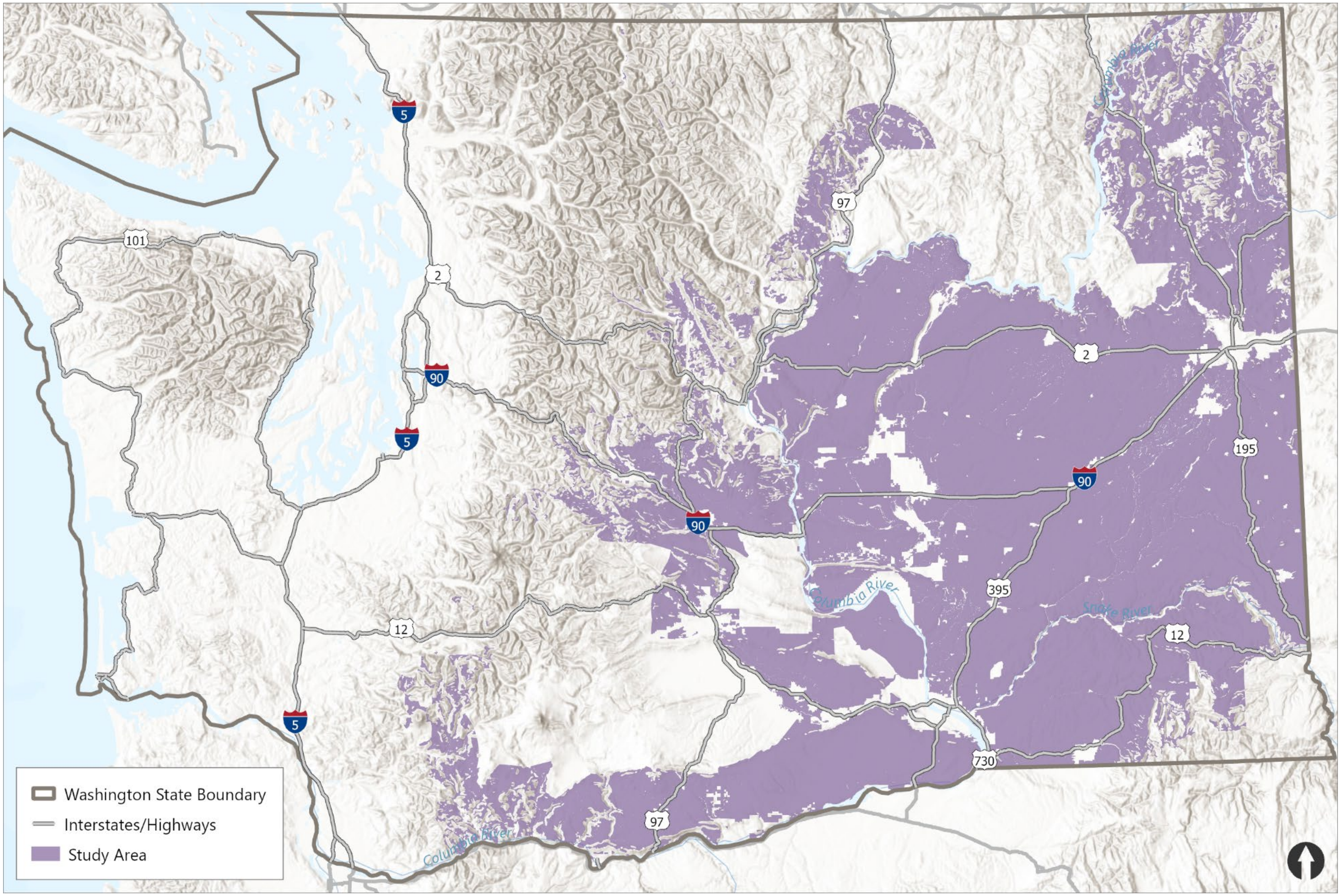


Figure 1-1. Solar Energy Facilities PEIS – geographic scope of study

1.5 State Environmental Policy Act process

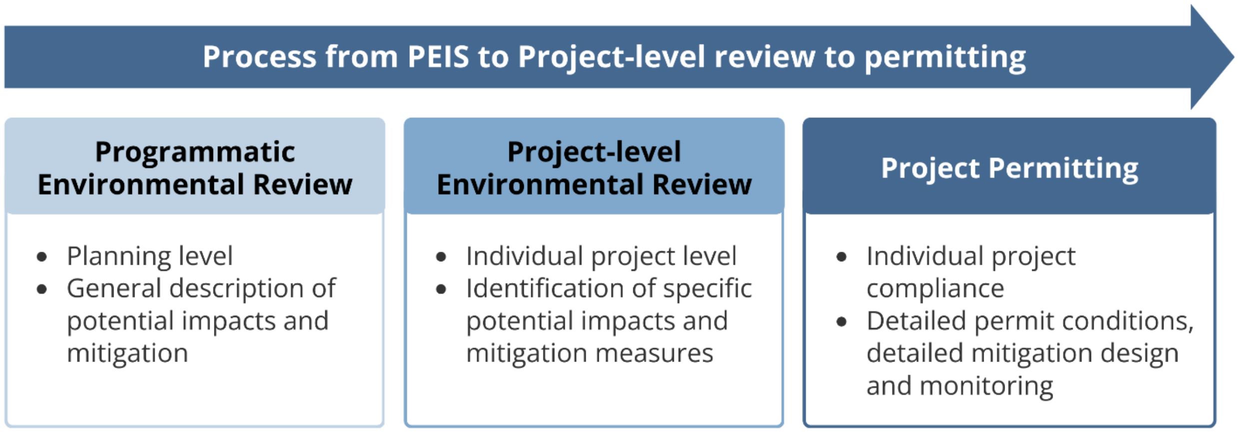
As the lead agency, Ecology prepared this PEIS in compliance with SEPA. The SEPA environmental review process provides a way to identify the possible environmental effects of a proposal and assess how they could be avoided or mitigated in advance. It helps decision-makers and the public understand how a proposed action could affect the natural and human environment.

The PEIS considers potential impacts from general types of solar energy facilities; it is not site-specific or for a specific facility. It evaluates environmental impacts over a broad geographic area and time horizon, and the depth and detail of the impact analysis is general, focusing on major impacts in a qualitative manner. Mitigation is also identified at a high level.

SEPA analyses for specific solar energy facility proposals would tier to this PEIS. Tiering means a broad nonproject evaluation is later used during the evaluation of a specific facility. Tiering can result in a more effective environmental analysis process for subsequent solar energy development proposals.

This PEIS identifies probable significant adverse environmental impacts and relevant mitigation applicable to utility-scale solar energy development in general. The PEIS does not assess site-specific issues associated with any individual energy development facility. Location-specific factors vary considerably from site to site. These include factors such as the soil type, groundwater availability, water types, habitat, vegetation, the presence of threatened or endangered species, and the presence of Tribal and cultural resources. The effects of location-specific and facility-specific factors cannot be fully anticipated or addressed in a programmatic analysis. The PEIS identifies potential impacts to be considered early and each solar facility proposal would be required to have its own SEPA environmental review. During that process, site-specific information and facility-specific effects would be evaluated.

A PEIS does not approve or deny a proposed facility. Federal, state, and local agencies may—and in some cases must, as explained below—use the information in the PEIS, along with other publicly available information and site-specific details, to inform project-level environmental reviews and permitting.



RCW 43.21C.538 requires SEPA lead agencies to consider the solar PEIS for any solar facilities. Each agency would be responsible for determining which elements of the PEIS analysis are applicable to their evaluation of a proposed facility and revising or supplementing the analysis to address facility-specific elements and circumstances that were not evaluated in the PEIS.

In summary, this PEIS can help:

- Developers avoid and minimize potential impacts as they work to site and develop their proposals and develop mitigation plans
- Local, state, and federal agencies conduct their environmental reviews and make permit decisions
- Provide information for the public and Tribes to use for future proposed facilities

1.6 PEIS organization

This PEIS is organized to provide information in three ways. The Summary provides brief, high-level information on key findings and probable significant adverse impacts. The PEIS chapters provide high-level information on the impact analysis and findings. The appendices contain the resource reports with detailed methods and technical information. For sections of this PEIS that have a related resource report, the report is the official technical documentation for this PEIS. If there is conflicting information between the Summary, PEIS chapters, or the resource report, the resource report is considered to be the controlling document. The Draft PEIS is organized as follows:

- **Publication and Contact Information, Cover Letter, and Fact Sheet**
- **Summary**
- **Draft PEIS:**
  - **Chapter 1: Introduction and Background** is contained in this chapter.
  - **Chapter 2: Utility-Scale Solar Energy Facilities** describes the purpose and objectives of the PEIS, typical components and phases of utility-scale solar energy facilities, and the alternatives considered for the PEIS.

- **Chapter 3: Study Area** describes the geographic and temporal scope of study that was used for the PEIS analysis.
- **Chapter 4: Affected Environment, Potential Impacts, and Mitigation** summarizes the current conditions in the study area and probable significant adverse impacts for each element of the environment. This chapter also identifies potential mitigation measures that could be implemented to reduce potential effects. References are provided to appropriate appendices for more details.
- **Chapter 5: Cumulative Impacts** summarizes the evaluation of potential cumulative effects of the alternatives. Additional detail is provided in Appendix Q.
- **Chapter 6: Consultation and Coordination** summarizes the PEIS scoping process; the roles of Ecology, other agencies, and Tribal governments in the development of the PEIS; and Ecology's coordination with Tribes, other agencies, the public, and stakeholders.
- **Chapter 7: Permits and Approvals** summarizes permits, licenses, and approvals that may be required for future proposed facilities.
- **Chapter 8: List of Preparers and Contributors** identifies state agencies, Tribes, and consulting firms who participated in the evaluation.
- **Chapter 9: Distribution List** identifies agencies, Tribes, organizations, and others who will receive this PEIS.

- **Appendices** include specific, detailed information relevant to the evaluation provided in this PEIS.

2 Utility-Scale Solar Energy Facilities

2.1 Purpose

As directed by the Legislature, this PEIS evaluates potential impacts and mitigation for utility-scale solar energy facilities in Washington state. Four types of utility-scale solar energy facilities (alternatives), and a No Action Alternative are assessed in this PEIS. The facility types include:

- **Utility-scale solar facilities:** solar energy facilities capable of generating between 20 and 1,200 MW of energy
- **Solar facilities with BESSs:** facilities with the addition of one or two BESSs, each capable of storing up to 500 MW of energy
- **Solar facilities that include agricultural uses**: dual-use facilities where agriculture would occur during facility operations and may include raising or modifying the solar panels to allow for agricultural land use

This chapter describes typical types of equipment and actions for site characterization, construction, operation, and decommissioning of these types of facilities, which are used for analysis in the PEIS.

This PEIS is expected to be used by energy facility developers in developing specific facilities. Project-level state environmental review would need to be completed for specific facilities, but such review can use information from this PEIS.

2.2 Typical components of utility-scale solar energy facilities

This PEIS evaluates utility-scale solar energy facilities consisting of solar arrays made from photovoltaic (PV) cells and associated power and electrical equipment. This section describes typical types of equipment and actions for site characterization, construction, operation, and decommissioning of these types of facilities, which are used for analysis in the PEIS. The typical components of utility-scale solar energy facilities are similar for the small to medium and large facility types analyzed, with larger facilities including proportionally more components.

PV systems are based on the use of semiconductors, materials that absorb light's energy and generate small amounts of electric current. Silicon, the earth's most abundant material after oxygen, is the cheapest and most frequently used semiconductor.

To produce electricity at the utility scale, multiple individual solar cells are connected to form a module. Modules are combined to make individual solar panels, and solar panels are grouped into arrays producing direct current (DC) electricity. This modular nature allows flexibility in sizing facilities based on factors such as the amount of power needed or the amount of land area available. Figure 2-1 illustrates these components.

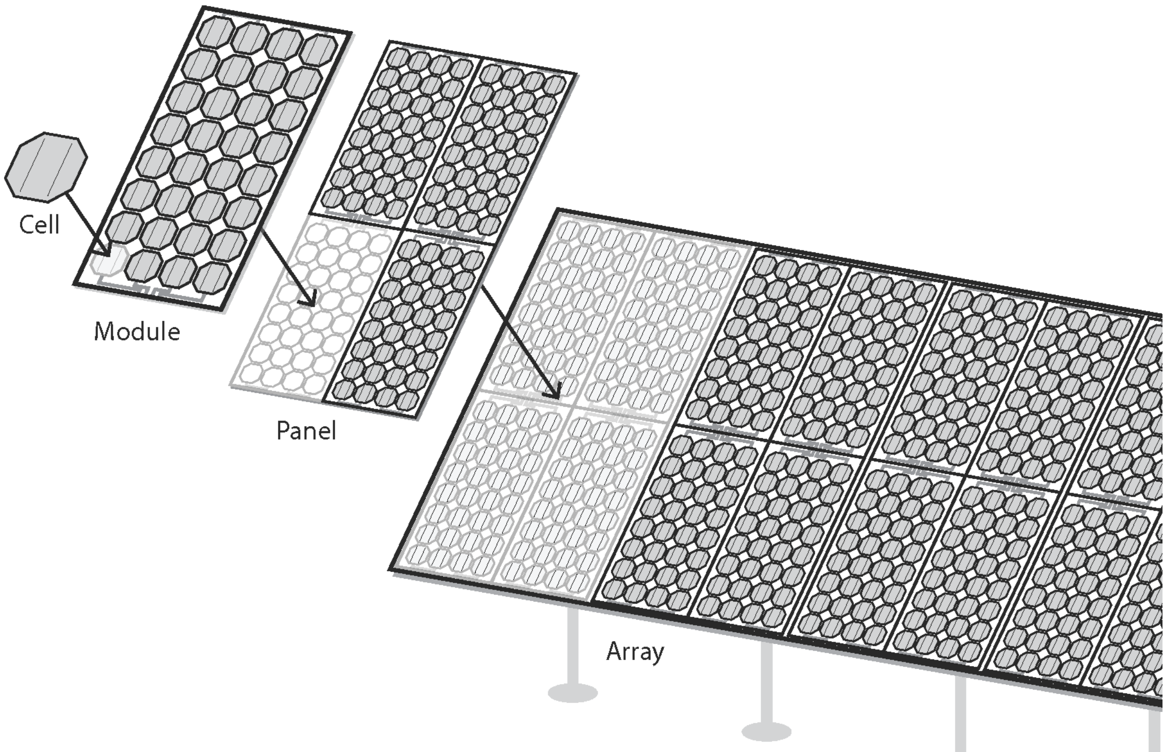


Figure 2-1. Solar cell, module, panel, and array

Solar energy facilities evaluated in this PEIS consist of two groups of equipment. The first is the solar field, which contains the solar array and may include a tracker system. The array is placed either in a fixed position optimal for capturing sunlight, or on a tracker system. A tracker system can be used to optimize electricity production by rotating the solar array to follow the path of the sun throughout the day.

The second group of equipment is the power collection system. This includes inverters to convert the produced DC power to alternating current (AC) power, transformers to increase voltage for feeding into the power grid, and a type of transmission line called a gen-tie line that connects the facility to the power grid.

One of the facility types analyzed in this PEIS includes a co-located BESS (refer to Section 2.3 for detailed discussion of this facility type). This type of facility would include a solar array and power collection system, along with batteries to store energy. This stored energy could be sent to the electrical grid at times other than when it is produced.

While the size of each facility would vary, for the purposes of this PEIS and based on examples of existing or permitted solar facilities in Washington, 10 acres for 1 MW of energy is used for estimating facility site size. The footprint for the solar array area would be within the facility site and would typically be about 10% to 15% of the total facility site size. Spacing is required between solar arrays and to allow for necessary infrastructure including access roads, operations and maintenance facilities, BESSs (if applicable), and the power collection system. The rest of the site is typically not developed. Actual facility sizes would vary based on geography and design. Figures 2-2 and 2-3 illustrate typical components of utility-scale solar facilities.

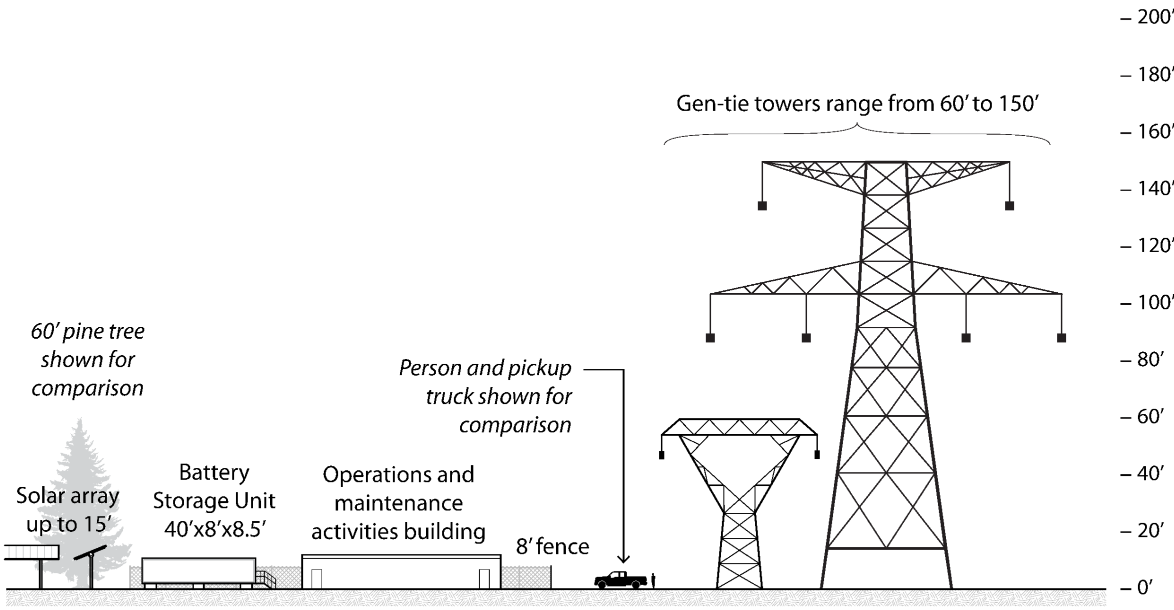


Figure 2-2. Relative scale of the typical components of a utility-scale solar facility

Example of a 194 MW solar facility

Photograph from [Business Wire]

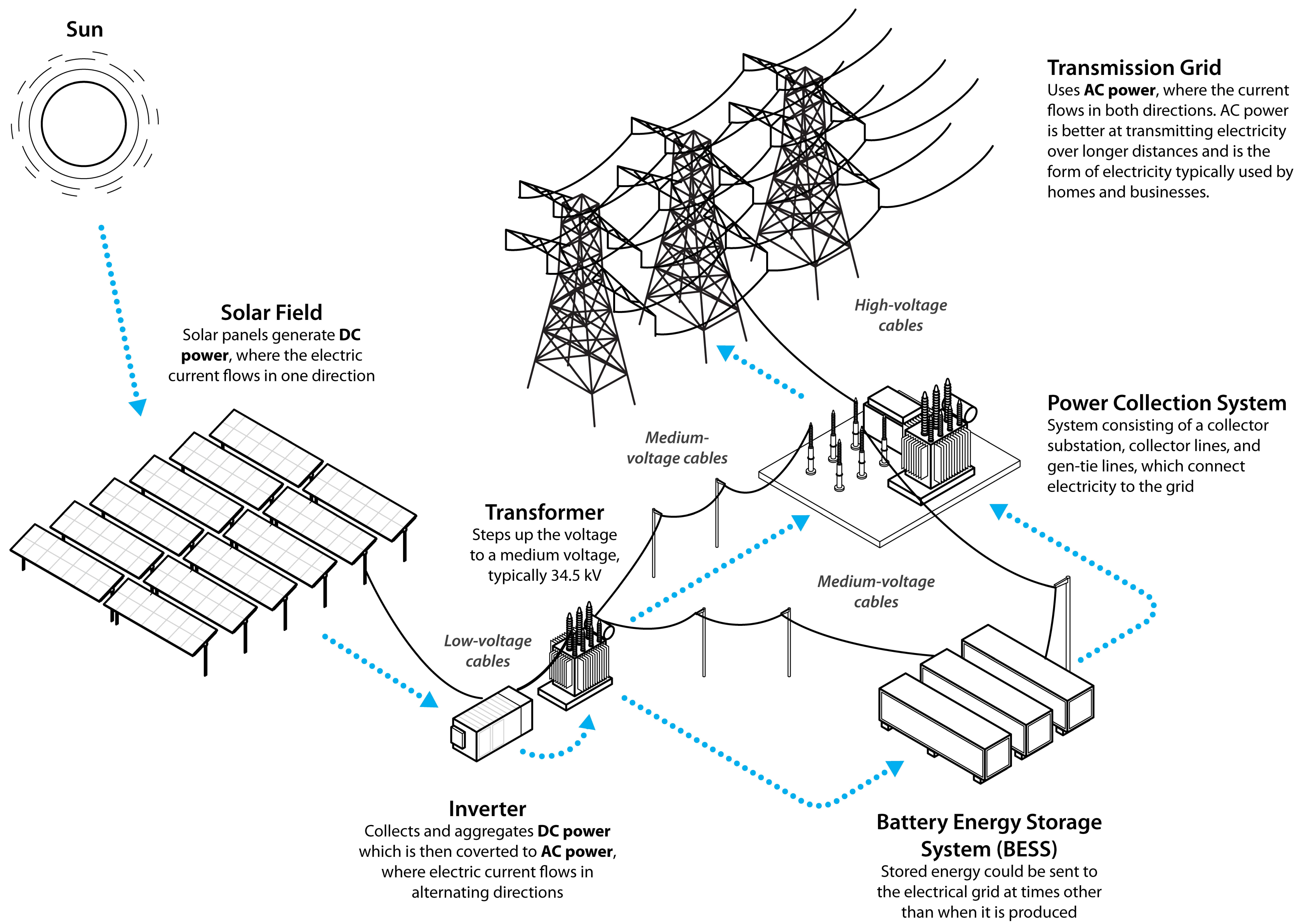


Figure 2-3. Typical components of utility-scale solar energy facilities

2.2.1 Solar array

For purposes of this analysis, a solar array consists of rows of solar panels, tracker system, posts, and cabling.

Developers may consider a range of options using this equipment in siting solar arrays. This includes micrositing, where individual rows of solar panels are positioned to maximize the solar energy received and orientations may not be identical. The PEIS does not look at specific siting layouts for the solar array equipment but rather analyzes the overall facility.

Example of solar panels installed in an array

Photograph from National Park Service Climate Change Response

2.2.1.1 Solar panels

Developers can choose from a variety of panels based on market conditions, availability, and environmental factors. For purposes of this PEIS, it is assumed mono- or poly-crystalline panels would be used to generate electricity by converting sunlight into DC electrical energy. Most solar panels are currently monofacial, which means that they have PV cells on one side, but bifacial solar panels, which have PV cells on both sides, are starting to become more common at utility-scale solar facilities.

Solar panels are made from many solar cells contained within anti-reflective glass and a metal frame. These panels are linked together with factory-installed wire connectors. The amount of electricity generated from a single panel varies by size and the number of cells per panel. Panels are connected in series to form long rows called arrays. The rows are then connected via cables and sent to inverters and transformers. Multiple rows may be configured in different ways, depending on the equipment type and topography. The spacing between rows, mounting equipment, and other design criteria may also affect the layout.

Once operational, solar panels typically require minimal maintenance, described in Section 2.5.3.

2.2.1.2 Solar tracker system

Solar panels mounted on tracker systems optimize electricity production by rotating the solar panels to follow the path of the sun throughout the day. Trackers can be single axis, which means they can rotate east-west, or they can be dual axis, which means they can rotate east-west and north-south. The length of each tracker row varies by topography and the number of panels that the tracker can hold.

A drive unit for the tracker system can control a single row or multiple rows of panels through a series of mechanical linkages and gearboxes. As the solar panels tilt throughout the day, the height of their top edges shift accordingly. They may be up to approximately 15 feet high. The tracker system and associated posts would be designed to withstand wind, snow, and seismic loads anticipated at the facility site.

Post depth would vary depending on ground conditions (e.g., soil, rock), but posts are typically installed 4 to 10 feet below the surface and protrude up to 12 feet above grade. Posts at the end of the tracker rows are usually installed at a greater depth to help them withstand wind uplift. Post locations would be determined based on geotechnical investigations and installed in soil or in concrete foundations, depending on geological conditions. Depending on the ground conditions, concrete fill may be used for each post. Approximately 0.3 cubic yard of concrete would be required for each post. The actual number of posts and foundation methods would vary depending on the tracker system components, topography, height of the solar panels, and site-specific geological conditions.

2.2.1.3 Cabling

The electrical current produced by solar panels is in the form of DC power. Cables collect and aggregate the DC power. Low-voltage (voltage ranges are illustrated in Figure 2-4) cabling connects the solar panels of each row in a series and brings them together into a single combiner box, which then connects to an inverter. Cabling can be mounted to the tracker system, placed in cable trays aboveground, or buried underground.

2.2.1.4 Inverters

Inverters convert DC power to AC power. Inverters are typically co-located with transformers on the same concrete slab; however, string inverters may also be used, which are located at the end of each PV row throughout the array. Inverters must comply with the applicable requirements of the National Electric Code and Institute of Electrical and Electronics Engineers standards.

2.2.1.5 Transformers

Transformers receive the AC power from the inverters and increase the voltage to a medium voltage, typically around 34.5 kV. The transformers could be co-located with the inverters associated with each array, or centrally located. Transformers must comply with the applicable requirements of the National Electric Code and Institute of Electrical and Electronics Engineers standards.

Transformers are filled with oil, up to 600 gallons depending on the size. These are located on concrete pads and must have a system to contain the oil in the event of a spill. If a facility has an aggregate combined storage capacity of oil greater than 1,320 gallons or is located where a discharge could reach a navigable waterbody, either directly or indirectly, a Spill Prevention, Control, and Countermeasure (SPCC) Plan is required (*Code of Federal Regulations* Part 112).

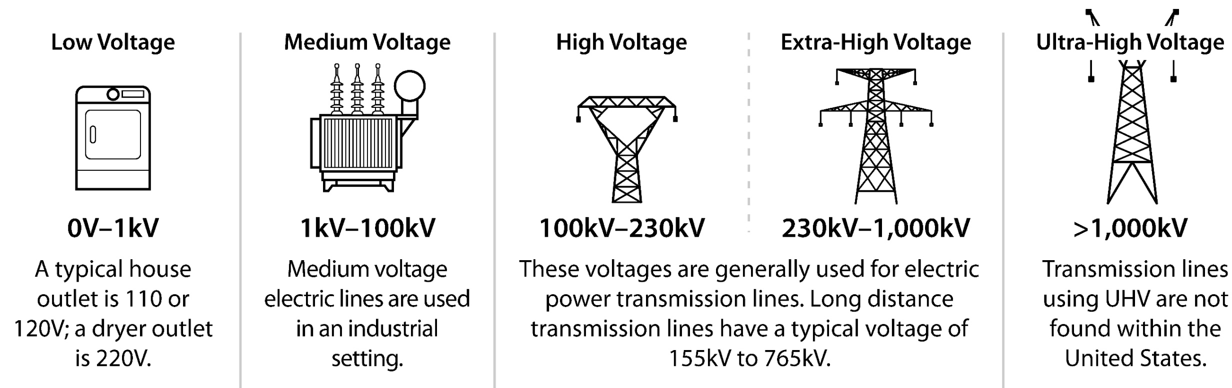


Figure 2-4. Voltage ranges

Note: Voltage measures the current strength or pressure that moves electricity from one point to another. Higher voltage means more electricity is flowing.

2.2.2 Power collection system

A power collection system typically consists of electrical collector lines, a collector substation, and facility generation interconnect (gen-tie) lines. This system connects the electricity generated by the array to the electrical grid via a substation that connects to transmission lines.

2.2.2.1 Electrical collector lines

Electrical collector lines link transformers throughout the solar array to the collector substation. Collector lines are located within the facility site and are typically buried underground in trenches approximately 3 feet deep. However, lines may be located aboveground to avoid sensitive environmental or cultural areas, minimize ground disturbance, or avoid rocky or unstable areas that could require blasting. Aboveground lines would be installed on steel or wooden pole structures approximately 60 to 150 feet tall.

Electrical collector lines are typically 34.5 kV. Higher voltage overhead lines of 100 kV or above may be used for larger solar energy facilities or if the distance to the electrical substation is long. In these cases, additional transformers would be required to increase the voltage from 34.5 kV to the required level.

2.2.2.2 Collector substation

A collector substation includes one or multiple transformers that increase the voltage for transmission to the grid. A collector substation is surrounded by a 7-foot chain-link security fence topped with barbed wire as required by National Fire Protection Association and Occupational Safety and Health Administration (OSHA) standards to ensure public safety from exposure to electrical facilities. One or more collector substations are typically located close to the operations and maintenance building or area.

Example of an electrical substation

Photograph from University of California, Davis

2.2.2.3 Interconnector lines and gen-tie lines

Interconnections are lines that carry electricity from the facility collector substation to a gen-tie line. The gen-tie lines then connect electricity to the power grid.

Lines must be constructed in compliance with codes and standards from the following: Washington regulations, National Electrical Safety Code (NESC), American National Standards Institute, National Electrical Manufacturers Association, American Society for Testing and Materials International, Avian Power Line Interaction Committee, as well as other applicable laws and construction codes.

Lines are installed on wood or steel towers that may be up to 150 feet in height. Tower types may include monopole, H-frame, lattice structures, or turning structures and are installed on concrete foundations. Ground clearances for the suspended portion of the line would conform to the NESC standards. The minimum clearance between the line and the ground (including local roadways and land used for agriculture) must be designed consistent with applicable standards identified above and not preclude or inhibit transportation or agricultural uses under the line.

The strip of land where gen-tie lines are built and operated is called a right-of-way (ROW). Local regulations usually require a minimum clearance distance for gen-tie lines based on the voltage of the line.

2.2.2.4 Connection to grid transmission lines

Utility-scale facilities typically connect to a main transmission line either through a substation or to a gen-tie line.

The length of these connections would depend on the distance from the site to existing transmission lines that have sufficient capacity to accept power from the facility. The distance from the grid connection point would vary by each facility and would be determined by the developer based on a selected site. The PEIS generally assumes the distance from a transmission line to the grid would be 25 miles or less for the analysis.

2.2.3 Buildings for operations and maintenance

Buildings or trailers may be utilized for operations and maintenance activities and would vary in size based on proposed uses. Buildings may be used for offices, restrooms, kitchens, material and equipment storage, or remote monitoring. There may also be an on-site area for parking and an open staging area. Buildings are expected to be fenced for security. Lighting would be needed for security and occasional work and maintenance. Service roads and the parking area must have sufficient space for emergency response vehicle access.

Local utilities would provide primary electrical and telephone connections. A facility may include aboveground fuel tanks for generators to serve as backup power. Systems such as a site monitoring system, supervisory control and data acquisition system, and a solar meteorological data system are expected to be installed to provide data for operations and security.

Buildings must be equipped with fire extinguishers, smoke detectors, and basic firefighting equipment for use on site. This includes shovels, beaters (consisting of a piece of rubber at the end of a pole used for extinguishing minor fires), portable water containers for hand sprayers, and personal protective equipment. The equipment used within the buildings must meet National Electrical Code and Institute of Electrical and Electronics Engineers standards.

2.2.4 Stormwater, wastewater, and water supply

Construction and operational stormwater management plans would be designed during the pre-construction engineering phase, and the developer would be required to obtain the appropriate National Pollutant Discharge Elimination System (NPDES) permits. Stormwater runoff would primarily be generated from rain that falls on solar panels, buildings, access roads, and foundations. Sanitary wastewater would be managed through municipal wastewater systems, a permitted on-site septic system, or a portable restroom.

Water used for operations and maintenance could be from on-site wells, commercially available wells, water brought to the site, or a municipal water system. Water cisterns may be used to store non-potable water for fire suppression needs.

2.2.5 Access roads and perimeter fencing

A facility site includes access roads, gates, and perimeter fencing. The road size and type would vary based on the facility location and expected use. Site entrances and main access roads leading to substations, parking areas, or operations and maintenance buildings are more likely to be paved two-lane roads, but interior roads are typically one-lane dirt or gravel roads. Access roads may be installed within the facility property to access certain areas and may also be needed outside of the facility to connect to the existing roadway system. Road widths would vary based on the type of road, use, and room for turning.

Perimeter fencing is expected to be installed around the facility and include vehicle and pedestrian access gates. Depending on security needs and the potential presence of wildlife corridors in the area, fencing may consist of 7- or 8-foot-high security fence. Fences around electrical installations would meet National Electric Code requirements. Temporary fencing may also be used during construction.

2.3 Battery energy storage system (BESS)

One of the facility types considered in this PEIS is a utility-scale solar facility with a co-located BESS as part of the facility proposal. A BESS stores and deploys energy generated by a facility. For purposes of the PEIS, the storage technologies evaluated are lithium-ion, flow, or zinc-hybrid batteries. These battery types would be stored in a series of self-contained enclosures located on a concrete pad within a fenced area, or within a warehouse-type enclosure.

Lithium-ion batteries are the most common type of utility-scale technology. They are a type of solid-state rechargeable battery in which lithium ions, suspended in an electrolyte, move from negative to positive electrodes and back when charging and recharging. Lithium-ion batteries have a typical lifespan of 5 to 10 years and would experience a gradual performance degradation over time. Lithium-ion batteries have the potential to overheat due to damage or failure of battery management systems, which can cause fires and shocks if not safely handled and managed. State regulations require fire suppression and safety measures.

Flow batteries are an emerging technology for utility-scale storage. Flow batteries use two electrolyte solutions, one with positive ions and the other with negative ions, where the movement of electrons from one solution to the other creates electricity. Flow batteries typically have a maximum lifespan of 10 to 20 years, and do not degrade over time like conventional batteries. During normal operations, the electrolyte solutions are recovered and reused during the recharging process and are generally not reactive or toxic substances.

Zinc-hybrid batteries store energy by using electricity to split zinc into water and oxygen. This process charges the zinc particles in the battery, which can hold a charge for weeks at a time. When needed, the charged zinc is combined with oxygen to release stored electricity. Zinc batteries have a life of almost 20 years with periodic replacement of some components. Zinc batteries are generally not flammable.

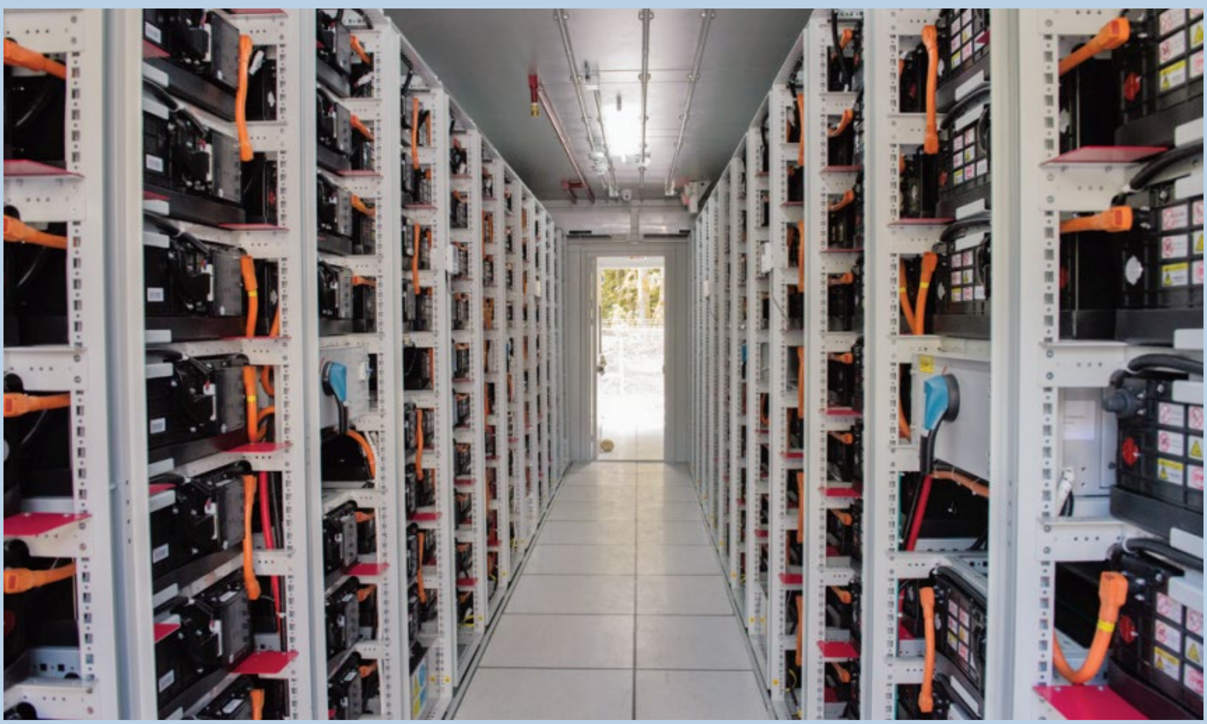
A BESS includes the following:

- Battery storage modules on racks or in containers with inverters, isolation transformers, and switchboards (which distribute power from one or more sources of supply to several smaller loads)
- Converters, which convert AC power to DC power
- High-voltage, medium-voltage, and low-voltage electrical systems (voltage ranges included in Figure 2-4; voltages have recently been advancing and may be as high as 1,500 volts)
- Heating, ventilation, and air conditioning (HVAC) units
- Building auxiliary electrical systems
- Fire suppression and prevention systems
- Control system, usually including data acquisition system

For this PEIS, it is assumed that BESSs would be installed within the solar facility site footprint. The BESSs can be distributed or consolidated, but are assumed to typically be in a single location, most likely near the collector substation. BESSs are typically installed in a graveled area where vegetation clearing and gravel surfacing would be required. Battery storage containers are typically 40 by 8 by 8.5 feet and installed on concrete foundations designed to contain spills. A warehouse-type enclosure of a similar scale and size may also be used. A building must be constructed in compliance with state structural and electrical code requirements. BESSs must comply with the latest Washington State Building Code Council regulations for batteries.

Example of a BESS exterior

Example of a BESS interior



Photographs from Puget Sound Energy Glacier Battery Storage Innovation Pilot Project

2.4 Solar facilities that include agricultural uses (agrivoltaics)

One of the facility types considered in this PEIS is a utility-scale solar facility with co-located agricultural land uses. This could include facilities that maintain an existing agricultural use, change an agricultural type, or add new agricultural use developed with the solar facility. This may involve raising or modifying spacing of solar panels to allow for growing crops or grazing underneath. The use of land for both agriculture or grazing and solar PV energy generation is referred to as agrivoltaics, agrisolar, or dual-use solar. The U.S. Department of Energy (DOE) includes crop production, livestock grazing, and pollinator habitat in its definition for agrivoltaics.[13]

Agrivoltaics is an emerging concept, and universities and federal agencies are conducting research throughout the country, including in the Pacific Northwest.[14] According to the U.S. Department of Agriculture,[15] agriculture and solar energy production can complement each other by allowing working lands to stay working, while helping farms diversify income. Potential benefits of agrivoltaics include a mutually beneficial "cooling" relationship when growing crops or grasses under solar panels. Plants growing under the diffused shade of PV panels are buffered from the day's most intense rays and air temperature, and the amount of water evaporating from soils is reduced. The plants in turn give off water vapor that helps to naturally cool the PV panels from below, which DOE reports[16] can increase panel efficiency.

[13] https://www.energy.gov/eere/solar/agrivoltaics-solar-and-agriculture-co-location
[14] https://www.climatehubs.usda.gov/hubs/northwest/topic/agrivoltaics-pairing-solar-power-and-agriculture-northwest
[15] https://www.climatehubs.usda.gov/hubs/northeast/topic/agrivoltaics-coming-soon-farm-near-you
[16] https://www.energy.gov/eere/solar/articles/potential-agrivoltaics-us-solar-industry-farmers-and-communities

Examples of solar facilities that include agricultural uses

Photographs from National Renewable Energy Laboratory

2.5 Phases of utility-scale solar energy facilities

Project design and site selection are often done before a developer submits an application and begins the SEPA environmental review process. It is during siting and design that developers can conduct pre-application discussions with agencies, Tribes, and communities to identify project and site-specific issues, and consider the PEIS findings and measures to avoid impacts.

Phases of utility-scale solar facilities analyzed in the PEIS include site characterization, followed by construction, into operations, through decommissioning at the end of the facility lifespan (Figure 2-5).

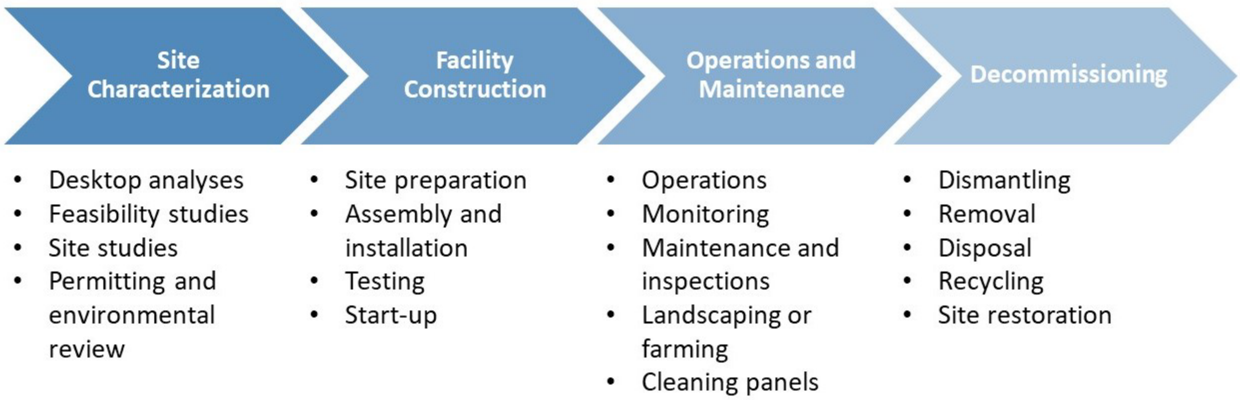


Figure 2-5. Phases of utility-scale solar facilities

2.5.1 Site characterization

It is assumed that developers would conduct desktop analyses and feasibility and site studies for characterization of potential sites, with agreement from the landowner(s) as needed. During site characterization, generally very little modification of a site would occur. Work would include conducting field surveys to gather data on biological, cultural, Tribal, and historical resources. Surveys would need to follow appropriate regulatory requirements and procedures.

Siting considerations typically include the availability of solar energy, the physical characteristics of the area, and access to electrical transmission lines. Considerations also include zoning requirements and identification of critical areas. Additional siting considerations are included for each resource in Chapter 4.

The following site characterization activities would involve minimal or no site disturbance:

- Assessment of baseline solar insolation level (availability of solar energy)
- Assessment of baseline climatic factors (e.g., wind speed and direction, precipitation type and amount, average snow or ice loads)
- Construction of meteorological (weather) stations, which may be towers approximately 30 to 70 feet in height or trailer-mounted portable equipment
- Land survey
- Mapping surface hydrology and floodplain
- Slope evaluation and soil stability studies
- Habitat mapping, including wetland identification
- Water type mapping, including identification of waters used by fish and fish passage barriers
- Species identification (plants and wildlife)
- Due diligence assessment for lands with previous industrial uses

- Evaluation of seismic stability
- Evaluation of potential storm event runoff
- Baseline air quality assessment
- Cultural resources surveys

The following site characterization activities could include ground disturbance:

- Soil sampling
- Cultural resources surveys

2.5.2 Facility construction

The time needed to construct a facility is expected to be between 6 and 18 months. Construction would generally be divided into two phases: a site preparation phase of relatively short duration (e.g., a few months) followed by a longer assembly, testing, and start-up phase. The second phase may include building of arrays areas in steps so completed arrays could go online while others are being constructed.

General construction activities include the following:

- Finalizing preconstruction surveys or conducting additional surveys
- Marking sensitive areas for avoidance, and installing best management practices (BMPs) and other preventative measures such as erosion and sedimentation control measures
- Establishing site access, constructing internal service roads, and modifying public roads, if needed
- Clearing, grading, and constructing temporary staging and laydown areas
- Erecting security fencing and road access gates
- Constructing foundation posts or piles to support the solar arrays, including pile driving
- Assembling the solar array tracker system and installing solar panels
- Grading and constructing foundations for solar array inverter and transformer pads, buildings, collector substation, and BESSs
- Installing and connecting inverter/transformer and electrical components
- Constructing building(s), collector substation, BESSs, and other supporting components
- Installing temporary or permanent meteorological stations
- Constructing and connecting the electrical collector lines and overhead gen-tie lines to the collector substation
- If BESSs are included in the facility, connecting the BESSs to the collector substation
- Conducting revegetation, including temporary staging and laydown areas

Typical construction equipment includes bulldozers, front-end loaders, graders, portable generators, mobile cranes, pumps, pile-drivers, and trucks. Concrete would either be delivered to facility sites via concrete trucks, or aggregate materials necessary to produce concrete would be delivered and concrete would be produced at on-site batch plants.

The number of people employed for the construction phase would vary but is expected to be between 100 and 400 workers for a 200 MW facility. Larger facilities may require approximately 300 to 800 workers. The number of workers on site daily would vary.

2.5.3 Operations and maintenance

Solar energy facilities would not typically have staff on site on a daily basis but would be monitored remotely 24 hours a day. There would be periodic maintenance and inspection of a facility, such as mowing, landscape maintenance, and electrical maintenance activities. The number of people needed to operate and maintain the facility would vary based on the facility type but the PEIS assumes this would be about five people.

For this PEIS, a solar energy facility is assumed to have an operational life of 30 years. PV panels may need to be replaced during the lifetime of the facility.

Mowing and vegetation management at the site would likely occur a few times a year. Application of herbicides may also occur. If the developer has designed the facility for dual use with agriculture, then planting, harvesting, grazing, or other agricultural operations would occur.

Washing of the solar panels is expected to occur approximately once every 6 months to optimize performance depending on site conditions and land uses of neighboring parcels. The Solar Energy Industries Association reports[17] that washing solar panels can use up to 0.25 gallon of water per panel, per wash, or about 20 gallons per megawatt-hour. The PEIS assumes that no cleaning additives would be used in wash water. Depending on the site, water may be available from local water supplies, a well on site, or water could be trucked in from a commercial source. Waterless cleaning can also be achieved by manually using brushes or using autonomous robots to brush dust particles from the surface of solar panels. If water is used, wash water is expected to infiltrate into the ground surface at and near the point of application.

[17] https://www.seia.org/initiatives/water-use-management#:~:text=Water%20use%20requirements%20for%20solar%20power%20plants%20depend,surfaces%20like%20mirrors%2C%20heliostats%2C%20and%20photovoltaic%20%28PV%29%20panels

Example of autonomous robots cleaning solar panels

Photograph by Lindsay Mackinson

2.5.4 Site decommissioning

A solar energy facility has a useful lifespan, which is expected to be approximately 30 years. According to DOE,[18] solar panels have a lifespan of 30 to 35 years, though some panels may be replaced over time due to normal degradation, physical damage, or upgrades due to technological advances. Solar facility components may be incrementally replaced over time or replaced in major renovations, allowing a facility to extend its lifespan. Eventually, a solar energy facility may no longer be used and the site fully decommissioned.

A developer may prepare or be required to prepare a decommissioning plan as part of the proposal. Cities, counties, or the State of Washington Energy Facility Site Evaluation Council (EFSEC) may require a financial security as part of a decommissioning plan.

Decommissioning activities would be similar to construction, including the equipment required and the number of people employed. Decommissioning time frames would be dependent on the restoration needed for habitat types.

Decommissioning actions include dismantling, removing, and disposing of aboveground solar array components and other aboveground components such as the collector substation, buildings, battery storage system, and overhead lines. Foundations may be removed to a level

[18] https://www.energy.gov/eere/solar/end-life-management-solar-photovoltaics

of 3 feet or more below the ground surface, while cables, lines, or conduit that are buried 3 feet below grade or may not to be removed. However, the depth to which facilities and infrastructure would be removed would depend on agreements with landowners and follow applicable regulatory requirements. Because transformers can include up to 600 gallons of oil, the removal of electrical substations would require inspection for contamination of the soil and decontamination if needed.

The facility site is assumed to be restored, which may include revegetation, to its pre-facility conditions unless the facility owners, permitting authority, and regulatory agencies agree on alternate actions. Service roads may be removed or may remain depending on agreements with the new or existing owner of the land.

RCW 70A.510.010, the Photovoltaic Module Stewardship and Takeback Program, requires manufacturers of solar panels to provide the public a convenient and environmentally sound way to recycle all solar panels purchased after July 1, 2017. The program was updated in 2020 to expand these requirements to include solar panels installed as part of a utility-scale system. Beginning July 1, 2025, no manufacturer, distributor, retailer, or installer may sell a PV panel in or into the state unless the manufacturer of the PV panel has submitted a stewardship plan to Ecology and received plan approval. As a result, PV panels are expected to be recycled by the applicable manufacturer at the end of their useful life.

2.6 Types of facilities (alternatives) considered for the PEIS

The types of facilities considered in this PEIS are described in Table 2-1. After analysis for the small to medium facilities and large facilities was completed, many of the potential impacts were found to be very similar. To simplify the PEIS, Ecology has combined these in the PEIS chapters, but they remain separate in the technical resource reports.

Land requirements of utility-scale solar energy facilities

The ranges of solar energy facility sizes (areas) include the total area of a perimeter surrounding all the arrays and associated equipment for the facility. However, the spacing between arrays could be large and the areas occupied by the arrays and other structures would typically be much smaller than the total perimeter area.

Table 2-1. Types of facilities (alternatives) considered in the PEIS

Utility-scale solar energy facilities	
Small to medium facilities	**Large facilities**
Facility size (power-generation capacity)	
20 to 600 MW	601 to 1,200 MW
Facility size (areas)	
200 to 6,000 acres (0.31 to 9.38 square miles)	6,010 to 12,000 acres (9.39 to 18.75 square miles)
5-acre collector substation area	10-acre collector substation area
5,000-square-foot operations and maintenance buildings on up to 2-acre area	5,000-square-foot operations and maintenance buildings on up to 5-acre area
Facility characteristics	
60,000 to 1,800,000 panels	1,800,000 to 3,600,000 panels
6,500 to 270,000 posts	195,000 to 540,000 posts
Approximately 30 inverter/transformer stations	80 to 90 inverter/transformer stations
Gen-tie lines to existing grid, suspended aboveground with monopole or wooden structures, up to 150 feet tall with typical 200-foot-wide ROW	
Utility-scale facilities with BESSs	
Small, medium, or large facilities	
Plus 1 or 2 BESSs, each capable of storing up to 500 MW	
Each BESS would include multiple containers arranged in geometric rows. Container dimensions and number of BESS units per container vary by manufacturer. Acreage for 200 MW BESSs proposed in Washington typically range from 10 to 20 acres. Acreage for a 500 MW BESS is assumed to range from 25 to almost 50 acres. The analysis in this PEIS assumes the upper end of the acreage range.	
Utility-scale facilities with agricultural uses	
Small, medium, or large facilities	
With agricultural uses such as crops, rangeland, or pollinator habitat	
Facilities could be located on lands with existing agricultural use that could continue, the type of agricultural use could change, or a site without prior agricultural use could add concurrent agriculture	

2.7 No Action Alternative

Under the No Action Alternative, the city, county, and state agencies would conduct environmental review and permitting for utility-scale solar energy development under existing state and local laws on a facility-by-facility basis but without the use of this PEIS for reference.

2.8 Alternatives considered but not evaluated in the PEIS

This PEIS focuses on utility-scale solar energy facilities as directed by the Legislature. Ecology is preparing separate PEISs that evaluate utility-scale onshore wind energy facilities and green electrolytic and renewable hydrogen facilities. The following other alternatives were considered in screening, but for the reasons listed below were eliminated from further detailed study, and are not evaluated in this PEIS:

- **Other types of energy facilities.** Other types of energy facilities, including geothermal facilities or stand-alone utility-scale battery facilities, were suggested in scoping comments. The Legislature, in RCW 43.21C.535,[19] directed that the scope of the PEIS review be specific to designated clean energy types of utility-scale solar, utility-scale onshore wind, and green electrolytic or renewable hydrogen[20]; therefore, review of other types of clean energy facilities, standalone battery storage, or fossil-fuel energy facilities would not be appropriate as alternatives in this PEIS.
- **Distributed energy generation.** Distributed solar, community solar, and home rooftop solar systems are other ways that solar energy is generated in many communities. These methods typically do not generate the amount of energy needed for utility use, and would not meet the intent of the PEIS to evaluate utility-scale facilities; therefore, they are not considered as alternatives.
- **Specific facility sizes.** Various sizes and ranges of solar facilities were suggested in scoping comments, including different ranges of facility wattages and different areas or configurations for facilities. The types of facilities (alternatives) evaluated in this PEIS were modified to include a range of utility scales.
- **Facilities over water.** Scoping comments suggested consideration of utility-scale solar on waterways, including irrigation canals. There are a few pilot projects for this type of facility but not at utility-scale and the probable impacts from these are not well known; therefore, this type of facility is not analyzed in the PEIS.
- **Combined wind and solar facilities.** Scoping comments suggested evaluation of a facility type composed of wind and solar facility components on a single combined site. PEISs will provide information on solar and wind facilities separately but the impact analysis and potential mitigation can be used in various configurations by facility developers.
- **Analysis of build-out of all clean energy in Washington.** Scoping comments suggested analysis of all types of clean energy for the total amount of clean energy needed for Washington state to achieve its climate goals. The PEIS is evaluating a single type of energy facility and is not considering all energy types so this is out of scope.

[19] https://app.leg.wa.gov/RCW/default.aspx?cite=43.21C.535
[20] https://ecology.wa.gov/regulations-permits/sepa/clean-energy/programmatic-eis

3 Scope of Study

The scope of study for utility-scale solar energy development was defined considering areas where facilities could be built (geographic bounds) and the time period in which facilities may be constructed and operational (time scale or temporal bounds).

3.1 Assumptions for determining geographic scope of study

The following assumptions were used to identify areas that may have characteristics suitable for utility-scale solar energy facilities (Figure 3-1). The area shown in Figure 3-1 is the geographic scope of study for this PEIS, where existing conditions and potential environmental impacts were analyzed.

For purposes of the PEIS, the study area for utility-scale solar energy includes areas that meet the following criteria:

Global horizontal irradiance (GHI): Areas with GHI of 3.5 kWh/m^2/day or greater (GHI is the total solar radiation received on a horizontal surface and is used to calculate the amount of energy a solar array could produce.)

Topography: Flat to moderately sloped ground surfaces (areas with 15% or less slopes)

Transmission line access: Areas within 25 miles of existing transmission lines that can handle the energy generation of utility-scale facilities (230 kV or greater lines)[21]

Existing utility-scale development areas: An area in eastern Washington with existing utility-scale solar facilities that does not meet the criteria above was included in the study area because the area has sufficient solar energy availability and other potentially favorable characteristics for utility-scale developments.

The geographic study area is broader than where facilities are being built now. This is because new technologies could allow development of solar facilities in areas not considered before. The geographic study area identifies different levels of solar energy available to provide context, but all shaded areas in Figure 3-1 are included in the study area.

The study area excluded the following areas:

- Tribal reservation and trust lands
- Military installations

[21] Restricting the study area to areas within 25 miles of a 230 kV or greater transmission line would exclude an area of eastern Washington that already includes several substantial utility-scale facilities, sufficient solar energy availability, and other potentially favorable characteristics for utility-scale developments. Therefore, an exception to the 25-mile distance was made to include this area.

- DOE Hanford Site[22]
- National parks, wilderness areas, and wildlife refuges
- Washington state parks
- Unincorporated areas zoned as urban or residential, areas inside city limits, and unincorporated urban growth areas (UGAs)[23]

The decision regarding where to site a utility-scale solar energy facility would be determined by future developers based on their needs and could result in facilities being sited anywhere in Washington with agreement from the landowner or manager. Utility-scale solar energy facilities could be built on lands owned or managed by private, city, county, state, or federal entities. In all cases, developers would need to work directly with the landowner(s) or land manager(s) for individual facilities.

The PEIS does not approve, authorize, limit, or exclude facilities on a site-specific basis.

3.2 Assumptions for determining the time scale of study

The PEIS considers utility-scale solar energy facilities that may be constructed after June 30, 2025, and before January 1, 2045. The Clean Energy Transformation Act (CETA) requires all Washington's electric utilities to meet 100% of their retail electric load using non-emitting and renewable resources by 2045. For the PEIS, a solar energy facility is expected to have an operational life of 30 years, at which time the developments are expected to be decommissioned.

Therefore, an approximate 50-year time period (July 2025 through June 2075) is used for resource analyses. This includes when developments are likely to be constructed and operational.

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[22] DOE has identified a small area of land at the Hanford Site as available for lease to develop utility-scale carbon pollution-free electricity facilities. This area is included in the study area, but the rest of the Hanford Site is excluded.

[23] Under the Growth Management Act, counties identify UGAs where "urban growth shall be encouraged and outside of which growth can occur only if it is not urban in nature" (RCW 36.70A.110) in consultation with cities in the county. UGAs include both unincorporated areas and areas within existing city boundaries and are intended to accommodate the projected population growth of cities and counties over the subsequent 20-year period.

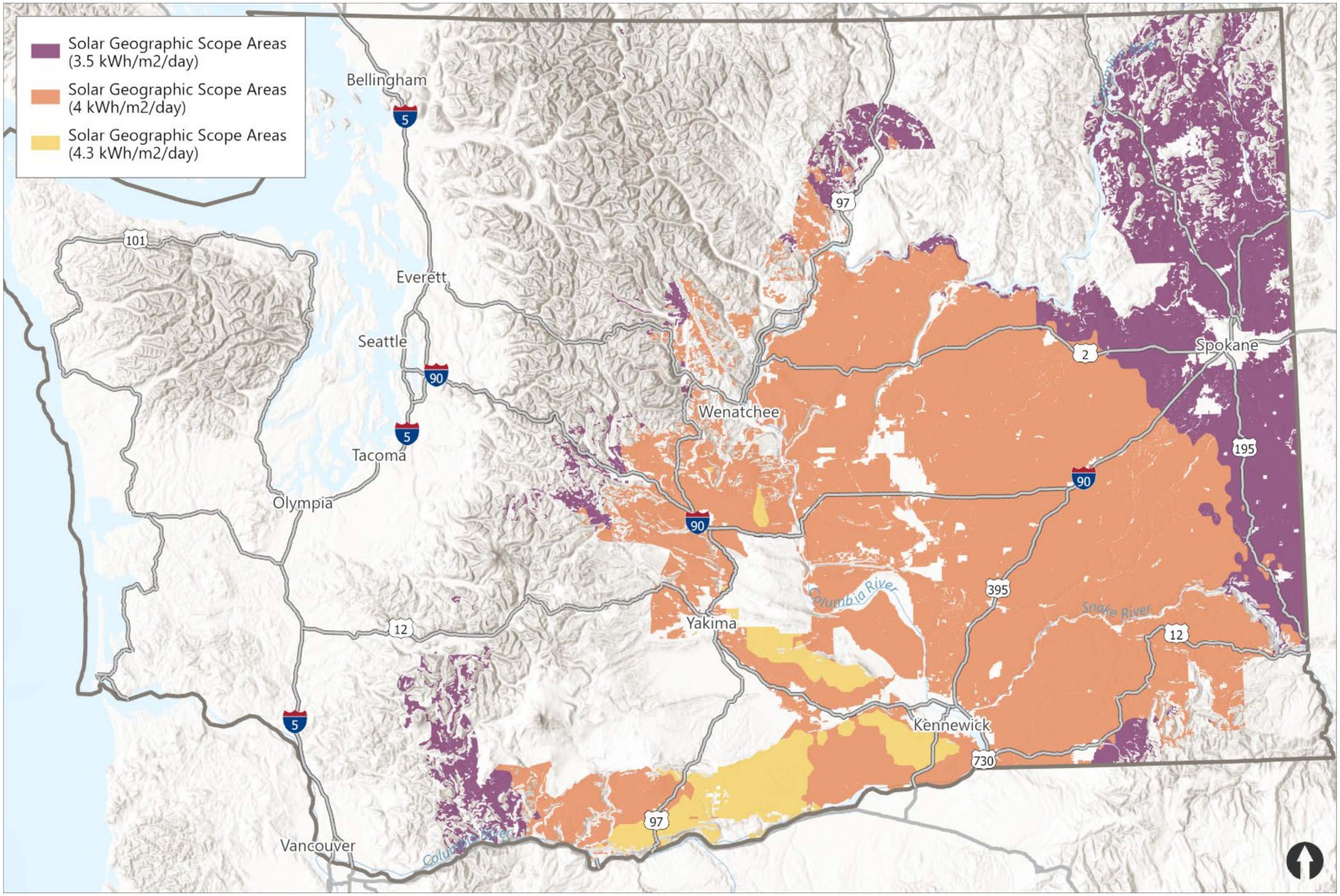

Figure 3-1. Geographic scope of study for utility-scale solar energy facilities PEIS

Note: The geographic scope of study includes all areas with solar energy levels depicted. Areas with GHI of 4 kWh/m^2/day or greater and 4.3 kWh/m^2/day or greater are shown to provide additional context for consideration of solar energy availability.

4 Affected Environment, Potential Impacts, and Mitigation

This chapter summarizes the affected environment, impacts, and actions that could avoid or reduce impacts for each resource considered. The following paragraphs summarize the general approach that was used for the analysis in this chapter and the attached reports. Key terms are highlighted and explained below.

The **affected environment** is the existing condition within the study area for each resource. The **study area**—or the area of focused analysis—is defined in Chapter 3. For some resources, additional areas adjacent to the study area were also considered to determine the impacts on the resource within a larger community or landscape. Because this programmatic review considers a large study area, and because specific locations for facilities are not known, descriptions of the affected environment within the study area for this PEIS are broad and qualitative.

Impacts are the effects or consequences of actions. This chapter discusses potential impacts that site characterization, construction, operation, and decommissioning of utility-scale solar facilities may have on resources. The chapter also considers the potential impacts of the No Action Alternative.

The PEIS focuses on significant adverse environmental impacts, with some information provided on less severe impacts. "Adverse" means an impact would have a negative change in the condition of the resource. Determining if an impact is "significant" involves consideration of both the intensity of the impact (magnitude and duration) and the context of the impact, which can vary with the setting and existing conditions for a particular resource. This programmatic analysis considers potential environmental effects over a broad geographic and time horizon. As a result, it is fairly general and focuses on probable significant impacts in a qualitative manner, often characterizing a range of probable impacts. Where there is overlap between resource areas, the related section is noted.

This chapter also identifies **actions that could avoid or reduce impacts**, often called mitigation measures. **Mitigation** is the avoidance, minimization, rectification, compensation, reduction, or elimination of adverse impacts on built and natural elements of the environment. Mitigation may also involve monitoring and a contingency plan for correcting problems if they occur. The PEIS evaluates types of mitigation actions developers could use to address the probable impacts. Some mitigation measures would need more details specific to each facility design and site location. Developers can use the mitigation in this PEIS to develop mitigation plans for potential impacts.

To identify probable significant adverse environmental impacts, the potential adverse environmental impacts of the different types of facilities were first evaluated at a broad level. Mitigation measures required by existing environmental laws and rules were then considered. Next, mitigation measures typically provided by permit conditions, required plans (e.g., Temporary Erosion and Sediment Control Plans, SPCC Plans), and standard BMPs that would avoid and reduce impacts were considered. The latter types of mitigation measures are listed in the PEIS technical appendices for each resource under the category "permits, plans, and BMPs." If these actions were sufficient to reduce impacts to levels below significance, they were identified as **less than significant impacts**.

Where these mitigation measures are not sufficient to reduce impacts below a level of significance, those impacts were identified as **potentially significant adverse impacts**. Two categories of mitigation measures could potentially mitigate significant adverse impacts to a non-significant level. These are listed in the PEIS as:

- **Siting and design considerations:** Provided for all environmental resources to help all facilities avoid and reduce environmental impacts
- **Additional mitigation measures to address potentially significant impacts:** Provided specifically to address potential significant impacts only for environmental resources for which potential significant impacts have been identified

Even with these mitigation measures, in some cases, some significant impacts would still not be able to be mitigated to a non-significant level. These impacts are identified in this PEIS as potentially **unavoidable significant adverse impacts**.

Avoiding and reducing impacts

When developing proposals, developers should seek to avoid or minimize impacts through thoughtful siting and design. Each resource report includes a list of siting and design considerations which can help avoid impacts. **Refer to the technical appendices for detailed actions to avoid and reduce impacts.**

If significant impacts are likely, site-specific mitigation actions would be developed during project-specific review to be included in permit applications. These include plans and BMPs. BMPs are activities, maintenance procedures, managerial practices, or structural features that prevent or reduce pollutants or other adverse impacts. These may be required in permits or plans by a regulatory agency.

RCW 43.21C.538 says utility-scale solar energy project proposals following the recommendations developed this PEIS must be considered to have mitigated the probable significant adverse project-specific environmental impacts for which recommendations were specifically developed, unless the project-level environmental review identifies project-level probable significant adverse environmental impacts not addressed in the PEIS.

The analysis of each resource was based on incorporation of the best available science and information, including:

- Studies, modeling, reports, and regulatory findings relevant to the study area
- Information received through the scoping process (see Appendix A)

- Information received from Tribes and interested parties (see Chapter 6)
- Expertise of state agency staff relevant to specific resources

Appendices B through P contain **technical resource reports** with more detailed information and specific analyses. The sections in this chapter are intended to be a summary and reference the corresponding report(s). The resource reports are the official technical documentation for this PEIS.

Separate from the effects considered in the sections of this chapter, **cumulative impacts** are effects that could result from the incremental addition of effects of a facility to the impacts from past, present, and reasonably foreseeable future actions (RFFAs). These effects are summarized in Chapter 5 to determine whether cumulative impacts could result from incremental, but collectively significant, effects that occur over time with other actions. Full details can be found in the *Cumulative Impacts Report* (Appendix Q).

4.1 Tribal rights, interests, and resources

Key findings

The significance of impacts to Tribal rights, interests, and resources can only be understood from within the cultural context of an affected Tribe. This will depend on the project and the federally recognized Tribes potentially affected. Accordingly, the impact assessment and determinations of significance or non-significance would be done with engagement and in consultation with potentially affected Tribes at the project level.

Tribes are recognized as unique sovereign people that exercise self-government rights that are guaranteed under treaties and federal laws. Tribal rights, interests, and resources refer to the collective rights and access to traditional areas and times for gathering resources associated with an Indian Tribe's sovereignty since time immemorial. They include inherent rights or formal treaty rights associated with usual and accustomed territories. Tribal resources include Tribal cultural lands, archaeological sites, sacred sites, fisheries, and other rights and interests in Tribal lands and lands within which a Tribe or Tribes possess rights reserved or protected by federal treaty, statute, or executive order. Resources include plants, wildlife, or fish used for commercial, subsistence, and ceremonial purposes.

The analysis of impacts to Tribal rights, interests, and resources is different than for the impact analysis for environmental resources. Natural and built resources were analyzed in other resource reports to determine whether solar energy facilities could have significant impacts from a non-Tribal perspective and whether those impacts could be mitigated. For impacts to Tribal rights, interests, and resources, any determinations of significance or non-significance would be done with engagement and in consultation with each potentially affected Tribe at the project level. This would be done through the SEPA process or the federal Section 106 process.

The *Tribal Rights, Interests, and Resources Report* (Appendix O) includes the full analysis and technical details used to evaluate Tribal resources in this Programmatic Environmental Impact Statement (PEIS). This section contains a summary of the affected environment, how impacts were analyzed, and the key findings. This section uses information from the other resource sections later in this PEIS. Refer to other resource sections for additional information and impact analysis.

4.1.1 Affected environment

The range of resources considered for the affected environment includes biological resources, cultural and historic resources, water resources, recreation resources, environmental health and safety (EHS), noise and vibration, aesthetics and visual quality, transportation, air quality, and cumulative resources.

Historic and cultural resources are analyzed in Section 4.13 of this PEIS. This section focuses on cultural resources associated with Tribes. These include archaeological sites and objects and historic sites and structures, representing people, events, and trends significant to the history of affected Tribes. These include ceremonial sites, sacred sites, places of funerary activity, and Traditional Cultural Properties (TCPs).

Many archaeological and ethnographic studies have been conducted in the study area and have inventoried archaeological sites and TCPs. This information may be public, but it may be sensitive information protected under state law. The Washington State Department of Archaeological and Historic Preservation's (DAHP's) predictive model classifies areas with different levels of risk of containing archaeological sites. However, only about 5% of the state has actually been surveyed for cultural resources. Therefore, it should not be assumed that a site has been intensively surveyed. Existing surveys may not account for all cultural resources that may be present within a particular area. Projects will need their own surveys for a specific site.

Natural resources of interest to Tribes include but are not limited to plants, animals, water, and natural settings. Built resources include transportation, noise, and visual quality. Resources can be used for food, medicine, recreation, or spiritual purposes. Areas important to traditional cultural practices and the resources associated with those practices include waterways, trails, plants, wildlife, or fish used for commercial, subsistence, and ceremonial purposes. Natural resources may also include landforms that have an important role in oral histories or use of the landscape.

Culturally significant plants are often used for medicine, food, clothing, basketry, structures, and aesthetic or ritual purposes. Plants and animals within the study area provide important subsistence and medicinal resources. Water plays an important role in the histories and oral traditions of Tribes. Tribal rights include recreation and access to traditional hunting, fishing, or gathering areas, or to areas where other traditional practices occur.

4.1.2 How impacts were analyzed

The significance of resources can only be understood from within the cultural context of an affected Tribe. The impact assessment considered comments provided by Tribes for early drafts of the *Tribal Rights, Interests, and Resources Report* (Appendix O) and the Final PEIS will consider comments provided on the Draft PEIS. Specific project impacts and determinations of significance or non-significance will be determined with engagement and in consultation with each potentially affected Tribe at the project level.

The analysis of impacts on Tribal resources considered the following:

- Impacts on plant and animal species used by Tribal members, including loss or modification of habitats, fragmentation of migration corridors, and loss of medicinal and traditional plants and foods
- Loss of access to traditional hunting, fishing, or gathering areas, to an area where other traditional practices occur, and recreation areas
- Impacts to TCPs, historical sites, and archaeological sites and objects
- Interruption of spiritual practices
- Changes in transportation routes that may interfere with access to culturally significant resources, health and safety, or economic activity
- Disruption and degradation of the health and mental wellbeing of Tribal members

4.1.3 Findings for all solar facility types evaluated in the PEIS

4.1.3.1 Impacts

Impacts from construction and decommissioning

Most site characterization activities would involve little or no ground disturbance. However, some ground-disturbing activities, such as drilling deep soil cores and building access roads, could result in impacts on historic and cultural resources.

Activities that could impact Tribal resources during construction and decommissioning include ground disturbance, restricted access, and degradation of visual quality. Other activities could cause noise and interruption of the landscape, habitats, and species. Tribal spiritual practices could be interrupted by construction impacts to land areas and cultural or sacred sites. Access to traditional gathering areas for medicinal and traditional plants and foods could be restricted during construction or permanently lost. Impacts to archaeological sites, sacred sites, TCPs, burials, and specific habitats for culturally important species could result from clearing, grading, and excavation. These could also be affected from construction or decommissioning of facilities and associated infrastructure.

Potential impacts on habitats and species include alteration of species migration routes, loss of biodiversity, and habitat fragmentation. Construction and decommissioning could have impacts to plants and changes in water chemistry and soil compaction. Mortality of species and changes to habitats could impact wildlife and plants important to Tribes. These impacts could disrupt traditional subsistence practices. Access to treaty-reserved fishing areas and food harvesting areas may be limited during construction. Construction could impact terrestrial wildlife associated with Tribal use and could interrupt hunting and other cultural practices.

Noise, aesthetics, and air quality impacts from constructing facilities and associated land disturbances may degrade settings associated with cultural resources and sacred landscapes. Increases of human access and disturbance of resources important to Tribes could result from the establishment of corridors or facilities in otherwise intact and inaccessible areas.

Ground disturbance may emit dust and result in erosion with potential to impact cultural and natural resources. Vehicle and equipment traffic has the potential to introduce invasive species to the area, and removal of infrastructure and site restoration could also disturb or cause the mortality of species.

Newly disturbed ground could create a visual contrast that could persist for several seasons before vegetation could begin to mature and restore the pre-facility visual landscape. For decommissioning, restoration of vegetation to pre-facility conditions may take much longer, along with the return of species and functioning habitats. Invasive species may colonize newly and recently reclaimed areas and could produce visual contrasts.

Impacts from operation

Ongoing operations and maintenance are not anticipated to include ground disturbance because the use of vehicles and equipment would generally be limited to access roads and facility areas developed during construction. Erosion, compaction, trampling, or exposure of Tribal resources could occur due to vehicles, equipment, workers, ongoing maintenance activities, and vegetation management or co-located agricultural activities, such as livestock grazing or farming. Ongoing ground disturbance could reveal previously unknown resources, such as archaeological sites.

Impacts that degrade fisheries, affect migration patterns of species, and reduce biodiversity and impacts to ecological communities from long-term vegetation management may impact Tribal resources. Air quality impacts from vehicle and dust emissions, ongoing noise and visual impacts, and facility fencing or other access restrictions may continue to impact Tribal rights and resources, including hunting. Facility security and fencing could restrict access to areas used for resource gathering, hunting, fishing, and cultural and spiritual practices.

4.1.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix O, *Tribal Rights, Interests, and Resources Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Contact potentially affected Tribes early in the siting process, ideally before land is acquired for a project or before permit applications are developed and offer information relevant to Tribal technical staff to help identify potential impacts to Tribes.
- Include Tribal treaty-reserved rights, Tribal reservations, off-reservation rights, trust lands, other Tribal-owned land, and other areas of significance to Tribes in consideration of potential impacts and mitigation.
- Consider requiring a Tribal monitor for each potentially affected Tribe on archaeological survey crews to provide input on TCPs, sacred sites, and culturally significant sites.
- Design and site projects to avoid, to the maximum extent, impacts to Tribal interests, treaty rights, and resources.
- Tribal preferred aesthetic or visual quality mitigation practices may vary from those considered for other visual quality mitigation; consult with potentially affected Tribes on any aesthetic or visual quality mitigation practices.
- Consider maintaining open Tribal access routes and aligning construction, operations, and decommissioning to avoid disrupting Tribal access to sites and resources.
- Additional actions to be determined after engagement and consultation with Tribes.

4.1.4 Findings for the No Action Alternative

Facilities developed under the No Action Alternative would be subject to the same regulatory standards as those noted for the types of facilities considered in this PEIS. It is expected there would be similar types of impacts on Tribal rights, interest, and resources from site characterization, construction, operation, and decommissioning for solar facilities under the No Action Alternative.

4.2 Environmental justice and overburdened communities

Key findings

Solar energy development could have **disproportionate impacts** on historic and cultural resources and Tribes and Tribal communities. The impact assessment and determinations of significance or non-significance would be determined through engagement and consultation with potentially affected Tribes and DAHP at the project level.

If a facility requires a conversion of natural resource lands of long-term commercial significance or conflicts with the rural character of an area containing a population of people of color or low-income population, this **would potentially result in a significant and unavoidable disproportionate impact**.

Depending on site location and facility design, long-term changes or reductions in visual quality **would also potentially result in a significant and unavoidable disproportionate impact** on people of color populations or low-income populations.

Impacts associated with increased wildfire risk or impacts to fire response capacity **would also potentially result in a significant and unavoidable disproportionate impact** on people of color populations or low-income populations.

RCW 70A.02.010(8) defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, rules, and policies." The *Environmental Justice Resource Report* (Appendix G) includes the full analysis and technical details used to evaluate whether potential impacts in this PEIS disproportionately affect people of color populations and low-income populations. The report also identifies where overburdened community areas are located in the study area. This section contains a summary of the affected environment, how impacts were analyzed, and the key findings. This section uses information from the other resource sections in this PEIS. Refer to other resource sections for additional information and impact analysis.

4.2.1 Affected environment

Census Bureau 2018–2022 ACS data were used to determine census tracts containing people of color populations and low-income populations that overlap the study area. People of color were defined as all people who identify in the census as a race other than white alone and/or list their ethnicity as Hispanic or Latino. Of the 198 census tracts that overlap the study area, 40 (or 18%) contain a people of color population. Low-income populations were defined as those households with an income at or below twice the federal poverty level. Of the census tracts that overlap the study area, 130 (or 66%) contain a low-income population.

The census tracts overlapping the study area were also evaluated for whether or not they meet the criteria to be considered in an overburdened community area. An "overburdened community" is "a geographic area where vulnerable populations face combined, multiple environmental harms and health impacts, and includes, but is not limited to, highly impacted communities" (RCW 19.405.020). Of the census tracts that overlap the study area, 43% were identified as an overburdened community area. Overburdened community areas identified in the study area are primarily rural areas.

4.2.2 How impacts were analyzed

The determinations of potential impacts and potential mitigation measures were reviewed for each element of the environment analyzed in the PEIS for each type of facility. Only resource areas with impacts that could affect people are analyzed further. Potential impacts that are less than significant are not anticipated to result in disproportionately adverse effects on-people of color populations or low-income populations and are not discussed further in this section.

Potentially significant adverse environmental impacts were overlaid with census tracts containing people of color populations and low-income populations. This was used to determine the relative type and severity of effects and the potential for environmental impacts to disproportionately affect those populations.

4.2.3 Findings for utility-scale solar facilities

Solar energy development could have **disproportionate impacts** on historic and cultural resources and on Tribal rights, interests, and resources. The level of impact to these resources can only be understood from within the cultural context of an affected Tribe. Accordingly, the impact assessment and determinations of significance or non-significance would be done with engagement and in consultation with potentially affected Tribes and DAHP at the project level. For this reason, the impacts are not discussed further in this section. For more information on these resources, see the *Historic and Cultural Resources Report* (Appendix L) and the *Tribal Rights, Interests, and Resources Report* (Appendix O).

4.2.3.1 Impacts

Impacts from construction and decommissioning

Land use

Construction and decommissioning of facilities has the potential to result in impacts such as increased dust, noise, traffic, and visual changes that could affect nearby land uses and people. People most likely to be affected by these impacts are those living in nearby areas or those whose work requires them to be near the construction area for long periods. The impacts of converting property to a utility-scale solar facility would depend on the existing use of the site. The siting of facilities could result in the long-term and permanent conversion of land uses, which would be a potentially significant adverse land use impact if natural resource lands of long-term commercial significance are converted.

Findings
If natural resource lands of long-term commercial significance are converted, this would be a potentially significant adverse impact on land use. If a facility is located near people of color populations or low-income populations, this **would potentially result in disproportionate impacts** on these populations.

Aesthetics/visual quality
Construction and decommissioning of facilities would involve a range of activities associated with potential visual impacts. Depending on the location and size of facility sites and visual characteristics of the construction activities, visual quality impacts would range from less than significant to potentially significant adverse impacts.

Findings
If construction or decommissioning of a facility results in significant adverse impacts on visual quality and is located near people of color populations or low-income populations, this **would potentially result in disproportionate impacts** on these populations.

Public services and utilities and environmental health and safety
Depending on the specific location, severity, and fire response capacity, there is a potential that construction or decommissioning would have potentially significant adverse impacts due to an increased risk of a wildfire. A facility would result in potentially significant adverse impacts to fire response if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site.

Findings
If construction or decommissioning of a facility results in significant adverse impacts of increased wildfire risk or impacts to fire response capacity and is located near people of color populations or low-income populations, this **would potentially result in disproportionate impacts** on these populations.

Other resource areas
Potentially significant adverse environmental impacts that could affect people during construction and decommissioning were identified for noise and vibration and recreation. These include increased noise and loss of recreational opportunities.

Findings
With the implementation of siting and design considerations, BMPs, and mitigation measures, construction and decommissioning impacts to other resources are expected to be less than significant and **would not result in disproportionate impacts** on people of color populations or low-income populations.

Impacts from operation

Land use

As described for construction, the operation of utility-scale solar facilities would result in the conversion of land uses to utility-related uses for the life of the facilities. Many of the census tracts overlapping the study area that have people of color populations and low-income populations identified are also rural communities. For facilities located in rural areas, there is also the potential to result in change to the rural character of the surrounding area and/or perceptions of the rural character.

Findings

Changes to rural character resulting from operation of a new utility-scale energy facility would range from less than significant impacts to potentially significant adverse impacts depending on whether plans and development regulations are in place to protect rural character and how they consider utility-scale solar facilities. If a facility is located near people of color populations or low-income populations, this **would potentially result in disproportionate impacts on these populations.**

Aesthetics/visual quality

The operation of solar energy facilities and associated transmission lines, roads, and rights-of-way would have potentially significant long-term visual impacts. Depending on the facility size range and the nature of the facility structures, visual quality impacts would result in a range from less than significant impacts to potentially significant-adverse impacts.

Findings

If operation of a facility results in significant adverse impacts on visual quality and is sited near people of color populations or low-income populations, operations **would potentially result in disproportionate impacts** on these populations.

Public services and utilities and environmental health and safety

There is a potential that facility operation would have potentially significant adverse impacts related to wildfire risk. A facility would result in potentially significant adverse impacts to fire response if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site.

Findings

If operation of a facility results in significant adverse impacts of increased wildfire risk or impacts to fire response capacity and is located near people of color populations or low-income populations, this **would potentially result in disproportionate impacts** on these populations.

Other resource areas
Potentially significant adverse environmental impacts that could affect people were identified for noise and vibration and recreation. These include increased noise and loss of recreational opportunities.

Findings
With the implementation of siting and design considerations, BMPs, and mitigation measures, impacts from operation on noise and vibration and recreation are expected to be **less than significant and would not result in disproportionate impacts** on people of color populations or low-income populations.

4.2.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities.

Siting and design considerations
The following siting and design considerations could be used to reduce impacts on people of color populations and low-income populations:

- Design and site projects to avoid, to the extent practicable, adverse impacts to populations with environmental justice considerations and overburdened community areas.
  - Use available information and mapping tools.
  - Use the latest Washington State guidance to identify communities of color, low-income communities, and overburdened communities potentially affected by a proposed project.
- Engage potentially affected communities early in the process to understand their concerns and issues, identify potential impacts, and consider preferred mitigation options.

Additional mitigation measures
Additional mitigation measures developers may consider could include, but are not limited to, the following:

- Develop and implement public information sharing to provide technical and environmental health information directly to potentially affected populations, overburdened communities, local agencies, and representative groups.
  - Include information on potential impacts and mitigation proposed.
  - Engage with communities on how they prefer to receive information and tailor communications to provide this.
  - Use a variety of media tailored to affected communities, such as local print, online publications, and radio.
- Develop Community Benefit Agreements in coordination with potentially affected communities to address impacts through mutually agreed upon mitigation, if possible.

- Consider economic actions that communities may consider mitigation, such as the following:
  - Develop workforce development opportunities.
  - Provide opportunities for training, apprenticeships, and high-quality jobs.
  - Include labor standards, workforce agreements, and local hiring provisions.

4.2.4 Findings for facilities with co-located battery energy storage systems

4.2.4.1 Impacts

Impacts from construction, operation, and decommissioning

Land Use

Impacts from facilities with co-located battery energy storage systems (BESSs) would be generally the same as for facilities without a BESS. The addition of battery storage could generate a small amount of additional traffic during construction and decommissioning. The addition of battery storage could be perceived as added industrial-type facilities resulting in a greater change in rural character than for facilities without BESSs.

Findings

Impacts on land use would be similar to findings for utility-scale solar facilities above. If a facility is sited near people of color or low-income populations, this **would potentially result in disproportionate impacts on these populations.**

Aesthetics/visual quality

Impacts from facilities with co-located BESS would be generally the same as for facilities without a BESS.

Findings

Depending on facility size range and the nature of facility structures, visual quality impacts would be significant and adverse. If a facility is sited near people of color or low-income populations, this **would potentially result in disproportionate impacts** on these populations.

Public services and utilities and environmental health and safety

Impacts from facilities with co-located BESSs would be generally the same as for facilities without a BESS; however, the BESSs present additional risks to emergency responders.

Findings

Impacts on public services and utilities or EHS would be similar to findings for utility-scale solar facilities above. If a facility is sited near people of color or low-income populations, this **would potentially result in disproportionate impacts** on these populations.

Other resource areas
Construction, operations, and decommissioning impacts on noise and vibration and recreation for facilities with co-located BESSs would be similar to facilities without a BESS, with additional BESS operation noise. Additionally, a thermal runaway event due to damage or battery management system failure at a facility with a co-located lithium-ion BESS would have additional risks to emergency responders related to hazardous air emission risks.

> *Findings*
> These effects would be potentially significant adverse impacts. With the implementation of siting and design considerations, BMPs, and mitigation measures, impacts to these other resources are expected to be less than significant and **would not result in disproportionate impacts** on people of color populations or low-income populations**.**

4.2.4.2 Actions to avoid and reduce impacts

The actions to minimize, reduce, and/or mitigate impacts for facilities with co-located BESS would be the same as those in Section 4.2.3.2.

4.2.5 Findings for facilities combined with agricultural land use

4.2.5.1 Impacts

Impacts from construction, operation, and decommissioning
Impacts for facilities co-located with agricultural uses would generally be the same as facilities without, but with some differences, including access limitations due to fencing.

> *Findings*
> If construction of a facility is near people of color or low-income populations, land use, aesthetics and visual quality, public services and utilities, and EHS impacts **would potentially result in disproportionate impacts** on these populations.

Construction, operations, and decommissioning impacts on noise and vibration and recreation for facilities combined with agricultural land use would be similar to facilities without, but with some differences, including restrictions to recreation and seasonal noise.

> *Findings*
> With the implementation of siting and design considerations, BMPs, and mitigation measures, impacts to these other resources are expected to be **less than significant and would not result in disproportionate impacts** on people of color populations or low-income populations**.**

4.2.5.2 Actions to avoid and reduce impacts

The actions to minimize, reduce, and/or mitigate impacts for facilities with co-located agricultural use would be the same as those in Section 4.2.3.2.

4.2.6 Findings for the No Action Alternative

Under the No Action Alternative, local, state, and federal agencies would continue to conduct environmental review, land use review and approval, and permitting for utility-scale solar energy development under existing state and local laws on a project-by-project basis. Solar energy development could have **disproportionate impacts** on historic and cultural resources and Tribes and Tribal communities. Some solar facilities could have significant adverse impacts on land use, aesthetics and visual quality, public services and utilities, and EHS. Project-specific mitigation measures may not be sufficient to avoid or reduce impacts to less than significant. The No Action Alternative **would potentially result in disproportionate impacts** on people of color populations and low-income populations.

4.2.7 Unavoidable significant adverse impacts

4.2.7.1 Tribal rights, interests, and resources and historic and cultural resources

Solar energy development could have **disproportionate impacts** on historic and cultural resources, Tribes, and Tribal communities. The impact assessment and determinations of significance or non-significance would be done with engagement and in consultation with potentially affected Tribes and DAHP at the project level.

4.2.7.2 Land use

Substantial changes to rural character and land use may be unavoidable for facilities located in rural areas. The impact on people of color populations and low-income populations would be determined at the project level. If a facility required a conversion of natural resource lands of long-term commercial significance depending on local plans and development regulations, or if it resulted in changes to rural character in an area containing a population of people of color or low-income population, this **would potentially result in a significant and unavoidable disproportionate impact**.

4.2.7.3 Aesthetics/visual quality

Medium- or large-sized facilities may have a long-term change or reduction in visual quality, even with mitigation measures. If these impacts occur in an area with a population of people of color or low-income population, this **would potentially result in a significant and unavoidable disproportionate impact** on these populations.

4.2.7.4 Public services and utilities and environmental health and safety

Impacts associated with wildfire risk may be potentially significant and unavoidable. A facility would result in potentially significant adverse impacts to fire response if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site. Depending on the specific location, severity, and fire response capacity, there is a potential for potentially significant adverse impacts due to an increased risk of a wildfire. If a facility is located near people of color populations or low-income populations, this **would potentially result in significant and unavoidable disproportionate impacts** on these populations.

4.3 Earth

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on earth resources (soil resources and geologic hazards).

No significant and unavoidable adverse impacts related to earth resources would occur.

This section evaluates geologic resources and geologic hazards, referred to as "earth" in this PEIS. The *Earth Resource Report* (Appendix B) includes the full analysis and technical details used to evaluate earth resources in this PEIS.

4.3.1 Affected environment

4.3.1.1 Geography and topography

The study area is within several different regional environment types, each with unique ecological conditions. Central Washington is composed of the Cascade Mountain range, which is characterized by higher levels of precipitation on the western side and decreasing amounts of precipitation and vegetation density on the eastern side. Eastern Washington includes the Columbia River basin and plateau, the Blue Mountains in the south, and the Okanogan region in the north, which are generally higher in elevation and more arid. The northern half of the state is also characterized by historic glacial activity.

4.3.1.2 Geology and seismicity

Geology is the study of the earth, the materials that make it up, their structure, and the processes that act upon them such as earthquakes, landslides, and erosion. Washington's geologic history is characterized by continental tectonic forces, volcanic activity, uplift, and glaciation. In central and eastern Washington, the Missoula floods caused massive flooding events that created geologic features in the Columbia River drainage basin such as scablands. The Palouse region is also notable for its undulating landscape made of windblown silt, which is rich in nutrients and important for agriculture in the region. The state's geology and effects of seismicity are highly variable between parts of the state and are largely affected by the Cascadia Subduction Zone (CSZ), the boundary of the Juan-de-Fuca plate and the North American Plate off the west coast.

There are several dense fault complexes throughout the state. The CSZ as well as several other fault systems in western Washington are capable of producing high-magnitude earthquakes and tsunamis. Central, southern, and southeastern parts of the state are also seismically active. Categories of surface geology in Washington and the study area are included in Figure 4-1.

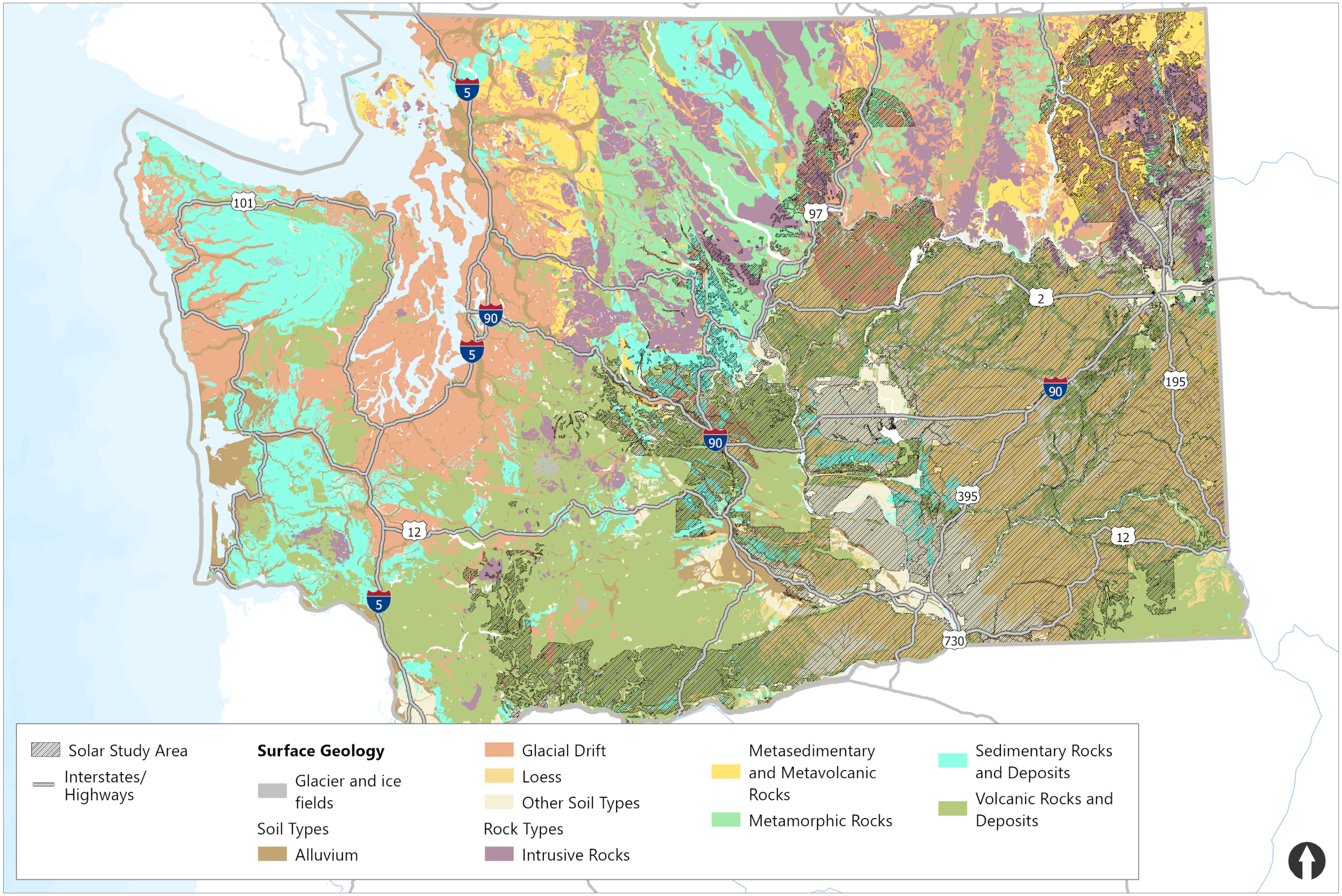

Figure 4-1. Surface geology categories

Data sources: DNR; Ecology.

4.3.1.3 Surface soils

The formation of soil is a long-term, complex interaction between climate, topography, ecology, and other characteristics of a given area. The study area encompasses several regions of the state that contain sensitive soil structures that play an important role in local ecology and if disturbed, can take a long time to recover. The study area contains agricultural and forested land types with unique soil attributes that may be federally protected. Studies to identify soil types on a site are expected to be done in researching project sites and during site characterization.

Exposed soils in central and eastern Washington, where it is characteristically dry and windy, lead to loss of soil and impacts to air quality, including from large dust storms that occur generally from spring through fall (see Section 4.4 for additional information on air quality).

4.3.1.4 Geologic hazards

Many regions in the study area are at risk from the following geologic hazards:

- **Fault ruptures** are a physical separation of opposite sides of a fault, which can cause damage to infrastructure.
- **Tsunamis and seiches** are waves caused by rapid displacement of water, generally resulting from seismic events; tsunamis occur in the ocean and seiches occur in contained bodies of water. The study area does not contain any tsunami inundation zones, and there are few areas adjacent to waterbodies where seiches would have an effect.
- **Liquefaction** is an event where water-saturated sediment temporarily loses strength and acts like a fluid. Earthquake hazard maps from the Washington State Department of Natural Resources (DNR) can be used to identify geologically sensitive areas, though areas susceptible to liquefaction may not be sufficiently identified.
- **Volcanic areas** in Washington include Mt. Saint Helens, Glacier Peak, Mt. Rainier, Mt. Adams, and Mt. Baker. Effects from an eruption could affect the study area. Effects could include airborne ash, lahars (mud or debris flows), lava flows, and pyroclastic flows (fast-moving gas and volcanic matter).
- **Landslides** are the movement of a mass of rock, debris, or earth down a slope. Landslides can be natural or human-caused, and nature and various ecological factors contribute to an area’s susceptibility. Generally, landslides are associated with areas containing slopes greater than 20%. Mapped landslide features are numerous in the study area.

4.3.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

Impacts on soil resources

- The potential impacts caused by direct ground disturbance associated with soil or rock excavation or grading

- The potential impacts caused by construction materials (such as quarried rock, sand, and general fill)
- The potential for soil erosion to be affected by ground-disturbing activities, changes in drainage patterns, or addition of impervious surfaces
- The potential for slope instability from ground-disturbing activities, underground construction, or other activities that could increase local susceptibility to certain geologic hazards
- The potential for subsidence from activities related to tapping, withdrawal, or disturbance of groundwater reserves

Impacts from geologic hazards

- The potential for a site to be affected by naturally occurring geologic or seismic hazards
- The potential for a site to be affected by geologic hazards that are influenced or altered by human activity

4.3.3 Findings for utility-scale solar facilities

4.3.3.1 Impacts

Impacts from construction and decommissioning

Soil resources

Site characterization activities done before construction would typically include field activities that would result in soil compaction, creation of ruts, and erosion due to the passage of vehicles and equipment. These activities would include site investigation, localized site clearing for subsurface investigation, and limited earthwork associated with test pit excavations, if required. In steeper areas, site grading as well as removal of surface and subsurface materials may be required if existing access routes are unavailable or unsuitable for the equipment.

Construction and decommissioning activities for facilities would include grading, vegetation removal, installation of underground infrastructure (e.g., foundations, pilings, utility trenches), stockpiling of site soils, bringing soils to the site, removing soils from the site, and placement and compaction of soils. Activities could also include development and decommissioning of an on-site concrete processing or batch plant, use of aggregate resources and concrete from local suppliers, and demolition. Impacts associated with these activities would include potential soil compaction, mixing of different layers of soil, surface erosion and runoff, sedimentation of nearby waterways, soil contamination, potential slope stability, and change in local drainage patterns. The potential loss of vegetation during clearing would reduce the ability of remaining plant root structures to resist the effects of wind and water resulting in increased soil erosion. The degree of impact from ground-disturbing activities would depend on site-specific factors such as surface soil properties, vegetation density and type, slope angle and extent, distance to waterways or water collection infrastructure, and weather.

Construction activities would include the potential for fluid (fuel, oil, hydraulic fluid, etc.) releases or spills and the potential application of herbicides and dust control stabilizers. These activities would introduce contaminants into local soils if not controlled with BMPs and other preventative measures. Spills to soil would likely be of small quantity and within containment areas, or able to be cleaned up.

Construction of access roads, post foundations, and subsurface utility installation would require excavation of soil and rock materials, depending on the site, and excavated materials may need to be hauled off site. Additionally, development of a solar energy facility could require importing aggregate and/or soil. Impacts on aggregate resources are described in Section 4.7, Energy and Natural Resources.

In general, impacts during construction would be larger for large facilities due to the increased disturbance area and potentially greater number of larger vehicles and equipment.

Decommissioning impacts would be similar to construction impacts but may be smaller due to the more limited duration of activities.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on soil resources.

Geologic hazards
Solar energy facilities are expected to be built on relatively flat areas, with slopes less than 15%. The effects of geologic hazards during construction are associated with increasing slope instability and landslide risks. Construction activities that can potentially increase this risk include grading that results in steepening of slopes, cutting mid-slope or at the base of a slope (e.g., for an access road or building pad), and alteration of drainage patterns and water infiltration rates. These activities are mainly related to roads and would increase the potential likelihood of landslides, which would affect surface waters through diversion or sedimentation. Landslides could also affect surrounding buildings, infrastructure, or people. Landslide risks would increase with facility size.

The potential that regional geologic hazards would occur (e.g., earthquake or volcanic hazards) or local geologic hazards would be triggered (e.g., landslide) during construction or decommissioning is low. A geologic event midway through construction or decommissioning may result in collapse of temporary support systems or toppling of unsecured equipment or materials. This would also increase the potential for limited fluid (fuel, oil, hydraulic fluid, etc.) releases or spills, including any herbicides and dust control stabilizers that are stored on site. These types of impacts are further discussed in the *Environmental Health and Safety Resource Report* (Appendix G).

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** from geological hazards.

Impacts from operation

Soil resources

Impacts from operations and maintenance of solar energy facilities are anticipated to be minimal. The use of maintenance vehicles and equipment would generally be limited to access roads and designated areas that were developed during construction, and little to no new ground disturbance is anticipated. Vehicles, equipment, and site management would include the potential for fluid releases or spills. Spills to soil would likely be of small quantity and within containment areas, or able to be cleaned up. Roads, parking areas, buildings, or other on-site developments, where runoff or wind is channeled around impermeable elements, would result in increased soil erosion.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on soil resources.

Geologic hazards

While a utility-scale solar facility is required to be designed to some level of seismic performance, if earthquake ground shaking intensity were to exceed design standards, damage to facility infrastructure may occur. Additionally, ground shaking may dislodge or topple materials stored on site in support of operations and maintenance activities, which could result in a small-scale fluid release or spill.

Volcanic hazards such as pyroclastic flows (fast-moving gas and volcanic matter) or lahars (mudflow or debris flow from a volcano) are less likely to affect facilities within the study area because they are often confined to existing drainage features. Ashfall from an erupting volcano would affect facilities in the study area. An extensive seismic activity monitoring network has been installed at active volcano sites throughout the region to provide advance warning of a potential volcanic eruption, which may allow for safe relocation of select equipment and personnel. The impacts associated with ashfall on a facility are highly dependent on wind conditions. Impacts may include ash accumulation; potential corrosion of surfaces, including solar collection panels; damage to ventilation systems; damage to facility equipment and electronics; and temporarily reduced or suspended operations.

While it is possible to avoid mapped landslide hazards during siting, the potential exists for sloughing of near-surface soils, on cut and fill slopes, during sustained or extreme rainfall events. Such instances would result in maintenance activity to clean up and repair slopes but are not expected to result in damage to a facility or impair general facility operation.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** from geologic hazards.

4.3.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix B, the *Earth Resource Report*, for a more detailed list of actions to avoid and reduce impacts, including typical BMPs and actions that may be included in plans or permit conditions and additional measures.

Siting and design considerations

- Conduct detailed geotechnical engineering, soil, and hydrologic studies to characterize site conditions.
- Avoid geologic hazards and hazard areas such as mapped landslide hazard areas, surface fault rupture hazard areas, and volcanic flow hazard areas.
- Select sites with minimal potential for impacts on soil health and stability to avoid soil erosion and compaction.
- Prioritize locations with suitable topography and soil characteristics to minimize the need for extensive grading and excavation, reducing soil disturbance. By focusing on sites with more gentle slopes, developers can mitigate erosion risks and preserve soil stability, because steep slopes are more prone to soil erosion and landslides.
- Select areas with favorable soil characteristics, such as well-drained soils with good permeability, to minimize soil disturbance during construction activities, by reducing the likelihood of soil compaction and waterlogging.
- Design facilities to account for current seismic design parameters and building codes, including the latest version of the International Building Code and American Society of Civil Engineers Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- Limit construction of new roads. Design new roads based on federal, state, and county requirements and based on local climate conditions, soil moisture, and erosion potential.
- Identify the level of seismic design, material types, and development strategies needed based on the potential risk of earthquakes.

4.3.4 Findings for facilities with co-located battery energy storage systems

4.3.4.1 Impacts

Environmental impacts for facilities with BESSs would be similar to the impacts considered for facilities without BESSs related to site characterization, construction, operation, and decommissioning. Specific differences are summarized in the following sections.

Impacts from construction, operation, and decommissioning

Soil resources

A BESS requires storage facilities, spill containment, additional electrical infrastructure, and operational management systems. This means a larger overall footprint and more soil disturbance.

State regulations require fire and spill containment measures for lithium-ion, flow, and zinc-hybrid batteries (WAC 51-54A-0322 and 51-54A-1207). Potential failure of BESS components during construction, operation, or decommissioning could result in the release of chemicals or metals used in batteries. Although the likelihood is remote, in the event of a BESS failure, there is a risk of environmental contamination to soil. Emergency response would not typically use water for battery incidents so soil contamination would be limited to the BESS site. Clean-up actions include removal and proper disposal of contaminated soils.

Decommissioning of BESS components may necessitate soil testing to determine if failure or contamination has occurred. If contamination is identified, soil remediation efforts would be necessary. Section 4.8, Environmental Health and Safety, includes more information on impacts on human health from these types of facilities.

Geologic hazards

The risk of impacts from ashfall would increase for facilities with BESSs. Impacts would include equipment vulnerability due to ash particle infiltration, insulation challenges from ash accumulation, and air intake blockages affecting cooling systems.

Findings

Impacts from construction, operation, and decommissioning of a facility with a BESS would be similar to those described for facilities without a BESS, with a slight increase due to the increased total disturbed area and increased activities. Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on earth resources.

4.3.4.2 Actions to avoid and reduce impacts

Actions for reducing impacts for solar energy facilities with a co-located BESS include those identified for facilities without a co-located BESS. Additional mitigation measures to address potentially significant adverse impacts caused by solar energy facilities with a co-located BESS include the following:

- Implement secondary spill and leak containment measures around BESS components for all battery types to prevent or minimize the spread of hazardous materials in the event of a failure. Examples include reinforced storage facilities and containment barriers to contain spills and leaks.

- Develop comprehensive training programs and safety protocols for personnel involved in BESS operations and maintenance. Proper training can help minimize the risk of accidents and ensure prompt and effective response in case of emergencies.
- Develop detailed emergency response plans specific to BESS operations to mitigate the consequences of potential failures. Robust plans include protocols for containment, cleanup, and remediation in the event of soil contamination or other environmental incidents.
- Implement regular maintenance schedules and inspections for BESS components to ensure optimal performance and early detection of potential issues. Routine maintenance can help prevent failures and minimize the risk of environmental contamination.

4.3.5 Findings for facilities combined with agricultural land use

4.3.5.1 Impacts

Environmental impacts from solar facilities combined with agricultural land use would be similar to the impacts considered for utility-scale facilities related to site characterizations, construction, operation, and decommissioning. Specific differences are summarized in the following sections.

Impacts from construction, operation, and decommissioning

Soil resources

During construction, the installation of solar panels and associated infrastructure may disrupt soil structure and compaction, potentially affecting soil fertility and productivity by reducing nutrient availability, altering water drainage patterns, and disturbing beneficial microbial communities. During operations, the design and orientation of solar panels may affect sunlight penetration, altering soil moisture levels and microbial activity. Additionally, certain crops—particularly those with shallow root systems or sparse canopy cover—or grazing practices can increase soil erosion on sloped terrain by reducing soil stability and protection against runoff. Grazing can also result in soil compaction, which can decrease moisture absorption and increase runoff as well as limit germination.

Geologic hazards

Geologic hazards for facilities combined with agricultural land use would be similar to the impacts considered for utility-scale facilities and large facilities related to site characterizations, construction, operation, and decommissioning. No additional geologic hazard impact considerations are associated with the inclusion of co-located agricultural land use.

Findings

Impacts from construction, operation, and decommissioning would be similar to those described for facilities without agricultural land use. Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on earth resources.

4.3.5.2 Actions to avoid and reduce impacts

Actions for reducing impacts for agrivoltaic facilities include those identified for facilities without combined agricultural use.

4.3.6 Findings for the No Action Alternative

The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on facility size and design, and would be **less than significant**.

4.3.7 Unavoidable significant adverse impacts

Through compliance with laws and permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale solar facilities would have **no significant and unavoidable adverse impacts** related to earth resources from construction, operation, or decommissioning.

4.4 Air quality and greenhouse gases

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on air quality and greenhouse gas (GHG) emissions.

No significant and unavoidable adverse impacts on air quality or GHG emissions would occur.

Air quality refers to the condition of the breathable air and the presence of pollutants or particles. The *Air Quality and Greenhouse Gases Resource Report* (Appendix C) includes the full analysis and technical details used to evaluate air quality and GHGs in this PEIS.

4.4.1 Affected environment

Pollutants can be local and affect a small area, or regional, such as ozone. Pollutants are regulated under state and federal laws. National Ambient Air Quality Standards and Washington Ambient Air Quality Standards are established for common "criteria pollutants." In general, if potential emissions from stationary sources exceed certain thresholds, they must get a Notice of Construction permit before beginning construction. The following common criteria pollutants have standards set by the U.S. Environmental Protection Agency (USEPA):

- Particulate matter smaller than 10 microns in diameter (PM_{10})
- Particulate matter smaller than 2.5 microns in diameter ($PM_{2.5}$)
- Ozone
- Sulfur dioxide (SO_2)
- Nitrogen dioxide (NO_2)

- Carbon monoxide (CO)
- Lead

Gases that trap heat in the atmosphere are referred to as GHGs because they capture heat radiated from the sun as it is reflected back into the atmosphere from the Earth, like a greenhouse does. Increasing amounts of GHGs trap more solar radiation and decrease the amount that is reflected back into the atmosphere, resulting in an increased global average temperature and climate change impacts to people and the environment. The Washington Legislature set new GHG emission limits (RCW 70A.45.020) to combat climate change. By 2050, the state must achieve net zero GHG emissions. CETA requires all electric utilities in Washington to be 100% carbon-free electricity by 2045.

Due to the large solar study area, existing air pollutant concentrations vary. Ambient air quality standards are met everywhere within the study area, though there are areas of concern for particulate matter and ozone. The Tri-Cities area (Kennewick, Pasco, and Richland) is an area of concern for ozone. Sunnyside, Toppenish, Yakima, Omak, and Colville are all areas of concern for particulate matter. Ecology monitors the air using Washington's Air Monitoring Network, and permitting regulations are in place to ensure air pollution levels do not increase to concentrations outside of ambient air quality standards. New sources of air pollution must obtain an air quality permit.

Carbon dioxide equivalent, or CO_2e, is the number of metric tons of CO_2 emissions with the same global warming potential as 1 metric ton of another greenhouse gas. In 2019, Washington produced about 102.1 million metric tons of CO_2e. Transportation is the largest source, at 40% of the state's GHG emissions, followed by residential, commercial, and industrial energy use at 31%, and electricity consumption at 21%. The remaining 8% of emissions are from agriculture, waste management, and industrial processes.

4.4.2 How impacts were analyzed

This analysis evaluated how solar facilities could affect air quality and contribute to GHG emissions. The primary emission sources include fuel combustion by equipment and vehicle traffic during construction and decommissioning. Disturbed soils from land clearing activities also result in airborne dust. Emissions and dust would be also generated by vehicles traveling on facility access roads to perform operations and maintenance functions.

Construction and operation emissions were estimated by reviewing emissions data from similar proposed and completed solar facilities in Washington and California and determining a scaled emissions rate in tons per MW to apply to this analysis. Projected emissions from each facility phase were compared to state and federal laws, policies, guidance, and permitting thresholds for context and to evaluate impacts. Dust was considered qualitatively for how it may impact biological resources or water quality.

GHG life-cycle emissions estimates were derived using GHG life-cycle assessments (LCAs) developed by the National Renewable Energy Laboratory. These assess the overall GHG impacts of the entire life cycle of solar facilities, from facility material production, to use, to disposal.

4.4.3 Findings for utility-scale solar facilities

4.4.3.1 Impacts

Impacts from construction and decommissioning

Air emissions associated with site characterization, construction, and decommissioning activities would be generated by construction equipment, haul-truck trips, worker trips, vehicle travel on paved and unpaved surfaces, and dust from material handling. Emission rates would be assumed to increase in relative proportion to the size of the facility. Estimated construction emissions for 600 MW and 1,200 MW facilities are provided in Table 4-1. Air emissions associated with decommissioning activities are expected to be similar to or less than the emissions generated from construction. Based on estimated emissions generated by facilities, emissions are not anticipated to exceed the significance thresholds for any criteria pollutant.

Table 4-1. Estimated construction emissions for types of facilities analyzed in this PEIS (tons)

Emission type	600 MW facility	1,200 MW facility	Threshold (tons per year)
Volatile organic compounds	5.8	11.7	100
Nitrogen oxides	42.0	84.0	100
Carbon monoxide	37.2	74.3	100
Particulate matter smaller than 10 microns in diameter	11.6	23.1	100
Particulate matter smaller than 2.5 microns in diameter	3.4	6.8	100
Sulfur dioxide	0.2	0.3	100

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on air quality.

Impacts from operation

Operations would generate exhaust and dust emissions from vehicles used for facility maintenance. Emission rates are assumed to increase in relative proportion to the size of the facility, as larger facilities are assumed to require more maintenance. Estimated operations emissions for 600 MW and 1,200 MW facilities are provided in Table 4-2. Operations are not anticipated to produce emissions at a level that would exceed any criteria pollutant thresholds.

Table 4-2. Estimated operations emissions for types of facilities analyzed in this PEIS

Emission type	600 MW facility	1,200 MW facility	Threshold (tons per year)
Volatile organic compounds	2.7	5.3	100
Nitrogen oxides	17.8	35.7	100
Carbon monoxide	14.9	29.8	100
Particulate matter smaller than 10 microns in diameter	3.3	6.6	100
Particulate matter smaller than 2.5 microns in diameter	1.4	2.9	100
Sulfur dioxide	<0.01	<0.01	100

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on air quality.

GHG LCA

The operation of solar energy facilities would reduce overall GHG emissions compared to a fossil fuel power plant that would otherwise be in operation to supply the same amount of electricity. Overall, GHG emissions would be reduced if solar energy production replaces fossil fuel energy production over the next 20 years. Washington State law requires utilities to have net-zero GHG emissions by 2045.

Federal studies by the National Renewable Energy Laboratory evaluated the life-cycle GHG emissions for the full lifespan of a solar energy facility, including upstream, downstream, and operational processes. Upstream processes include the raw material extraction and construction of PVs and associated components, along with the construction of the solar plant. Operational processes include vehicle exhaust emissions from maintenance activities. Downstream processes include decommissioning and disposal of the solar installation.

The resulting operational facility GHG emissions for a 30-year life cycle are estimated to be up to 71,040 metric tons of CO_2e or up to 2,368 metric tons of CO_2e annually. For comparison, the emissions for the same size of coal facility are estimated to be up to 9.19 million metric tons of CO_2e or up to 306,425 metric tons of CO_2e annually. Emissions for a natural gas facility of the same size are estimated to be up to 4.1 million metric tons of CO_2e or up to 136,850 metric tons of CO_2e annually.

Offsets could be used to reduce the amount of GHGs in the atmosphere.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on GHGs.

4.4.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix C, *Air Quality and Greenhouse Gases Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Design facility to minimize use of fossil fuels to reduce GHG and air emissions.
- Surface access roads, on-site roads, and parking lots with aggregate with hardness sufficient to prevent vehicles from crushing the aggregate and causing excessive dust or compacted soil conditions. Paving could also be used on access roads and parking lots.

Additional mitigation measures:

- Use offsets to reduce the amount of GHGs in the atmosphere. Offset projects must result in GHG reductions that are real, permanent, quantifiable, verifiable, and enforceable.

4.4.4 Findings for facilities with co-located BESS

4.4.4.1 Impacts

Impacts from construction, operations, and decommissioning
Air emissions for facilities with BESSs would be slightly higher than the impacts considered for utility-scale facilities without a BESS related to site characterization, construction, operation, and decommissioning. This is due to more construction equipment and vehicles. The total construction and decommissioning emissions from a facility with a co-located BESS are not anticipated to exceed any criteria pollutant thresholds (Table 4-3). Operation of a facility and co-located BESSs would generate similar emissions as those analyzed for facilities without a BESS.

Impacts related to fires and explosions are included in Section 4.8, Environmental Health and Safety, and Section 4.15, Public Services and Utilities.

Table 4-3. Estimated construction emissions for a 1,200 MW solar energy facility and two 500 MW co-located battery energy storage systems

Emission type	Estimated emissions (tons)	Threshold (tons per year)
Volatile organic compounds	13.4	100
Nitrogen oxides	98.7	100
Carbon monoxide	81.6	100
Particulate matter smaller than 10 microns in diameter	23.6	100
Particulate matter smaller than 2.5 microns in diameter	7.3	100
Sulfur dioxide	0.3	100

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities with a co-located BESS would likely result in **less than significant impacts** on air quality.

GHG LCA
The GHG emissions for facilities with a co-located BESS would be greater than the range described above, with the addition of upstream and downstream LCA emissions from the BESS. Applying studied percentage increases in GHG life-cycle emissions for a case study in Texas where a 500 MW BESS was added to wind and solar applications, the GHG emissions for two 500 MW BESSs would range from 2,096 to 4,192 metric tons of CO_2e a year depending on the size of the facility.

Offsets could be used to reduce the amount of GHGs in the atmosphere.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, facilities with a co-located BESS would likely result in **less than significant impacts** on GHGs.

4.4.4.2 Actions to avoid and reduce impacts

Actions for reducing air and GHG-related impacts for solar energy facilities and co-located BESSs are the same as those identified for facilities without a BESS.

4.4.5 Findings for facilities combined with agricultural land use

4.4.5.1 Impacts

Impacts from construction, operations, and decommissioning
Air emissions resulting from site characterization, construction, and decommissioning of facilities combined with agricultural land use would be similar to the impacts considered for

facilities without agricultural uses. Emissions generated by the construction and decommissioning of solar energy facilities that include agricultural land use are not anticipated to exceed the significance thresholds for any criteria pollutant.

Operation of agrivoltaic facilities would generate similar emissions as solar facilities that do not include agricultural land use, with the addition of emissions from equipment for agricultural operations. The overall emissions footprint of an agricultural operation is highly variable, dependent on the types of crops or livestock, number of tilling operations per year, age of equipment being used, and many other variables. This may include emissions from operation of diesel-powered equipment, livestock operations, and fertilizer operations. However, it is not anticipated that the scale of agricultural operation that would be combined with solar facilities would cause an emissions threshold to be exceeded.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities with co-located agricultural use would likely result in **less than significant impacts** on air quality.

GHG LCA
The GHG emissions for agrivoltaic facilities would likely be similar to the range described for utility-scale facilities that do not include agricultural land use but would vary based on the type of land use and amount of land. An LCA would need to be conducted to estimate GHGs for each project based on its specific design.

Offsets could be used to reduce the amount of GHGs in the atmosphere.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, agrivoltaic facilities would likely result in **less than significant impacts** on GHGs.

4.4.5.2 Actions to avoid and reduce impacts

Actions for reducing air and GHG-related impacts for solar energy facilities that include agricultural land use are the same as those identified for facilities that do not include agricultural land use. Additionally, agriculture-specific measures that can help to limit the emissions produced from agriculture operations include the following:

- Limit the amount of soil or unpaved surface disturbances during operations.
- Optimize agricultural operations to reduce air emissions.

4.4.6 Findings for the No Action Alternative

The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on facility size and design, and would be **less than significant**.

4.4.7 Unavoidable significant adverse impacts

Through compliance with laws and permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale solar facilities would have **no significant and unavoidable adverse impacts** related to air quality or GHGs from construction, operation, or decommissioning.

4.5 Water resources

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on water resources (surface water, groundwater, wetlands, and floodplains).

No significant and unavoidable adverse impacts related to water resources would occur.

This section evaluates surface water, groundwater, wetlands, and floodplains. This section evaluates the following features related to water resources: water quality, water quantity (flows and levels), and water availability and water rights.

The *Water Resources Report* (Appendix D) includes the full analysis and technical details used to evaluate water resources in this PEIS.

4.5.1 Affected environment

4.5.1.1 Surface water

Surface water includes streams, rivers, lakes, and reservoirs. The study area encompasses land along surface waters ranging in size from the Columbia River to unnamed smaller creeks with only seasonal flow. Seven of the eight hydrologic sub-regions in Washington as identified by the U.S. Geological Survey (USGS) are found within the study area. The study area also falls within 41 of Washington's 62 Water Resource Inventory Areas (WRIAs; Figure 4-2). WRIAs provide a framework for water resources management in the state.

Water quality is a key element of surface water regulation and management in Washington. Water quality conditions across the study area vary by location. In general, surface water quality conditions are typically better higher in a watershed, upstream of intensive land uses. Common water quality issues that affect some waters within Washington and the study area include elevated temperature, low dissolved oxygen, high turbidity, bacteria, and toxics and other pollutants from industrial activities and stormwater runoff.

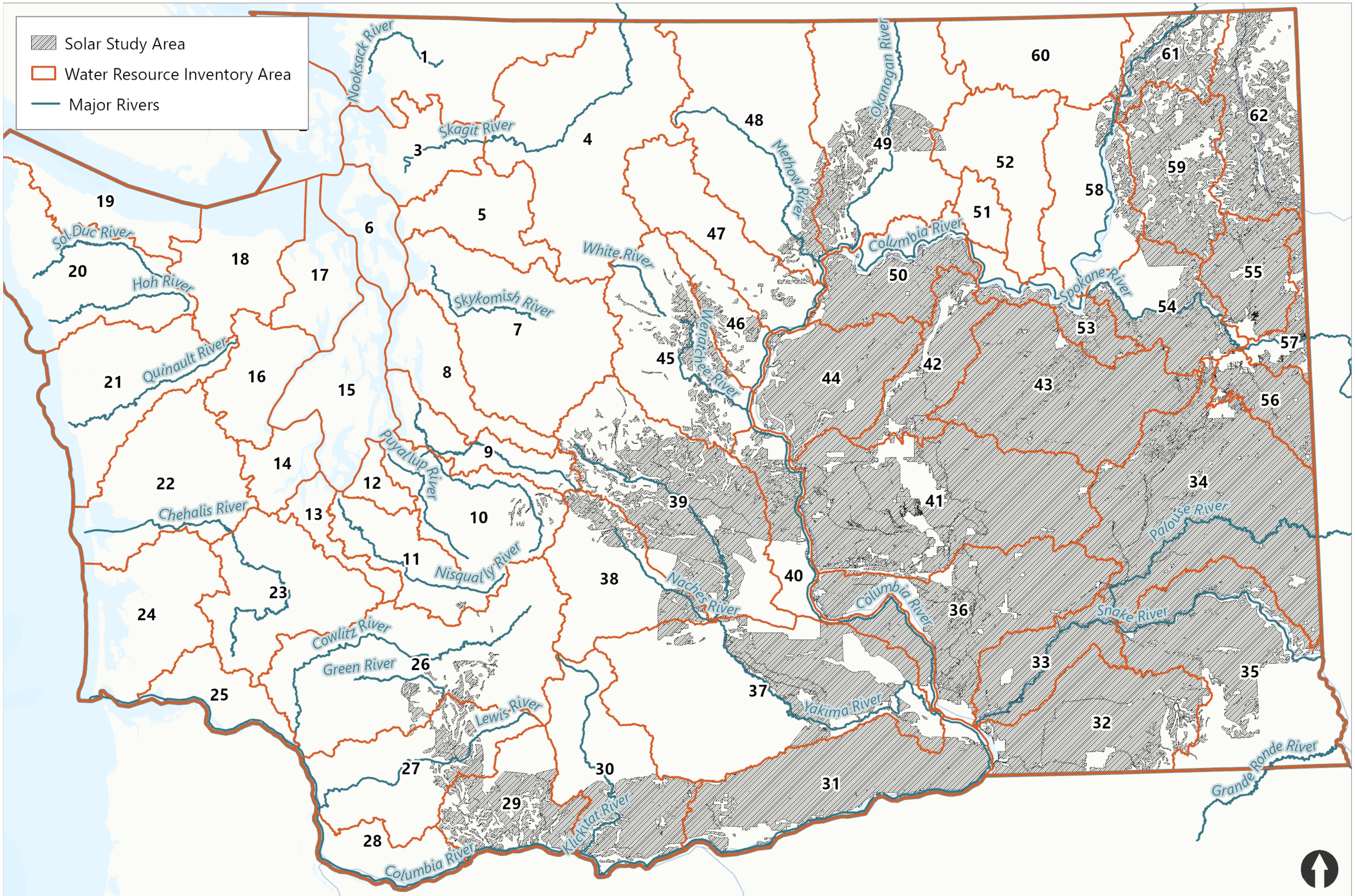

Figure 4-2. Water Resource Inventory Areas (WRIAs)

4.5.1.2 Groundwater

Groundwater is the water found in a saturated zone beneath the ground surface. A saturated soil or rock layer with spaces that allow water to move through it is called an aquifer. There are seven main aquifers in Washington as identified by USGS. The study area includes land over portions of most of these aquifers.

Sole source aquifers are defined as aquifers that supply at least 50% of the drinking water for its service area and for which there are no reasonably available alternative drinking water sources if the aquifer becomes contaminated. USEPA has designated 13 sole source aquifers in Washington, and three of them overlap the study area: the Lewiston Basin, Spokane Valley Rathdrum Prairie Aquifer, and the Cedar Valley Aquifer.

4.5.1.3 Water availability and water rights

Across the study area, water availability varies by location and is dependent on many factors such as local hydrology and climate conditions, land uses, and existing water rights. Ecology has responsibilities for managing waters of the state, including issuing rights to use water while protecting water resources for public benefit. Nearly 80% of the state's overall water use is for irrigation and public supply with more water used for public supply on the west side of the state, and more water used for irrigation on the east side of the state. In addition to water rights for withdrawal, water availability is also influenced by the requirement to maintain minimum instream flows. These requirements are in place to protect fish and wildlife, Tribal resources, water quality, recreation, aesthetics, and navigation. Ecology considers instream flow requirements and closed waterbodies when reviewing new water rights applications.

4.5.1.4 Wetlands

Wetlands are areas frequently saturated or inundated by surface or groundwater and supporting wetland vegetation and functions. They include areas that are commonly referred to as swamps, marshes, bogs, and fens. Wetlands can occur in and adjacent to stream and river channels, on floodplains, in low-lying areas and depressions, around the edges of ponds and lakes, and on slopes. Wetlands occur throughout the study area; however, there is no detailed single source that identifies the presence of all wetlands. For this reason, developers would be required to conduct wetland determinations or delineations to determine wetland presence. In Washington, wetlands are rated and categorized using Ecology's Washington State Wetland Rating System. Under this system, wetland categories range from Category I wetlands, which are a unique or rare wetland type, are more sensitive to disturbance, or are relatively undisturbed, to Category IV wetlands, which have the lowest levels of function and are often heavily disturbed. State law requires wetland mitigation plans to ensure no net loss of function.

4.5.1.5 Floodplains

Floodplains are low-lying areas around surface waters that may sometimes flood. Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps identify flood hazard areas regulated under the National Flood Insurance Program. Special flood hazard areas are areas that would be inundated by a flood event that has a 1% chance of occurring in any year (i.e., the

"100-year" flood). These special flood hazard areas generally are the basis for floodplain management regulations. Flood risks vary across the study area based on location and setting. Information on flood risks for a given site should be evaluated using FEMA's Risk Mapping, Assessment, and Planning program tools available on the FEMA website.[24]

4.5.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Alterations to the course of surface water
- Changes in surface water quality
- Disruption of the groundwater flow regime (including groundwater recharge)
- Changes in groundwater quality
- Alterations to water availability or rights
- Wetland area alteration or loss
- Wetland function alteration or loss
- Wetland buffer area alteration or loss
- Alterations to floodplain functions and/or any loss of floodplain storage

The assessment of impacts was qualitative, and potential impacts considered applicable laws and regulations (e.g., water quality standards, water rights laws, and wetland regulations).

4.5.3 Findings for utility-scale solar facilities

4.5.3.1 Impacts

Impacts from construction and decommissioning

Facilities would require a water supply during construction for dust control, equipment cleaning, and potentially for concrete production. Construction of utility-scale solar energy facilities would require supplying drinking water to an estimated 100 to 400 construction workers. Water could also be needed to irrigate site restoration plantings for some period after structures are removed and grading is complete, until successful plant establishment.

Surface water

Site characterization, construction, and decommissioning activities could impact surface water flows for facilities that involve elements within or adjacent to streams. Streamflows could be temporarily re-routed from their natural channels by diversions needed to construct access road crossings. Permanent alterations to streams could occur if culvert installations are needed at access road crossings. These impacts would be minimized by following design guidelines and adhering to water crossing regulations including the Washington Department of Fish and Wildlife's (WDFW's) Water Crossing Guidelines for fish-bearing streams.

[24] https://www.fema.gov/flood-maps/tools-resources/risk-map

Ground disturbance would impact flow rates and volumes of surface runoff reaching nearby streams. Vegetation clearing and soil compaction in site investigation and construction areas would reduce the potential for land to absorb and infiltrate precipitation, potentially leading to increases in stormwater peak flows. Construction of operations and maintenance buildings and service roads would add impervious surface area. The addition of impervious surfaces would increase surface water runoff from those areas and, depending on how stormwater drainage is managed, could permanently change the amount and timing of surface flows reaching nearby streams. Grading, installation of access roads, and installation of utility trenches all affect how surface runoff moves across a site to nearby streams. Additionally, the solar arrays themselves could impact local drainage patterns by redirecting where precipitation falls on the land and how it infiltrates or flows to surface waters.

Site characterization, construction, and decommissioning activities would adversely affect surface water quality in several ways. In-water construction for elements such as new stream crossings for roads would temporarily elevate stream turbidity levels from sediment disturbance and temporary water management (e.g., bypassing and then re-introducing flows). Soil disturbance from establishing initial site access for geotechnical surveys, installing meteorological towers, structure and access road removal, and from site grading would temporarily increase erosion potential and sediment transport to receiving waters in runoff or by wind, contributing sediment and associated pollutants such as metals and organics. The erosion potential of the soils, the proximity of disturbance to surface waters, and the size and nature of construction activity would all influence the potential for water quality issues from ground disturbance. Revegetation of temporarily disturbed areas would limit the length of time soils are exposed. Structure removal during decommissioning would be expected to restore pre-facility drainage patterns.

The presence of construction equipment and materials would increase the potential for associated pollutants to enter surface waters during in-water construction or through stormwater runoff from areas of upland construction or demolition. Potential pollutants from operating such equipment would include fuel (gasoline and diesel fuel), oil, grease, coolant, and hydraulic fluid. Hazardous material storage requirements and federal requirements for facilities storing more than 1,320 gallons of petroleum fuel would require secondary containment. For these types of quantities, spills would likely be to secondary containment or nearby soil and able to be cleaned up. EHS impacts are discussed in Section 4.8. Developers would be required to be in compliance with applicable permits such as an NPDES construction permit and implement erosion control plans. Implementation of permit requirements would reduce impacts on surface water.

Construction would include on-site concrete pouring and could also include concrete production at on-site batch plants. Concrete production and pouring create the potential for introducing high-pH discharges to surface waters. Demolition of concrete pads and foundations could result in water coming into contact with freshly exposed concrete surfaces and debris/dust, which could lead to elevated water pH levels. Activities such as concrete production and pouring must meet water discharge requirements.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on surface water.

Groundwater
Site characterization includes groundwater or geotechnical drilling and testing to gather information. Construction of foundations for solar energy facilities, including buildings and electrical substations, include subsurface excavation and fill and concrete pouring, and potentially require dewatering during construction. Such activities would depend on the site, but could locally affect shallow groundwater flows, to approximately the depth of the drilling or excavation.

The construction of new impervious surfaces in the form of facility buildings and access roads would locally change surface-to-groundwater interactions and reduce groundwater recharge capability within those footprints. These make up a small portion of a facility site. The installation of new solar panels would reduce precipitation reaching the ground directly below the panels but would maintain the infiltration capabilities of the underlying ground. Wells using groundwater may be used for construction of solar energy facilities and result in localized water table drawdown. These would require a water right.

At decommissioning, removal of structures and their foundations, access roads, and solar panel arrays, and restoration to more natural, pre-facility conditions would allow surface-groundwater interactions, including infiltration of rain and snowmelt and groundwater recharge.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on groundwater.

Water availability and water rights
Depending on the site, water may be available from existing municipal sources, transported to the site by truck, or could require water from new surface water diversions or groundwater withdrawals.

Diversions of surface water for construction or decommissioning would require obtaining a water right prior to diversion. Groundwater pumping would also require a water right if withdrawals were to exceed groundwater permit exemption thresholds of 5,000 gallons per day for industrial uses. Water used to produce concrete and for other construction activities could likely exceed 5,000 gallons per day; this would require a water right.

Water availability and the likelihood of obtaining new water rights for construction or decommissioning vary by location in the study area. Water rights may not be granted in watersheds that are over-appropriated and subject to closures or instream flow requirements that are often not met. If water is not available, a water right will not be issued.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on water availability or water rights.

Wetlands
Impacts to areas and functions of wetlands could occur during the site characterization, construction, and decommissioning phases. Wetlands may need to be cleared and/or filled for the construction of meteorological towers, staging/laydown areas, roads, solar array fields, gen-tie line corridors, and other supporting facilities. Roads and other infrastructure constructed near wetlands could introduce invasive plant species, change surface drainage patterns, and/or introduce sediments or pollutants into adjacent wetlands via runoff.

The removal of solar arrays, supporting infrastructure, access roads, and culverted road crossings from wetlands (or areas adjacent to wetlands) during facility decommissioning could introduce invasive plant species and temporarily increase erosion potential and soil compaction in those areas. Such impacts would be minimized by the implementation of erosion control measures and BMPs and via prompt revegetation and decompaction of disturbed soils.

Wetlands may be present on a facility site, and the types of wetlands would be identified as part of the site characterization phase. The impacts would vary based on the type and area of wetlands affected. If wetland impacts are likely, project developers would need to comply with a mitigation sequencing process in order to achieve the state goal of no net loss of wetland acreage and function. As part of the agency review process, a mitigation plan will need to be submitted that explains how wetland impacts will be compensated for ecologically and appropriately. The mitigation plan would need to be approved by regulatory agencies before permits would be issued.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on wetlands.

Floodplains
Site characterization, construction, and decommissioning activities could impact floodplains for solar energy facilities that involve elements within or adjacent to a stream, such as for a facility access road crossing of a stream. The majority of a solar energy facility would not include construction of impermeable areas and would not be likely to affect floodplain functions.

Permanent alterations to streams could occur with culvert installations at access road crossings, which could restrict natural stream and floodplain functions for flood storage, sediment transport, and large wood transport and could also restrict aquatic species movements. Projects would be required to meet state and local standards for culverts which would require they pass flows for a 100-year flood. Temporary work activity and ground disturbance in the floodplain could result in temporary impacts on floodplain functions. During decommissioning, floodplain functions could be restored to pre-facility conditions following structure and road removal and restoration grading and planting.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on floodplains.

Impacts from operation

Surface water

Operations and maintenance would involve the on-site storage and use of potential pollutants including oil for electrical transformers and fuel and oil for generators to provide backup power. Transformers typically contain 600 gallons of oil or less. Fuel is expected to be stored in aboveground storage tanks with containment. If more than 1,320 gallons is stored on site, a facility must have a plan to prevent, control, and respond to spills. For these types of quantities, spills would likely be to secondary containment or nearby soil and able to be cleaned up. EHS impacts are discussed in Section 4.8, Environmental Health and Safety.

Impervious surfaces for buildings and access roads, on-site oil and fuel storage, and the periodic presence of maintenance vehicles and equipment would create some potential for pollutants in stormwater discharges. Maintenance of facilities could also involve periodic use of herbicides to manage unwanted vegetation, which could impact water quality in receiving streams if not applied properly.

Maintenance of solar panels could involve periodic washing of the panels with water, to remove particulates that accumulate on the surface of the panels. Runoff from panel washing could cause localized erosion and increase the potential for sediment transport to nearby streams. It is assumed that no surfactants would be used in panel washing.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on surface water.

Groundwater

On-site storage and use of generator fuel and transformer oil present some risk of spills or releases of pollutants to the subsurface and could present a potential source of groundwater contamination. Buildings for operation of solar energy facilities could include sanitary wastewater discharges (e.g., from restrooms) to the subsurface through on-site septic systems. Septic systems could present risks of bacterial contamination of groundwater if not designed and maintained in accordance with local codes.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on groundwater.

Water availability and water rights
Water supply would be needed for use in buildings and potentially for periodic washing of solar panels. If water is used for solar panel washing, a small to medium facility could use approximately 3.3 million gallons per year. A large facility would require more water, though this would vary based on panel size, soiling rates, and cleaning frequency. Facilities could also use dry cleaning methods. Water from municipal sources may be used or water may be trucked to the site. If an on-site well is proposed, it would require a water right based on the expected amounts needed. Waterless cleaning methods may be utilized by some facilities, but panel washing with water is common practice.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on water availability or water rights.

Wetlands
Potential water quality impacts on wetlands could occur during periodic washing of solar panels or rain events, which could create runoff that carries sediment. Spills of pesticides, fuel, vehicle fluids, or other hazardous materials used or stored at the facility could impact nearby wetlands if outside of containment. Runoff from parking areas, buildings, and other facility infrastructure or septic system discharges would also degrade water quality in adjacent wetland areas. Maintenance activities such as routine mowing, vegetation removal in gen-tie line corridors, and access road maintenance would also affect wetlands. Developers would be required to complete operational activities with standard BMPs and spill prevention measures and in compliance with applicable permits. Implementation of permit requirements would reduce impacts to wetlands.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on wetlands.

Floodplains
Potential operations and maintenance impacts on floodplains would be similar to those described above for surface waters. Maintenance of facility elements within floodplains could interfere with floodplain functions. For example, if vegetation maintenance at facilities and along access roads were to prevent natural vegetation from re-establishing, it could affect vegetation support for floodplain functions for water quality, habitat, and restricting the speed of moving floodwater. Overall, facility operation is not expected to lead to alterations to floodplain functions and/or any loss of floodplain storage that would cause a net rise in flood elevation during a 100-year flood.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on floodplains.

4.5.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix D, *Water Resources Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Conduct a hydrologic study of the site. Identify site surface runoff and drainage patterns and groundwater levels and flow direction.
- Perform a wetland delineation on the site.
- Avoid siting structures and roads within critical areas.
- Avoid siting structures in areas of known soil or groundwater contamination, or in direct proximity to impaired receiving waters.
- Avoid siting facility infrastructure in floodplains.
- Where gen-tie or utility line crossings of streams cannot be avoided, prevent impacts on surface waters by spanning the stream (aboveground lines) or using horizontal directional drilling to cross beneath the stream (underground lines).
- Where stream and wetland impacts cannot be avoided, minimize impacts on water quality by working below the ordinary high water mark or within the wetland boundary during the dry season when no rain is predicted, and/or within the WDFW-recommended in-water work window for minimizing impacts on aquatic species.
- Minimize impacts of stream and wetland crossings by following applicable design guidelines (e.g., WDFW *Water Crossing Design Guidelines*) and adhering to regulations, including WAC 220-660-190 (Water Crossing Structures).
- Avoid alteration of existing drainage patterns to the extent practicable, especially in sensitive areas such as erodible soils or steep slopes.

- Avoid siting facility infrastructure in floodplains. If floodplains cannot be avoided, design the structures located within them so as not to restrict or redirect flows from their natural flow path.

4.5.4 Findings for facilities with co-located BESS

4.5.4.1 Impacts

Impacts from construction, operation, and decommissioning
The potential impacts on water resources for facilities with BESSs would be similar to the impacts described for facilities without BESSs for site characterization, construction, operation, and decommissioning.

Co-locating BESSs with solar energy facility development would require additional construction-related ground disturbance and an increased building footprint relative to facilities with no BESS. A BESS at a solar energy facility would add another stormwater consideration to a facility, from the container and concrete foundation, and potentially another regulated element to be included in an Industrial Stormwater Pollution Prevention Plan. Firefighters are not expected to use water for combating a fire at a BESS. Emergency response actions are to allow the fire to burn to prevent water contaminated with pollutants to affect surface water and groundwater quality.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities with a co-located BESS would likely result in **less than significant impacts** on water resources.

4.5.4.2 Actions to avoid and reduce impacts

The actions for reducing impacts for facilities with co-located BESSs are also the same as those identified for facilities without a BESS, with the added recommendation:

- BESS facilities and associated infrastructure should be located away from surface waters and wetlands.

4.5.5 Findings for facilities combined with agricultural land use

4.5.5.1 Impacts

Impacts from construction, operation, and decommissioning
The potential impacts on water resources for facilities combined with agricultural land use would be similar to the impacts described for utility-scale facilities related to site characterization, construction, operations, and decommissioning.

There are some ways the impacts on water resources from facilities combined with agricultural land use would differ from facilities without agricultural land use:

- A facility growing crops would have a higher demand for water than the same facility without agricultural use. For sites with an existing agricultural use, the increase in water demand would only result from the addition of a solar facility. For sites with changed agricultural types or the addition of an agricultural use where there was not one previously, the demand for water could be higher for a site with irrigated crop production, and lower for a site with livestock grazing. These changes could increase the importance of considering water availability and water rights issues, depending on the specifics of the facility design and site considerations.
- Substances commonly associated with farm operations such as pesticides, fertilizers, and livestock waste could lead to increased pollutants in stormwater runoff.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities with a co-located agricultural use would likely result in **less than significant impacts** on water resources.

4.5.5.2 Actions to avoid and reduce impacts

The same regulatory triggers and permitting needs would apply to facilities combined with agricultural land use. The actions for reducing impacts for facilities with agricultural land use are also the same as those identified for facilities without agricultural use.

4.5.6 Findings for the No Action Alternative

The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on the facility size and design, and would be **less than significant**.

4.5.7 Unavoidable significant adverse impacts

Through compliance with laws and permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale solar facilities would have **no significant and unavoidable adverse impacts** on water resources from construction, operation, or decommissioning.

4.6 Biological resources

Key findings

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, some construction, operation, and decommissioning activities of utility-scale solar energy facilities would result in **less than significant impacts** on terrestrial habitats and vegetation, including special-status habitats and vegetation. Activities that cause the permanent degradation, loss, or conversion of suitable habitat that is critical to species viability or disrupt habitat continuity along migration routes would result in **potentially significant adverse impacts** on terrestrial habitats and vegetation.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, some construction, operation, and decommissioning activities of some utility-scale solar energy facilities would result in **less than significant impacts** to terrestrial wildlife, including special-status species. Activities that affect species viability and the mortality of any individual species or disturbance that disrupts successful breeding and rearing behaviors would result in **potentially significant adverse impacts** on terrestrial wildlife.

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, construction, operations, and decommissioning activities would result in **less than significant impacts** on aquatic habitat and species and wetlands.

Construction, and operation, and decommissioning of utility-scale solar facilities may result in **potentially significant and unavoidable adverse impacts** on terrestrial special-status habitats and species if activities cause the permanent degradation, loss, or conversion of suitable habitat that is critical to habitat or species viability; affect the mortality of any individual species or create a disturbance that disrupts successful breeding and rearing behaviors; or disrupt habitat continuity along migration routes. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site. Mitigation to reduce impacts below significance for terrestrial special-status habitats or species may not be feasible.

This section evaluates potential impacts and mitigation related to aquatic and terrestrial species and habitats. The *Biological Resources Report* (Appendix E) includes the full analysis and technical details used to evaluate biological resources in this PEIS. This section contains a summary of how impacts were analyzed and the key findings.

4.6.1 Affected environment

4.6.1.1 Terrestrial habitats and species

Terrestrial habitats refer to non-aquatic or upland areas of the landscape that support plants and wildlife. Examples include forests, shrubsteppe, grasslands, deserts, shorelines, and underground habitats like caves and burrow systems. Terrestrial species are plants or animals that live on or use these habitats for the majority of their life functions. Examples of terrestrial plants include trees, shrubs, and grasses that prefer upland or riparian habitats. Examples of terrestrial wildlife include mammals, birds, invertebrates, and reptiles.

Terrestrial habitats within the study area encompass diverse landscapes such as mountains, deserts, forests, and agricultural lands. These areas provide critical habitats for a wide range of species. There are many state and federal resources with maps and data on habitats and species. These are described in the *Biological Resources Report* (Appendix E) and *Cumulative Impacts Report* (Appendix Q). Figure 4-3 is an example of the type of information available about specific habitats that should be considered during siting and design to avoid impacts and for evaluation in project-level reviews. This map describes priorities for dry shrubsteppe habitat from the Washington Shrubsteppe Restoration and Resiliency Initiative.

The study area for solar energy development in Washington includes multiple distinct ecological regions (Figure 4-4), including the following:

- **Cascades:** Steep mountain ranges, volcanoes, and diverse coniferous forests.
- **Eastern Cascades Slopes and Foothills:** Dry climate, coniferous forests, and susceptibility to wildfires.
- **Columbia Plateau:** Arid sagebrush steppe, grasslands, and extensive agricultural use.
- **Blue Mountains:** Volcanic mountain ranges with coniferous forests and prairie ecosystems.
- **Northern Rockies:** Mountainous region with boreal forests, alpine meadows, and riparian woodlands.
- **North Cascades:** High, rugged mountains with active alpine glaciers and diverse forest types.

Wildlife migration corridors and landscape-scale habitat connectivity are critical for species movement. The study area is part of the Pacific Flyway, one of the four main north-south migratory routes in North America. Ungulate (small hooved mammals) migration corridors within the study area span broad landscapes, including the Northern Rockies, North Cascades, Eastern Cascades Slopes and Foothills, Cascades, and Columbia Plateau. Species include elk, moose, deer, bighorn sheep, mountain goats, pronghorn antelope, and woodland caribou. Seasonal migration between distinct summer and winter ranges is common among ungulate herds. The *Biological Resources Report* (Appendix E) and *Cumulative Impacts Report* (Appendix Q) include information on reports and websites with these data and maps.

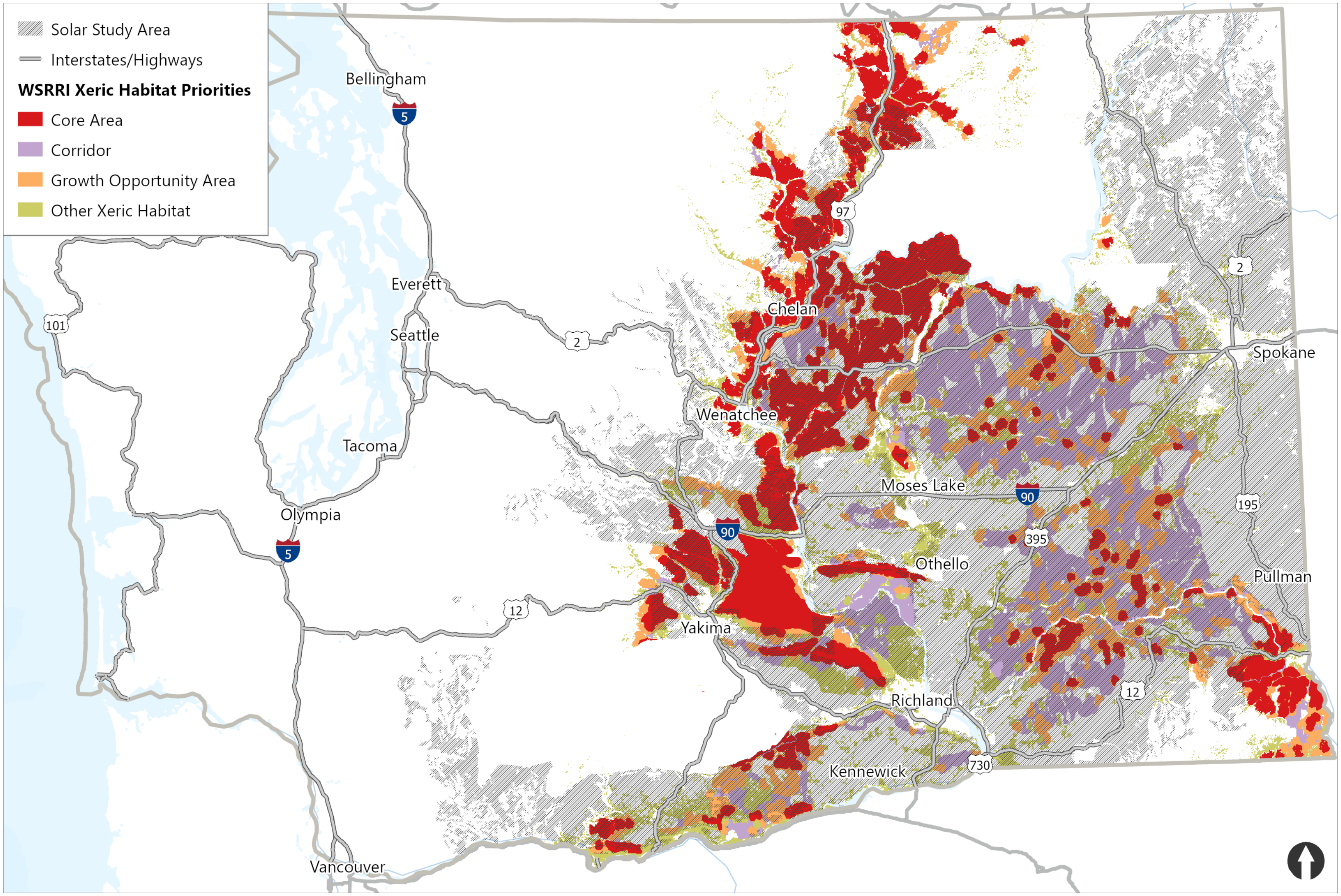

Figure 4-3. Example WSRRI priority map for a dry (xeric) ecosystem

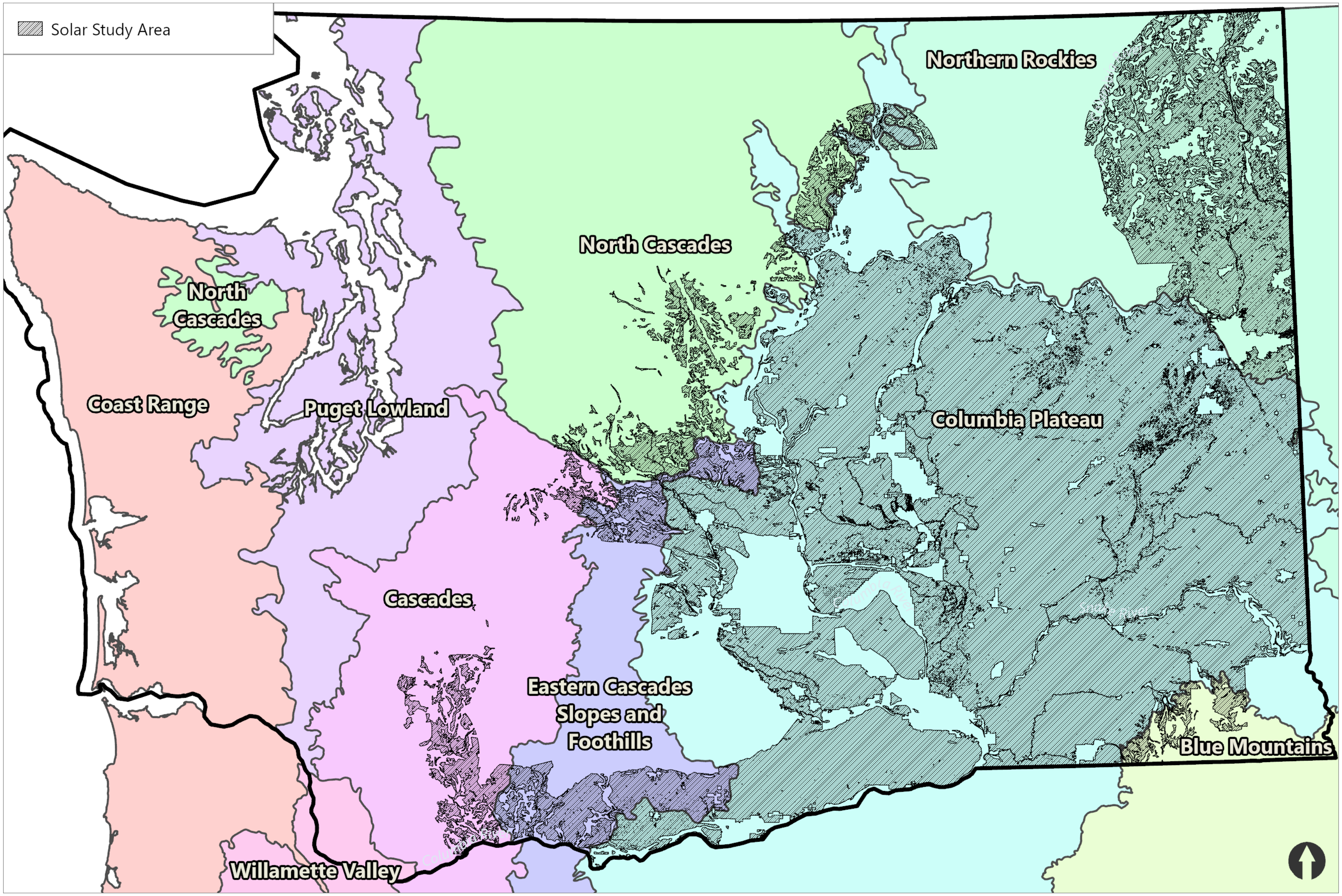

Figure 4-4. Level III Ecoregions

4.6.1.2 Aquatic species and habitats

Aquatic species are those that require water for some or all of their life cycles. Aquatic species that could be present in the study area include fish, amphibians, turtles, mollusks, and crustaceans. Aquatic habitat includes areas that have flowing or still surface water either year-round (perennial), seasonally (intermittent), or for short periods after rainfall or snowmelt events (ephemeral). Aquatic habitats commonly include rivers, streams, lakes, ponds, and wetlands. Human-created water systems and storage features such as ditches, irrigation canals, or water retention ponds can provide habitat for aquatic species although they often lack important habitat elements and may be lower quality. Instream, fresh deepwater, and freshwater wetland habitats occur throughout all six ecoregions present in the study area. Persistent snowpack in the mountain regions creates snowmelt-dominated waterbodies, which provide cold aquatic habitat. In contrast, large portions of the eastern, semi-arid ecoregions that lack high-altitude water sources are characterized by low precipitation and higher water temperatures in summer and fall.

4.6.1.3 Wetlands

Wetlands are areas frequently inundated or saturated by surface or groundwater and supporting wetland vegetation and functions. They include areas that are commonly referred to as swamps, marshes, bogs, and fens. Wetlands can occur in and adjacent to stream and river channels, on floodplains, in low-lying areas and depressions, around the edges of ponds and lakes, on slopes, and in estuaries and coastal areas. Wetlands provide numerous ecological functions, including water filtration, flood control, and habitat for a wide range of species. Wetlands occur throughout the study area, but not all wetlands have been identified at a site level. For this reason, developers would be required to conduct wetland determinations or delineations to determine if wetlands are present. If wetlands are impacted, a mitigation plan will be required to ensure there is no net loss of wetland functions.

4.6.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Terrestrial species and habitats, including:
  - Terrestrial species (including waterfowl) listed under the Endangered Species Act (ESA), Washington State species of concern (listed and candidate species), and those listed by county-specific code ordinances identifying species of local importance
  - Unique, priority, and culturally important terrestrial species and habitats
  - Wildlife migration routes
- Aquatic and amphibious species and habitats, including:
  - Aquatic and amphibious species listed under the ESA, Washington State species of concern (listed and candidate species), and those listed by county-specific codes or ordinances identifying species of local importance
  - Unique, priority, and culturally important aquatic and amphibious species and habitats

    - Salmon, steelhead, trout, and other fish migration routes
    - Wetland habitats
- Special status species and habitats, including:
    - ESA-listed species
    - Washington State-listed species (including those on the Priority Habitats and Species List)
    - DNR heritage species
    - Species defined in county code or ordinance as species of local importance

The assessment of impacts in this PEIS was qualitative, and potential impacts considered applicable laws and regulations.

4.6.3 Findings for utility-scale solar facilities

4.6.3.1 Impacts

Impacts from construction and decommissioning
Site characterization, construction, and decommissioning of solar energy facilities would occur mainly in upland areas. Gen-tie lines, roads, and fencing may cross wetlands, streams, or rivers, and sites may include wetlands. Development could affect a wide variety of species in the areas where it occurs. In general, impacts would increase proportionally with the size of the facility because they are expected to occur over a larger area of habitat and affect a greater number of individual species as well as population levels.

Terrestrial habitats
Impacts on terrestrial habitats associated with construction of solar facilities include fragmentation, degradation, or loss of habitat associated with site characterization and site preparation. This includes infrastructure, access and service roads, and associated construction for solar fields, power collection systems, buildings, and fencing. Land clearing and grading can alter existing habitats or habitat connectivity and may introduce invasive species. The reduction of habitat can also isolate communities, which could affect population sizes and movement. A facility could disrupt habitat continuity along migration routes for species such as birds, elk and deer.

Adjoining habitats may also be affected by habitat fragmentation, degradation, or loss. Disturbances from humans and construction-related noise, dust, and nighttime lighting could also affect nearby habitat. Development could also result in erosion, dust, changes in hydrologic regimes, increased human access, spills, soil compaction or removal, or sedimentation. Activities would reduce plant growth and reproduction and could cause plant loss. They could reduce opportunities for wildlife species to use the habitat for shelter, food, and breeding.

Impacts on special-status habitats would be similar to those for non-special-status habitats. However, because of the more sensitive nature of special-status habitats and the special-status species those habitats support, the impacts would be greater.

The magnitude of impacts would depend on the number, configuration, and overall size of solar fields and associated infrastructure as well as the location and extent of access roads and ROWs for gen-tie line corridors. Facility lighting, noise, and dust generation would also affect the level of impacts.

During decommissioning, it is assumed that habitat disturbance would primarily occur in the previously disturbed areas. The degree of impact would vary depending on how much the previously disturbed habitat had recovered during the operational phase.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, some construction and decommissioning activities of utility-scale solar energy facilities would result in **less than significant impacts** to terrestrial habitats, including special-status habitats. Activities that cause the permanent degradation, loss, or conversion of suitable habitat that is critical to species viability or disrupt habitat continuity along migration routes would result in **potentially significant adverse impacts** on terrestrial habitats.

Terrestrial species
Construction of facilities may adversely affect terrestrial wildlife species, depending on the types of wildlife and the stressors associated with specific site characterization and construction activities. Wildlife may be affected by site clearing and grading, solar field and associated infrastructure construction, and access road and gen-tie line corridor construction. It may also be affected by construction noise, visual disturbance, and the movement of construction vehicles and equipment. Vehicle collisions could result in wildlife injury or mortality.

The magnitude of potential impacts on wildlife depends on how long construction takes, if activities happen in the day or night, and the season of wildlife activity (e.g., nesting, wintering, migration). The type of impacts associated with construction activities are generally related to habitat disturbance or conversion and wildlife disturbance, injury, or mortality.

More mobile wildlife would avoid areas where activities are occurring. Terrestrial wildlife species that are less capable of avoiding disturbance include non-winged invertebrates, reptiles, juvenile mammals, burrowing species, and nesting birds. These would be more severely affected than more mobile wildlife species by site characterization, construction, or decommissioning activities.

Construction of solar facilities may require the removal of most vegetation in the solar field and for roads and gen-tie ROWs. Construction may also increase the risk of invasive species introduction and changes in species composition and distribution. It could also result in erosion, dust, altered drainage patterns, increased human access, spills from construction-related chemicals or fuel, soil compaction or removal, or sedimentation.

Impacts on special-status species would be greater than those described for non-special-status species because special-status species vitality and populations are more sensitive to impacts, and these populations are often geographically restricted.

Decommissioning activities would be similar to construction. Vegetation would be removed or damaged in areas of disturbed soil, and these areas would require the re-establishment of plant communities. However, the disturbance of vegetation would be expected to primarily occur in areas previously disturbed by construction. Wildlife could be affected by changes to existing habitats depending on the extent of infrastructure that would need to be removed, generation of waste materials and accidental spills, future land use, and the amount of required site restoration (e.g., regrading, revegetation). Restoring a site to pre-project conditions could take several years and for some habitat types, such as sagebrush-dominated shrubsteppe, restoration could take several decades.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, some construction and decommissioning activities of utility-scale solar energy facilities would result in **less than significant impacts** to terrestrial vegetation, including special-status plants. Activities that cause the permanent degradation, loss, or conversion of suitable habitat that is critical to species viability would result in **potentially significant adverse impacts** on terrestrial vegetation.

Through compliance with laws, permits, and with implementation of actions that could avoid and reduce impacts, some construction and decommissioning activities of utility-scale solar energy facilities would result in **less than significant impacts** to terrestrial wildlife, including special-status species. Activities that affect species viability, the mortality of any individual species, or disturbance that disrupts successful breeding and rearing behaviors would result in **potentially significant adverse impacts** on terrestrial wildlife.

Aquatic habitats and species

Utility-scale solar facilities are unlikely to be sited in aquatic areas and most aquatic impacts can be avoided or minimized. Construction may affect aquatic habitats and species through site clearing and grading, installing permanent meteorological towers, constructing access roads, excavating and installing solar field and associated infrastructure, and gen-tie line corridor construction.

During construction and decommissioning, aquatic habitats and species could be affected by a temporary increase in erosion during the building and removal of access roads and culverts. They can also be affected by soil compaction, vehicle and foot traffic through aquatic habitat, release of hazardous materials, introduction of invasive plant species, and disturbance. Removal of facility infrastructure and access roads could also alter drainage patterns on the site, potentially affecting aquatic habitat nearby. Installing and removing buried cables could introduce sediments into adjacent waterbodies through runoff and erosion. Such impacts could be minimized by the implementation of erosion control, soil decompaction, and hazardous material management plans and BMPs. Impacts could be minimized by implementing erosion control measures, BMPs, and safe equipment and hazardous material management.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on aquatic habitats and species.

Wetlands
Wetlands may need to be cleared and/or filled for the construction of staging/laydown areas, access roads, gen-tie line corridors, and other supporting facilities. Roads and other infrastructure constructed in the vicinity of wetlands could change surface drainage patterns and/or introduce sediments or pollutants into those areas via runoff. Building or removing access roads and culverted road crossings from wetlands could temporarily increase erosion potential. This would disturb species in the vicinity.

State law requires a mitigation plan be developed and approved to ensure there is no net loss of wetland functions for wetlands and wetland buffers. A facility would require an approved wetland mitigation plan before permits are issued.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of utility-scale solar energy facilities would result in **less than significant impacts** to wetlands.

Impacts from operation
Operation of solar energy facilities would likely occur mainly in upland areas. Gen-tie lines, roads, and fencing may cross wetlands, streams, or rivers, and sites may include wetlands. Operations could cause ongoing or repeated disturbance of terrestrial and aquatic habitats.

Terrestrial habitats
Impacts on terrestrial habitats associated with the operation of utility-scale facilities include impacts from the long-term effects of habitat fragmentation, degradation, or loss associated with the facility ongoing operations and maintenance activities. Adjacent habitats may also be affected by the long-term effects of habitat fragmentation, degradation, or loss, as well as by disturbances from human activities and noise and movement from maintenance vehicles.

The introduction and spread of invasive vegetation from vehicle and human disturbance could result in long-term impacts on terrestrial habitats. Vehicle movements and trampling by humans may lead to soil erosion.

Migration routes and wildlife corridors could be anywhere from 200 meters to several miles wide depending on the species. Migratory species that may be affected include birds, deer, pronghorn, and elk species. Solar energy development may affect the long-term persistence of existing wildlife migration corridors, particularly where herds use relatively narrow corridors.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, some operation activities of utility-scale solar energy facilities would result in **less than significant impacts** to terrestrial habitats, including special-status habitat. Activities that cause the permanent degradation, loss, or conversion of suitable habitat that is critical to species viability or disrupt habitat continuity along migration routes would result in **potentially significant adverse impacts** on terrestrial habitats.

Terrestrial species
Operations could affect the viability of plant communities within and near facilities as a result of mowing and vegetation maintenance. Impacts could also occur from use of herbicides, trampling and soil compaction from humans and vehicles, and from fire suppression.

The introduction and spread of invasive vegetation could also result in long-term impacts on plant communities. The increase in edge habitats, vehicle movements, and trampling by humans can create gaps in vegetation and allow exotic, non-native plant species to become established and displace native species over time. In addition, changes to wildlife diversity could affect pollinators for plants. These factors could lead to loss of native plant species and vegetation communities.

Operations could result in adverse effects to wildlife depending on number, sizes, and locations of the solar fields and gen-tie lines in relation to bird and bat activities. Birds and bats are at risk of collisions with gen-tie lines and vehicles, and all wildlife may be potentially affected by noise, vehicle traffic, hydrologic changes, and runoff.

Specific impacts would depend on the types of habitats affected, the amount of habitat disturbance over time, the amount and type of infrastructure present, and the occurrence and use of those areas by special-status species. Impacts could be avoided through siting and design of a facility. Impacts on special-status species could result from the following:

- Long-term effects from reduced species use of habitat due to changes such as mowing or vegetation management
- Collision with gen-tie lines and facility fences
- Noise from solar energy support machinery, motorized vehicles, and mowing equipment
- Periodic habitat disturbance within the gen-tie line ROWs and along the access roads from maintenance activities, including the risk of oil or other contaminant spills and the continued spread of invasive species
- Altered migration routes
- Disturbance to foraging, breeding, and nesting behaviors due to placement of facilities or increased human activities
- Altered fire regimes that negatively impact fire-adapted species

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, some operation activities of utility-scale solar energy facilities would result in **less than significant impacts** to terrestrial wildlife. Activities that affect species viability would result in **potentially significant adverse impacts** on terrestrial wildlife.

Aquatic habitats and species
During operations, potential impacts from the use of motorized equipment and runoff of surface soils would be minimized by limiting the amount of maintenance activities occurring near riparian and aquatic habitat. The risk of waterbody contamination from hazardous materials used in site maintenance would be minimized through restriction of machinery use and herbicide and pesticide application near waterways. If water drainage patterns, sediment delivery to waterbodies, riparian area function, or water quality are changed during construction, those impacts could continue to affect aquatic habitat and species during the operational period.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of utility-scale solar energy facilities would likely result in **less than significant impacts** on aquatic habitats and species.

Wetlands
Operations could affect wetland plant communities as a result of mowing and vegetation maintenance, application of herbicides, and soil compaction from humans and vehicles. Activities could affect native amphibian species dispersal into and out of wetland breeding habitats. Wetland impacts could be minimized through the proper management of wastewater systems and safe use and management of hazardous materials.

Findings
Through compliance with laws, permits, and with implementation of actions that could avoid and reduce impacts, the operation of utility-scale solar energy facilities would likely result in **less than significant impacts** on wetlands.

4.6.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix E, *Biological Resources Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

WDFW is developing mitigation guidelines for solar facilities and expects to finalize them by the end of 2024. WDFW's mitigation guidelines will be incorporated into this section in the Final PEIS.

Siting and design considerations

Terrestrial habitats and species

- Contact appropriate agencies early to identify potentially sensitive ecological resources.
- Site and design the facility to avoid priority habitat, such as shrubsteppe habitat, to the maximum extent possible.
- Conduct surveys for special-status habitat and species. If special-status habitat or species are observed, site and design the facility to avoid individuals and populations to the extent possible.
- Screen potential facility sites through local, state, and federal mapping resources to identify sensitive habitat and wildlife areas and critical areas such as steep slopes, priority habitats, and sensitive species occurrence locations to avoid these areas.
- Have all pre-construction biological surveys, such as special status plant surveys, conducted by qualified biologists following accepted protocols established by federal or state regulatory agencies.
- Establish buffer zones around sensitive habitats and areas identified as critical to sensitive species (e.g., nests) and exclude or modify facilities and activities within those areas.
- Consider the Washington State University Least-Conflict Solar Siting Study maps (conservation layer) to avoid areas identified as having highest conservation value.
- Site and design facilities to minimize habitat loss, habitat fragmentation, and resulting edge habitat.
- Use existing roads. Limit new road construction. Design new roads to follow natural land contours and avoid or minimize hill cuts in and adjacent to a facility site.
- Minimize overhead collector lines, unless underground collector lines are not appropriate or feasible due to environmental conditions or cultural or Tribal resource concerns.
- Avoid construction during bird nesting seasons to the maximum extent possible. If construction occurs during bird nesting seasons, conduct nest clearance surveys prior to site disturbance.
- Avoid surface water or groundwater withdrawals that affect sensitive habitats (e.g., riparian habitats) and any habitats occupied by special-status species.

Aquatic habitats and species

- Contact appropriate agencies early to identify potentially sensitive ecological resources, including but not limited to aquatic habitats, wetland habitats, and special-status species locations and habitats, as well as designated critical habitat, that might be present in the area proposed for a facility and associated access roads and ROWs.
- Site and design the facility to avoid all types of aquatic habitat to the maximum extent possible.
- Conduct an aquatic habitat survey of the site to identify surface waters, their drainage routes, and the potential habitat that they provide.

- Have all pre-construction biological surveys conducted by qualified biologists following accepted protocols established by federal or state regulatory agencies, to identify and delineate the boundaries of important, sensitive, or unique aquatic habitats and wildlife species within and adjacent to the facility including waters of the United States, wetlands, springs, seeps, ephemeral streams, intermittent streams, 100-year floodplains, ponds and other aquatic habitats, and habitats supporting special-status species populations.
- Avoid or minimize impacts on streams by designing the site and roads to avoid or minimize crossing streams. Design stream crossings to minimize permanent impacts as required in WAC 220-660-190 and local regulations.
- Avoid surface water or groundwater withdrawals that affect sensitive habitats (e.g., aquatic habitats) and any habitats occupied by special-status species.

Wetlands

- Perform a wetland reconnaissance or delineation study on the site to identify and map any potential wetlands that may be present.
- Avoid siting structures and roads within wetlands or wetland buffers.

Additional mitigation measures to address potentially significant impacts
Terrestrial habitats and species

- Designate a qualified biologist to be responsible for overseeing compliance with and implementation of all mitigation measures in the Wildlife Habitat Mitigation Plan.
- For impacts to shrubsteppe habitat, incorporate higher compensatory mitigation ratios because such a large percentage of the shrubsteppe landscape in Washington has already been lost.
- Develop mitigation measures using WDFW's recommendations for solar power mitigation for temporary and permanent impacts to wildlife and habitat.

4.6.4 Findings for facilities with co-located BESS

4.6.4.1 Impacts

Impacts from construction, operation, and decommissioning
The potential impacts on biological resources for facilities with co-located BESSs would be similar to the impacts considered for utility-scale facilities related to site characterization, construction, operations, and decommissioning.

Co-locating BESSs would require some additional construction-related ground disturbance and an increased building footprint. The presence and use of a BESS at a solar energy facility would add another stormwater consideration to a facility due to the container and concrete foundation. BESSs require HVAC units, which could generate increased noise that may disturb wildlife.

Overall, BESSs are not expected to substantially add to the overall level of impact on terrestrial habitats and species if BMPs are implemented. In addition, during normal operations, BESSs are unlikely to release reactive or toxic substances, so it is unlikely the BESS would additionally impact terrestrial habitats and species.

> *Findings*
> Impacts on biological resources would be similar to findings for utility-scale solar facilities above.

4.6.4.2 Actions to avoid and reduce impacts

Actions for reducing impacts for facilities with a co-located BESS are the same as those identified for utility-scale solar energy facilities without a co-located BESS with the following additional measure:

- Site all BESS facilities and associated infrastructure away from surface waters and wetlands.

4.6.5 Findings for facilities combined with agricultural land use

4.6.5.1 Impacts

Impacts from construction, operation, and decommissioning
The potential impacts on biological resources for solar facilities that include combined agricultural use would be similar to the impacts considered for solar facilities without agricultural uses related to construction, operations, and decommissioning.

Impacts for agrivoltaic facilities would differ from facilities without combined agricultural land use as follows:

- Because the solar panels for agrivoltaic facilities could be raised or modified to allow for growing crops, creating pollinator habitat, or grazing underneath them, the impact of the panels on local surface water hydrology, infiltration, and groundwater recharge may be reduced. With raised or movable panels, more rain and snow would likely reach the ground directly beneath the panels.
- The solar panels may be organized in a more dispersed way to allow for enhanced agricultural activities and grazing, which may provide additional corridors for some species.
- Agricultural activities could include maintenance of existing or addition of new infrastructure, roads, fences, gates, and traffic, which could have proportionately increased impacts on habitats and species.
- Human use at a site would increase for agrivoltaic facilities due to continued or new agricultural use and would result in an increase in noise, herbicide and pesticide use, crop rotation, and livestock activities that would impact habitats and species.

Findings

Impacts on biological resources would be similar to findings for utility-scale solar facilities above.

4.6.5.2 Actions to avoid and reduce impacts

Actions for reducing impacts for facilities with co-located agricultural land use are the same as those identified for facilities without agricultural land uses.

4.6.6 Findings for the No Action Alternative

The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for site characterization, construction, operations, and decommissioning, depending on facility size and design, and would range from **less than significant adverse impacts** to **potentially significant adverse impacts** on terrestrial and aquatic habitats and species, including wetlands.

4.6.7 Unavoidable significant adverse impacts

Construction and operation of solar facilities may result in **potentially significant and unavoidable adverse impacts** on terrestrial special-status habitats and species if activities cause the permanent degradation, loss, or conversion of suitable habitat that is critical to habitat or species viability, affect the mortality of any individual species, cause a disturbance that disrupts successful breeding and rearing behaviors, or disrupt habitat continuity along migration routes. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site. Mitigation to reduce impacts below significance for terrestrial special-status habitats or species may not be feasible.

4.7 Energy and natural resources

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on energy and natural resources.

No significant and unavoidable adverse impacts on energy and natural resources would occur.

This section describes sources and availability of energy and natural resources and the amount that would be required by the facilities considered in this PEIS. Impacts on public service or utility providers are described in the public services and utilities resource section. Emissions associated with use of energy and natural resources are described in the air quality and greenhouse gases section.

The *Energy and Natural Resources Report* (Appendix F) includes the full analysis and technical details used to evaluate energy and natural resources in the PEIS. This section contains a summary of how impacts were analyzed and the key findings.

4.7.1 Affected environment

The type and quantity of energy and natural resources used in construction and operation can affect overall availability of these resources for other uses. The resources evaluated include electricity, transportation fuel, and construction aggregate.

4.7.1.1 Electricity

In 2023, Washington state used 88,702 million kilowatt-hours (kWh) of electricity, while it produced 98,725 million kWh.

4.7.1.2 Transportation fuel

Transportation fuels include gasoline and diesel fuel. In 2019, Washington consumed 2.8 billion gallons of gasoline and 950 million gallons of diesel fuel. Washington has several refineries and imports crude oil from Alaska and other locations and exports refined products. The state has a processing capacity of 648,000 barrels of crude oil per day, which produces 4.2 billion gallons of gasoline and 2.5 billion gallons of diesel annually. Much of this is exported.

4.7.1.3 Construction aggregate

Construction aggregate is a collective term for sand, gravel, and crushed stone. State production is monitored by USGS and surface mine permitting is handled by DNR. Though it is a non-renewable resource, construction aggregate is readily available in Washington. In 2023, the state produced 30.9 million metric tons of sand and gravel, and 14.4 million metric tons of crushed stone.

4.7.2 How impacts were analyzed

The assessment of impacts was qualitative and considered if utility-scale solar facilities could result in increased demand for electricity, transportation fuel, or construction aggregate that could require new mines or affect statewide annual production.

4.7.3 Findings for utility-scale solar facilities

4.7.3.1 Impacts

Impacts from construction and decommissioning

Electricity

During site characterization, construction, and decommissioning activities, electricity would be needed to power tools, equipment, and lighting. This demand could either be met with diesel fuel from portable generators or with electricity provided by a utility.

Transportation fuel
Facilities would consume transportation fuels during construction and decommissioning for worker commuting, haul-truck trips, and site equipment. The combined transportation fuel consumed by worker commuting, delivery, and site equipment would range from 127,000 to 5.64 million gallons based on the facility size. This represents 0.004% to 0.2% of the total transportation fuel resource produced in the state for the 6- to 18-month construction period. Decommissioning would require similar amounts.

Construction aggregate
Construction of facilities would use aggregate for concrete foundations for the solar array, gen-tie lines, and buildings and for constructing access roads. Gravel would likely be used for parking areas and equipment storage areas.

Facilities would require between 5,750 cubic yards and 345,000 cubic yards of aggregate based on the facility size. This is 0.01% to 0.76% of the total available resource produced annually in the state. Aggregate may need to be obtained from multiple mines, depending on the facility location.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on energy and natural resources.

Impacts from operation
Electricity
A facility would consume electricity during operations and for maintenance. Electricity would be used to power the panel array tracking system, buildings, sensors, lights, and other features. A facility may use energy either from its own generation or the local electric utility.

Transportation fuel
Utility-scale facilities would consume gasoline and diesel fuels to power maintenance vehicles during operations. Demand for transportation fuels during the operations phase would be estimated at about 58 gallons of diesel and/or gasoline per year, per MW. Depending on the facility size, a facility would require between 1,150 gallons and 69,000 gallons throughout the operations phase.

Construction aggregate
During operations and maintenance, only a small amount of construction aggregate would be needed to maintain maintenance roads. Assuming a new surface gravel would be required every 5 years to a thickness of 4 inches, the average annual demand would range between 500 to 31,000 cubic yards depending on facility size and access points.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operations of facilities would likely result in **less than significant impacts** on energy and natural resources.

4.7.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix F, *Energy and Natural Resources Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Limit construction of new roads. Base design and planning of new roads on regulatory requirements and standards, and on local conditions.
- Minimize electricity demand by using facility power for operational needs whenever possible, and by using high-efficiency fixtures, appliances, and security lighting.

4.7.4 Findings for facilities with co-located BESS

4.7.4.1 Impacts

Energy use for facilities with BESSs would be similar to the impacts considered for utility-scale facilities without BESSs related to site characterization, construction, operation, and decommissioning. Specific differences are summarized in the following sections.

Impacts from construction, operation, and decommissioning
Electricity
Electricity use may be more intensive for short periods during testing of the installed BESS equipment. The demand for energy during construction is not expected to require new or substantially modified production or energy transmission. Decommissioning of a facility with co-located BESS would require similar electricity as anticipated during construction.

Transportation fuel
Adding BESSs to solar facilities would require additional hours for construction and installation, increasing demand for transportation fuels to support worker commuting. Delivery of BESS components to the work site would increase demand for transportation fuels to support materials and equipment delivery. The increase in fuel demand created by BESSs would be minimal compared to what is already demanded by the facility construction. Decommissioning would have approximately the same demand for transportation fuels as construction.

Construction aggregate
A BESS would typically be installed on a concrete slab. The concrete needed for these slabs would require an additional approximately 1,000 cubic yards of aggregate per BESS. These additional aggregate needs for the BESS would not be a large increase relative to the amounts for utility-scale facilities without a BESS.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operations, and decommissioning of facilities with a co-located BESS would likely result in **less than significant impacts** on energy and natural resources.

4.7.4.2 Actions to avoid and reduce impacts

Actions for reducing impacts for facilities with a co-located BESS are the same as those identified for facilities without a co-located BESS.

4.7.5 Findings for facilities combined with agricultural land use

4.7.5.1 Impacts

Energy use for facilities co-located with an agricultural use would be similar to the impacts considered for utility-scale facilities not co-located with an agricultural use related to site characterization, construction, operation, and decommissioning. Specific differences are summarized below.

Impacts from construction, operation, and decommissioning
Agrivoltaics can be expected to increase solar energy production from the cooler air zone that would be created under modules. Agriculture uses can also draw significant amounts of electricity, in particular for running irrigation pumps. Agricultural uses would require additional transportation trips and associated fuel consumption. Agrivoltaics systems are also expected to demand less construction aggregate than for utility-scale facilities not co-located with an agricultural use because system design would maximize arable land and minimize incursions from access roads.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operations, and decommissioning of facilities with co-located agricultural use would likely result in **less than significant impacts** on energy and natural resources.

4.7.5.2 Actions to avoid and reduce impacts

Actions for reducing impacts for facilities with and without agriculture are the same.

4.7.6 Findings for the No Action Alternative

The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on facility size and design, and would be **less than significant adverse impacts.**

4.7.7 Unavoidable significant adverse impacts

Through compliance with laws, permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale solar facilities would have **no significant and unavoidable adverse impacts** on energy and natural resources from construction, operation, or decommissioning.

4.8 Environmental health and safety

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction, operations, and decommissioning activities would likely result in **less than significant impacts** related to hazardous materials and health and safety.

Depending on the specific location, severity, and fire response capacity (described in Section 4.15), there is potential that construction, operations, and decommissioning of a facility would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.

A thermal runaway event due to damage or battery management system failure at a facility with a co-located lithium-ion BESS would have a **potentially significant adverse impact** related to hazardous air emission risks for emergency responders.

If there are new ignition sources in remote locations with limited response capabilities, this may result in **potentially significant and unavoidable adverse impacts**. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

EHS refers to the risks or hazards that threaten the well-being of people or other elements of the environment. Impacts related to emergency response services are discussed in Section 4.15, Public Services and Utilities. The *Environmental Health and Safety Resource Report* (Appendix G) includes the full analysis and technical details used to evaluate EHS in the PEIS.

4.8.1 Affected environment

Workplace accidents or system failures can result in EHS hazards, such as fires, explosions, hazardous material spills, injury, or structural damage. In this section, EHS includes hazardous materials and toxic substances exposure, health and safety, and wildfire hazards.

4.8.1.1 Hazardous materials

Hazardous materials include petroleum products, heavy metals, pesticides, fertilizers, solvents, compressed gases, and batteries. Large concentrations of these materials are found at industrial sites, commercial properties, and agricultural lands. Small quantities of hazardous materials may also be present along roads due to vehicular activity or illegal dumping.

Ecology regulates and monitors the storage, use, and disposal of hazardous materials. Active land uses in the study area that handle hazardous materials must document their presence. A large portion of these hazardous materials are associated with agricultural land uses in rural areas. Toxic substance cleanup sites are recorded in Ecology's Contaminated Site Register.

4.8.1.2 Health and safety risks

Hazardous materials may affect workers and emergency responders at utility-scale solar facilities. Solar panels and electrical components and structures may pose risks of electrical hazards and accidents during maintenance activities.

4.8.1.3 Wildfire risk

Wildfires pose significant risks of injury, loss of life, and damage. Wildfires can occur from either humans or natural causes. Washington has experienced extreme fire events, partly due to climate change and forest fire suppression practices, and this is expected to increase in the future. The combination of longer fire seasons, population growth, and declining forest health increases wildfire risks.

The landscape, weather conditions, and vegetation present can influence the degree of fire risk and fire behavior in an area. The region west of the Cascade Mountains receives more rain, while eastern Washington (where most of the study area is located) is drier and more prone to wildfires. Weather conditions such as wind, temperature, and humidity also influence fire behavior.

Wildfire risk is increasing in Washington due to climate change. Climate change impacts variables related to fire risk, including temperature, precipitation, humidity, and forest health. The University of Washington's climate resilience mapping projects a significant increase in high fire danger days between 2040 and 2069. The region's most at-risk areas include the eastern slope of the Cascades, Okanogan Big Bend, northeastern Washington, and the Blue Mountains of the southeastern Palouse.

4.8.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Potential for release of hazardous materials that increases the risk of environmental contamination (e.g., air or water) or increased threat to human health and safety
- Increase in physical safety risks resulting in a high likelihood of harm to facility workers or the public
- Increase in wildfire risk and associated hazard conditions

4.8.3 Findings for utility-scale solar facilities

4.8.3.1 Impacts

Impacts from construction and decommissioning

Hazardous materials

Hazardous materials may be present in solar modules, including cadmium telluride, copper indium diselenide, and copper-indium gallium selenide. Hazardous materials in solar modules are typically only present in small amounts, and some modules do not contain hazardous materials or contain them in amounts small enough to not be classified as hazardous materials.

The International Energy Agency conducted a human health risk assessment and found 0.04% of solar panels may break during transport, installation, or during operations. It looked at impacts from runoff and exposure. The study found exposure from broken panels is below USEPA health screening levels for soil, air, and groundwater.

Hazardous materials are present in vehicles, construction equipment, transformers, and other materials used in utility-scale facility construction and decommissioning. These include petroleum products, hydraulic fluids, batteries, solvents, corrosion control coatings, and spent hazardous material containers. Solar facilities store and use these in small quantities. If more than 1,320 gallons of petroleum fuel is stored on site, an SPCC Plan would be required. In the case of accidents, equipment failure, or damage to construction materials, spills of small amounts of hazardous materials are possible. The Washington State Model Toxics Control Act regulates the handling and cleanup of these types of hazardous materials. Spills would need to be contained, assessed, and remediated, with hazardous waste transported and disposed of in line with state and federal regulations.

Decommissioning could involve a higher risk of releasing hazardous materials due to degradation of facility components or dismantling facility components. This phase would also include recycling and disposal of solid and hazardous waste. A substantial portion of the materials that make up solar energy facilities are recyclable, such as steel, aluminum, glass, copper, and plastic. Under state law, by 2025 manufacturers of solar energy modules that operate or sell solar panels in Washington state will be required to take back and recycle them.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** related to hazardous materials.

Health and safety

Construction activities in the study area would present similar health and safety risks to workers as those that are present on other industrial construction sites. Common occupational health and safety risks include falls from facility structures, collisions with construction vehicles, and exposure to electricity, hazardous materials, fire, the elements, or noise. Impacts on the public are unlikely. Decommissioning could involve a higher risk of exposure for workers to hazardous materials, electricity, or fire due to degraded or malfunctioning facility components. Public access to the facility would be restricted by fences which would limit public exposure to potential hazards.

Facilities would follow Occupational Safety and Health Act (OSHA) regulations. Additional health and safety requirements would be established during site-specific, facility-level planning to address hazards specific to the facility.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** related to health and safety.

Wildfire risk
Construction and decommissioning of solar energy facilities could generate ignition risks from equipment or materials. The likelihood of a solar energy facility or related gen-tie lines igniting a wildfire is low. These risks are similar to other industrial facilities and require careful management, especially in areas of high fire risk. Fires from PV solar panels are rare. Facilities could alter the behavior of fire due to structures, mowing, and land use changes. Equipment would need to meet state and international building and fire code standards. Proactive planning with federal, state, and local wildfire and emergency response agencies and compliance with OSHA requirements would reduce construction-related ignition risks. See Section 4.15 for an evaluation of fire response impacts.

Findings
Depending on the specific location, severity, and fire response capacity (described in Section 4.15), there is potential that construction and decommissioning of a facility would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.

Impacts from operation
Hazardous materials
Accidents or failures that could result in the release of hazardous materials are rare, and are typically small quantities that would not likely result in risk of environmental contamination or threats to human health and safety.

Hazardous materials present would be consistent to those used during construction. Operations and maintenance of a facility would require fewer on-site personnel and less-intensive labor than construction, which would result in lower use of vehicles and equipment that could accidentally release hazardous materials.

A facility’s exposure to the elements and degradation over time could potentially increase the risk of damage or infrastructure failure. In the case of a wildfire that damages PV panels, exposure would likely be limited to on-site workers or emergency responders. Damaged PV modules would be disposed of under state and federal rules.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** related to hazardous materials.

Health and safety
The types of occupational health and safety hazards during operation are similar to those during construction. However, the scale and intensity of on-site labor would be much less, reducing the risk of falls, vehicle collisions, and noise exposure. While accidents could occur, laws, regulations, and industry standards are in place to prevent health and safety hazards in the workplace. Additionally, public access to the facility would be restricted.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** related to health and safety.

Wildfire risk
The potential for solar energy facilities to contribute to wildfire risk considers ignition risk associated with operations activities, along with the change in the landscape due to the presence of the facility. Fires from PV solar panels are very rare. The presence and use of electrical equipment at the facilities, including gen-tie lines, would have risks of ignition. Most wildfires started by electrical power are caused by the contact of trees and surface fuels with power lines. All solar and electrical equipment would be required to conform to state and international building and fire code standards and these facilities would be regularly maintained and monitored to reduce ignition risks. Accidents and fires could still occur. There is a low likelihood of operations activities igniting a wildfire. Operations and maintenance activities would also include regular mowing and trimming of trees to control vegetation on the facility sites and associated electrical corridors. While these activities reduce a fuel source, they also involve ignition risks that could generate sparks and cause wildfires, which could spread into the surrounding landscape. However, these risks can be reduced through appropriate implementation of an Operational Site Safety Management Plan. See Section 4.15 for an evaluation of fire response impacts.

Findings
Depending on the specific location, severity, and fire response capacity, there is potential that operation of facilities would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.

4.8.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix G, *Environmental Health and Safety Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- In areas susceptible to wildfires, coordinate with local fire organizations early in the facility planning process to determine measures that would be incorporated into the design of the facility to prevent an increase in wildland fire frequency.
- Design facilities to reduce risks to neighboring land uses from gen-tie lines or other solar facility components, including potential setbacks, to reduce the risk of ignitions in fire-prone environments.
- Determine appropriate setbacks in consultation with local, state, or federal land managers. Setback distances should consider proximity to residences, terrain, vegetation management clearance requirements for gen-tie lines, vegetation and natural communities on surrounding lands, and the need to maintain access for maintenance and emergency response, among other considerations.
- Install water cistern(s) on site to store water for wildfire and structure fire suppression needs, as determined by the local fire marshal.
- Implement lightning protection measures to protect generators and other associated ground equipment, as well as reduce the potential for wildfires or other damage to equipment.
- Establish roads before accessing the site to minimize vehicle contact with grass.
- Design gen-tie ROWs to be wide enough to ensure there is a sufficient firebreak inside the ROW.
- Consider underground gen-tie lines for areas with high-fire risk.
- Design a minimum 20-foot, noncombustible, defensible space clearance around the solar site perimeter fencing and structures, particularly buildings, to serve as a fire break.
- Install fire protection equipment in accordance with Washington State fire code.
- Locate refueling areas on paved surfaces and away from surface water locations and drainages; features should be added to direct spilled materials to sumps or safe storage areas where they can be subsequently recovered.
- Align solar arrays to reduce or avoid glare impacts on off-site areas.
- Select solar panels that can be recycled (for damaged or end-of-life modules) to reduce their negative impact on the environment.

Additional mitigation measures to address potentially significant impacts

- Develop and implement a site-specific Emergency Management Plan to address worker health and safety, standards concerning potential release of hazardous materials, and site-specific Construction/Operational Fire Prevention and Response Plans for fire prevention and control. These plans provide safety guidelines and procedures for

potential emergency-related incidents during the facility's construction, operation, and decommissioning phases. The plan must meet applicable laws/codes, and should be developed in coordination with local fire and emergency service providers.
- In areas susceptible to wildfires, coordinate with local fire organizations and emergency management departments early in the facility planning process to determine measures to be incorporated into the design of the facility to prevent an increase in wildland fire frequency.
- The construction and facility manager would be responsible for contacting DNR and/or the U.S. Forest Service (USFS) for updates on wildfire conditions in the area and implementing any necessary wildfire precautions.
- Ensure that emergency service providers receive specialized training and are fully informed regarding the facility's fire and hazardous materials risks and how to safely respond to fires.
- Wildfire activity would be monitored during facility construction, decommissioning, and operation and, if necessary, activities would be modified, schedules changed, construction or operation ceased, or equipment removed.
- Staff who have 24-hour access to the site would be trained to prevent and control potential wildfires and structure fires inside the facility.

4.8.4 Findings for facilities with co-located BESS

4.8.4.1 Impacts

Impacts from construction, operations, and decommissioning

Hazardous materials

Additional hazardous materials for construction of facilities with co-located BESSs include the following:

- Battery electrolytes, typically used in vehicle, equipment batteries, and BESSs
- Materials typically used in anti-conductive insulation for electric components, such as wires

This PEIS analyzes impacts from lithium-ion, iron-flow, and zinc-bromide batteries. Batteries from the BESS would contain toxic chemicals that could be hazardous in the event of a system failure, which could result in the battery leaking. If the batteries overheat or are damaged, they could leak toxic gases. This would be less likely during construction compared to operation because BESSs would not be storing energy generated on site, which would greatly reduce the likelihood of batteries failing due to overheating. There could be risk of hazardous materials leaks from batteries during operations due to the potential for batteries to leak or ignite when overheating from energy storage. BESS storage includes containment for spills. Similar to facilities without a BESS, the Model Toxics Control Act would dictate the handling and cleanup of these types of hazardous materials.

Flow batteries and zinc-bromide batteries are generally not flammable. Firefighting does not typically use water because it can increase exposure to toxic chemicals through smoke, vapor, or contaminated runoff. Once a fire has self-extinguished, there may be releases of flammable or toxic gases. Spraying water on smoke or vapor released from the battery, whether burning or not, may cause skin or lung irritation. This is one additional reason for allowing the battery to burn in a controlled manner. The site should be entered only by trained firefighters wearing full protective gear.

WAC 51-54A-0322 includes requirements for storage and fire prevention for lithium-ion and lithium metal batteries. A fire safety plan is required and must include emergency responses to be taken upon detection of a possible fire. Fire code officials may require a report to evaluate the fire and explosion risks associated with the storage area and to make recommendations for fire and explosion protection. The report must be approved by a fire code official.

During decommissioning, batteries would be stored, handled, and transported in accordance with either hazardous waste regulations or battery-specific disposal standards, which would reduce the risk of releases of hazardous material. Batteries can be recycled but are often disposed of as hazardous waste due to a lack of recycling service providers for batteries. Because of the growing use of lithium-ion batteries for energy storage and other purposes, the USEPA has proposed rules to establish waste management regulations specific to the batteries. The Washington State Legislature has directed Ecology to assess and recommend options for collection and end-of-life management of large batteries, such as those used in BESSs. Regardless of whether the batteries are recycled or disposed of as hazardous waste at their end of useful life, the batteries would be stored, handled, and transported in accordance with either hazardous waste regulations or battery-specific disposal standards, which would reduce the risk of releases of hazardous material.

Health and safety

Facilities with BESSs would largely include the same health and safety risks during construction, operations, and decommissioning as other utility-scale facilities without BESSs, with higher operating risks due to the health and safety risks associated with BESSs. The addition of BESSs could create hazards with the possibility of explosions, flammable gases, toxic fumes, water-reactive materials, electrical shock, corrosives, and chemical burns that could affect human health and safety. Batteries in the BESS could impact worker health and safety if there was a release of hazardous materials or a fire. Exposure to toxic gases leaking from damaged batteries could cause irritation to the skin and lungs. Battery failures that could produce these health and safety impacts are rare. Compliance with requirements, regular maintenance, and proactive emergency plans would help mitigate risks.

Wildfire risk

Facilities with co-located BESSs would largely include the same wildfire risks during construction, operations, and decommissioning as those described for other utility-scale facilities without BESSs. The BESSs present additional fire risk and risks to emergency responders, and utility-scale energy storage requires specialized and reliable equipment to perform firefighting operations; further details are available in the *Public Services and Utilities Resource Report* (Appendix N).

Battery overheating events due to damage or failure of battery management systems are very rare for BESSs and, if properly installed and maintained, they are generally not flammable. Rooms and areas within buildings and walk-in units containing BESSs would be protected by an automatic fire protection system. Battery incidents require specialized response training for first responders due to risks from hazardous materials. Battery incidents can be difficult to extinguish, and some battery types can reignite above certain temperatures after being put out. WAC 51-54A-0322 requires lithium battery storage containers to include a fire protection system. As described above, an Emergency Response Plan would include emergency responses to be taken upon detection of a possible fire and including setback distances in siting and design would reduce risks of a fire spreading.

BESSs generally come equipped with remote alarms for operations personnel and emergency response teams, including voltage, current, or temperature alarms from the battery management system. Other protective measures include ventilation, overcurrent protection, controls to operate the batteries within designated parameters, temperature and humidity controls, smoke detection, and maintenance in accordance with manufacturers' guidelines.

Findings
Most impacts on EHS would be similar to findings for utility-scale solar facilities above. Facilities with lithium-ion BESSs would have **potentially significant adverse impacts** due to hazardous air emission risks to emergency responders associated with the BESS.

4.8.4.2 Actions to avoid and reduce impacts

Available actions for facilities with BESSs would be the same as those proposed for utility-scale facilities without BESSs. Additional actions relative to the BESS are detailed below.

Siting and design considerations

- BESSs should be designed and sited in a manner consistent with the current International Building Code and National Fire Protection Association (NFPA) Standards to minimize overheating and enable clearing of hazardous gases in the event of battery leaks or thermal runaway events. They must also comply with the latest Washington State Building Code Council regulations for batteries.
- Setback distances allowing for emergency accesses and management or removal of dry vegetation would also reduce risks of explosion and potential release of hazardous materials. If there is a thermal runaway event, the required setback distances also prevent spread from one container to another.

Additional mitigation measures to address potentially significant impacts

- Develop and implement fire protection, prevention, and detection measures and design features in accordance with NFPA 855 Standards for Installation of Energy Storage Facilities and the current Washington Fire Code, including requirements for providing redundant separate methods of BESS failure detection. In addition, the proponent should develop an Emergency Response Plan in advance of construction.

- Develop and implement comprehensive training programs and safety protocols for personnel involved in BESS operations and maintenance.
- Develop and implement regular maintenance schedules and inspections for BESS components to ensure optimal performance and early detection of potential issues.
- Develop and implement detailed emergency response plans specific to BESS operations to mitigate the consequences of potential damage or failure of battery management systems.

4.8.5 Findings for facilities combined with agricultural land use

4.8.5.1 Impacts

Impacts from construction, operations, and decommissioning

Hazardous materials

Hazardous materials for site characterization, construction, operations, and decommissioning would be the same as for utility-scale facilities without agricultural land use, but would also include agricultural machinery and equipment that may require use of petroleum and the use of fertilizers, herbicides, and pesticides. The use of farm vehicles or equipment could increase the risk of accidents that could release hazardous materials. Decommissioning would also include disposal of solid and hazardous waste.

The presence of agricultural operations does not greatly increase the risk of adverse impacts. Accidents or failures that could result in the release of hazardous materials are rare, and if they do occur, they are unlikely to result in environmental contamination or an increase in threats to human health and safety.

Health and safety

The types of health and safety hazards that people could be exposed to would largely be the same as those considered for utility-scale facilities without agricultural land use. Agricultural activities on site could increase the presence or risk of exposure to certain occupational health and safety hazards, such as potential exposure to fertilizers, pesticides, herbicides, livestock, biohazards associated with livestock, or other hazards associated with agricultural operations. Agricultural operations would not occur in active construction and decommissioning areas, but agricultural activities nearby could increase the risk of exposure to certain occupational health and safety hazards. The risk of exposure to occupational hazards that were present during construction would decrease during operation in conjunction with a decrease in the scale and intensity of on-site labor compared to construction. Decommissioning could involve a higher risk of exposure to hazardous materials, electricity, or fire due to degraded or malfunctioning facility components.

Wildfire risk

Construction, operations, and decommissioning of facilities combined with agricultural use would involve the use of equipment and activities that could generate ignition risks. Facilities with agricultural land use would entail active management of the vegetative landscape (e.g., grazing, crop production, pollinator habitat) in conjunction with solar energy facilities. Because there would be active management of the vegetative landscape and a beneficial cooling effect to the land, it is assumed that fire risk, and therefore demand for fire response, for the agrivoltaics sites would generally be reduced compared to facilities without agriculture. However, coordination to reduce potential ignition risks at the agrivoltaics sites would still be required and emergency responders could face delays or obstacles to accessing the facility because of fences or gates related to agricultural operations.

Findings
Impacts on EHS would be similar to findings for utility-scale solar facilities above.

4.8.5.2 Actions to avoid and reduce impacts

Available actions for facilities that include agricultural uses would be the same as those proposed for utility-scale facilities without agricultural land uses. Additional siting and design considerations relative to the co-located agricultural land use are detailed below.

- Engage in early consultation with agricultural operators to outline plans for acceptable compatible uses of the agricultural site.

4.8.6 Findings for the No Action Alternative

The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on facility size and design, and would range from **less than significant** to **potentially significant adverse impacts**.

4.8.7 Unavoidable significant adverse impacts

Construction, operation, and decommissioning of utility-scale solar facilities may result in **potentially significant and unavoidable adverse impacts** related to wildfires if there are new ignition sources in remote locations with limited response capabilities. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.

4.9 Noise and vibration

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction, operation, and decommissioning activities would likely result in **less than significant impacts** on noise and vibration.

Potentially significant adverse impacts related to noise would occur if:

- Construction, operations, or decommissioning activities occur within 1,000 feet of a noise-sensitive receptor in quiet rural areas
- During operations, stationary equipment is closer than 350 feet from a noise-receptor or closer than 1,100 feet from a noise-sensitive receptor in quiet rural areas
- During operations, facility substations are closer than 110 feet from a noise-sensitive receptor or closer than 350 feet from a noise-sensitive receptor in a quiet rural area, or substations for large facilities are closer than 650 feet from a noise-sensitive receptor or 2,000 feet from a noise-sensitive receptor in quiet rural areas
- Facilities with a BESS of certain design and consolidated configuration are closer than 1.5 miles from a noise-sensitive receptor

Potentially significant adverse impacts related to vibration would occur if:

- Pile driving during construction and decommissioning activities occur closer than 350 feet from residential land uses, or in close proximity to modern or historic structures
- Blasting is conducted within 2,000 feet of historic structures

No significant and unavoidable adverse impacts related to noise and vibration would occur.

Noise is unwanted sound that can affect people, fish, and wildlife. Vibration is motion through something solid, like the ground, which can affect living creatures or damage buildings. The information in this section summarizes the full analysis and technical details used to evaluate noise and vibration in the PEIS, which can be found in the *Noise and Vibration Resource Report* (Appendix H).

4.9.1 Affected environment

4.9.1.1 Ambient noise levels

Due to the large extent of the study area, ambient noise levels and their effect on the surrounding environment vary based on location. Generally, noise levels are higher around transportation corridors, airports, industrial facilities, and construction activities. Noise levels associated with general community activities throughout the study area can be estimated based on population density. More densely populated counties have background values between 45 and 55 A-weighted decibels (dBA); counties with sparser densities are less than 35 dBA.

Utility-scale solar energy facilities would typically be located in rural areas with low population density, where ambient sound levels would be low. Noise may be sporadically elevated in localized areas due to roadway noise or periods of human activity.

The existing acoustic environment could include existing wind turbines, motor vehicle traffic, mobile farming equipment, farming activities such as plowing and irrigation, all-terrain vehicles, local roadways, periodic aircraft flyovers, as well as natural sounds such as bird calls and wind. Sound moving through the air is affected by air temperature, humidity, wind and temperature gradients, vicinity and type of ground surface, obstacles, and terrain features. Natural terrain features such as hills, and constructed features such as buildings and walls, can significantly affect noise levels.

4.9.1.2 Noise-sensitive receptors

Some land uses are considered more sensitive to noise than others due to the amount of noise exposure and the types of activities typically involved. Residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, and auditoriums generally are more sensitive to noise than are commercial and industrial land uses.

Sensitive wildlife and habitats, including the habitat of rare, threatened, or endangered species, can also be affected by noise. For noise impacts on wildlife including airborne noise effects on terrestrial wildlife and waterborne noise effects on fish and marine mammals, please refer to the *Biological Resources Report* (Appendix E). Recreational uses are also sensitive to noises, please refer to the *Recreation Resource Report* (Appendix K) for an analysis of noise impacts on recreationists.

4.9.1.3 Vibration-sensitive land uses and structures

Sensitive receptors for vibration include structures, such as older masonry structures or historic structures, and people, particularly in residential locations during nighttime hours. Information on impacts on historic properties is included in the *Historic and Cultural Resources Report* (Appendix L).

4.9.2 How impacts were analyzed

Construction-related noise impacts were evaluated using the General Assessment methodology of the Federal Transit Administration (FTA) Noise and Vibration Impact Assessment Manual. The Federal Highway Administration’s Roadway Construction Noise Model was also used to calculate noise levels at certain distances for comparison to FTA’s published construction noise criteria. The approach for construction-related vibration impact assessment used an estimate of vibration generation at varying distances from specific construction equipment known to generate vibration.

For operational impacts from utility-scale solar energy facilities, reference noise levels from sources associated with these facilities were researched from existing facility-level analyses and a conservative estimate of noise generation with distance was developed for distances at which potential impacts of operational noise may occur from the extent of a solar energy facility footprint.

Noise impacts were also evaluated for likely conflicts with local ordinances, potential exposure of noise-sensitive land uses in excess of the FTA criteria, and potential to exceed the maximum permissible environmental noise levels specific to land use (Chapter 173-60 WAC). For residential uses, an environmental designation for noise abatement (EDNA) of 50 dBA would apply during nighttime hours. Note that most local jurisdictions and the noise standards in Chapter 173-60 WAC exempt sounds originating from temporary construction site activities between the hours of 7:00 a.m. and 10:00 p.m. In addition, WAC 173-60-050(2)(a) specifically exempts noise from electrical substations from its EDNA standards.

The extent of a noise impact would depend on the existing ambient noise level at any given receptor, and site-specific modeling would be needed for each future facility proposed. Existing noise levels are commonly low in rural areas where siting of energy facilities would likely occur. For facility operation, an increase of 5 dBA could result in a noise impact at noise-sensitive receptors.

Construction vibration impacts were evaluated for the potential to expose nearby land uses and structures to peak particle velocity levels that would meet or exceed FTA criteria.

4.9.3 Findings for utility-scale solar facilities

4.9.3.1 Impacts

Noise impacts from construction and decommissioning
Potential construction or decommissioning noise impacts would depend on the activities, terrain, vegetation, and local weather conditions as well as distance to the nearest sensitive receptors. Most sensitive receptors are assumed not to be located close to potential utility-scale facility locations.

Construction and decommissioning of a utility-scale facility could generate noise from multiple sources, including:

- Off-road equipment used for site preparation and construction
- Blasting
- Truck trips to bring materials to work sites including sand, fly ash, and cement to a concrete batch plant
- Noise generated by rock processing at a concrete batch plant and by pile driving

Off-road equipment noise for site preparation and construction
Heavy equipment use would vary during the site preparation and construction activities. The construction phase would also include noise-generating site characterization activities, including soil coring and the construction of meteorological towers. Typically, noise levels are highest during site preparation when land clearing, grading, and road construction would occur.

A prolonged noise contribution of 45 to 50 dBA could also result in a noise impact at noise-sensitive receptors located closer than 2,500 feet, particularly during nighttime hours. The extent of a construction or decommissioning noise impact would depend on the existing ambient noise level at any given receptor.

All construction and decommissioning activities except forklift operations would be below 45 to 50 dBA when the receptor is located 2,500 feet away. Pile driving or drilling may be needed to install solar panel foundations, which could have a duration of impact of several weeks during construction.

However, most construction activities would be temporary and of short duration. Most local jurisdictions and the noise standards in Chapter 173-60 WAC exempt temporary construction site noise between the hours of 7:00 a.m. and 10:00 p.m. Outside of these times, construction activities would be required to meet noise limits.

Blasting noise

Blasting within 50 feet would affect noise-sensitive receptors but this is not likely. Blasting is not expected to be needed for construction of most facilities but may occur as part of site preparation activities, depending on subsurface conditions. Blasting would typically be a part of site preparation and, therefore, not occur simultaneously with pile driving or other construction building activities. Noise generated by blasting is similar in magnitude to that of other construction activities. Decommissioning is not expected to require blasting.

Noise from trucks

Noise from trucks moving materials to and from a construction site would potentially increase noise levels along roadways used to access the solar facility. These truck trips would typically be made throughout the day, and, except in cases where substantial volumes of material would be hauled, the increase in noise levels would not be enough to result in a noticeable increase in traffic noise.

Concrete batch plant noise

Concrete batch plants may be used to provide material for construction of foundations and would occur simultaneously with pile driving or other construction activities. Estimated noise levels from a concrete batch plant during facility construction are similar in magnitude to that of other construction activities.

Decommissioning

Facility decommissioning activities would result in similar noise levels as would occur during construction, except for pile driving and blasting activities, which are not expected during decommissioning.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction and decommissioning activities would likely result in **less than significant impacts** related to noise.

If construction or decommissioning activities occur within 1,000 feet of noise-sensitive receptors in quiet rural areas, this would result in a **potentially significant adverse impact**.

Vibration impacts from construction and decommissioning
Potential construction and decommissioning vibration impacts would depend on the equipment, methods, and distance to sensitive receptors or structures. Construction may involve blasting and the use of equipment such as impact pile drivers and vibratory rollers, which can generate substantial vibration. Vibration from pile driving during construction would exceed the applicable FTA criterion at distances closer than 350 feet, while vibration from vibratory rollers would exceed FTA criterion at distances closer than 50 feet. All other construction and decommissioning equipment could be 25 feet or closer without exceeding FTA criteria. Therefore, vibration from specific activities occurring at distances closer than 350 feet from residential land uses could be a potential impact to people.

Vibration has the potential to result in architectural damage to nearby structures. Cosmetic damage could result from pile driving closer than 30 feet to a modern building, or closer than 80 feet to a historic building. Therefore, vibration from specific construction and decommissioning activities occurring in close proximity to modern or historic structures could result in building damage. However, these are not likely to be that close to utility-scale facilities.

Blasting could cause cosmetic damage to sensitive structures because of vibration or acoustic overpressures. Some types of blasting would result in vibration impacts on historic structures located within 2,000 feet.

Facility decommissioning would result in similar vibration levels as would occur during construction, except for pile driving and blasting activities, which are not expected during decommissioning.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction and decommissioning activities would likely result in **less than significant impacts** related to vibration.

Vibration from specific construction and decommissioning activities occurring at distances closer than 350 feet from residential land uses, or in close proximity to modern or historic structures, would be a **potentially significant adverse impact** with respect to human annoyance or building damage. If some types of blasting are conducted within 2,000 feet of historic structures, it would result in a **potentially significant adverse impact.**

Noise and vibration impacts from operation

Solar energy facility noise

The major noise sources during operations are inverters, inverter distribution transformers, and substation transformers. It is expected that all equipment would operate during the day, and only the substation transformers would operate at night. Larger facilities would likely require a larger, and potentially louder, substation transformer.

For residential uses, an EDNA of 50 dBA would apply during nighttime hours. Therefore, siting of stationary equipment closer than 350 feet from a given noise-sensitive land use would have the potential to exceed the WAC standards. In quiet rural areas, an increase of 5 dBA over ambient could result in a noise impact at noise-sensitive receptors. Remote, sparsely populated counties can have a background value of 35 dBA or lower. If stationary equipment generates a noise level of 40 dBA this would be an impact. This increase is estimated to have potential to occur within approximately 1,100 feet of stationary equipment.

Substation noise

Based on a reference facility assessment, a typical substation transformer is estimated to generate a noise level of 72 dBA at a distance of 6 feet during full load with fans and pumps running. Any receptor more than 110 feet away from such a substation, or 350 feet away in quiet rural areas, would be unlikely to be affected by noise associated with the substation. Larger facilities would likely require a larger, and potentially louder, substation transformer. For larger substations, any receptor more than 650 feet away from such a substation in a noise-sensitive area or more than 2,000 feet away from such a substation in a quiet rural areas would be unlikely to be affected by noise associated with the substation. WAC 173-60-050(2)(a) specifically exempts noise from electrical substations from its EDNA standards.

Corona noise

The localized electric field near an energized overhead electric power line conductor can be sufficiently concentrated to produce a small electric discharge, which can ionize air close by. This effect is called corona and can produce small amounts of sound. Corona noise is typically characterized as a hissing or crackling sound, which may be accompanied by a hum. Slight irregularities or water droplets on the conductor and/or insulator surface accentuate the electric field strength near the conductor surface, making corona discharge and the associated audible noise more likely.

Computer modeling software developed by the Bonneville Power Administration indicates that, during wet weather conditions, audible noise levels of up to 46 dBA can occur within the gen-tie ROW corridor for a 230 kV line. The study assumed a ROW 80 feet wide and the gen-tie ROW for solar facilities is assumed to be wider than this. Outside the ROW, 34.5 kV lines would likely be inaudible. Noise from lower voltage lines and/or during dry conditions would be lower. This noise level would be below the 50 dBA EDNA applicable to residential uses.

Vibration

Operation activities would not be expected to generate vibration.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most operations activities would likely result in **less than significant impacts** related to noise and vibration.

Stationary equipment for facilities located closer than 350 feet from a noise-sensitive land use or closer than 1,100 feet from a noise-sensitive land use in a quiet rural area would have a **potentially significant adverse impact**.

Facility substations located closer than 110 feet from a noise-sensitive land use or closer than 350 feet from a noise-sensitive land use in a quiet rural area, or larger substations for large facilities closer than 650 feet away from a noise-sensitive receptor or 2,000 feet from a noise-sensitive receptor in a quiet rural area, would also have a **potentially significant adverse impact**.

4.9.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix H, *Noise and Vibration Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Complete a project-level noise and vibration analysis during siting.
- For facilities sited in quiet rural areas, place stationary noise sources at least 1,100 feet away from the closest noise-sensitive receptors. Larger substations may require greater setback distances of 2,000 feet.
- Locate transformers and inverters 350 feet or farther from the closest noise-sensitive land use.
- Site facilities such that the construction zone and sources of vibration would be at least 80 feet from the closest structure.

Additional mitigation measures to address potentially significant impacts

- Acoustical enclosures or barriers may be used to reduce potential operational noise impacts. Acoustical barriers may be designed for a particular noise-generating source or group of sources.
- For construction areas closer than 1,000 feet from a noise-sensitive receptor, develop and implement a Construction Noise Management Plan.
- Develop and implement a Construction Vibration Management Plan for any construction areas closer than 80 feet from existing structures.

4.9.4 Findings for facilities with co-located BESS

4.9.4.1 Impacts

Impacts from construction and decommissioning

Site characterization, construction, and decommissioning of a utility-scale solar energy facility with a co-located BESS would generate similar noise and vibration levels as those analyzed for utility-scale facilities of the same size without a BESS.

> *Findings*
>
> Noise and vibration impacts during construction and decommissioning would be similar to findings for utility-scale solar facilities above.

Impacts from operation

The BESS would not be expected to generate operational vibration.

Solar energy facility and corona noise

Operation of a utility-scale solar energy facility with a co-located BESS would add BESS to the same equipment analyzed for utility-scale facilities evaluated in Section 4.9.3. Noise would be generated by battery storage liquid cooling units as well as inverters specific to the BESS. In general, these sources would likely operate 24 hours a day and would generate noise during the more noise-sensitive nighttime hours.

Reference facility-level noise assessments were used to estimate the noise generation potential during operations. Noise modeling for these indicated that the cooling units do not meaningfully contribute to the noise generated by the substation transformers where they are typically co-located, but can generate higher noise levels when concentrated in a single area.

Review of proxy projects indicates that there is a wide range of variability in predicted noise levels based on BESS design and configuration, particularly when comparing distributed and consolidated BESSs. The potential exists for some BESS operations to exceed the Chapter 173-60 WAC EDNA of 50 dBA at distances of up to 1.5 miles from consolidated BESS equipment, depending on the design layout of the BESS.

Corona noise for overhead lines for utility-scale solar energy facilities with BESS would be the same as identified for facilities without BESS.

> *Findings*
>
> The operational noise impact for co-located BESSs would range from a **less than significant impact** to a **potentially significant adverse impact** depending on the design and layout of the BESS and distance of sensitive receptors from the facility.

4.9.4.2 Actions to avoid and reduce impacts

Actions for reducing noise and vibration-related impacts for solar energy facilities with co-located BESSs include those identified for facilities without a BESS. Additionally:

- Include acoustical enclosures or barriers for BESS containers to reduce potential operational noise impacts.
- Utilize a dispersed or distributed layout of BESSs.

4.9.5 Findings for facilities combined with agricultural land use

4.9.5.1 Impacts

Impacts from construction, operations, and decommissioning
Site characterization, construction, and decommissioning of a utility-scale solar facility that includes agricultural land uses would generate the same noise and vibration levels as those analyzed for utility-scale facilities without combined agriculture land use.

Operational activities may include maintenance of existing or addition of new infrastructure (e.g., roads, fences, gates) and operation of farming machinery. If the agricultural uses exist prior to facility construction, any noise contribution from these existing activities would reduce the increase over ambient described for the other types of facilities. New agricultural uses could generate seasonal noise from discing, harvesting, or other activities involving agricultural equipment. Overall, the same operational noise impacts identified for facilities without agriculture could occur, depending on siting proximity to noise-sensitive receptors. While mobile agricultural equipment could represent a new additional noise source, the seasonality of such operations and temporary duration of any additional noise generation would not be considered a significant noise contribution.

Findings
Noise and vibration impacts would be similar to findings for utility-scale solar facilities above.

4.9.5.2 Actions to avoid and reduce impacts

Actions for reducing noise and vibration-related impacts for agrivoltaic facilities are the same as those identified for facilities without co-located agricultural use.

4.9.6 Findings for the No Action Alternative

The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on facility size and design, and would range from **less than significant impacts** to **potentially significant adverse impacts**.

4.9.7 Unavoidable significant adverse impacts

Through compliance with laws and permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale solar facilities would have **no significant and unavoidable adverse impacts** on noise from construction, operation, or decommissioning.

4.10 Land use

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction, operation, and decommissioning activities would result in **less than significant impacts** on land use.

Construction would have **potentially significant adverse impacts** if natural resource lands of long-term commercial significance are converted.

Changes to rural character resulting from operation of a new utility-scale energy facility would have **potentially significant adverse impacts** depending on whether plans and development regulations are in place to protect rural character and how they consider utility-scale solar facilities.

Some utility-scale solar energy facilities may result in **potentially significant and unavoidable adverse impacts** on natural resource lands of long-term commercial significance or rural character. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

Land use refers to how land is developed for various human uses or preserved for natural purposes. The *Land Use Resource Report* (Appendix I) includes the full analysis and technical details used to evaluate land use in the PEIS. This section contains a summary of how impacts were analyzed and the key findings.

4.10.1 Affected environment

Major land types and land uses in the study area include agricultural, rural residential, forestry, wildlife conservation, and undeveloped recreation areas. Major categories of land ownership include private, public, federal, state-managed, and state trust.

The Natural Resources Conservation Service classifies and maps farmland to identify the location and extent of prime farmland, farmland of unique importance, and farmland of statewide importance for Washington. The Washington State University *Least-Conflict Solar Siting Study for the Columbia Plateau* identified areas of high and low value for farmland and ranchland. Washington state has more than 1.4 million acres enrolled in the Conservation Reserve Program to re-establish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat.

The Growth Management Act (GMA) requires all counties and cities to designate agricultural resource lands. Criteria for designating agricultural resource lands include the following (WAC 365-190-050):

- The land is not already characterized by urban growth.
- The land is used or capable of being used for agricultural production.
- The land has long-term commercial significance for agriculture.

Land use planning designations considered in the PEIS analysis include GMA comprehensive plans, subarea plans, zoning, and Shoreline Master Programs. The analysis also considered GMA critical areas and resource lands designations, prime farmland, and farmland conservation reserves. In addition, it analyzed mapped flood hazard areas and state-designated areas for agriculture, commerce, conservation, tourism, clean energy development, opportunity zones, and rural character. Military training, testing, and operation areas as well as commercial and aircraft routes are also considered.

Several, but not all, of the counties in the study area plan under the GMA. Counties planning under GMA must include a "rural element" in their comprehensive plans that addresses "lands that are not designated for urban growth, agriculture, forest, or mineral resources." Counties not planning under GMA are not required to have this element in their comprehensive plans. A key requirement of a rural element are measures to protect rural character.

Rural character includes many considerations such as vegetation, views, housing, employment, fish and wildlife habitat, government services, and water. However, under GMA, individual counties are responsible for adopting a locally appropriate definition of local character that guides the development of the rural element and its implementing development regulations.

Under GMA, all cities and counties in Washington are required to adopt regulations for critical areas. Critical areas regulations include standards such as the types of activities allowed within each type of critical area as well as standard buffers and building setbacks. Critical areas include:

- Wetlands
- Critical aquifer recharge areas
- Fish and wildlife habitat conservation areas
- Frequently flooded areas
- Geologically hazardous areas

Also under GMA, all cities and counties in Washington must designate and protect natural resource lands of long-term commercial significance. These include agricultural, forest, and mineral lands that have long-term significance for the commercial production of food, agricultural products, timber, or for the extraction of minerals.

4.10.1.1 Population

The estimated population of Washington state was approximately 7.95 million in 2023. Population densities are generally highest on the west side of the Cascades. Between 2020 and 2023, the state's population increased by 244,840 people, driven largely by people moving into the state. In 2023, population growth remained concentrated in more metropolitan areas, consistent with trends over the past few decades. Washington's population is expected to continue growing in all counties to a total of almost 9.9 million in 2050.

4.10.1.2 Land ownership

The estimated total land area of Washington state is 45.7 million acres (including aquatic lands). In 2009, private ownership made up approximately 54% of the state's land area, with national forests covering approximately 21% (Figure 4-5). State, local, and other federal ownership made up the remainder. Federal agencies that own or manage large areas of land overlapping the study area include USFS and the Bureau of Land Management (BLM). State land ownership within the study area includes DNR and WDFW.

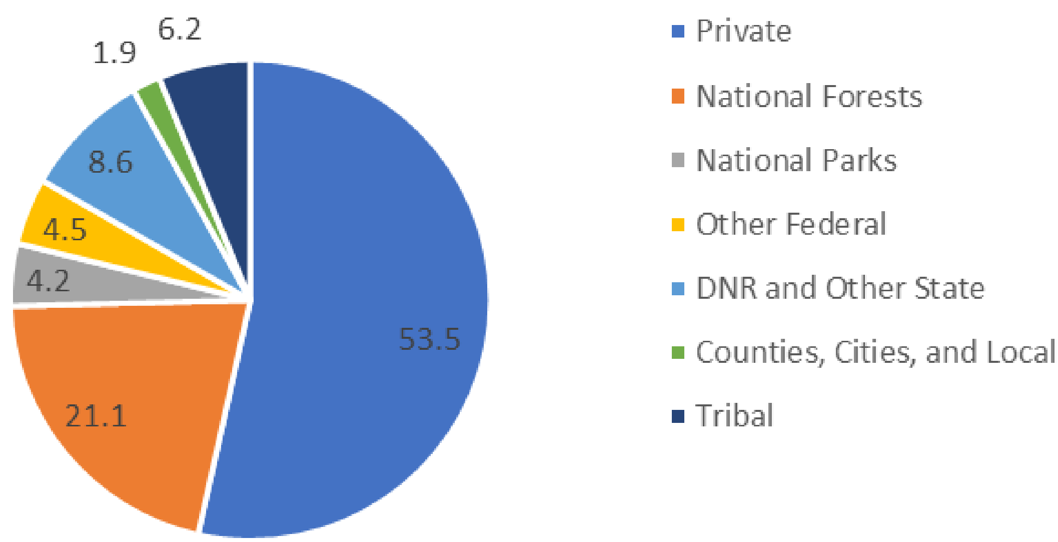

Figure 4-5. Land ownership percentages in Washington in 2009

4.10.1.3 Land uses

The study area encompasses various types of land uses, which each present unique considerations and potential for impacts associated with the development of utility-scale solar facilities. Washington's cities and unincorporated UGAs support much of the state's population and more intensive land uses, such as high-density residential, industrial, and concentrated commercial uses. Outside of cities and UGAs, which are excluded from the land use study area, common land uses include agricultural, rural residential, forestry, wildlife conservation, and undeveloped recreation areas.

Agricultural land use

Approximately 11.2 million acres in Washington are used for agriculture. Agriculture is a dominant land use in eastern Washington, encompassing millions of acres in the solar study area and including crop production, livestock grazing, and other farming activities. The study area also includes areas of prime farmland, which is land that has the best combination of characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses.

Forestry

Forestry is a significant land use in rural areas, covering approximately 22 million acres or half of the state. Timber harvest occurs on private lands as well as on public lands owned by USFS, BLM, and DNR.

Mining

Mineral resources include sand, gravel, and valuable metallic substances, as well as other minerals. There are dozens of active surface mines across Washington. DNR mapping indicates most of the active surface mine permits are for mining of sand, gravel, rock, and stone, which are important building materials.

Limited areas of more intensive development

Counties may designate "limited areas of more intensive development" in rural areas to allow for existing commercial, industrial, residential, or mixed-use areas; small-scale recreation and tourist use areas; and intensification of development on lots containing nonresidential uses. Washington has many small communities located in rural areas.

Military areas

Large areas of land, water, and air outside of military installations are used for military testing, operations, and training. The GMA prioritizes protecting lands around military installations from development that would reduce the ability of personnel to fulfill their mission requirements (RCW 36.70A.530). Development that is incompatible with this priority poses risks to operational efficiency and the safety of military personnel and the public. Energy developers and reviewers should consult with the U.S. Department of Defense (DoD) early during project planning to address these issues. Use the Compatible Energy Siting Assessment (CESA)[25] mapping tool to identify military utilized airspace and if applicable, submit plans to the DoD.

4.10.2 How impacts were analyzed

Impacts that utility-scale solar facilities would have on land use were analyzed by considering how a proposed solar energy facility could impact existing and planned land uses, the supply of land suitable for such uses, and the future viability of affected land uses. The analysis included

[25] https://cesa-wacommerce.hub.arcgis.com/pages/tool

the potential impacts associated with site characterization, construction, operation, and decommissioning of new utility-scale solar facilities as related to the following:

- Conversion of land from an existing low-intensity use (rural, agricultural, or other resource uses) to a new utility-scale solar use
- Potential for co-location of other land uses with utility-scale solar facilities
- Potential conflicts with aviation or military operations
- Effects on existing or future land uses resulting from off-site changes in road networks, views, and increased noise, traffic, or water use
- Consistency with local, state, or federal land use plans, policies, or regulations

4.10.3 Findings for utility-scale solar facilities

4.10.3.1 Impacts

Impacts from construction and decommissioning
Effects on existing adjacent land uses
Construction and decommissioning of utility-scale facilities have the potential to create impacts such as increased dust, noise, traffic, and visual changes that could affect adjacent existing land uses on properties near the facility. People most likely to notice these impacts are those living or working near the construction area. Agricultural land uses could be affected by increased dust settling on crops or by noise disturbance to livestock.

Potential disturbance impacts would depend on the activities, site conditions, adjacent land uses, and distance. Impacts would be less in uninhabited areas and greater in areas close to residences or communities, along important travel routes, or near view areas that are considered important to local communities.

Conversion of existing land use
The siting and development of solar facilities would result in the long-term (and potentially permanent) conversion of existing or designated future land uses to utility-related uses at the solar facility sites for the life of the facilities. The impacts of converting property to a utility-scale solar facility would depend on the existing use of the site. Changing the use of these lands to a renewable energy facility would make the land no longer available for these other uses for the life of the facility. Removing these lands, particularly those of high quality, from their resource uses would reduce the area available to continue producing agricultural, forestry, and mining products in the future. Larger facilities may be more difficult to site because they require larger land areas and therefore would have a greater potential to overlap with lands designated for natural resource use and protection.

Land use impacts during facility decommissioning would be similar to those for construction. If a facility is not required to be restored to pre-facility conditions and uses, it is possible that a decommissioned site could be used for something other than its use prior to development of the facility.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, construction and decommissioning activities would likely result in **less than significant impacts** on existing adjacent land uses.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, construction of most facilities would result in **less than significant impacts** on land use. Construction would have **potentially significant adverse impacts** if natural resource lands of long-term commercial significance are converted.

Impacts from operation

Land use conflicts with rural character

Rural character encompasses many considerations such as vegetation, views, housing, employment, fish and wildlife habitat, government services, and water. A utility-scale solar facility would likely affect vegetation, views, and habitat for species (see biological resources findings in Section 4.6). Installing facilities would result in increased development intensity at facility sites and a change to the visual landscape on and adjacent to those sites that includes a greater presence of built elements. These changes could result in changes to and/or perceptions of the rural character of the surrounding area (see aesthetics/visual quality findings in Section 4.11).

Findings
Changes to rural character resulting from operation of a new utility-scale energy facility would range from **less than significant impacts** to **potentially significant adverse impacts** depending on whether plans and development regulations are in place to protect rural character and how they consider utility-scale solar facilities.

Consistency with plans, policies, and regulations

The consistency of a proposed utility-scale solar energy facility with federal, state, and local regulations and planning documents would depend on a number of factors, such as:

- If on state or federal lands, if the facility is considered an allowed use
- If allowed by local Comprehensive Plan future land use designations, zoning, and Shoreline Management Plan (SMP) designations
- If the facility would impact areas with specific use restrictions and standards (such as SMP-regulated shorelines, critical areas, designated natural resource lands, or prime farmlands) and mitigate impacts
- If the facility can be sited and designed to avoid interfering with civil air navigation and military testing, operations, and training

Depending on the extent of critical areas on the site proposed for a facility, impacts on critical areas can often be avoided through facility design. Certain critical areas impacts must be addressed through compensatory mitigation. See the other PEIS resource sections for additional discussion of impacts on water (Section 4.5), wildlife (Section 4.6), and earth resources (Section 4.3).

> *Findings*
> A utility-scale solar facility could be proposed that is inconsistent with federal, state, and/or local plans and regulations. Plans and regulations may be changed (e.g., through a rezone or comprehensive plan amendment) to resolve inconsistencies and allow a facility to proceed with **less than significant impacts.**

Military areas
Conflicts with potential physical or visual obstructions from facility towers and activities could interfere with military activities. However, early consultation with the Federal Aviation Administration (FAA) and DoD should allow facilities to be sited and designed to avoid these issues.

> *Findings*
> Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of most facilities would likely result in **less than significant impacts** related to military areas.

4.10.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix I, *Land Use Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Consider existing uses, land ownership, and associated plans and regulations such as the following when siting and designing a facility:
  - Local Comprehensive Plans and zoning
  - Land leases (e.g., grazing, farmland, forestry)
  - Designated flood zones, shorelines, critical areas, natural resource lands, and other lands prioritized for resource protection
  - Military testing, training, and operation areas
- Consider the WSU Least-Conflict Solar Siting Study maps and agricultural lands mapping to avoid areas with the highest ranchland and farmland values.
- If siting on DNR-managed lands, contact the Clean Energy Program aligned with the DNR’s Product Sales and Leasing Division.
- Coordinate with federal, state, and county agencies; Tribes; property owners; and other interested parties as early as possible in the planning process to identify potentially significant land use conflicts and issues and state and local rules that govern solar energy development.

- Contact the FAA early in the process to determine if there might be any potential impacts on aviation and if any mitigation might be required to protect military or civilian aviation use. Submit plans for proposed construction of any facility that is 200 feet or taller or that is located in proximity to airports to the FAA to evaluate potential safety hazards.
- Contact the DoD early in the siting process for any facility near or within military training routes, military bases, or training areas in order to identify and mitigate potential impacts on military operations. Site design must consider military installations and airspace needs. Use the CESA[26] mapping tool to determine if impacts are possible and submit plans to the DoD.
- Use existing roads and utility corridors when possible and minimize the number and length of new roads and lay-down areas.
- For roads in agricultural areas, include appropriate fencing, cattle guards, and signs.
- Site and design the facility to avoid critical areas, SMP-regulated shorelines, and designated agricultural lands, forestlands, and rangelands as much as possible.
- Site and design facilities to minimize impacts on specially designated shrubsteppe areas (see the biological resources section).
- Consider wildland fire risk mapping when siting and designing and incorporate appropriate design criteria to achieve wildland fire resistance (see the environmental health and safety section).

Additional mitigation measures to address potentially significant impacts

- Evaluate opportunities to co-locate agricultural uses with projects, considering how solar facilities and agricultural activities may influence each other.

4.10.4 Findings for facilities with co-located BESS

4.10.4.1 Impacts

Impacts from construction, operations, and decommissioning

Construction, operations, and decommissioning impacts for utility-scale solar facilities with BESSs would be generally the same as for facilities without BESSs. The addition of battery storage could generate additional traffic for specialized equipment and construction workers. The addition of battery storage could be perceived as added industrial-type facility, resulting in a potential greater change in rural character than for facilities without BESS.

> *Findings*
> Impacts on land use would be similar to findings for utility-scale solar facilities above.

[26] https://cesa-wacommerce.hub.arcgis.com/pages/tool

4.10.4.2 Actions to avoid and reduce impacts

Actions for reducing land use-related impacts for solar facilities with BESSs are the same as those identified for facilities without BESSs.

4.10.5 Findings for facilities combined with agricultural land use

4.10.5.1 Impacts

Impacts from construction, operation, and decommissioning
Impacts during construction of a solar facility combined with agricultural use (agrivoltaic) would be generally the same as for solar facilities without agricultural land use. Land use conversion impacts could be less than other alternatives because existing rural or agricultural lands may not need to be converted if agricultural uses would be co-located with energy facilities. Incorporating ongoing agricultural uses along with utility-scale solar energy during operations may improve a facility's compatibility with local goals and policies related to preserving rural character.

Impacts from decommissioning an agrivoltaic facility would be similar to those for decommissioning a solar facility without agricultural land use. Land in agricultural use prior to facility construction would require less area to be restored following removal of solar facility equipment, and decommissioning would return the property to full agricultural use.

Findings
Impacts on land use would be similar to findings for utility-scale solar facilities above.

4.10.5.2 Actions to avoid and reduce impacts

Actions that can be taken to avoid and reduce impacts would be the same as for the facilities without co-located agricultural use.

4.10.6 Findings for the No Action Alternative

The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on facility size and design, and would range from **less than significant impacts** to **potentially significant adverse impacts**.

4.10.7 Unavoidable significant adverse impacts

There may be **potentially significant and unavoidable adverse impacts** on rural character or from conversion of resource lands of long-term commercial significance depending on local plans and development regulations. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

4.11 Aesthetics/visual quality

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, construction, operations, and decommissioning activities would likely result in **less than significant impacts** related to light or glare.

Depending on the location and size of facility sites and visual characteristics of the construction, operation, and decommissioning, visual quality impacts would range from **less than significant impacts** to **potentially significant adverse impacts**. In general, larger facilities and facilities located in high-value scenic landscapes have a greater potential to impact visual quality.

Some utility-scale solar energy facilities may result in **potentially significant and unavoidable adverse impacts** on visual quality, depending on location and design. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

Visual resources refer to all objects (built and natural, moving and stationary) and features (e.g., landforms and waterbodies) that are visible on a landscape. These resources add to or detract from the aesthetic or scenic quality (or visual appeal) of the landscape. A visual impact is the creation of an intrusion or perceptible contrast that affects the scenic quality of a landscape. A visual impact can be perceived by an individual or group as either positive or negative, depending on a variety of factors or conditions (e.g., personal experience, time of day, and weather/season). The information in this section summarizes the full analysis and technical details used to evaluate aesthetics and visual quality in the PEIS, which can be found in the *Aesthetics/Visual Quality Resource Report* (Appendix J).

4.11.1 Affected environment

Visual resources considered in this analysis include the following:

- Designated scenic vistas
- Designated scenic corridors, including roadways, trails, rivers, and streams (including federally designated Wild and Scenic Rivers)
- Designated viewsheds
- Designated ridgelines and other elevated (i.e., visually prominent) natural features
- Areas with comprehensive plans, zoning, or other land controls that define an area as scenic or as designated/protected rural character
- Publicly accessible vantage points having moderate to high visual or rural character and quality and that are well traveled and populated
- Recreational resources
- Areas sensitive to light and/or glare, including designated night sky areas, as well as areas potentially affecting aircraft

The study area includes physically diverse regions such as the Columbia River basin, the foothills of the Cascade Range, Okanagon Big Bend, the Yakima Valley, and the Palouse region. Landscape types encompassed within the study area vary widely based on geology, topography, climate, soil type, hydrology, and land use. The study area is generally split between level terrain with long viewing distance and hilly topography. Human activity like agriculture has altered much of the landscape in the study area despite a generally sparse population density. Undeveloped areas in hilly terrain are forested up to tree-line elevation, while undeveloped flatter areas contain sparsely vegetated plains and plateaus. The central part of the state is dominated by the Columbia River and its tributaries, along with large parcels of government-owned land and Tribal reservations.

In many of the undeveloped portions of the study area, the land is generally flat and there are few obstructing structures. This, combined with generally high air quality and low humidity, means that it is possible to see for long distances. Minimal light pollution allows for dark night skies.

The western portion of the study area is higher in elevation. Visual characteristics may be impacted by recreation and resource extraction activities such as logging and mining. More hilly and mountainous terrain as well as the presence of vegetation and other ecological features contribute to a greater visual diversity and quality in this part of the study area. Areas of highest visual quality may attract tourists and other recreationists.

Extensive scenic resources occur within or near the study area, many on government- or Tribal-owned lands. Tourism in these areas is a major contributor to the regional economy. Of particular importance is the viewshed from major roadways that pass through the area. There are numerous national and state-designated scenic byways that traverse or are near portions of the study area. Parts of the Klickitat River and White Salmon River that are designated as National Wild and Scenic Rivers also traverse portions of the study area.

Sensitive viewer groups are varied throughout the study area. These groups range from people in residential areas in less developed and agricultural areas, to motorists and recreationalists/tourists. The viewing experience for each group would vary, depending on the length of time and distance the viewer would be exposed to a solar facility and the physical conditions of the view.

4.11.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Existing visual or rural character, land uses that may be sensitive to strong visual contrast (including light and glare), and sensitive viewer groups in the study area
- Potential impacts of facilities on existing visual or rural character and sensitive viewer groups or land uses in the study area
- Effects of lighting and glare on sensitive receptors

The magnitude of the aesthetics and visual quality impacts associated with a solar energy facility would depend on site- and project-specific factors, including the following:

- Distance of the facility from publicly accessible vantage points, and their placement within the context of foreground, middleground, and background views[27]
- Size of the facility
- Size and height of the solar panel array trackers
- Surface treatment (such as color) of solar panels, buildings, and other structures
- The presence and arrangement of lights in the solar array field and on other structures
- The presence of workers and vehicles for maintenance activities
- Viewer characteristics, such as the number and type of viewers and their attitudes toward renewable energy and solar power
- The visual quality and sensitivity of the landscape, including the presence of sensitive visual, Tribal, and cultural resources, including historic properties
- The existing level of development and activities in the solar energy facility area and nearby areas, and the landscape's capacity to withstand human alteration without loss of landscape character
- Weather and lighting conditions

4.11.3 Findings for utility-scale solar facilities

4.11.3.1 Impacts

Impacts from construction and decommissioning

Change or reduction in visual quality

Construction of a utility-scale solar energy facility would involve a range of activities that could have potential visual impacts. Construction and site characterization activities are site and facility dependent; however, construction of a typical solar energy facility in the study area would normally involve the following major actions with potential visual impacts: clearing and grading for construction laydown areas, access roads, and pad foundations; constructing supporting elements like internal service roads, fences, gates, and buildings; and constructing facility components such as solar arrays, inverters/transformers, and electrical transmission lines. Construction vehicles, equipment, and worker presence and activity may also generate dust and emissions that can result in visual impacts. Additional construction activities may be necessary at very remote locations or for very large solar facilities, such as the construction of temporary offices or sanitary facilities.

Construction visual impacts would vary in frequency and duration throughout the course of construction. There may be periods of intense activity followed by periods with less activity. Visual impacts would, to some degree, vary in accordance with construction activity levels.

[27] The foreground, middleground, and background refer to areas in space. The foreground refers to the nearest area. The background refers to the area of space in the distance. The middleground occupies the space in between.

Construction schedules are also facility-specific, with some taking longer and therefore extending the duration of construction-related visual impacts.

Construction of a solar panel array, support facilities, and an interconnector and gen-tie line would be required for utility-scale solar energy facilities. The relative scale of typical solar array components and other buildings and potential elements of solar facilities are illustrated in Figure 2-2 in Chapter 2. In general, larger facilities would require construction of more PV arrays and ancillary structures and facilities over a much larger and broader land area, which would lead to more impacts.

Depending on the facility location, there could be some situations where work areas would be blocked from view by intervening topography or screened by vegetation. There could also be cases where a development site would be in an area where there are limited views of the facility. However, some facility development sites would be in proximity to roadways, towns and cities, recreational areas, and other vantage points that would have views of these facilities. In general, larger facilities would require much larger and broader land areas, which could lead to more impacts.

Visual impacts associated with vegetation clearing include the potential loss of vegetative screening, which would result in the opening of views, potentially substantial visual changes for viewers close to the solar field, and potentially substantial changes for viewers with distant views of the solar field.

Decommissioning activities would produce visual impacts similar to construction activities. Restoration activities would typically include recontouring, grading, scarifying, seeding and planting, and stabilizing disturbed surfaces. Newly disturbed soils would create a visual contrast that would persist for several seasons before vegetation would begin to mature and restore the pre-facility visual landscape. Complete restoration of vegetation to pre-facility conditions may take much longer. Invasive species may colonize newly and recently reclaimed areas and could produce visual contrasts. Vegetation restoration at some decommissioned facilities may be more challenging due to factors such as soil degradation, the extent of invasive species colonization, a change in seed dispersal patterns, or degradation of adjacent habitats. The length of time it takes for native vegetation to re-establish varies greatly depending on location, weather patterns, soil fertility, surrounding land use, and the type of vegetation planted or recruited. Decommissioning impacts would last until restoration of the site is complete.

Findings

Depending on the location and size of facility sites and visual characteristics of the construction and decommissioning activities, impacts from facility construction and decommissioning would range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. In general, larger facilities and facilities located in high-value scenic landscapes have a greater potential to impact visual quality.

New sources of light or glare

Site characterization, construction, and decommissioning of a utility-scale solar energy facility would be expected to occur during daylight hours. Some nighttime activities may be performed such as electrical connection, inspection, and testing activities. Any lighting used during construction activities would be occasional, temporary, and shielded downward. Also, these facilities would require big areas of undeveloped or minimally developed land (up to approximately 6,000 acres), which would put much of the construction activities away from receptors sensitive to light. Therefore, the potential for nighttime lighting during construction or decommissioning to impact nighttime views would be minimal.

Construction would involve increased vehicle traffic and the presence, transport, and use of construction equipment and materials. These activities would temporarily increase glare in and around a facility site if activities were associated with an increased presence of reflective materials, potentially including construction equipment, shiny materials, and vehicle windows. However, an increase in glare that could result from the presence of construction equipment or materials would be minimal and temporary. Only portions of the facility site would be actively under construction at a particular time. Such new temporary sources of glare would not remain in any one fixed location for the entire duration of construction but would be present at different locations depending on the phase of construction activities throughout the site.

Although decommissioning activities would require the use of vehicles and equipment similar to those required for construction, any sources of glare would be minimal and temporary as equipment would be moved between active work locations on the facility site, and the activities would occur over a shorter period of time. Because the facility site would be restored to pre-facility conditions following the operational life of the facility, there would be no remaining permanent sources of light or glare.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, construction and decommissioning activities would likely result in **less than significant impacts** related to light or glare.

Impacts from operation

Change or reduction in visual quality

Operations and maintenance of solar energy facilities and associated electricity interconnector and gen-tie lines, roads, and ROWs would result in long-term visual impacts. Site operation impacts would generally occur throughout the life of the facility. Impacts may occur from cleared areas, built structures, roadways, and operational activities.

Cleared areas would include maintenance roads, facility access roads, and other support facilities. Visual contrasts associated with these cleared areas would include the potential loss of vegetative screening, which would result in the opening of views and potentially significant visual changes for viewers close to the cleared area. For both maintenance and access roads, the cleared area would be relatively narrow. The cleared area for interconnector and gen-tie lines are typically wider and longer than roads. For these reasons, contrasts from roads would normally be far less severe than for interconnector and gen-tie lines.

Built structures associated with utility-scale facilities would introduce complex shapes and lines and artificial-looking textures and colors into the landscape that would likely contrast noticeably with natural-appearing landscapes (see Figure 2-2 in Chapter 2). Because PV arrays are generally low to the ground, most buildings, some tanks, and possibly other facility components would protrude above the PV arrays and would be visible from outside the facility even when viewed from relatively flat areas. When viewed from elevated positions, more of the facility would be visible and the regular geometry of the panel arrays would be more apparent.

The visual pattern created by many thousands of identical solar panels and mounting structures in evenly spaced rows creates a distinctly non-natural and sometimes striking and unusual view of a facility that contrasts strongly with natural-appearing backgrounds.

Operational activities associated with the PV arrays and support facilities include routine maintenance (such as washing of PV panel surfaces), road and building maintenance, and repairs. These activities would be visible off site and might generate visible dust plumes in some circumstances.

Site entrances and main access roads leading to substations, parking areas, or operations and maintenance buildings are more likely to be paved two-lane roads, but interior roads are typically one-lane dirt or gravel roads. Roads may introduce strong visual contrasts to the landscape, depending on width, length, surface treatment, and route relative to surface contours. Improper road maintenance could lead to the growth of invasive species or erosion, both of which could introduce undesirable contrasts in line, color, and texture, primarily for foreground and near-middleground views.

The relatively low population density of most of the study area suggests that while solar energy facilities may be visible for long distances (potentially greater than 20 miles away), many facility locations would generally be viewed by few people. Impacts on residents are generally greater than those on more transient viewers, such as drivers, workers, or recreationalists, in part because residents are likely to view solar energy facilities more frequently and for longer durations.

A solar energy facility located in a high-value scenic landscape typically would be more conspicuous and therefore perceived as having greater visual impact than if that same facility were present in a setting of low scenic value where similar facilities were already visible. Some landscapes have special meaning to some viewers because of unique scenic, Tribal, cultural, or ecological values and are therefore perceived as being more sensitive to visual disturbances. Depending on visibility factors, solar energy facilities located near sensitive landscapes, such as national parks, historic sites, landscapes sacred to Tribes, scenic highways and trails, recreational attractions, and other valued cultural features, may be of particular concern.

Findings
Depending on the facility size range and the nature of the facility structures, operation of utility-scale solar energy facilities could result in a range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. In general, larger facilities and facilities located in high-value scenic landscapes would have a greater potential for impacts.

New sources of light or glare
Solar energy facilities would include exterior lighting around buildings, parking areas, and other work areas. Security and other lighting could contribute to light pollution. Maintenance activities conducted at night, such as panel washing, might require vehicle-mounted lights, which also could contribute to light pollution. Light pollution impacts associated with utility-scale solar energy facilities include skyglow, light trespass, glare, light clutter, and over-illumination.

FAA-compliant aircraft warning lights could be required for meteorological or interconnector towers, gen-tie towers, or other structures 200 feet (61 meters) tall or higher and might be required in some circumstances for lower height structures. FAA guidelines for marking and lighting facilities could require aircraft warning lights that flash during the day and at night. The presence of aircraft warning lights would greatly increase visibility of the facilities and associated interconnector and gen-tie lines at night, because the synchronized flashing red warning lights or strobes could be visible for long distances. For larger facilities, operation of aircraft warning lights would occur over a broader area depending on the siting and design for tall structures.

The reflection of sunlight off solar panel surfaces would be the primary source of potential glare from a facility. Solar panels are designed to be as light-absorptive as possible in order to maximize the efficiency of energy production, and they typically are covered with a tempered glass layer that is treated with an anti-reflective coating to further reduce their reflectiveness. PV panel tracking systems would position the arrays so that the sun's rays are perpendicular to the face of the panel, reflective light back toward the sun and above the line of sight of most viewers. These design features reduce the potential for glare impacts from the arrays.

In addition to the panels, facilities would include other components that may have reflective surfaces, such as panel support structures, support building windows, fencing, and interconnector and gen-tie towers and lines, which may also cause glint or glare. Surface coatings can be applied to facilities to reduce glare, and these reflections would be minimal when considered with the PV panels and would not contribute substantially to glare.

Because of their intermittent operation, aircraft warning lights would likely not contribute to sky glow from artificial lighting. Security and other lighting on support structures (e.g., the control building) could contribute to skyglow. These impacts could be reduced by shielding or other measures and would be expected to be minimal because typically only a few structures would have lighting capable of producing skyglow.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, operation of facilities would likely result in **less than significant impacts** related to light or glare.

4.11.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix J, *Aesthetics/Visual Quality Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- To the extent practicable, site facilities to avoid or substantially reduce visual impacts.
- Incorporate assessment of visual resources as part of the facility's early pre-planning phases and continue the assessment throughout the life of the facility.
- Include a visual resource specialist as part of the planning team evaluating visual resource issues as facility siting options are considered.
- Complete a detailed visual resource analysis during siting to identify and map landscape characteristics, key observation points (KOPs), and key viewsheds; prominent scenic, Tribal, and cultural landmarks; and other visually sensitive areas near the facility location.
- Consult with the appropriate land management agencies, planning entities, Tribes, and the local public to provide input on the identification of important visual resources and on the siting and design process.
- Avoid siting facilities where the landscape setting observed from national historic sites, national trails, and cultural resources may be a part of the historic context contributing to its historic significance.
- Locate facilities outside the viewsheds of KOPs, highly sensitive viewing locations, and/or areas with limited visual absorption capability[28] and/or high scenic integrity where possible. If a solar energy development and/or associated facilities must be sited within view of KOPs, they should be sited as far away as possible to reduce the visual impacts.
- Site facilities in already developed landscapes, where possible.
- Use existing topography and vegetation, where possible, as screening devices to reduce views of facilities from visually sensitive areas.
- Avoid siting facilities next to prominent features (e.g., knobs and waterfalls), where possible.
- Avoid siting linear facilities, such as interconnector and gen-tie lines, and roads, so that they bisect ridge tops or run down the center of valley bottoms.

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[28] Visual absorption capability is a tool to assess a landscape's susceptibility to visual change caused by human activities.

- Avoid siting substations, interconnector and gen-tie structures, communication towers, and other structures on ridgelines, summits, or other locations where they would be silhouetted against the sky from important viewing locations (referred to as “skylining”).
- Site facilities to avoid skylining by taking advantage of opportunities to use topography as a backdrop for views of facilities and structures.
- Prepare spatially accurate and realistic photographic simulations of solar array fields in the proposed location as part of the siting process.
- Where it can be accomplished without introducing unacceptable impacts on other resources, site linear features (e.g., roads, ROWs) following natural contours in the landscape.
- Site facilities to take advantage of natural topographic breaks (i.e., pronounced changes in slope), and avoid siting facilities on steep side slopes.
- Set back the edges of solar panel field arrays where solar panel tracker array fields would be bisected by public roadways, railways, trails, and other linear features used by the public, so as not to create a “tunnel” effect.
- In forested areas or shrublands, where possible, linear facilities should follow the edges of clearings (where they would be less conspicuous) rather than pass through their center.
- In forested areas or shrublands, site facilities to take advantage of existing clearings to reduce vegetation clearing and ground disturbance where possible.
- Locate ROWs to cross linear features (e.g., trails, roads, and rivers) at right angles whenever possible.
- Co-locate interconnector and gen-tie lines and roads associated with solar energy facilities within a corridor to use existing/shared ROWs, existing/shared access and maintenance roads, and other infrastructure to the extent possible.
- Design facilities, structures, roads, and other facility elements to match and repeat the form, line, color, and texture of the existing landscape where possible.
- Site solar array fields to be sensitive to and respond to the surrounding landscape in a visually pleasing way where possible.
- Design facilities to provide visual order and unity among clusters of solar panel arrays (visual units) and avoid visual disruptions and perceived “disorder, disarray, or clutter” where possible.
- Design solar array trackers and other ancillary facilities to exhibit visual uniformity in shape, color, and size where possible.
- Bury power collection cables or lines on the site in a manner that minimizes additional surface disturbance (e.g., co-locating them with access roads).
- Choose low-profile structures for buildings and other structures, whenever possible, to reduce their visibility.
- Where screening topography and vegetation are absent, use natural-looking earthwork berms and vegetative or architectural screening where possible to minimize visual impacts associated with ancillary facilities.

- In forested areas and shrublands, openings in vegetation for facilities, structures, and roads should mimic the size, shape, and characteristics of naturally occurring openings to the extent possible.
- Minimize the number of structures required.
- Design and locate structures and roads to minimize and balance cuts and fills.
- Locate facilities, structures, and roads in stable, fertile soils to reduce visual contrasts from erosion and to better support rapid and complete regrowth of affected vegetation where possible.
- Strip, stockpile, and stabilize topsoil from sites before excavating earth for facility construction.
- Include the feathering of cleared area edges (i.e., the progressive and selective thinning of trees from the edge of the clearing inward) combined with the mixing of tree heights from the edge in the vegetation-clearing design in forested areas.
- Set back structures, roads, and other facility elements as far from road, trail, and river crossings as possible to avoid a visual tunneling effect, and use vegetation to screen views from crossings, where feasible.

Additional mitigation measures to address potentially significant impacts
Building and structural materials

- Paint structures and use materials and surface treatments to blend into the landscape as much as possible.

Construction

- Where possible, site staging and laydown areas outside the viewsheds of KOPs and not in visually sensitive areas; they should be sited in swales, around bends, and behind ridges and vegetative screens, where these screening opportunities exist.
- Implement a site restoration plan prior to construction with the goal of restoring the original site contours and vegetation as closely and quickly as possible after construction is complete.
- Preserve existing rocks, vegetation, and drainage patterns to the maximum extent possible.
- Protect valuable trees and other scenic elements.
- Avoid installation of gravel and pavement where possible to reduce color and texture contrasts with the existing landscape.
- For road construction, use excess fill to fill uphill-side swales to reduce slope interruption that would appear unnatural and to reduce fill piles.
- Round road-cut slopes and ditches, and vary the cut/fill pitch to reduce contrasts in form and line. Vary the slope to preserve trees and nonhazardous rock outcroppings.
- Leave planting pockets on slopes, where feasible.
- Sculpt and shape natural or previously excavated bedrock landforms into a final landform that repeats the natural shapes, forms, textures, and lines of the surrounding landscape when excavation of these landforms is required.

- Bury communication and other local utility cables, where feasible.
- Paint or coat culvert ends to reduce color contrasts with existing landscape.
- Minimize and color or coat signage to reduce color contrasts with the existing landscape.
- Implement dust abatement measures in arid environments to minimize the impacts of vehicle and foot traffic, construction, and wind on exposed surface soils.

Operations and maintenance

- Implement interim restoration as soon as possible after conducting activities that cause disturbance.

Decommissioning

- A reclamation plan that includes visual impact mitigation measures should be in place prior to construction, and reclamation activities should be undertaken as soon as possible after disturbances occur and be maintained throughout the life of the facility.
- Consider combining seeding, planting of nursery stock, transplanting of local vegetation within the proposed disturbance areas, and staging of construction, enabling direct transplanting. Use native vegetation for revegetation. Coordinate with local authorities such as country extension services, weed boards, or land management agencies on seed mixes.

4.11.4 Findings for facilities with co-located BESS

4.11.4.1 Impacts

Impacts from construction, operations, and decommissioning

Change or reduction in visual quality and light or glare

The construction, operation, and decommissioning activities occurring for facilities with co-located BESSs would be similar to other support facilities and structures described for facilities without BESSs. BESSs are typically installed in a graveled area where vegetation clearing and gravel surfacing would be required.

The addition of BESSs would not change or reduce the visual nature of solar energy development because the racks, containers, buildings, control systems, and other elements associated with a BESS would look similar to other elements associated with a solar facility.

BESS construction and decommissioning may require night work lighting; however, these activities would be occasional, temporary, and shielded downward. The potential for nighttime lighting during construction or decommissioning to impact nighttime views would be minimal. Lighting associated with a BESS would be the same type as for utility-scale facilities and the addition of BESSs would not change the sources of light and glare of a solar energy facility. Because the facility site would be restored to pre-facility conditions following the operational life of the facility, there would be no remaining permanent sources of light or glare.

Findings
Impacts to aesthetics and visual quality would be similar to findings for utility-scale solar facilities above.

4.11.4.2 Actions to avoid and reduce impacts

Actions for reducing aesthetic and visual quality impacts of facilities with co-located BESSs would be the same as for facilities without a BESS.

4.11.5 Findings for facilities combined with agricultural land use

4.11.5.1 Impacts

Impacts from construction, operations, and decommissioning
Change or reduction in visual quality and light or glare
The construction and decommissioning activities for facilities combined with agricultural land use would be the same as for the other types of facilities evaluated in the PEIS. Agrivoltaics could include construction of facilities on active agricultural land (or a new agricultural land use could be added), which would be similar to the construction of solar energy facilities on broad expanses of undeveloped or fallow land.

Long-term changes or reduction in visual quality from facilities with agricultural use would be the same as for facilities without agricultural land use. The co-location on agricultural land would not change or reduce the visual nature of a solar energy development.

New sources of light or glare
Facility construction and decommissioning activities for facilities with agricultural use would be the same as those occurring for facilities without agricultural land use. Agricultural activities are not anticipated to involve nighttime lighting, except for emergency or other episodic use.

The types of light and glare impacts, as well as actions to avoid and mitigate light and glare, during operation would be the same as for facilities without agricultural land use. It is assumed that current agricultural activities would continue to occur and would not result in additional sources of light and/or glare that are not present under existing conditions.

Because a facility site would be restored to pre-development conditions or continue as agricultural fields following the operational life of the facility, there would be no remaining permanent sources of light or glare.

Findings
Impacts to aesthetics and visual quality would be similar to findings for utility-scale solar facilities above.

4.11.5.2 Actions to avoid and reduce impacts

Actions for reducing aesthetic and visual quality impacts of agrivoltaic facilities, including the restoration of agricultural land, would be the similar to those for facilities without co-located agricultural use.

4.11.6 Findings for the No Action Alternative

The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on facility size and design. Facilities could result in a **less than significant** to **potentially significant adverse impact** on aesthetic and visual resources and would result in a **less than significant impact** attributable to light and glare.

4.11.7 Unavoidable significant adverse impacts

Some utility-scale solar energy facilities may result in **potentially significant and unavoidable adverse impacts** on visual quality, depending on location and design. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

4.12 Recreation

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction, operations, and decommissioning activities would likely result in **less than significant impacts** on recreation.

Potentially significant adverse impacts would occur if:

- The facility results in the loss of recreation resources or crowding of alternative recreational opportunities
- Increased use of neighboring recreational opportunities were to result in overcrowding and overuse of those resources
- The facility results in segmentation of recreational facilities, such as severing trail connections, and recreationists no longer have access to the full activity

No significant and unavoidable adverse impacts related to recreation would occur.

Recreation provides people with the opportunity to engage with and enjoy both the natural and built environments. Washington has vast opportunities for outdoor recreation, from mountains to deserts, including both land- and water-based activities. Recreation opportunities include activities in parks, rivers, on state and federally managed lands, and on privately owned lands. Outdoor recreation is an important aspect of life and provides economic and health benefits to communities in the study area.

The *Recreation Resource Report* (Appendix K) includes the full analysis and technical details used to evaluate recreation in the PEIS. This section contains a summary of how impacts were analyzed and the key findings. Visual impacts can be found in the *Aesthetics/Visual Quality Resource Report* (Appendix J).

4.12.1 Affected environment

The study area encompasses a wide range of landscapes, including mountains, deserts, lakes, and rivers. Designated recreation areas in or adjacent to the PEIS study area include local parks, national forest land managed by USFS, wilderness areas, national monuments, state and local parks, and lands managed by DNR, WDFW, BLM, Bureau of Reclamation, and U.S. Fish and Wildlife Service (USFWS).

Recreational activities vary with terrain, season, and land use. During the summer, recreational activities include hiking, biking, camping, and water activities such as swimming, rafting, and kayaking. These activities are popular in designated recreation areas and on public lands, especially in the Cascade Range. Winter activities include skiing, snowboarding, and snowshoeing, and are concentrated in mountainous regions. Agritourism activities like u-pick produce, farm tours, and seasonal events also occur across the study area. Other common recreational activities in the study area include the following:

- **Hunting and fishing** are significant recreational activities with varying seasons that occur throughout the state. Hunting and fishing seasons vary throughout the year by the species of animal. Tribal hunting and fishing take place throughout the state at various times during the year. More details are provided in the *Tribal Rights, Interests, and Resources Report* (Appendix O).
- **Informal recreation** on public or private lands includes dispersed camping, wildlife viewing, backcountry driving, off-trail hiking, and shooting.
- **Water-based recreation** is prevalent in rivers, reservoirs, and lakes. Wild and scenic rivers within the study area include the White Salmon River and Klickitat River, both located in the southern portion of the state.

4.12.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Potential loss or segmentation of existing recreational resources
- Potential for loss of existing recreational opportunities or areas to result in overuse and overcrowding of other recreational activities in the surrounding area

This analysis uses information and findings from visual impacts (see Section 4.11, Aesthetics/Visual Quality), noise impacts (see Section 4.9, Noise and Vibration), and air quality (see Section 4.4, Air Quality and Greenhouse Gases).

4.12.3 Findings for utility-scale solar facilities

4.12.3.1 Impacts

Impacts from construction and decommissioning

Potential site characterization, construction, and decommissioning impacts on recreational areas located on or adjacent to solar energy facility sites could include increased noise, dust (and reduced visibility), and traffic, and temporary changes in access. There could be a temporary increase in use at alternative recreation sites during construction. The decommissioning and removal of a facility could result in the restoration of recreational opportunities that were previously lost from construction of solar facilities.

> *Findings*
>
> Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction and decommissioning activities would likely result in **less than significant impacts** on recreation.
>
> If construction or decommissioning of the facility results in the loss of recreation resources or crowding of alternative recreational opportunities, there would be **potentially significant adverse impacts**.

Impacts from operation

Some facilities may allow continued or new recreation on some of their facility site, whereas others may restrict recreational access for safety and security reasons. Elimination of recreational opportunities may also result in higher uses of neighboring recreation opportunities or segmentation of existing recreational areas (such as trails).

Recreationists near a facility during operations could experience changes that diminish their recreational experience, including changes in the noise and views created by a solar facility. For more discussion of these impacts, refer to the *Aesthetics/Visual Quality Resource Report* (Appendix J) and the *Noise and Vibration Resource Report* (Appendix H).

An increased facility size could increase the risk for significant adverse impacts from lost recreation opportunities and increase potential for impacts on nearby recreational opportunities. This could include a variety of recreational areas and opportunities. For example, perimeter fencing could exclude access to an area for mountain biking, hunting, or hiking.

Operations of solar energy facilities could impact plants, wildlife, and wildlife habitat, which could, in turn, impact hunting and wildlife viewing. For more information related to the impacts on wildlife and habitats, see the *Biological Resources Report* (Appendix E).

Findings
If operation of the facility results in the loss of recreation resources or crowding of alternative recreational opportunities, it would be a **potentially significant adverse impact**. If increased use of neighboring recreational opportunities throughout the operations phase were to result in overcrowding and overuse of those resources, such conditions would be **potentially significant adverse impacts**. Segmentation of recreational facilities, such as severing trail connections, could also result in **potentially significant adverse impacts** if recreationists no longer have access to the full activity.

4.12.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix K, *Recreation Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Consider local, state, and federal recreation areas and current uses when siting a facility.
- Avoid siting facilities in areas valued for recreational opportunities, areas with unique recreation resources, areas that would divide existing recreation areas, or cause overuse of neighboring recreational activities. This includes both informal recreational areas and recreation in designated local, state, and federal recreational areas.

Additional mitigation measures to address potentially significant impacts

- Mitigate for lost recreational opportunities by providing new opportunities for recreational activities. Solar energy facilities could be designed with biking or hiking trails, wildlife viewing areas, or be open to hunting during portions of the year. Avoid segmenting recreational areas or creating vast areas that are inaccessible to the public.
- Engage with statewide and local interest groups dedicated to conserving natural resources and recreation (for example, trail associations and environmental advocacy groups) regarding potential development of a recreation mitigation plan.

4.12.4 Findings for facilities with co-located BESS

4.12.4.1 Impacts

Impacts from construction, operation, and decommissioning
The construction and decommissioning activities for facilities with a co-located BESS would be the same as those for facilities without a BESS. For this analysis, it is assumed the BESS would be located within the solar energy facility site footprint and would require a small additional area of development, but would not contribute other recreational impacts than described for facilities without a BESS.

Findings
Impacts to recreation would be similar to findings for utility-scale solar facilities above.

4.12.4.2 Actions to avoid and reduce impacts

Actions for reducing the recreational impacts for facilities with a co-located BESS are the same as those identified for facilities without a BESS, with the addition of:

- Site the BESS away from any recreational uses to further avoid and minimize potential noise or visual impacts.

4.12.5 Findings for facilities combined with agricultural land use

4.12.5.1 Impacts

Impacts from construction, operation, and decommissioning
Recreational opportunities are generally less prevalent in agricultural landscapes because these areas have a primary purpose of raising livestock or crops, they are often located on private property, and they typically do not provide features like trails to support recreation. However, privately owned lands can still be used for recreation by the property owner or the public, including for hunting as part of WDFW's Private Land Program. Agricultural activities located on lands that are multi-use could also support recreational activities.

Impacts from construction, operation, and decommissioning of solar energy facilities co-located with agricultural land uses would largely be the same as those discussed for facilities without agricultural land use.

Findings
Impacts to recreation resources would be similar to findings for utility-scale solar facilities above.

4.12.5.2 Actions to avoid and reduce impacts

Actions for reducing the recreational impacts of facilities combined with agricultural land use would be the same as those for facilities without co-located agricultural use. An additional mitigation measure to address potentially significant impacts for lost recreational uses could include:

- Offering agritourism activities where a solar energy facility and agriculture use are co-located

4.12.6 Findings for the No Action Alternative

The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on facility size and design, and would range from **less than significant impact** to **potentially significant adverse impact**.

4.12.7 Unavoidable significant adverse impacts

Through compliance with laws and permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale solar facilities would have **no significant and unavoidable adverse impacts** on recreation resources from construction, operation, or decommissioning.

4.13 Historic and cultural resources

Key findings

Each historic or cultural resource's significance is unique to that resource; therefore, the impact analysis will also be unique and would need to be conducted during future project-level review for facilities. The significance of Tribal cultural resources can only be understood from within the cultural context of an affected Tribe. Accordingly, impact assessment and determinations of significance or non-significance would be done with engagement and in consultation with potentially affected Tribes and DAHP at the project level.

The land in Washington state has been utilized since before glaciers retreated at the end of the Pleistocene era. During the succeeding millennia, people have used a wide variety of strategies and approaches to interact with the landscape and its resources. As the environment has changed, so have those approaches. This has resulted in a history of human use and occupation that is reflected in historic and cultural resources. The *Historic and Cultural Resources Report* (Appendix L) includes the analysis and technical details used to evaluate historic and cultural resources in this PEIS. This section contains a summary of the affected environment, how impacts were analyzed, and the key findings.

4.13.1 Affected environment

The study area includes a diverse range of geological formations, animals, and plants. Each of these regions has a unique geological history that has formed the current landscape, and which plays an important role in archaeological site formation. The presence of an archaeological site means there was past human activity and physical objects or remains have been preserved there. Archaeological resources are typically identified through archaeological survey work.

Throughout the study area there are lands and shorelines where Tribes have lived for thousands of years and continue to live and use. Archaeological sites, historic properties, and Tribal place names exist throughout the study area. They include areas connected to Tribal cultural and spiritual practices and are represented within oral tradition stories and historic documents. Historic architectural resources include buildings, sites, structures, objects, or districts that have reached a particular age threshold to be considered for eligible for listing in a historic register. Many of these resources are present in the study area.

A Traditional Cultural Property (TCP) is a property or a place that is inventoried or determined to be eligible for inclusion on the National Register of Historic Places or the Washington

Heritage Register because of its association with cultural practices and beliefs. These are rooted in history and are important to maintaining the continuing cultural identity of the community's traditional beliefs and practices. DAHP maintains a database of TCPs, but very few are publicly disclosed. TCPs can be any location, landform, or object that has distinct association and importance to a group. The scale can be as large as an entire river or mountain or be confined to a single boulder. Many TCPs are present in the study area.

4.13.2 How impacts were analyzed

The PEIS evaluated how facilities could affect the following key features of historic and cultural resources:

- Archaeological resources, both recorded and unrecorded
- Historic architectural resources listed in a historic register or not listed but eligible for listing in a historic register
- Human remains and cemeteries
- Sacred sites
- Documented and undocumented TCPs

DAHP's databases identify the risk of potential historic and cultural resources at a broad level and identify known resources. Only a small portion of the state has been mapped in detail for historic and cultural resources. A future proposed facility would need to conduct site-specific cultural surveys to evaluate potential impacts in accordance with DAHP and federal requirements and guidance. General language about potential impacts to historic and cultural resources is identified in the PEIS.

The significance of Tribal cultural resources can only be understood from within the cultural context of an affected Tribe. Accordingly, the impact assessment and determinations of significance or non-significance of Tribal cultural resources would be done with engagement and in consultation with Tribes. This would be done through the SEPA process or the federal Section 106 process.

4.13.3 Findings all solar facility types evaluated in the PEIS

4.13.3.1 Impacts

Impacts from construction and decommissioning

Most site characterization activities would involve little or no ground disturbance. However, some ground-disturbing activities, such as drilling deep soil cores and building access roads, could result in impacts on or inadvertent discoveries of historic and cultural resources. In mountainous terrain, additional site grading and clearing may be required if existing access routes are unavailable or unsuitable for the planned investigation equipment.

Construction and decommissioning activities that could impact historic and cultural resources include ground disturbance, degradation of visual quality, noise, and interruption of the landscape and habitat. Tribal spiritual practices could be interrupted by construction impacts on land areas and cultural or sacred sites, including degradation of visual quality, noise, and interruption of access.

Construction could result in damage or destruction of historic and cultural resources from the clearing, grading, and excavation of the site and from building facilities and associated infrastructure. Construction will likely include subsurface infrastructure (e.g., foundations, pilings, utility trenches). Ground disturbance during construction is likely to impact undiscovered archaeological resources because there are many such sites throughout the study area and because most of the study area has not been archaeologically surveyed.

Degradation and destruction of historic and cultural properties could result from changes to the landscape and water flow patterns. The removal of soils, erosion of soils, and runoff into adjacent areas could also affect resources. Oil or other contaminant spills could affect resources.

Increased human access and subsequent disturbance such as looting, vandalism, and trampling of cultural resources could result from creating corridors or facilities in otherwise intact and inaccessible areas. Visual changes, changes in light, dust, and human presence could affect cultural resources for which visual integrity is a component of sites' significance, such as Tribal sacred sites, historic structures, trails, and historic landscapes.

Construction noise would depend on the activities, terrain, vegetation, and local weather conditions but may involve blasting and the use of equipment such as impact pile drivers and vibratory rollers. These can generate substantial noise and vibration. Cultural resources that are susceptible to noise impacts include TCPs or sacred sites because the cultural uses or practices that occur at these locations could be interrupted or diminished. Construction vibration could adversely affect cultural resources by damaging rock features or archaeological sites.

Decommissioning would involve similar types of activities as for construction. Site restoration activities may include recontouring, grading, seeding, planting, and perhaps stabilizing disturbed surfaces. The types of impacts would be similar to those associated with facility construction.

Impacts from operation

Operational activities that could affect historic and cultural resources include changes in access to natural and cultural resources and increased human activity with associated noise, light, dust, and human presence. Ongoing operations and maintenance are anticipated to include little new ground disturbance because the use of maintenance vehicles and equipment would generally be limited to access roads and areas already developed during construction.

Archaeological sites could still be affected by the increase in activity during operation of a facility. This includes increased vehicle traffic, vegetation management, or other activities, as well as the presence of people who might disturb surface artifacts. Ongoing ground disturbance could reveal previously unrecorded archaeological sites that are associated with TCPs.

Visual degradation of settings associated with cultural resources could result from the presence of utility-scale solar energy facilities and associated land disturbances. Visual changes could include the presence of rectangular solar arrays and structures. These could also include lighting, fencing, roads, vehicles, and workers conducting maintenance activities. These could affect cultural resources for which visual integrity is a component of sites' significance, such as Tribal sacred sites and landscapes, historic structures, trails, and historic landscapes.

Facility fencing and ongoing operations could impact access and travel paths traditionally utilized by Tribes for significant historic and cultural resources. This is most likely to impact TCPs, sacred sites, cemeteries, or precontact period archaeological sites where setting, feeling, and association are key aspects of the site.

4.13.3.2 Actions to avoid and reduce impacts

Mitigation would be done with engagement and in consultation with potentially affected Tribes and DAHP at the project level. Mitigation may be developed through consultation with affected Tribes as part of the SEPA process. Mitigation may also be developed under federal Section 106 of the National Historic Preservation Act. This is a separate, federal process.

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix L, *Historic and Cultural Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Design and site projects to avoid to the maximum extent impacts on cultural and historic resources. Begin with the use of the DAHP predictive model, then refine through the development of site-specific environmental and cultural context and Tribal coordination.
- Contact potentially affected Tribes early in the siting process, ideally before land is acquired for a project or before permit applications are developed, and offer information relevant to Tribal technical staff to help identify potential impacts on Tribes.
- Consider potential impacts on Tribal treaty-reserved rights, Tribal reservations, off-reservation rights, trust lands, other Tribal-owned land, and other areas of significance to Tribes during project design and in siting decisions.
- Conduct a site-specific cultural survey to evaluate potential impacts in accordance with DAHP and federal requirements and guidance. Offer DAHP and cultural experts from potentially affected Tribes the option to help develop the survey strategy.
- Consider requiring a Tribal monitor for survey crews to provide input on TCPs, sacred sites, and culturally significant sites during site selection.
- Provide cultural resource survey results to potentially affected Tribes for early review.
- Use previously disturbed lands and lands determined by archaeological inventories to be devoid of historic properties to the maximum extent possible.
- In areas where homesteading was a prevalent historic activity, contact the local assessors and historic museums to determine if the area includes known homestead sites.

Additional mitigation measures

- Conduct a cultural resources survey of the entire project site.
- Use training/educational programs for workers to reduce occurrences of disturbances, vandalism, and harm to historic properties. Plans should incorporate adaptive management protocols for addressing changes over the life of the project, should they occur.
- Address impacts to historic and cultural resources that follow the best available guidance and strategies developed by the federal, Tribal, and state governments, including, but not limited to, compensatory mitigation, formalized ongoing consultation between Washington State and Tribes to address new concerns and monitor long-term mitigation, and the development and maintenance of new technologies and geospatial analysis that help identity and avoid historic and cultural resources.

4.13.4 Findings for the No Action Alternative

Facilities developed under the No Action Alternative would be subject to the same regulatory standards as those noted for the types of facilities considered in this PEIS. It is expected there would be the same ranges and types of impacts on historic and cultural resources, from site characterization, construction, operation, and decommissioning activities for solar facilities under the No Action Alternative.

4.14 Transportation

Key Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on transportation.

No significant and unavoidable adverse impacts related to transportation resources would occur.

The term "transportation" refers to the system of roads, transit routes, railroads, waterways, and airport facilities that move people and goods. In this PEIS, transportation includes roadways and travel patterns, railroads, air travel, and navigable waterways.

The *Transportation Resource Report* (Appendix M) includes the full analysis and technical details used to evaluate transportation in the PEIS. This section contains a summary of how impacts were analyzed and the key findings.

4.14.1 Affected environment

4.14.1.1 Roadways and travel patterns

Washington's road network spans over 80,000 miles, including 764 miles of interstate highways and 1,602 miles of U.S. highways. Major roads in the study area include interstate highways I-90 and I-82, along with numerous state highways. These corridors serve as principal freight arterials, moving regional and international cargo, and providing commute and recreation routes. I-90 serves as the primary east-west corridor through Washington state. I-82 connects Ellensburg to Oregon.

The road system supports commercial, commuter, and recreation traffic, providing access to cities, rural towns, and outdoor recreational areas. Eighty percent of communities in Washington rely solely on trucks for their goods. Major agricultural production areas, including Yakima, Whitman, and Grant counties, depend heavily on the road network for transporting agricultural products.

4.14.1.2 Railways

Washington's rail transportation system moves over 95 million tons of freight annually. The study area includes over 3,200 miles of freight railroad tracks, with major operators being Burlington Northern-Santa Fe and Union Pacific. Rail freight is preferred for transporting high tonnage, oversize, and high-value cargo, such as solar panels, due to its fuel efficiency and capacity for heavy loads. The study area contains seven intermodal facilities for transferring cargo between rail and other transportation methods.

4.14.1.3 Air travel

Air transport is primarily used for smaller solar energy components, such as solar panels. Commercial airports outside of the study area could be used to receive solar facility components that are then transported to facilities within the study area. Major air cargo hubs in Washington that could support shipping of solar energy components include Seattle-Tacoma International Airport, King County International Airport-Boeing Field, and Spokane International Airport. Seattle-Tacoma International Airport serves as a primary gateway for international air freight, particularly from Asia. The study area also includes 98 general aviation airports, with additional airports nearby. These airports vary in size and uses but are primarily small airports serving local uses, including private aviation and agricultural operations.

4.14.1.4 Navigable waterways

Navigable waterways and ports are used to transport solar facility components. The Columbia River and the Snake River are key waterways located within the study area. Ports within or near the study area, such as Vancouver and Longview, receive solar energy components and transfer them to other modes of transport. Washington ranks fifth in the United States for maritime freight volumes, with 18 public ports and numerous marine terminals. Eight ports are located within the study area.

Using marine waterways can reduce road and rail congestion and system wear. The Columbia-Snake River System, part of the marine highway M-84, is a crucial route for transporting agricultural, energy, and manufacturing products. The study area's ports facilitate efficient and cost-effective freight transport, essential for regional and international trade.

4.14.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Traffic volumes and distances for construction and operation of facilities
- Potential water (barge), rail, and air traffic
- Potential new or redeveloped access roads or parking/staging areas for facility construction, operation, and maintenance activities

This programmatic analysis evaluated how the solar facilities could result in the following:

- Impacts on traffic patterns, volumes, hazards, or risks to other users, including commercial and military aircraft
- Road closures or interruptions to traffic patterns or volumes, affecting the movement of people and goods
- Damage to roadways or related infrastructure (e.g., culverts or bridges)
- Damage or change to transit, rail, air, or water transportation

4.14.3 Findings for utility-scale solar facilities

4.14.3.1 Impacts

Impacts from construction and decommissioning

Depending on location, solar energy facilities could impact local roads. Construction and decommissioning would require transporting equipment, materials, and workers to a facility site, potentially utilizing road, rail, air, or water (barge) transport. This would cause a temporary increase in demand for transportation services and a temporary increase in traffic on roads during construction (6 and 18 months) and decommissioning.

Worker commute

Workers would likely commute using existing roads. The workforce would likely be between 100 to 400 workers for a small to medium facility and may be between 300 to 800 workers for a large facility, depending on the timing and schedule for construction. The number of workers on site daily would vary. The location of the facility and commuting routes would determine whether construction or decommissioning would cause traffic congestion. Major roads typically accommodate more traffic than local roads, so a site closer to major roads may generate less congestion.

Material and component transport

Shipments to and from the solar energy facilities would mostly be by truck, although rail transport to the closest intermodal facility for materials or water (barge) transport could be used. The demand for transport would increase in proportion to the size of the facility. For truck transport, between 120 and 6,000 truckloads would be needed for panel delivery for a small to medium facility, with additional trucks needed for the delivery of other components, materials, and supplies. The number of overall truck trips for a large facility would range from approximately 230 to 4,600 trips. The number of daily truck trips would vary depending on construction activities and the length of the construction period. The number of daily truck trips would also vary throughout the construction and decommissioning periods depending on the stage in the process.

Solar panels often require oversize shipping services and can be transported by truck, rail, air, and water. The choice of solar panel transportation method would depend on the size and quantity of solar panels, the manufacturer's location, and the site location. If oversize or overweight truck shipments are required, local traffic would be temporarily affected.

For rail transport, utility-scale solar energy facilities would be unlikely to impact railroad operations because the solar equipment would represent a small part of the total amount of freight transported on a regular basis by railroads in the study area. However, roadway congestion, delays, or safety issues could arise if there are rail crossings near roads with high volumes of construction traffic. Due to the choices and availability of intermodal transportation within the study area, the highway, air, rail, and water transportation system in the study area could likely accommodate the additional demand associated with utility-scale facilities.

When compared to the existing volume of supplies, equipment, and materials that are shipped via truck, rail, air, and barge into, out of, and throughout the study area, the temporary increase in traffic volumes associated with construction or decommissioning would represent a small amount of the total traffic volumes in the area. Local transportation management plans and municipal regulations would address temporary traffic volume increases, detours, signage, and construction timing. No long-term road closures or interruptions to traffic patterns or volumes are expected during construction or decommissioning.

Road development

The construction or decommissioning of a facility could require new roads or development of existing roads. Road developments could include adding driveways or turning lanes or widening roads to accommodate larger truck turns. Road building or development would require construction labor, supplies, and equipment. It would also result in temporary traffic disruptions. However, these activities are temporary and there are policies and regulations in place to reduce impacts on the public (such as Traffic Management Plans). No substantial damage to roadways or related infrastructure (e.g., culverts or bridges) or transit, rail, air, or water transportation would occur.

> *Findings*
>
> Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, construction and decommissioning activities would likely result in **less than significant impacts** on transportation.

Impacts from operation

Traffic impacts

Operations would result in a small increase in vehicle trips caused by maintenance employees periodically traveling to the facility site. Periodic equipment repair or replacement would require the use of road, rail, water, or air shipping. Deliveries of materials during operations could include water or fuel for backup generators or maintenance vehicles. Fuels are routinely shipped for other applications and pose no unusual hazards. If on-site water is not available on-site during operations, water would need to be transported to the facility.

No long-term road closures or interruptions to traffic patterns or volumes are expected during operations. Air or marine transport would only be needed for periodic replacement of large components. No substantial damage to roadways or related infrastructure (e.g., culverts or bridges) or transit, rail, air, or water transportation would occur.

Aviation impacts
Authorization from FAA is required for any structure over 200 feet tall. Electrical interference from solar array control systems with aircraft operations is unlikely but should be evaluated for any new installation.

The potential for sun glare off PV panels is unlikely to impact pilot vision. PV panels are typically treated with an anti-reflective coating. Along busy air routes, such as airport approach routes, the solar array patterns could be adjusted to minimize interference. With the implementation of mitigation to avoid or reduce impacts (see the *Aesthetics/Visual Resources Resource Report*, Appendix J), and adjustments to solar array patterns to minimize interference with pilot vision, no permanent changes to aviation are expected to occur from solar energy facility operations.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on transportation.

4.14.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix M, *Transportation Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Consider traffic routes and peak hour traffic volumes when designating and designing access roads.
- Consider using existing roads, parking and staging areas, and utility corridors when possible.
- Design any new access roads to the appropriate standard, no higher than necessary for the intended function.
- Assess potential transportation impacts in coordination with appropriate state and local agencies, and consult land use plans, transportation plans, and other local plans, as appropriate.
- Coordinate with interested agencies, Tribes, and interested parties if facility design proposes or requires a change in interstate access or a new interstate access. Proposed

access changes should be considered in the context of statewide and local transportation and land use planning because they can affect local and regional traffic circulation.

- Design the facility to comply with applicable FAA regulations, including lighting requirements, to avoid or reduce potential safety issues.
- Coordinate with FAA early to identify and reduce impacts on military and civilian airport and airspace use.
- If the proposed facility is located under military utilized airspace with a floor of 500 feet above ground level, recommend coordinating with the local military representative to conduct a Glint/Glare Analysis to identify if there are potential impacts.
- Contact DoD early in the process on siting of a solar facility and transmission facilities near or within military training routes, military bases, or training areas in order to identify and mitigate potential impacts on military operations. Site design must consider military installations and air space needs. Use the CESA mapping tool to determine if solar projects are under military utilized airspace. If so, submit plans to the DoD for review.

4.14.4 Findings for facilities with co-located BESS

4.14.4.1 Impacts

Impacts from construction, operations, and decommissioning

Impacts would be similar to facilities without BESSs, except that more truck trips would be required to transport the BESSs during construction and decommissioning. Some of those additional trips would be oversize or overweight loads, which could have localized temporary impacts. In addition, BESSs are typically constructed on gravel areas, so additional gravel may need to be transported to the site.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operations, and decommissioning of facilities with a co-located BESS would likely result in **less than significant impacts** on transportation.

4.14.4.2 Actions to avoid and reduce impacts

Actions to avoid and reduce impacts from construction, operation, and decommissioning of facilities with co-located BESSs would be the same as those identified for facilities without a BESS.

4.14.5 Findings for facilities combined with agricultural land use

4.14.5.1 Impacts

Impacts from construction, operation, and decommissioning

Impacts during construction, operation, and decommissioning would be similar to facilities without co-located agricultural use, except that more materials or components and associated truck trips could be required due to changes in the layout or panel heights in order to accommodate agricultural use under the panels. There would also be additional traffic associated with the agricultural use during operations. Traffic would be similar to that of existing agricultural areas and activities in the study area.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operations, and decommissioning of facilities with agricultural use would likely result in **less than significant impacts** on transportation.

4.14.5.2 Actions to avoid and reduce impacts

Actions to avoid and reduce impacts from construction, operation, and decommissioning of facilities combined with agricultural land use would be the same as those identified for facilities without co-located agricultural use.

4.14.6 Findings for the No Action Alternative

The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on facility size and design, and would be **less than significant**.

4.14.7 Unavoidable significant adverse impacts

Through compliance with laws and permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale solar facilities would have **no significant and unavoidable adverse impacts** on transportation from construction, operation, or decommissioning.

4.15 Public services and utilities

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction, operation, and decommissioning activities would likely result in **less than significant impacts** on public services and utilities.

A facility would result in **potentially significant adverse impacts** to fire response if activities required a large fire response in remote locations with limited response capabilities, or if there are other unique aspects of a facility site.

This may result in a **potentially significant and unavoidable adverse impact**. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.

Public services and utilities include basic services and facilities that support development and protect public health and safety.

The public services evaluated include the following:

- Fire and emergency response
- Law enforcement
- Hospitals
- Emergency management
- Public schools

The utilities evaluated include:

- Electrical power
- Water supply
- Wastewater
- Solid waste services
- Natural gas
- Communications

The *Public Services and Utilities Resource Report* (Appendix N) includes the full analysis and technical details used to evaluate public services and utilities in the PEIS. This section contains a summary of how impacts were analyzed and the key findings. Information on EHS can be found in the *Environmental Health and Safety Resource Report* (Appendix G).

4.15.1 Affected environment

4.15.1.1 Public services

The study area is served by a variety of public service providers. Depending on the local conditions, public services may be provided by federal, Tribal, state, county, or local governments as well as volunteer fire departments and other volunteer groups. Public services addressed in this section include fire protection, law enforcement, emergency or other medical services, and schools.

Emergency response

Emergency response services include the following:

- **Law enforcement** services are provided by various county, municipal, and state entities including local county sheriff's offices and the Washington State Patrol. Portions of the study area are outside of local law enforcement jurisdictions. For example, DNR and federal agencies provide enforcement on their lands.
- **Fire prevention and response** are managed by local county fire departments, supported by volunteer units and other response teams.
- **Wildfire response** is provided by local fire departments as well as DNR, USFS, and BLM. DNR supports local responders and during high-risk conditions has helicopter and aircraft teams staged to respond to remote locations.

- **Emergency Medical Services** include paramedics to respond to medical emergencies.
- **Hospitals and medical facilities** provide public health preparedness and response services, with medevac services supported by public and private entities.

Public schools

A variety of public education school districts serve portions of the study area. These districts range in size from small, rural school districts to larger districts with numerous schools.

4.15.1.2 Utilities

The study area includes utility service areas and areas without services. Utilities described in this section include communications, gas and electrical, water, wastewater, and solid waste management. Depending on the area, utilities may be provided by county, city, Tribal, or private suppliers. In general, utility infrastructure often correlates to the size of the population it serves.

Communications

Communications services, including internet, broadband, and cell service, are generally available in populated areas, while rural parts may have limited or no service. Emergency alerts are communicated through radio, cell phones, and email.

Gas and electric

Four natural gas companies operate in Washington state. Electrical utilities are provided through public utility districts and three main corporations. Solar energy facilities are unlikely to require gas service connections but must identify existing subsurface utilities before construction.

Water and wastewater

Water supply in the study area comes from groundwater wells, surface water, and other sources. Solar facilities typically do not use wastewater systems, relying instead on septic or portable sanitary systems.

Solid waste landfills and recycling

Solid waste is managed by cities, counties, and private entities, with nearly 1,000 facilities in Washington, including 14 municipal solid waste landfills. Municipal and commercial solid waste is the largest contributor to solid waste. The next largest is construction and demolition debris, industrial waste, and cured concrete. A substantial portion of the materials that make up solar energy facilities are recyclable, such as steel, aluminum, glass, copper, and plastic. Under state law, by 2025 manufacturers of solar energy modules that operate or sell solar panels in Washington state will be required to take back and recycle them. The disposal of hazardous materials from batteries is described in Section 4.8, Environmental Health and Safety.

4.15.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Increased demand for public services that would exceed existing capacities of public service providers or such that unplanned new or physically altered governmental facilities would be needed to serve the facility
- Relocation or construction of new or modified utilities or service systems
- Potential to obstruct or otherwise impact aerial emergency response capabilities

4.15.3 Findings for utility-scale solar facilities

4.15.3.1 Impacts

Impacts from construction and decommissioning
Impacts associated with the site characterization, construction, and decommissioning of solar energy facilities could consist of those related to exceeding emergency response capacity, conflicts with other existing utilities, and potential prolonged service interruptions that may occur over portions of the construction period.

Emergency response
Construction and decommissioning of utility-scale solar energy facilities would employ a temporary workforce. This could result in an increased demand for public services including law enforcement, fire departments, and other emergency service response within and near the study area.

Materials and equipment on site may increase the potential for theft, vandalism, trespass, fire, safety issues, and/or accidents requiring law enforcement or other emergency response services. Facilities are expected to have site security including a combination of fencing, lighting, security patrols, security cameras, and other electronic security monitoring systems. It is anticipated that proactive planning, including a construction site security plan, would reduce potential law enforcement response demands.

Activities during construction of solar energy facilities would introduce ignition risks. In rural areas, the fire response demand posed in the event of a construction-related fire at a solar facility could limit fire response resources needed elsewhere in the area. Wildfire risks are discussed in Section 4.8, Environmental Health and Safety.

Worker safety training and adherence to safety procedures during construction would reduce potential emergency medical response demands. Solar energy facilities are frequently sited in locations that are far from hospitals or other emergency facilities. Winter conditions could make medical response more difficult if weather conditions prevent a medevac landing or access roads are closed. Consultation or early coordination with emergency response providers to ensure access and other proactive safety planning would reduce such risks. Additional discussion regarding emergency response is included in the *Environmental Health and Safety Resource Report* (Appendix G).

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction and decommissioning activities would likely result in **less than significant impacts** on law enforcement, emergency medical response, and most fire response.

A facility would result in **potentially significant adverse impacts** to fire response if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site.

Public schools

Findings
The impact on local schools would be minor, because few out-of-area workers are likely to permanently relocate their families to the community where the solar energy facility is being developed. For this reason, impacts on school enrollment would be **less than significant**.

Gas, electrical, and communications systems
Although new gas lines are not likely to be installed as part of a solar energy facility, existing gas and electrical lines would need to be located, marked, and avoided prior to ground-disturbing construction. During construction, there would also be the potential for temporary service interruptions as electrical systems are connected to the solar energy facility. Service providers require that line outages be scheduled during off-peak times, which would be coordinated to limit service disruptions. Notifications to residents and businesses for planned service interruptions would also likely be required.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, construction and decommissioning activities would likely result in **less than significant impacts** on gas, electrical, and communication systems.

Water and wastewater
Information on impacts on water resources is included in Section 4.5. Water demand would consist of the supply needed for activities such as concrete mixing, dust control, fire control, or for initial revegetation efforts. Sanitation and wastewater could be managed through contracted portable systems or septic systems. Water for non-potable uses may be accessed from reclaimed/recycled water supplies where available. Potable water would be needed for drinking water and could be supplied by a commercial supplier, on-site well, or a public or community water system.

Conflicts with existing subsurface water lines, wells, and wastewater lines could be addressed through utility mark and locate activities, which would be required prior to construction ground disturbances.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, construction and decommissioning activities would likely result in **less than significant impacts** on water and wastewater utilities.

Solid waste and recycling
During construction, the primary solid waste generated would consist of solid construction debris and a limited amount of waste associated with the construction workforce. Some of this waste, such as scrap metal or cardboard, could be recycled; the remainder would be transported to a licensed transfer station or landfill. Based on the quantities generated by similar-sized solar energy facilities, the nearly 1,000 solid waste providers in the state and 14 landfills could likely accommodate construction waste.

During decommissioning, remediation of the substation and electrical sites may be necessary due to the use of oils and other hazardous materials during energy facility operation. The precise quantities and content of solid waste would vary depending on the facility size, and the actions associated with decommissioning would depend on materials used and specific site restoration actions needed. Decommissioning would typically involve removal of all aboveground components of the solar facilities and would be likely to generate more solid waste than during the construction or operation phases. The regulatory requirements of the PV Module Stewardship and Takeback Program would reduce the quantity of PV waste content that would reach area landfills during decommissioning. Hazardous waste would be disposed of under federal and state requirements.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, construction and decommissioning activities would likely result in **less than significant impacts** on solid waste and recycling.

Impacts from operation
Emergency response
As with construction, solar energy facility operations could increase the demand for law enforcement services due to potential theft, accidents, vandalism, or trespassing. However, various security measures would typically be in place as part of normal operations to protect the facilities. Such measures would reduce demand for law enforcement services.

Impacts related to fire protection and response services involve consideration of two main types of fire risks during facility operation: 1) fire risks caused by solar energy facility operational activities; and 2) fires started outside of facilities that are affected (i.e., spread, movement, or ability to be suppressed) by the presence of a solar energy facility.

Like other electrical installations, PV solar systems can be subject to electrical faults. Incorrectly specified, sized, or faulty wiring or equipment can cause a fire at a solar energy facility site.

However, fires from PV solar panels are uncommon. All solar and electrical equipment would be required to conform to state and international building and fire code standards, including protective measures to reduce the potential of fires from lightning. These design measures would reduce ignition risks. Facilities would require testing and inspection for grid and system safety prior to commissioning, which would reduce operational fire risks.

Activities involving regular maintenance of a solar energy facility may include periodic electrical repair, welding, and equipment use and fueling. Such activities introduce risk for sparks or other ignition sources to an operational facility. However, these risks can be reduced through appropriate implementation of an Operational Site Safety Management Plan. This analysis assumes that solar energy facilities would be regularly maintained and monitored to reduce these risks. Accidents and fires could still occur; however, there is a low risk of operations activities igniting a wildfire.

Siting solar energy facilities in rural areas could have fencing and facility access restrictions that could delay emergency response if not proactively coordinated. Local and/or volunteer fire departments and responders may not be adequately trained and equipped to respond to wildfires that may occur on utility-scale solar energy facility sites. Specific facility access procedures, training, and coordination for response providers and volunteer units can help address concerns with local fire response capacity. The siting and height of structures such as substations, meteorological towers, and overhead gen-tie lines can also present risks to aerial firefighting. These should be addressed through early consultation with DNR or federal agencies to evaluate the siting and design for solar energy facilities.

Emergency medical services could be needed for employees. For example, periodic routine maintenance activities could involve a fire, electrical shock, or a medical emergency. The challenges of an emergency medical response could be exacerbated by winter conditions, distance of the facility site from medical services, and access to the site. However, the operational staffing for solar energy facilities would likely be small and not regularly on site. Additionally, facility operators would be expected to use appropriately trained technicians to operate and maintain the equipment. These considerations should result in a minimal increase in emergency medical service needs.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most operations of a facility would likely result in **less than significant impacts** on law enforcement, emergency medical response, and most fire response.

A facility would result in **potentially significant adverse impacts** to fire response if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site.

Public schools

Findings
Facilities would not be expected to require full-time permanent staff for facility operations and maintenance. Facilities would not increase the population such that new or modified public schools would be needed and impacts on local school enrollment during the operations phase would be **less than significant**.

Gas, electrical, and communications systems
Once operational, solar facilities would not be anticipated to increase demand for gas or electricity services. Solar energy facilities and their associated substations may include communication systems or tall meteorological structures, the presence of which could impact existing communication systems or low-wave radio signals. An evaluation of specific potential communications conflicts would occur as part of the Federal Communications Commission review or during the conditional use permit/land use approval process. Solar facilities would not be anticipated to increase demand for gas or electricity services during operations.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, operations of facilities would likely result in **less than significant impacts** on gas, electrical, and communications systems.

Water and wastewater
Water demand may include requirements for dust control, panel cleaning, potable water, vegetation, fire control, or sinks or toilets. If water is used for solar panel washing, a small to medium facility could use approximately 3.3 million gallons per year. A large facility would require more water, though this would vary based on panel size, soiling rates, and cleaning frequency. Facilities could also use dry cleaning methods. This water could come from a municipal supply, if water is available and approved by the utility. It could also be trucked in or from an on-site well, in which case a water right would be needed. If consistent with public health requirements and available supply, reclaimed water may supply some of such water demands. Additional discussion of water supply is provided in Section 4.5, Water Resources.

Potable water also may be needed for on-site drinking water, which could be supplied by a well or trucked to the site. The small number of operational staffing would limit impacts associated with waste and wastewater. If solar energy facilities include on-site septic systems during operation, such systems would conform to state requirements for the protection of water resources and public health. Septic systems or portable units, if utilized, would typically be maintained by a licensed service provider.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, construction and decommissioning activities would likely result in **less than significant impacts** on water and wastewater utilities.

Solid waste and recycling
A small amount of solid waste would be generated as part of normal operations and maintenance activities. Periodic replacement of PV solar panels would occur over the 30-year operational lifespan of solar facilities. These PV materials would be replaced in a manner consistent with state PV Module Stewardship and Takeback Program requirements. Other types of waste may include broken or rusted metal, defective or malfunctioning equipment, electrical materials, empty containers, miscellaneous solid waste, and typical refuse from operations and maintenance staff. Approximately 1 to 2 cubic yards of waste per week would be expected, which would be collected by a commercial waste management service.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, operation of facilities would likely result in **less than significant impacts** on solid waste and recycling.

4.15.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale solar facilities. See Appendix N, *Public Services and Utilities Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Coordinate with the local fire district, emergency management departments, USFS, and/or DNR (if facility siting is proposed on or near forests or wildlands) prior to and during construction and throughout the life cycle of the facility.
- Coordinate with the local fire district and DNR (as applicable, if the solar energy facility would be located in or near forests or wildlands) to ensure that adequate water supply is available for fighting fires. The facility developer may also be able to demonstrate that adequate water supply is available for firefighting via an on-site well or other water storage.
- Design facilities to reduce risks to neighboring land uses from gen-tie lines or other solar facility components, including potential setbacks, to reduce the risk of ignitions in fire-prone environments.
- Determine appropriate setbacks in consultation with local, state, or federal land managers. Setback distances should consider proximity to residences, terrain, vegetation management clearance requirements for gen-tie lines, vegetation and natural

communities on surrounding lands, and the need to maintain access for maintenance and emergency response, among other considerations.

Additional mitigation measures to address potentially significant impacts

- Develop and implement a site-specific Fire Prevention and Response Plan. This plan would include specific measures for coordinating and training response personnel, such as guidelines for first responders to safely shut electrical systems down in the event of fire, management requirements to reduce ignition risks throughout the sites, site management fire safety and awareness protocols including tracking fire conditions in the surrounding region, among others.
- Develop and implement a Decommissioning and Site Reclamation Restoration Plan to include fire prevention measures.

4.15.4 Findings for facilities with co-located BESS

4.15.4.1 Impacts

Impacts from construction, operation, and decommissioning

The site characterization, construction, operation, and decommissioning of a facility co-located with a BESS is anticipated to include the same impacts on public services and utilities as those described for facilities without BESSs.

Co-location of BESSs introduces an additional fire risk management and emergency response consideration. The types of BESSs evaluated in this PEIS rarely start fires if properly installed and maintained. Flow batteries and zinc-bromide batteries are generally not flammable. BESSs come equipped with remote alarms for operations personnel and emergency response teams. Other protective measures include ventilation, overcurrent protection, battery controls to operate the batteries within designated parameters, temperature and humidity controls, smoke detection, and maintenance in accordance with manufacturers' guidelines. Some battery types may contain hazardous materials that pose potential risks for environmental release if not handled correctly and could introduce hazards for first responders. BESS facilities could create extreme hazards for firefighters and emergency responders with the possibility of explosions, flammable gases, toxic fumes, water-reactive materials, electrical shock, corrosives, and chemical burns. Utility-scale energy storage requires specialized and reliable equipment to perform firefighting operations safely and effectively to the Washington Fire Code, NFPA, OSHA, and Underwriters Laboratories codes and standards, as discussed in the environmental health and safety section, as well as the applicable county fire protection district codes and standards.

Specialized advanced planning and procedures for enhanced fire response training would be required to ensure that the solar energy facilities and co-located BESSs do not initiate or exacerbate wildfires during construction, operation, or decommissioning or otherwise generate hazards that could interfere with or exceed emergency response capabilities. The recommended approach from the American Clean Power Association is not to use water for firefighting but allow the battery to burn in a controlled manner. This would result in air emissions which could be hazardous to emergency responders and would require protective gear.

Findings
Impacts to public services and utilities would be similar to findings for utility-scale solar facilities above, with additional fire response considerations for BESS.

4.15.4.2 Actions to avoid and reduce impacts

Available actions for facilities with BESSs would be the same as those proposed for utility-scale facilities without BESSs. Additional mitigation measures to address potentially significant impacts specific to BESS safety training and emergency response are below:

- Develop and implement the fire protection, prevention, and detection measures and design features in accordance with NFPA C855 Standards for Installation of Energy Storage Facilities and the current Washington Fire Code, including requirements for providing redundant separate methods of BESS failure detection.
- Develop and implement an Emergency Action Plan in advance of construction to train local emergency response personnel on hazards specific to BESSs during development and operation of the facility.
- Develop and implement regular maintenance schedules and inspections for BESS components to ensure optimal performance and early detection of potential issues.

4.15.5 Findings for facilities combined with agricultural land use

4.15.5.1 Impacts

Impacts from construction, operation, and decommissioning
Impacts on public services and utilities are anticipated to be similar to facilities without agricultural land use. However, because facilities would include active management of the vegetative landscape (e.g., grazing, irrigated crop production, pollinator habitat) and provide a beneficial cooling effect to the land, fire risk for the agricultural uses would generally be less compared to the other facilities analyzed. Emergency fire response demand may correspondingly decrease due to this type of land management. Agricultural land uses involve specific access considerations relevant to public services due to the shared land uses. Facilities could include fencing to accommodate grazing or other agricultural activities, which could pose challenges for first responders.

Findings
Impacts to public services and utilities would be similar to findings for utility-scale solar facilities above.

4.15.5.2 Actions to avoid and reduce impacts

The actions to avoid, reduce, and mitigate impacts for facilities would be the same as those identified for facilities without agriculture use.

4.15.6 Findings for the No Action Alternative

The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on facility size and design, and would range from **less than significant** to **potentially significant adverse impacts**.

4.15.7 Unavoidable significant adverse impacts

Construction, operation, and decommissioning of utility-scale solar facilities may result in a **potentially significant and unavoidable adverse impact** if activities required a large fire response in remote locations with limited response capabilities, or if there are other unique aspects of a facility site that affect fire response. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

5 Cumulative Impacts

5.1 Cumulative impacts analysis

Cumulative impacts are effects that would result from the impacts of utility-scale solar energy facilities added to the impacts from other past, present, and RFFAs. Cumulative impacts can result from incremental, but collectively significant, actions that occur over time. The cumulative impacts analysis was prepared in accordance with SEPA (WAC 197.11.060) and RCW 43.21C.535. The purpose is to make sure that decision-makers consider the full range of consequences under anticipated future conditions. Future project-specific environmental reviews would need to consider the cumulative impact of the project with other local and regional actions.

The cumulative impact analysis considered the following:

- Effects of multiple actions in the geographic study area (see Figure 3-1)
- Effects on the same resource
- Long-term effects

The following steps were used:

- Identify the resources that could be adversely affected by the future utility-scale solar energy facilities evaluated in the PEIS.
- Assess the current condition and historical context for each resource including trends affecting the resource.
- Consider RFFAs in the same time frame and affecting the geographic study area for each resource.
- Analyze cumulative impacts using the best available data.

Key findings

Due to the large geographic study area and broad trends of RFFAs identified in Table 5-1 that are considered in this planning document, all resources in this section would have impacts that range from **less than significant** to **potentially significant**. Future projects would need to conduct cumulative analyses relative to their proposal.

For some resources, the study area for cumulative impacts may extend beyond the geographic scope of study in Figure 3-1 to evaluate the incremental impacts on the resource within a larger community or landscape, such as migration corridors. Appendix Q contains the *Cumulative Resource Report* with more detailed information and specific analyses.

5.2 Past, present, and reasonably foreseeable future actions

Current conditions are a result of past and present actions. The current conditions in the study area were used as the baseline existing environmental conditions for the resource analyses in the PEIS and are described as part of the affected environment for those resources. Therefore, past actions were not considered again for most resources. Tribes have noted that resources in the study area are part of a much larger integrated cultural network and that impacts can extend far beyond the study area in space and time. To analyze the full range of consequences of potential cumulative impacts on Tribal rights, interests, as well as resources and cultural resources, some additional past and present actions are considered in this analysis (see Sections 5.3.1 and 5.3.13).

RFFAs, including the solar energy facilities evaluated in this PEIS, are activities that could affect the geographic study area over the 50-year study period (July 2025 through June 2075). These include trends that could affect humans and the environment within the study area during the study period. This trend analysis is appropriate for this planning document.

Table 5-1 outlines the types of future actions identified as reasonably foreseeable in the relevant geographic study area and time frame. These were used to identify trends that were used for the cumulative analysis.

Table 5-1. Summary of reasonably foreseeable future actions affecting the study area

RFFA	Associated activities	Trends identified
Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Development of new energy-generating facilities, including the solar energy facilities evaluated in this PEIS; transmission systems; and distribution networks • Modification of existing energy generation, transmission, and distribution infrastructure including those for electricity, natural gas, and petroleum products (e.g., gasoline and oil) • Decommissioning, decontamination, and demolition of former coal-fired power plants and associated facilities	• State committed to reducing GHG emission by 95% below 1990 levels by 2050 • Increased development of clean energy sources to meet state goals
Urban, Commercial, and Industrial Activities and Development	• Local residential developments • Urban redevelopment projects • Utility infrastructure (e.g., water/sewer, electrical distribution, and communications) rehabilitation and expansion • Industrial development • Industrial facility decommissioning	• 28% increase in population by 2050 • 1.04% to 1.27% increase in workforce growth for nonfarm occupations over next 10 years • Increased development to support population and workforce growth

RFFA	Associated activities	Trends identified
Rural and Agricultural Activities and Development	• Changes in the types of crops farmed • Conversion of non-designated agricultural land • Irrigation system maintenance and upgrades • Livestock grazing development and expansion	• Overall decline in agricultural land use from 1997 to 2022 (1.9 million acres of farm converted to other uses) • Future conversion of higher valued agricultural land less likely due to Goal 8 of Growth Management Act • Increased changes in farming practices and improvements to rural and agricultural-based infrastructure • Changes in agricultural activities to adapt to climate change
Federal, State, Tribal, and Local Wildlife and Habitat Projects	• Growth management programs • Stream and riparian habitat projects • Watershed planning and implementation	• Ongoing long-term strategies and activities that improve habitat and ecosystem functions, habitat connectivity, and species-specific conservation projects • Statewide 30-year program in place to restore and improve resiliency of shrubsteppe habitat
Transportation Infrastructure Development and Modification	• Highway and road expansion and maintenance • Rail transportation expansion and maintenance • Port and navigation channel expansion and maintenance • Airport and aviation support infrastructure expansion and maintenance • Mass transit projects	• Ongoing activities that maintain, expand, and improve state road and rail transportation systems and increase air and watercraft cargo shipping • Increased development and enhancement of multimodal (e.g., road, rail, waterway, bicycle, pedestrian) connections and choices
Timber and Forestry Management	• Expansion/reduction in forest management areas • Updates to the state's Forest Practices Rules • Timber harvests • Fire/fuel management projects • Fire suppression/firefighting activities	• Ongoing programs and activities to reduce fire risk in timber and forestry areas considering the effects of climate change
Contaminated Site Cleanup and Remediation	• Initial and remedial site investigations • Site cleanup activities • Monitoring and maintenance activities	• Ongoing cleanup and remediation activities at known contaminated sites

RFFA	Associated activities	Trends identified
Mining Operations	• Expansion of existing mining and processing facilities • Development of new mines and processing facilities • Changes in mining processes and procedures • Performance of reclamation activities	• Ongoing development expansion, operation, and reclamation of existing and newly permitted mining sites
Recreation Activities on Public Lands	• Management plans to continue and/or increase access to and use of hiking, biking, and equestrian trail systems; winter recreation areas; camping and RV sites; and areas for hunting, fishing, and off-road motor vehicle use	• Increased recreational use of public lands • Increased development and maintenance of public access points, trail systems, and other recreational use areas
Military Use	• Development or modification at military facilities • Runway resurfacing, construction, rehabilitation, and maintenance projects, and expansion of exclusion areas • Changes to surface and air training, operations, and testing	• Ongoing assessments of civilian-military compatibility needs to ensure military use and safety of military personnel
Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Development and use of reservoirs, well fields, water distribution systems, water treatment plants, and pump stations for municipal, agricultural, and industrial uses • Implementation of projects designed to improve water conservation and encourage water storage and flood risk reduction • Implementation of projects that support streamflow for aquatic species • Changes in water rights policy and water availability • Dam removals	• Increased risk of drought and subsequent water shortages considering the effects of climate change • Ongoing activities related to the development, improvement, and use of water supply systems to address future water supply issues

5.3 Cumulative impacts by resource

This section provides a summary of potential cumulative effects from the types of facilities considered in the PEIS and other RFFAs on resources. In general, the larger the facility the greater the potential for cumulative impacts because of the larger footprint, the increased need for construction materials, and the increased scale of the supporting infrastructure. It is assumed that energy projects included in RFFA 1 are likely to be located relatively near each other to take advantage of the same energy source conditions and infrastructure.

5.3.1 Tribal rights, interests, and resources

Tribes are recognized as unique sovereign people that exercise self-government rights that are guaranteed under treaties and federal laws. Tribal rights, interests, and resources refer to the collective rights and access to traditional areas and times for gathering resources associated with an Indian Tribe's sovereignty since time immemorial. They include inherent rights or formal treaty rights associated with usual and accustomed territories.

Tribal resources include areas important to traditional cultural practices and the natural and cultural resources associated with those practices including plants, wildlife, or fish used for commercial, subsistence, and ceremonial purposes. Tribal resources may also include archaeological or historic sites or TCPs associated with Tribal use and sites considered sacred by Tribes. Tribal resources, archaeological sites, historical and cultural sites, TCPs, and natural resources can often be interconnected and overlapping as Tribal resources. Additional details can be found in the *Tribal Rights, Interests, and Resources Resource Report* (Appendix O).

Tribal rights, interests, and resources have been repeatedly affected by past and present actions. Construction of past and present projects has included a range of ground disturbance and alterations to the landscape, some of which persist and contribute to the cumulative impacts that may result from solar energy facilities. The assessment of cumulative impacts on Tribal rights, interests, and resources includes these considerations.

All RFFAs identified in Table 5-1 have the potential to contribute to cumulative impacts on Tribal rights, interests, and resources. These could be from ground disturbance; restrictions to access; noise impacts; degradation of visual quality; or by affecting landscape, habitats, and species. The development of new energy, industrial, commercial, and agricultural facilities and transportation, mining, or forestry activities could impact Tribal resources. This could be from erosion, water quality impacts and water consumption, biological resource impacts, and disruption of access to resources. Federal, state, Tribal, and local wildlife and lands management and habitat projects would be expected to maintain, restore, or create habitats, including wetlands. Contaminated site cleanup and remediation projects would also be expected to improve habitats in the long term, but there would be short-term risks from leaks or spills during cleanup and remediation. Increased human access from recreational activities could potentially disrupt, alter, or degrade habitats and species. Water supply development and withdrawals for municipal, agricultural, industrial, and conservation uses could result in improvements to water resources but could also potentially disrupt, alter, or degrade habitats and species.

Construction and decommissioning activities of utility-scale solar facilities could result in cumulative impacts when combined with the impacts of these activities. Cumulative impacts on plants, animals, and ecological communities used by Tribal members could occur if multiple facilities and other activities are in the same area. These could result in changes to vegetation, fragmentation of habitats, degradation of fisheries, or restricted movement of animals and impacts to migration paths due to increased fencing, roads, and other structures. Tribal spiritual practices could be interrupted by construction impacts, and access to land areas and cultural or sacred sites could be limited. Sensitive viewers or sensitive receptors of noise impacts could include members of Tribes, and some landscapes can have special meaning because of Tribal connections or values. Multiple solar facilities and other activities developed in close proximity to each other could intensify disruption to sacred religious and ceremonial practices. As such, projects that are being constructed at the same time and near each other could intensify impacts from degradation of visual quality, noise, and interruption of culturally significant landscapes and habitats.

Potential cumulative impacts on Tribal rights, interests, and resources during operation of solar facilities include disturbance of previously unrecorded archaeological sites and visual degradation of settings associated with Tribal resources. Impacts could also include limitation of access and travel paths traditionally utilized for hunting, fishing, and other ritual and cultural activities. Impacts from limiting access and travel and from visual degradation are likely to be more significant cumulatively than on an individual project basis.

5.3.2 Environmental justice and overburdened communities

RCW 43.21C.535 requires this PEIS to consider environmental justice and overburdened communities. This PEIS considers whether potential environmental impacts disproportionately affect people of color populations and low-income populations. Of the 198 census tracts that overlap the study area, 40 (or 18%) contain a people of color population and 130 (or 66%) contain a low-income population. This PEIS also identifies where overburdened communities are located in the study area. An overburdened community is defined as a geographic area where highly impacted communities and vulnerable populations face multiple combined environmental harms and health impacts. Of the census tracts that overlap the study area, 43% were identified as overburdened community areas. Additional details regarding environmental justice and overburdened communities can be found in the *Environmental Justice Resource Report* (Appendix P).

All RFFAs identified in Table 5-1 have the potential to contribute to cumulative impacts on people of color populations and low-income populations. This is mostly because if projects are sited in or near these communities, residents could be disproportionately affected by project activities. These include increased traffic, noise, air emissions, hazards, visual impacts, and land use changes. The development of new energy, industrial, commercial, and agricultural facilities and transportation and forestry activities would have a greater risk of visual changes and conversion of land uses that affect the rural character of surrounding areas. These impacts could occur disproportionately in areas containing low-income populations and people of color populations. Mining is also likely to result in EHS risks and adverse environmental impacts from the use of hazardous materials that could disproportionately impact low-income populations and people of color populations.

Construction, operation, and decommissioning of the types of solar energy facilities evaluated in this PEIS are most likely to have cumulatively considerable impacts on people of color populations or low-income populations from visual changes, conversion of land uses, and impacts on fire response. The siting and operation of these facilities could result in the conversion of existing land uses. The specific impacts from these would depend on the existing use of the site where the facility would be located. Solar arrays and activities could have visual impacts from long distances, depending on topography and other factors. These changes could result in changes to perceptions of the rural character of the surrounding area. Facility activities could result in an impact on fire response if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site. If a facility is located near people of color populations or low-income populations, this would potentially result in disproportionate impacts on these populations.

Solar facilities and other activities near each other could also result in cumulative impacts on other resource areas, which could result in further cumulative impacts on people of color populations or low-income populations. Potentially significant impacts on resource areas that may disproportionally affect people of color or low-income populations, if cumulatively considered with similar effects from other RFFAs, include the following:

- Land use
- Aesthetics and visual quality
- Historic and cultural resources
- Tribal rights, interests, and resources
- Public services and utilities
- EHS
- Noise and vibration
- Recreation

5.3.3 Earth

Earth resources include geology, like soils and topography, and geologic and seismic hazards. Details can be found in the *Earth Resource Report* (Appendix B).

All RFFAs identified in Table 5-1 have the potential to result in impacts on earth resources. The cumulative impacts would depend on the location and number of activities and how near they are to each other. Ground-disturbing activities would impact soils. These may include grading for roads and development, clearing a site, and installing infrastructure. They could also include stockpiling and removing soils, changing the flow of water, and construction of access roads and facilities. These impacts may increase the potential for soil compaction, surface erosion and runoff, sedimentation of nearby waterways, soil contamination, slope instability, landslide risks, and changes in local drainage patterns. Grading and fill activities of multiple developments in the same area could result in an increased risk of large-scale landslides.

Cumulative impacts to earth resources from solar facilities and other RFFAs would be expected to increase but would vary depending on the size, type, and number of activities within a given area.

5.3.4 Air quality and greenhouse gases

All of the study area meets all ambient air quality standards. There are some areas of concern for particulate matter and ozone within the study area. Washington has requirements for reducing GHG emissions to achieve net zero emissions by 2050. Additional details regarding air quality and GHGs can be found in the *Air Quality and Greenhouse Gases Resource Report* (Appendix C).

Most RFFAs in Table 5-1 could contribute to cumulative impacts on air quality and GHGs. These RFFAs would use equipment and burn fossil fuels that would result in air pollutant and GHG emissions. These activities could create dust emissions from land-clearing activities and vehicle travel on paved and unpaved roadways.

State GHG emissions are expected to decrease over time to meet regulatory requirements like CETA, the Climate Commitment Act (CCA), and the Clean Fuels Standard. Clean energy sources would add to the state energy system, coal-fired power plants would be retired, and the use of electric cars would increase. However, population growth would lead to increases in urban, commercial, transportation, and industrial developments. These would emit GHGs but would need to meet regulatory requirements. More frequent and intense wildfires due to climate change could become an increasing source of particulate matter emissions and GHGs.

Cumulative impacts to air resources from solar facilities and other RFFAs may increase or decrease, depending on the size, type, and number of activities within a given area.

5.3.5 Water resources

Water resources include surface water and groundwater quantity and quality, water availability and water rights, streams and stream buffers, wetlands and wetland buffers, and floodplains. Further details on water resources can be found in the *Water Resources Report* (Appendix D).

All RFFAs identified in Table 5-1 have the potential to result in impacts on water resources. Cumulative impacts would occur when activities are within or adjacent to streams, wetlands, and floodplains. Ground disturbance, vegetation clearing, soil compaction, and increased impervious surface area would impact surface runoff. Sedimentation and spills of hazardous materials would adversely impact water quality in wetlands and other shared waters. Multiple developments within floodplains would result in cumulative impacts on floodplain functions. New development would increase the need for water use and obtaining water rights. Some activities, such as wildlife and habitat projects, could decrease impacts on water.

Cumulative impacts to water resources from solar facilities and other RFFAs may increase or decrease, depending on the size, type, and number of activities within a given area.

5.3.6 Biological resources

Biological resources considered in this cumulative analysis include terrestrial, aquatic, and wetland wildlife species, plant species, and habitats. These resources are described in detail in the *Biological Resources Report* (Appendix E).

All RFFAs identified in Table 5-1 have the potential to contribute to cumulative impacts on biological resources. Construction activities like land clearing, excavation, fill, and grading could affect species and habitat. Building and using roads, transmission lines, and facilities would also affect them.

Terrestrial, aquatic, and wetland habitats, including special-status habitats, would be affected by development activities. Impacts include habitat fragmentation, degradation, and loss, which could also affect landscape-scale habitat connectivity and wildlife migration corridors. Impacts may also include creating edge habitat.

Cumulative impacts would primarily be related to the disturbance, injury, and mortality of species. Wildlife would be affected by the movement of vehicles and equipment. Habitat changes across the landscape would adversely affect these species by limiting suitable habitats for cover, foraging, nesting, breeding, rearing, and migration activities. It would also result in the increased potential for invasive species to displace native species. Mobile species, like birds or larger animals, may be able to move into unaffected habitats. Special-status species may be particularly vulnerable to decreases in habitat connectivity due to their already declining populations and sensitivity to changes in their preferred habitats.

Wildlife may be affected by the movement of vehicles and equipment for solar energy facilities and nearby RFFAs.

Cumulative impacts on landscape-scale habitat and migration and wildlife corridors would occur if multiple RFFAs are developed in the same area, resulting in habitat degradation, fragmentation, and loss affecting landscape-scale habitat connectivity and wildlife migration corridors and the creation of edge habitat. This would restrict of the movement of animals and migration paths due to increased fencing, roads, and other structures.

Migration routes and wildlife corridors provide important habitats for migrating species like birds and large animals. Cumulative impacts on landscape-scale habitat and migration and wildlife corridors would occur if multiple activities occur in the same area. Some animals and birds could be affected by activities that restrict their movements. This could be from construction, operation, or increased fencing, roads, and other structures. Many ungulates, or large hooved animals, migrate on a seasonal basis. The viability of these animals could be affected if summer and winter migration patterns are disrupted. USGS reports provide detailed mapping of migration routes (see Figure 5-1 for an example of this mapping).

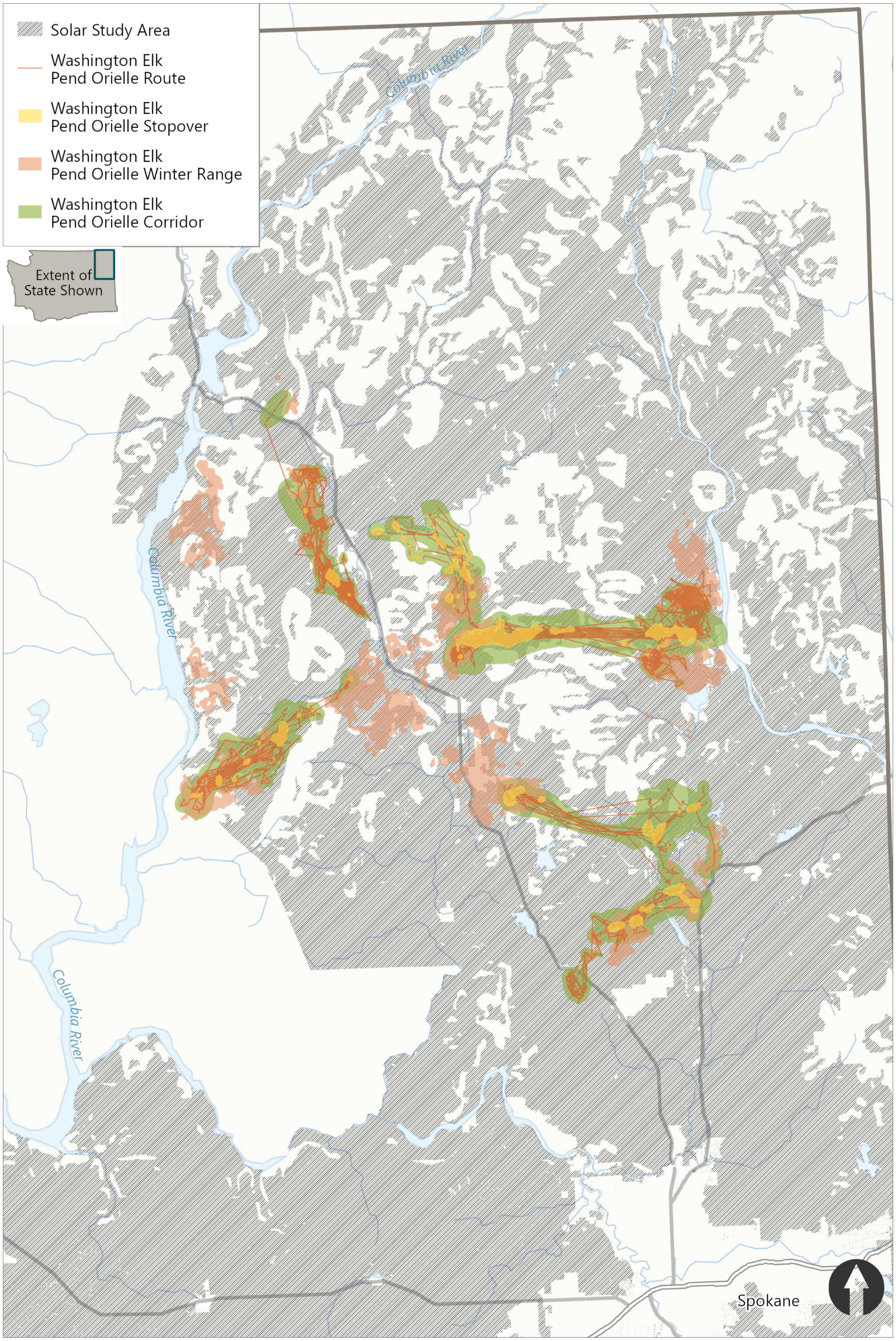

Figure 5-1. Example ungulate migration map for Pend Oreille elk winter range

If multiple solar facilities are developed in the same area, birds may be at risk of collision or altered behavior because they may confuse solar panels with water bodies. This may attract migrating birds and cause them to collide with the panels, or they may try to use the panels as places to rest or feed.

Cumulative impacts to biological resources from solar facilities and other RFFAs would be expected to increase but would vary depending on the size, type, and number of activities within a given area and the magnitude and extent of disturbance to terrestrial, aquatic, and wetland habitats and species.

5.3.7 Energy and natural resources

The study area contains substantial energy sources, including wind, sunlight, electricity, and fuels. Mines and quarries throughout the area produce sand, gravel, and crushed stone. These resources are described in detail in the *Energy and Natural Resources Report* (Appendix F).

Most RFFAs have the potential to contribute to cumulative impacts on energy. Clean energy projects would add electricity resources while other energy projects could use electricity. New development would use resources to grow. Changes in land designations would make a site suitable or unsuitable for development. Improved transportation infrastructure would be expected to lead to improved energy distribution. Conservation efforts could reduce the need for energy-intensive water treatment systems. Activities could increase the need for electricity and fuels for new development. There may be an increased need for aggregate to construct infrastructure, urban developments, transportation projects, and water supply projects.

Cumulative impacts to energy from solar facilities and other RFFAs may increase or decrease, depending on the size, type, and number of activities within a given area. Cumulative impacts to natural resources from solar facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

5.3.8 Environmental health and safety

EHS includes hazardous materials exposure, wildfire hazards, and worker health and safety. For more information, refer to the *Environmental Health and Safety Resource Report* (Appendix G).

All RFFAs identified in Table 5-1 have the potential to result in impacts on EHS. Many activities are permitted to store, use, or dispose of hazardous materials. The study area contains cleanup sites on the National Priorities List under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund sites. These sites have hazardous material contamination present in the soil, surface water, or groundwater. Decommissioning for solar energy facilities and other energy facilities and cleanup and mining sites could involve a higher risk of releasing hazardous materials. This could be from degradation of facility components or from increased movement of hazardous materials.

Washington has experienced many extreme fire events in recent years due to climate change. Due to the relatively dry conditions, wildfires in eastern Washington occur more often than in other parts of the state and this trend is expected to continue in the future. Based on research conducted by the University of Washington, all counties in Washington show a significant increase in the projected number of high fire days between the years 2040 and 2069. Development or land use changes could lead to increased ignition risks or create areas with elevated fire risk. Some activities, such as land management and habitat projects, could potentially reduce wildfire risk by improving the health of ecosystems and communities.

Cumulative impacts to wildfire risk and hazardous materials from solar facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

5.3.9 Noise and vibration

Impacts from noise and vibration are based on distance to potential sensitive human receptors. In general, noise levels are high around major transportation corridors, airports, and industrial facilities and low in rural or non-industrial areas. For more information, refer to the *Noise and Vibration Resource Report* (Appendix H).

Most RFFAs identified in Table 5-1 have the potential to result in noise and vibration impacts. Noise levels for activities are highest during construction when land clearing, grading, and road construction would occur. These could include heavy equipment operation, pile driving, and blasting. These would typically be temporary and of short duration.

Noise impacts during operations of activities would depend on the type, terrain, vegetation, and local weather conditions as well as distance to the nearest sensitive receptors. Sources of noise and vibration from operations of solar facilities would contribute to cumulative impacts. Urban, rural, agricultural, commercial, mining, and transportation development and use are expected to add to noise and vibration.

Cumulative impacts from noise and vibration from solar facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

5.3.10 Land use

Most of the study area is agricultural, rural residential, forestry, wildlife conservation, and undeveloped recreation areas. GMA counties must develop Comprehensive Plans to manage their land use. Non-GMA counties must still plan for critical areas and natural resource lands. For more information, refer to the *Land Use Resource Report* (Appendix I).

Most RFFAs identified in Table 5-1 have the potential to result in land use impacts. Cumulative impacts on land use would occur as a result of the construction and operation of energy, urban, industrial, and transportation activities. The general trend towards conversion of land uses to urban developments combined with solar energy facilities in rural areas would lead to a cumulative loss in other land uses such as agricultural or undeveloped lands. Activities could result in increased dust, noise, traffic, and visual changes that could affect other properties.

The operation of solar energy facilities would also result in changes to the visual landscape from the presence of solar arrays, with the facility potentially visible from long distances. Other development activities would also result in change to the visual landscape. These changes would result in changes to and/or perceptions of the rural character of the surrounding area.

The nature and extent of cumulative effects on land use in the study area would depend on whether the RFFAs resulted in changes or conversions to the same types of land uses and designations.

5.3.11 Aesthetics/visual quality

The study area for aesthetic and visual resources includes the overall solar energy geographic study area, as well as surrounding viewsheds. Visual resources include all objects and features that are visible on a landscape and that add or detract from its aesthetic or scenic quality. Additional details can be found in the *Aesthetics/Visual Quality Resource Report* (Appendix J).

Most RFFAs identified in Table 5-1 have the potential to result in impacts on aesthetics and visual quality. Development and operation would involve a range of activities with potential visual impacts. These include the removal of vegetation; dust generation; new roads; and modifying or building residential, industrial, commercial facilities. Multiple utility-scale solar energy facilities in the same area would introduce visual contrasts because of the horizontal rows of PV panels. This visual impact would likely be seen from long distances.

Typically, vegetation-clearing activities for facilities, forestry management, and roads would create visual impacts primarily by changing the color and texture of the cleared areas. Other RFFAs, such as other energy facilities, land use changes, and the development of water reservoirs or major transportation infrastructure projects, would also introduce visual contrasts and glare from artificial light sources.

Cumulative impacts to visual resources from solar facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

5.3.12 Recreation

Recreation resources include parks, recreational opportunities, public lands, and public amenities such as trails. Designated recreation areas include local parks, federal lands, and state lands. Hunting and fishing seasons vary throughout the year by the species of animal. For more detailed information, see the *Recreation Resource Report* (Appendix K). Tribal hunting and fishing also occur throughout the state at various times during the year. For more detailed information, see the *Tribal Rights, Interests, and Resources Report* (Appendix O).

Some RFFAs identified in Table 5-1 have the potential to result in impacts on recreational resources. Construction of utility-scale solar energy facilities, other energy facilities, new commercial and industrial development, mining operations, transportation projects, and water supply projects would increase temporary noise, dust and visibility, and traffic, and result in temporary changes in access to recreation resources. Larger transportation networks would also involve more vehicle traffic, resulting in more sources of noise and vibration and air pollution near recreation areas. Construction and operations could restrict access to existing recreational sites on a site or affect access to nearby areas. Increased fencing could also result in loss of recreational opportunities. As described in Section 5.3.6, activities are expected to have cumulative impacts on habitat and species, reducing opportunities for hunting and wildlife viewing. Some activities, such as wildlife and habitat projects, could improve recreational opportunities.

Cumulative impacts to recreation resources from solar facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

5.3.13 Historic and cultural resources

Archaeological sites, historic properties, and Tribal place names exist throughout the study area. They include areas connected to spiritual practices and named places and are represented within oral tradition stories and historic documents. Historic and cultural resources include recorded and unrecorded archaeological resources, historic architectural resources listed or eligible for listing in a historic register, human remains and cemeteries, sacred sites, and documented and undocumented TCPs. Historic and cultural resources have been repeatedly affected by past and present impacts. Additional details regarding historic and cultural resources can be found in the *Historic and Cultural Resource Report* (Appendix L).

All RFFAs identified in Table 5-1 have the potential to result in impacts on historic and cultural resources. Construction of past and present projects has included a range of ground disturbance and alterations to the landscape, some of which persist and contribute to the cumulative impacts that may result from solar energy facilities. The assessment of cumulative impacts on historic and cultural resources includes these considerations.

Construction and decommissioning of all utility-scale solar energy facilities considered in this PEIS along with other activities could result in cumulative impacts on, or inadvertent discoveries of, historic and cultural resources. Construction and decommissioning activities that could impact historic and cultural resources include ground disturbance, degradation of visual quality, noise, and interruption of the landscape. Ground disturbance is likely to impact undiscovered archaeological resources due to the prevalence of such sites throughout the study area and the fact that the majority of the study area has not been archaeologically surveyed. Other cumulative impacts that may result from solar energy facilities along with other activities could include degradation and interruption of culturally significant landscapes and habitats. Increased human access exposes archaeological sites and historic structures and features to greater probability of impact from a variety of stressors.

Potential cumulative impacts on historic and cultural resources during operation include disturbance of previously unrecorded archaeological sites. They also include visual degradation of settings associated with historic and cultural resources and limitation of access and travel paths traditionally utilized for cultural resources. These impacts are likely to be more significant cumulatively than on an individual project basis.

Together, past and present projects, the future activities identified here, and potential solar facilities represent changes to culturally important landscapes. Archaeological sites and TCPs are non-renewable resources; impacts on these resources could contribute to cumulative impacts from past, present, and future projects.

5.3.14 Transportation

Transportation includes roadways, railroads, airports, ports, transportation systems, traffic, parking, and movement of people and goods. For more information, refer to the *Transportation Resource Report* (Appendix M).

Most RFFAs identified in Table 5-1 have the potential to result in impacts on transportation. Transporting resources and workers during construction, operation, and decommissioning contribute to cumulative impacts on transportation and traffic. Activities may include road modifications or new road construction. Transportation activities would directly affect transportation resources and would be likely to result in improvements to traffic or movement. Increases in traffic from transportation infrastructure projects and urban, rural, industrial, agricultural, and commercial facilities would result in impacts.

Cumulative impacts to transportation resources from solar facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

5.3.15 Public services and utilities

Public services in the study area include public schools, fire departments, emergency medical services, and law enforcement. Public services may be provided by federal, Tribal, state, county, or local governments as well as volunteer fire departments and other volunteer groups. Utilities include telecommunications, gas and electrical, water, wastewater, and solid waste management. Depending on the area, utilities may be provided by county, city, Tribal, or private suppliers. These resources and activities are described in detail in the *Public Services and Utilities Resource Report* (Appendix N).

Some RFFAs identified in Table 5-1 have the potential to contribute to cumulative impacts on public services and utilities. New urban, commercial, and industrial activities and development would be expected to increase the demand and availability of public services and utilities, as would activities associated with changes in rural and agricultural activities. Increased demand from activities could exceed existing capacities of public service providers and result in the need for new or modified utilities or service systems.

Firefighting and emergency response needs would increase from changes in land management and the development and operation of energy facilities, water supply projects, and rural and urban developments. These activities would introduce ignition sources that would increase the risk of fire. Urban, commercial, industrial, rural, and agricultural development may also increase demand for potable water and wastewater treatment. If waste associated with urban, rural, commercial, agricultural, and industrial activities is not managed appropriately, it would exceed capacities for utility providers such as landfills and transfer stations.

Cumulative impacts to public services and utilities from solar facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

6 Consultation and Coordination

This chapter describes how information was shared during the development of the Draft PEIS. Ecology used several methods to reach out to Tribes, local and state agencies, solar energy developers, environmental organizations, and other interested parties. These groups were provided opportunities to share information, comments, and perspectives and to engage in the development of the Draft PEIS.

6.1 PEIS scoping process

Scoping for the PEIS began on September 27, 2023. The Determination of Significance and Scoping Notice for the PEIS initiated Ecology's environmental review process. The public scoping comment period was held from September 27 to October 27, 2023. Two online public scoping meetings were held for the public to provide verbal comments on October 5 and October 10, 2023. Spanish interpreters were available at meetings, and materials were translated into Spanish. A separate Tribal scoping meeting was held on October 17, 2023. Tribes were provided an additional 30 days to submit comments. Ecology accepted written scoping comments online and by mail, and verbally during online public scoping meetings.

A variety of scoping materials were available on Ecology's PEIS website for public review throughout the scoping period. The website provided information on scoping, including how to comment and a link to an online comment form. The *Scoping Summary Report* can be found in Appendix A.

Scoping outreach summary

- **Legal notices** published on the SEPA Register on September 27, 2023, and published in *The Seattle Times*, *The Spokesman-Review*, *Columbia Basin Herald*, *TriCity Herald*, and *Tú Decides*
- **Notifications** sent to Tribal Chairs, Natural and Cultural Resources Directors, and Executive Directors of Tribal Organizations
- **Public, agency, and media notifications** through social media post on Twitter, email and listserv distributions, and news releases
- **PEIS website** developed and provided information and links
- **Information** published on Ecology's Public Input and Events Listing website

6.2 Additional outreach and coordination with interested parties

A series of meetings were held with interested parties during development of the Draft PEIS. These meetings were designed to engage environmental organizations, the solar industry, utilities, federal and local governments, and ports. Invited parties included those that have been active in discussions about solar energy development in the state, expressed an interest in contributing information for the PEIS process, or are located in areas where future facilities considered in this PEIS may be proposed.

Meetings were designed to share Ecology's clean energy legislative directive, updates on the purpose of the PEIS and how it can be used, as well as the PEIS timeline. Meetings were also used to gather general input and specific information and feedback from participants.

Ecology will host three public hearings, two in person and one virtual, to collect comments on the Draft PEIS. Ecology will respond to comments in the Final PEIS. Materials for the public hearings will be available in English and Spanish. Public hearings will take place within 30 days of the date of publication of the Draft PEIS.

6.3 Tribal engagement and consultation

Ecology provided notification of the scoping period to Tribal Chairs and Natural and Cultural Resources Directors of all federally recognized Tribes with lands and territories in Washington state, and Executive Directors of Tribal organizations. Government-to-government consultation was offered to federally recognized Tribes in Washington as an option at any time during the PEIS process. After scoping, Ecology repeated this invitation for consultation at Tribal forums in spring 2024 where the scoping report was discussed.

Ecology provided opportunities where Tribes could choose to share information, comments, and perspectives on clean energy planning as well as facility environmental review and permitting processes. A Tribal scoping meeting was held on October 17, 2023.

Tribal forums were held during development of the Draft PEIS on March 12 and April 30, 2024, with representatives of interested Tribes and Tribal associations attending. At Tribal forums during development of this Draft PEIS, Ecology presented the geographic scope of study. The study area excludes Tribal reservation and trust lands, and Ecology asked if Tribes wanted to include their lands in the scope of study. Ecology offered Tribes an opportunity to review draft sections of the *Tribal Rights, Interests, and Resources Report* (Appendix O) and *Historic and Cultural Resources Report* (Appendix L). The Columbia River Inter-Tribal Fish Commission and Suquamish Tribe provided comments, which Ecology considered in developing this Draft PEIS.

Ecology will continue to offer Tribal forums once per quarter to provide information and discuss ideas and issues related to clean energy coordination. These forums are opportunities for Ecology to request early and continued feedback from and involvement by Tribes potentially affected by planning actions or facilities and ensure Tribes are informed of opportunities to comment on the PEIS.

6.4 Agency coordination

Ecology worked with state agencies that have expertise in the areas evaluated in the Draft PEIS. These included EFSEC, WFDW, DNR, WSDOT, and DAHP. State agency coordination included a series of meetings in early 2024 on how impacts on specific resources would be technically evaluated in the PEIS. Ecology met with EFSEC, DAHP, WDFW, and DNR staff on several occasions to discuss sources of information, potential impacts, and measures to avoid and reduce impacts. State agency staff reviewed draft technical reports and chapters of the Draft PEIS. Ecology also provided regular updates to the interagency Clean Energy Siting Council.

7 Permits and Approvals

7.1 Federal

- **Bald and Golden Eagle Protection Act (USFWS):** This permit is required for any facility activities that may disturb or harm bald or golden eagles or their habitats, especially during construction near nesting sites.
- **Determination of No Hazard to Air Navigation Approval (FAA):** Submission of FAA Form 7460-1 is required for any structure that exceeds certain height limits or is near airports to ensure it does not pose a hazard to air navigation.
- **Endangered Species Act (USFWS/National Oceanic and Atmospheric Administration [NOAA] Fisheries):** This consultation is required for any facility that may affect endangered or threatened species or their habitats, ensuring no jeopardy to their existence or destruction of critical habitats.
- **Magnuson-Stevens Fishery Conservation and Management Act (NOAA Fisheries):** This consultation is required to protect essential fish habitats affected by the facility, particularly those near significant waterbodies.
- **Migratory Bird Treaty Act (USFWS):** This permit is required for any facility activities that may disturb or harm migratory birds, their nests, or eggs.
- **National Environmental Policy Act (federal agency):** This environmental review is required for all federal actions including federal projects or any project requiring a federal permit, federal funding, or located on federal land.
- **National Historic Preservation Act (Advisory Council on Historic Preservation):** A Section 106 consultation is required for facilities that may affect historic properties and is typically completed as part of the federal permitting or other approval process. The process includes consultation with interested and affected Tribes, the State Historic Preservation Officer with DAHP, and other interested parties.
- **National Oceanic and Atmospheric Administration Radar Operations Center Approval (NOAA):** This approval is required to ensure the facility does not interfere with NOAA radar operations.
- **Section 4(f) Review (U.S. Department of Transportation):** This review is required to ensure the protection of publicly owned parks, recreation areas, wildlife refuges, and historic sites.
- **Section 401 Water Quality Certification (USEPA, Ecology, or Tribes):** This certification is required for any facility needing a federal permit or license that may result in discharges to waters of the United States, ensuring compliance with state water quality standards.
- **Section 404 Permit (U.S. Army Corps of Engineers):** This permit is required for facilities involving the discharge of dredged or fill material into U.S. waters, including wetlands.
- **U.S. Department of Defense Clearance for Radar Interference (DoD):** This clearance is required for facilities that may interfere with military radar operations, particularly for tall structures near military installations.

- **Determination of No Hazard to Air Navigation Approval (FAA):** This approval ensures that the facility does not pose a hazard to air navigation, which is critical for tall structures.
- **Federal Aviation Administration Form 7460-1 (Notice of Proposed Construction or Alteration) (FAA):** This form is submitted for structures affecting navigable airspace.

7.2 Washington State

- **Aquatic Use Authorization (DNR):** This authorization is required for any facility activities involving the use of state-owned aquatic lands.
- **Archaeological Excavation and Removal Permit (Washington Department of Archaeology and Historic Preservation):** This permit is required for excavating or removing archaeological resources within the facility area.
- **Air Prevention of Significant Deterioration Permit (EFSEC, Ecology):** This permit ensures that air discharges from the facility meet state standards.
- **NPDES Permit (Ecology):** This permit may be required for construction or for industrial uses that include discharges from the facility site.
- **State Waste Discharge Permit (Ecology):** These permits regulate discharges from municipalities or industries to groundwater and from commercial industry to a publicly owned treatment works.
- **Surface Mining Reclamation Permit (DNR):** This permit is required for each surface mine that results in more than 3 acres of disturbed ground, or has a high-wall or disturbance area that meets certain criteria.
- **State Environmental Policy Act (state or local agency):** This environmental review helps state and local agencies identify environmental impacts that may result from projects and decisions.
- **Coastal Zone Management Act (Ecology):** A notice of consistency with the state Coastal Zone Management Program is a condition of federal activities, federal license, and permit approval. This permit ensures compliance with state coastal management policies.
- **Washington Forest Practices Act (DNR):** A permit is not required for every forest practice, but the forest practices rules must be followed when conducting all forest practices activities. A permit may be required for logging or forest road construction activities.
- **Electrical Permits (Washington State Department of Labor and Industries):** These permits ensure all electrical installations meet state safety standards.
- **Washington State Hydraulic Project Approval (WDFW):** This permit is required for any work that uses, diverts, obstructs, or changes the natural flow or bed of any fresh water or saltwater of the state.
- **Washington State Shoreline Management Act (Ecology):** The Shoreline Management Act requires all counties and most towns and cities with shorelines to develop and implement Shoreline Master Programs. Local governments issue shoreline substantial

development, conditional use, and variance permits, as well as shoreline exemptions pursuant to the policies and use regulations in their Shoreline Master Programs.

- **Water Pollution Control Act (Ecology):** This is used to authorize projects that will result in the alteration or loss of non-federally regulated wetlands and other waters of the state that are not within federal jurisdiction certifications. **Water Right Permit (Ecology):** This permit is necessary for new water diversions, withdrawals, or changes to existing water rights.
- **Utility Accommodation Permits and Franchises (WSDOT):** These permits are required for utility installations crossing state highway ROWs.
- **Overweight/Oversize Permits (WSDOT):** These permits are required for overweight/oversize loads.

7.3 Local

- **Air Quality Permits (local air quality management authority or Ecology):** These permits are required to control and manage emissions from construction and operation activities.
- **Blasting Permits (local fire department or building authority):** These permits are necessary for any blasting activities.
- **Construction Permits (local building authority):** Various permits are required for construction activities, including ROW access, clearing, grading, building, mechanical, and electrical permits.
- **Floodplain Development Permits (local planning department):** These permits are required for construction activities within designated floodplain areas.
- **Critical Areas Codes, Shoreline, Zoning Ordinances, and Other Land Use Requirements (local planning department):** Compliance with these local regulations ensures the facility meets land use, zoning, and environmental protection standards.

8 List of Preparers and Contributors

Name	Subject matter
Agencies	
Washington State Department of Ecology	Tribal rights, interests, and resources, environmental justice and overburdened communities, earth, air quality and GHGs, water resources, biological resources, energy and natural resources, EHS, noise and vibration, land use, aesthetics/visual quality, recreation, historic and cultural resources, transportation, public services and utilities, cumulative impacts
State of Washington Energy Facility Site Evaluation Council	SEPA process, energy facility considerations
Washington Department of Fish and Wildlife	Earth, water resources, biological resources, recreation
Washington State Department of Natural Resources	Earth, water resources, biological resources, EHS, land use, recreation, transportation
Washington State Department of Transportation	Transportation
Washington State Department of Archaeological and Historic Preservation	Historic and cultural resources
Department of Defense	Military areas
Consultant team	
Anchor QEA	Tribal rights, interests, and resources, environmental justice and overburdened communities, earth, water resources (wetlands), biological resources, land use, cumulative impacts
Environmental Science Associates	Air quality and GHGs, water resources, EHS, noise and vibration, aesthetics/visual quality, recreation, historic and cultural resources, transportation, public services and utilities
Hammerschlag	Energy and natural resources, climate change assumptions
Dynamic Language	Document accessibility and language translation
Ross Strategic	Stakeholder and public engagement
Triangle Associates	Tribal engagement

9 Distribution List

Governments, agencies, and regional councils

- Association of Washington Cities
- Bonneville Power Administration
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Reclamation
- Clean Air Agencies
- Clean Energy Siting Coordination Council
- State of Washington Energy Facility Site Evaluation Council
- Environmental Justice Council
- Federal Aviation Administration
- Federal Emergency Management Agency
- Federal Energy Regulatory Commission
- General Services Administration
- Governor Jay Inslee and executive and policy staff
- Governor's Office of Indian Affairs
- Governor's Office for Regulatory Innovation and Assistance
- National Marine Fisheries Service
- National Park Service
- Northwest Power and Conservation Council
- Puget Sound Partnership
- Puget Sound Regional Council
- U.S. Army Corps of Engineers
- U.S. Department of Defense
- U.S. Department of Energy
- U.S. Department of the Interior
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- Washington city and county planning agencies and SEPA lead agencies
- Washington State Department of Fish and Wildlife
- Washington State Department of Natural Resources
- Washington Emergency Management Division
- Washington State Association of Counties
- Washington State Conservation Commission
- Washington State Department of Agriculture
- Washington State Department of Archaeological and Historic Preservation
- Washington State Department of Commerce
- Washington State Department of Health
- Washington State Department of Social and Health Services
- Washington State Department of Transportation
- Washington State Legislators and Legislative Committees
- Washington State Parks and Recreation Commission
- Washington State Utilities and Transportation Commission

Tribes and Tribal representation

- Affiliated Tribes of Northwest Indians
- Columbia River Inter-Tribal Fish Commission
- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Chehalis Reservation
- Confederated Tribes of the Colville Reservation
- Confederated Tribes of the Umatilla Indian Reservation
- Confederated Tribes of Warm Springs
- Cowlitz Indian Tribe
- Hoh Indian Tribe
- Jamestown S'Klallam Tribe
- Kalispel Tribe of Indians
- Lower Elwha Klallam Tribe
- Lummi Nation
- Makah Tribe
- Muckleshoot Indian Tribe
- Nez Perce Tribe
- Nisqually Indian Tribe
- Nooksack Indian Tribe
- Port Gamble S'Klallam Tribe
- Puyallup Tribe
- Quileute Tribe
- Quinault Indian Nation
- Samish Indian Nation
- Sauk-Suiattle Indian Tribe
- Shoalwater Bay Indian Tribe
- Skokomish Indian Tribe
- Snoqualmie Indian Tribe
- Spokane Tribe of Indians
- Squaxin Island Tribe
- Stillaguamish Tribe of Indians
- Suquamish Tribe
- Swinomish Indian Tribal Community
- Tulalip Tribes
- Upper Skagit Indian Tribe

Utilities and industry

- Solar energy developers
- Association of Washington Business
- NW Energy Coalition
- Public Power Council
- Renewable Northwest
- Utilities
- Washington Public Utility District Association
- Washington Rural Electric Cooperative Association
- Washington Public Ports Association

Environmental, labor, and other organizations

- Agricultural and farmland organizations
- Environmental justice organizations
- Environmental organizations
- Washington State Building and Construction Trades Council
- Washington State Labor Council

Other distribution

- Ecology's SEPA Register
- Ecology's clean energy and SEPA email distribution lists
- Published legal notices and public and media notifications
- Ecology's PEIS website

Appendix A. Scoping Summary Report

Appendix B. Earth Resource Report

Appendix C. Air Quality and Greenhouse Gases Resource Report

Appendix D. Water Resources Report

Appendix E. Biological Resources Report

Appendix F. Energy and Natural Resources Report

Appendix G. Environmental Health and Safety Resource Report

Appendix H. Noise and Vibration Resource Report

Appendix I. Land Use Resource Report

Appendix J. Aesthetics/Visual Quality Resource Report

Appendix K. Recreation Resource Report

Appendix L. Historic and Cultural Resources Report

Appendix M. Transportation Resource Report

Appendix N. Public Services and Utilities Resource Report

Appendix O. Tribal Rights, Interests, and Resources Report

Appendix P. Environmental Justice Resource Report

Appendix Q. Cumulative Impacts Report