Appendix Q: Cumulative Impacts Technical Report

For Programmatic Environmental Impact Statement on Utility-Scale Onshore Wind Energy Facilities in Washington State

By

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For the

Shorelands and Environmental Assistance Program

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Acronyms and Abbreviations List

BESS	battery energy storage system
BMP	best management practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	Compatible Energy Siting Assessment
dBA	A-weighted decibel
DAHP	Washington State Department of Archaeology and Historic Preservation
DNR	Washington Department of Natural Resources
DOC	Washington Department of Commerce
DoD	Department of Defense
Ecology	Washington State Department of Ecology
EDNA	environmental designation for noise abatement
EFH	Essential Fish Habitat
EFSEC	Washington State Energy Facility Site Evaluation Council
EHS	environmental health and safety
ESA	Endangered Species Act
gen-tie line	generation-tie transmission line
GHG	greenhouse gas
GMA	Growth Management Act
L_{dn}	average A-weighted noise level during a 24-hour day
MW	megawatt
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
OFM	Washington State Office of Financial Management
PEIS	Programmatic Environmental Impact Statement
PHS	Priority Habitats and Species
PV	photovoltaic
RCO	Washington State Recreation and Conservation Office
RCW	Revised Code of Washington
RFFA	reasonably foreseeable future action
SEPA	State Environmental Policy Act
TCP	Traditional Cultural Property
USFWS	U.S. Fish and Wildlife Service
VSP	Voluntary Stewardship Program
WAC	Washington Administrative Code
WDA	workforce development area
WDFW	Washington Department of Fish and Wildlife
WSRRI	Washington Shrubsteppe Restoration and Resiliency Initiative

Summary

Cumulative impacts are effects that would result from the impacts of utility-scale onshore wind energy facilities added to the impacts from other past, present, and reasonably foreseeable future actions (RFFAs). Cumulative impacts can result from incremental, but collectively significant, actions that occur over time. The purpose of the cumulative impacts analysis 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 broad geographic study area includes many reasonably foreseeable actions (past, present, and future) which could together result in impacts. These were evaluated as trends and include the following:

- Energy projects, including clean energy development and changes to energy systems
- Urban, commercial, and industrial activities and development
- Rural and agricultural activities and development
- Federal, state, Tribal, and local wildlife and habitat projects
- Transportation infrastructure development and modification
- Timber and forestry management
- Contaminated site cleanup and remediation
- Mining operations
- Recreation activities on public lands
- Military use
- Water supply development and withdrawals for municipal, agricultural, industrial, and conservation uses

All RFFAs have the potential to impact resources. The cumulative impacts would depend on the location and number of activities and how near they are to each other. Due to the large geographic study area and broad trends of reasonably foreseeable actions identified and considered in this planning document, cumulative impacts for all resources would **range from less than significant to potentially significant**.

Crosswalk with Cumulative Impacts Technical Report for Utility-Scale Solar 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 cumulative technical reports for each PEIS.

Utility-Scale Solar Energy PEIS	Utility-Scale Onshore Wind Energy PEIS (this document)
• None	• Some differences in habitats due to larger geographic scope of study.

1 Introduction

The State Environmental Policy Act (SEPA) requires consideration of potential contributions to cumulative impacts from other developments in the study area over time. Cumulative impacts are effects that would result from the incremental addition of utility-scale onshore wind energy facilities considered in the wind programmatic environmental impact statement (PEIS) to the impacts from other past, present, and reasonably foreseeable future actions (RFFAs). Cumulative impacts can result from incremental, but collectively significant, actions that occur over time.

The purpose of the cumulative impacts analysis is to make sure that decision-makers consider the full range of consequences under anticipated future conditions. The analysis in this document considers the range of utility-scale onshore wind energy facilities and other programmatic scale actions. The analysis of individual projects and other local actions to cumulative impact assessments would be conducted as part of project-specific environmental reviews.

The cumulative impact assessment considered the following:

- Proximity, such as several actions that affect the geographic study areas over the 50-year lifetime of the utility-scale onshore wind facilities evaluated
- Similar effects on the same resource
- Effects that are long term and therefore likely to interact with other actions

1.1 Regulatory context

The cumulative impacts analysis was prepared in accordance with SEPA requirements (Washington Administrative Code [WAC] 197-11-060). Additional guidance developed by the Council on Environmental Quality in the handbook entitled *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997) was also considered where SEPA requirements are consistent with requirements of the National Environmental Policy Act. Revised Code of Washington (RCW) 43.21C.535 specifically requires consideration and analysis of the following cumulative impacts in the onshore wind PEIS, which are included in Section 4:

- Historic and cultural resources
- Species designated for protection under RCW 77.12.020 or the federal Endangered Species Act (ESA)
- Landscape-scale habitat connectivity and wildlife migration corridors
- Environmental justice and overburdened communities as defined in RCW 70A.02.010
- Cultural resources and elements of the environment relevant to Tribal rights, interests, and resources, including Tribal cultural resources and fish, wildlife, and their habitat
- Land uses, including agricultural and ranching uses
- Military installations and operations

2 Methodology

The purpose of this section is to provide an overview of the process for evaluating potential cumulative impacts and the criteria for determining the occurrence and degree of impact on all resource areas in the PEIS.

2.1 Study area

The geographic and temporal boundaries for cumulative impacts are primarily based on the study areas for the resources analyzed in the PEIS as shown in Figure 1. For some resources, the study area for cumulative impacts may extend farther to evaluate the incremental impacts on the resource within a larger community or landscape, such as migration corridors.

The PEIS geographic scope of study includes various federal, state, and locally managed lands; however, Tribal reservation lands; national parks, wilderness areas, and wildlife refuges; state parks; and areas within cities and urban growth areas were excluded.

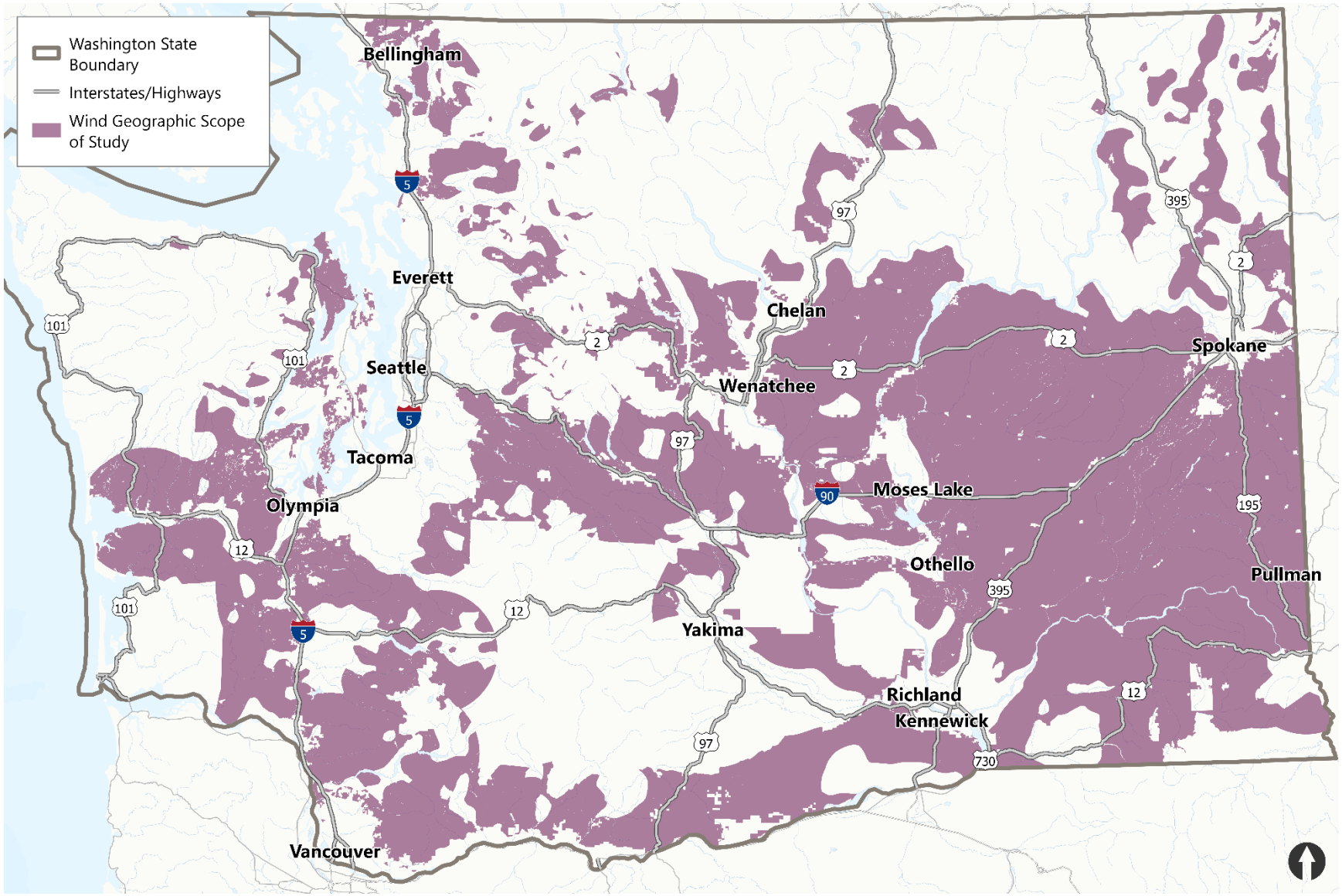

Figure 1. Geographic scope of study for utility-scale onshore wind facilities PEIS

2.2 Technical approach

The PEIS analyzes a timeframe of up to 20 years of potential facility construction and up to 30 years of potential facility operations (totaling up to 50 years into the future).

The cumulative impacts analysis was prepared in accordance with SEPA requirements (WAC 197-11-060) and also considered the federal Council on Environmental Quality approach for analyzing cumulative impacts. The following steps were used:

- Identify the resources that could be adversely affected by the future utility-scale onshore wind energy facilities evaluated in the PEIS.
- Assess the current condition and historical context for each resource, including trends affecting the resource.
- Consider other RFFAs in the same geographic study area for each resource.
- Consider other RFFAs with effects during the same time period as effects from facility site characterization, construction, operation, and decommissioning.
- Analyze cumulative impacts using the best available data.

The cumulative impacts analysis builds upon information derived from the resource impact analyses. As such, consideration for the cumulative impacts analysis includes resource areas for which the future utility-scale onshore wind energy facilities evaluated in the PEIS could cause significant adverse impacts, or resources currently at risk even if impacts from facilities are anticipated to be relatively small. Each resource impact analysis identifies the criteria under which a significant impact would occur as a result of a utility-scale onshore wind energy facility. This cumulative impact analysis evaluates the potential for significant cumulative impacts using the same criteria considered for each of the resource areas. These criteria are identified in Section 2.3 (Impact Assessment) of each technical resource report. The assessment of cumulative impacts also considered the possibility of multiple utility-scale wind energy facilities being developed in the same area and how these could amplify environmental effects, potentially presenting increasing challenges or risks for developers of such facilities.

Current conditions are a result of past and present actions. The current conditions in the study area were used as the baseline existing environmental condition for the resource analyses in the PEIS and are described as part of the affected environment for those resources. Therefore, past actions are not cumulatively considered again in this report for most resources. However, 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 to Tribal rights, interests, and resources, as well as cultural resources, some additional past and present actions are considered in this analysis.

To identify RFFAs to be considered in the cumulative impacts analysis, the SEPA Register and other published notices and planning documents were reviewed. Scoping comments related to other actions and cumulative impacts were also considered. RFFAs identified in Section 3

(below) primarily detail future trends within the study area. The trends analysis for Section 3 encompassed planning efforts, programs, proposals, projects, and new legislation and determines whether each is probable enough or too speculative to warrant further consideration. The PEIS uses information from the State Energy Strategy, information on proposed projects or trends identified by agencies (e.g., Washington Department of Fish and Wildlife [WDFW] and Washington State Energy Facility Site Evaluation Council [EFSEC]) and industry members and considers areas where clean energy development is likely or already being developed.

Once a list of RFFAs was developed, the RFFAs were evaluated to determine whether they would have an impact on the resources considered in the PEIS. The PEIS focuses on probable significant adverse impacts, with some information provided on non-significant adverse impacts. Impacts were evaluated relative to site characterization, construction, operation, and decommissioning of the types of facilities considered. Elements of the environment without significant adverse impacts were summarized more briefly than elements with significant adverse impacts. Instances where a potential cumulative benefit may occur are also identified.

For most resources, the cumulative impacts analysis in Section 4 considers whether the facilities considered in the PEIS, in combination with the RFFAs, could cumulatively contribute to impacts related to the resource. The methods and conclusions underlying the analysis, and data gaps or limitations in the analysis, are described.

All RFFAs have the potential to impact resources. The cumulative impacts would depend on the location and number of activities and how near they are to each other. Due to the large geographic study area and broad trends of reasonably foreseeable actions identified and considered in this planning document, cumulative impacts for all resources would **range from less than significant to potentially significant**.

3 Reasonably Foreseeable Future Actions

RFFAs are future potential activities that could cause similar effects in the same space and time as the types of facilities evaluated in the PEIS. These include trends that could affect humans and the environment within the study area and within the defined timeframe of 50 years (July 2025 through June 2075). This trend analysis is appropriate for this planning document because it considers impacts at a broad level. Other future actions are described in this analysis as "reasonably foreseeable" because they are ongoing, are funded for future implementation, or are included in local, state, or federal near-term plans.

Table 1 outlines the types of future actions identified as reasonably foreseeable in the study area and timeframe. Specific activities and trends for each RFFA are further described in Sections 3.1 through 3.11, following Table 1. Only the RFFAs that could impact resources considered in this PEIS were included in this analysis. Note the facilities considered in the PEIS and other projects or activities considered as RFFAs would be required to complete project-specific environmental reviews and permitting, as appropriate and as determined by the lead agency.

Table 1. Summary of reasonably foreseeable future actions in the study area

RFFA ID	RFFA trend	Associated activities
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Development of new energy-generating facilities, 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
RFFA 2	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
RFFA 3	Rural and Agricultural Activities and Development	• Crop changes • Conversion of non-designated agricultural land • Irrigation system maintenance and upgrades • Livestock grazing development and expansion
RFFA 4	Federal, State, Tribal, and Local Wildlife and Habitat Projects	• Growth management programs • Stream and riparian habitat projects • Watershed planning and implementation

RFFA ID	RFFA trend	Associated activities
RFFA 5	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 • Multimodal transportation projects
RFFA 6	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
RFFA 7	Contaminated Site Cleanup and Remediation	• Initial and remedial site investigations • Site cleanup activities • Monitoring and maintenance activities
RFFA 8	Mining Operations	• Expansion of existing mining and processing facilities • Development of new mines and processing facilities • Changes in mining processes and procedures • Performance of mine reclamation activities
RFFA 9	Recreation Activities on Public Lands	• Changes in hiking, biking, and equestrian trail systems • Changes in existing winter recreation areas • Changes in camping and RV sites • Changes in areas available for hunting, fishing, and off-road motor vehicle use
RFFA 10	Military Use	• Development or modification at military facilities • Changes in land use and management • Runway resurfacing • Changes in surface and air training operations, training, and testing
RFFA 11	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 removal

3.1 RFFA 1 – Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems

Clean energy is rapidly growing in Washington. A regionwide trend exists for ongoing and additional future development and increased use of clean energy sources with the primary goal of economy-wide reduction in greenhouse gas emissions and statewide decarbonization of energy sources. Many of these projects are being driven by multiple legislative actions, mandates, and national, statewide, or regional initiatives designed to induce long-term changes, including the following:

- State and municipal greenhouse gas (GHG) emissions reduction limits (Chapter 70A.45 RCW)
- Washington State Energy Strategy (DOC 2020)
- Washington State Clean Energy Transformation Act (Chapter 19.405 RCW)
- Washington State Climate Commitment Act (Chapter 70A.65 RCW)
- Federal Affordable Clean Energy Rule
- Federal Cleaner Trucks Initiative
- Electric vehicle use and government incentive programs: Chapter 173-423 WAC, Clean Vehicles Program, and WAC 173-400-025, Low Emission Vehicles
- Baseload Electric Generation Performance Standard, including the process for implementing the required phase-out of electricity generated by coal-fired facilities (Chapter 80.80 RCW)
- Pacific Northwest Electric Power Planning and Conservation Act
- U.S. Department of Energy Cleanup to Clean Energy Plan
- Energy Facility Site Evaluation Council *Draft PEIS for High-Voltage Transmission Facilities in Washington* (EFSEC 2025)
- Washington State Department of Commerce (DOC) Rural Clean Energy Legislative Report (DOC 2022)
- Federal Energy Regulatory Commission Order No. 1920 for the reform of high voltage transmission planning for projects under its jurisdiction
- Bureau of Land Management amendments to Resource Management Plans for Utility-Scale Solar Energy Development (BLM 2024)

One of the key components of these legislative actions, mandates, and initiatives is the Washington State Energy Strategy, which is focused on providing a roadmap for the state to meet the requirements of multiple state regulations, including the Energy Independence Act, Clean Energy Transformation Act, and the state's GHG emission reduction limits (DOC 2021). The state has committed to reducing GHG emission by 45% below 1990 levels by 2030, 70% below 1990 levels by 2040, and 95% below 1990 levels with net zero emissions by 2050. As part

of the State Energy Strategy, the following five decarbonization scenarios that reflect different pathways to achieving those goals were analyzed:

- Electrification Scenario: Models a rapid shift to electrified end uses where total energy demand drops by 28%, but electricity demand increases 90% over 2020 levels by 2050 through the displacement of fossil fuels in buildings and transportation.
- Transport Fuels Scenario: Models a slower transition to electrification in transportation uses, either due to policy driving a more gradual shift or because of slower than expected electric vehicle adoption. This scenario includes a 23% drop in total energy demand with fossil fuels still being a significant component of transportation uses in 2050.
- Gas in Buildings Scenario: Models a scenario where the use of gas in the built environment continues through 2050 with the use of pipeline gas composed of natural gas mixed with a combination of cleaner alternatives such as biogas, synthetic gas, or hydrogen. Includes a 24% drop in total energy demand by 2050 largely through the replacement of existing gas-consuming appliances with more efficient gas-consuming appliances and changes in gas composition.
- Constrained Resources Scenario: Models the impact if the state were unable to expand electricity transmission interties to other states, requiring expansion of in-state clean energy generation capacity. This scenario includes a total energy demand reduction scenario identical to the Electrification Scenario.
- Behavior Changes Scenario: Models the impact of consumer choices to decrease energy consumption by driving less and reducing demand for energy services in buildings. This scenario includes a 30% drop in total energy demand through reduced use of energy services.

For all of these scenarios, the achievement of lower energy demands and reduction in associated GHG emissions would be driven by improvements in the production of clean electricity, cleaner (i.e., decarbonized) liquid fuels, and the efficiency of energy product transmission. Approximately 69% of the state's electricity supply is already provided by clean sources, primarily hydroelectricity (DOC 2020). Additional clean energy needed to support future demands under the decarbonization scenarios is either expected to be imported from other states (e.g., Montana and Wyoming wind generation) or obtained by expanding in-state clean energy generation capacity.

As indicated by the scenarios analyzed in the State Energy Strategy, expected trends for energy projects from now until 2050 include increases of in-state electricity generation via clean sources, production of decarbonized liquid fuels using electricity, and improvements in energy transmission throughout the state. RFFAs likely to occur as part of these trends include development, operation, maintenance, and decommissioning of clean energy generating facilities (including the types of onshore wind energy facilities contemplated by the PEIS), energy transmission systems, and energy distribution networks, including those for electricity, natural gas, coal, and other petroleum products like gasoline and oil. This RFFA also includes construction and modification of existing energy generation, transmission, and distribution infrastructure, including the expansion or rehabilitation (e.g., reconductoring, pole/tower

replacement/upgrade) of existing transmission and distribution lines, substations, and grid management systems.

Some of the larger future clean energy projects and initiatives that overlap with the study area for this PEIS include the following:

- Horse Heaven Wind Energy Project, Benton County
- Wallula Gap Solar Energy Project, Benton County
- Badger Mountain Solar Energy Project, Douglas County
- Goldendale Energy Storage Project, Klickitat County
- Carriger Solar Energy Project, Klickitat County
- Desert Claim Wind Power Project, Kittitas County
- Whistling Ridge Wind Energy Project, Skamania County
- Goose Prairie Solar Energy Project, Yakima County
- Hanford Clean Energy Development Area, Benton County
- The Pacific Northwest Hydrogen Association Regional Clean Hydrogen Hub Node locations in Whatcom, Benton, and Lewis counties

Many of these projects would require similar siting conditions; therefore, there is increased potential for multiple onshore wind and other clean energy generation facilities to be located proximate to one another.

3.2 RFFA 2 – Urban, Commercial, and Industrial Activities and Development

Urban, commercial, and industrial activities and development are largely influenced by changes in the local and regional population including both increases and decreases in the number of people living and working in a particular area and associated changes in population density. Population growth typically results in an increased demand for housing, employment, public services, municipal water/sewage treatment systems, and related utility infrastructure.[1] Decreases in population often result in the abandonment of residential, urban, and industrial lands and related changes in land use.

According to the Washington State Office of Financial Management (OFM), the state's population is expected to continue growing from 7.7 million in 2020 to almost 9.9 million in 2050 (28% increase), for an annual average growth rate of approximately 0.8% (OFM 2024). Between 2020 and 2050, Washington is expected to add about 2,160,800 people, reaching 9,867,100 in 2050. Of that expected increase, OFM (2024) estimates that approximately 84% (1,819,000 people) would be due to net migration, with the other 16% (341,800 people) due to natural change (i.e., births and deaths). According to an OFM press release from June 30, 2023, the majority of state population growth between 2022 and 2023 occurred in the five largest

[1] Changes in transportation infrastructure associated with such trends are included under RFFA 5.

metropolitan counties, which include King County, Pierce County, Snohomish County, Spokane County, and Clark County. The top ten cities for population change are, in descending order, Seattle, Kirkland, Redmond, Bellingham, Lynnwood, Vancouver, Spokane, Mountlake Terrace, Tacoma, and Ridgefield (OFM 2023). Percent population change in the 36 counties overlapping the geographic scope of study for this PEIS[2] ranged from 0% (Columbia, Ferry, and Garfield counties) to 1.51% (Benton County) between 2022 and 2023.

Although areas zoned as urban or residential, located inside city limits, or classified as unincorporated Urban Growth Areas were specifically excluded from the study area for this PEIS, development activities occurring in those excluded areas would still have the potential to affect both natural and built environment resources in the larger watershed or ecoregion. RFFAs considered under this category include construction of new commercial and industrial developments, expansion of existing developments, and decommissioning, decontamination, and demolition of former facilities that are no longer used.

Many of the changes in urban/suburban, commercial, and industrial activities and development would be influenced by changes in workforce concentration and location. The Washington State Employment Security Department develops employment projections for the state and for 12 regional workforce development areas (WDAs) within the state (ESD 2024). The onshore wind PEIS geographic scope of study extends across all 12 WDAs and includes the following:

- WDA 1 – Olympic Consortium (Clallam, Jefferson, and Kitsap counties)
- WDA 2 – Pacific Mountain (Grays Harbor, Lewis, Mason, Pacific, and Thurston counties)
- WDA 3 – Northwest Washington (Island, San Juan, Skagit, and Whatcom counties)
- WDA 4 – Snohomish (Snohomish County)
- WDA 5 – Seattle-King (King County)
- WDA 6 – Tacoma-Pierce (Pierce County)
- WDA 7 – Southwest Washington (Clark, Cowlitz, and Wahkiakum counties)
- WDA 8 – North Central Washington (Okanogan, Chelan, Douglas, Grant, and Adams counties)
- WDA 9 – South Central Washington (Kittitas, Yakima, Skamania, and Klickitat counties)
- WDA 10 – Eastern Washington (Ferry, Stevens, Pend Orielle, Lincoln, Whitman, Walla Walla, Columbia, Garfield, and Asotin counties)
- WDA 11 – Benton-Franklin (Benton and Franklin counties)
- WDA 12 – Spokane (Spokane County)

According to the Washington State Employment Security Department, the projected long-term (10-year) growth rates for nonfarm occupations in the WDAs that overlap the PEIS geographic

[2] Washington counties that overlap the utility-scale onshore wind PEIS geographic scope of studyinclude Adams, Asotin, Benton, Chelan, Clallam, Clark, Columbia, Cowlitz, Douglas, Ferry, Franklin, Garfield, Grant, Grays Harbor, Jefferson, King, Kitsap, Klickitat, Kittitas, Lewis, Lincoln, Mason Okanogan, Pacific, Pend Oreille, Pierce, Skagit, Skamania, Snohomish, Spokane, Stevens, Thuston, Wahkiakum, Walla Walla, Whatcom, Whitman, and Yakima counties.

scope of study range from 1.04% (WDA 9) to 1.34% (WDA 5). Potential activities to support such workforce growth could include urban/suburban infill development, commercial and industrial development, and conversion of previously developed land to a different use type.

3.3 RFFA 3 – Rural and Agricultural Activities and Development

The study area for the utility-scale onshore wind PEIS consists largely of agricultural lands, forested areas, and other undeveloped open space. As such, there is a high likelihood that future onshore wind facilities considered in this PEIS would be located in the vicinity of agricultural activities and rural land uses.

The general trend relating to agricultural activities and land use in Washington is similar to that of the Unites States as a whole, with an ongoing decline in the number of farms and in the area of land in agricultural production as more land is converted urban, highly developed or low-density residential land uses (Freedgood et al. 2020). The overall number of farms in Washington declined from over 40,000 in 1997 to approximately 32,000 in 2022, and the land in farms in Washington in the same period declined from nearly 15.8 million acres to approximately 13.9 million acres in 2022 (USDA 2024a).

The eighth planning goal of the Growth Management Act (RCW 36.70A.020) identifies agricultural lands as natural resource-based lands and encourages the preservation of designated agricultural land following the criteria established in WAC 365-190-050.

In the *Washington Department of Agriculture Strategic Plan 2022–2025* (WSDA 2022), the Washington State Department of Agriculture identifies five priorities for the future of agriculture in the state. Those priorities include ensuring that Washington's agricultural system is equitable, resilient, and prosperous; ensuring the availability, safety, and integrity of the state's food supply for humans and animals; enforcing agricultural and environmental laws; protecting animals and plants from invasive species and diseases; and enhancing environmental justice practice within Washington State Department of Agriculture programs (WSDA 2022). Some of the strategies proposed to support these priorities include the following:

- Supporting the economic viability of small, diversified farms and ranches
- Increasing the marketability and export of fresh and processed fruits and vegetables
- Enhancing large-scale trade of grains and other commodities in domestic and international markets
- Promoting the voluntary adoption of climate-friendly agricultural practices and strategies
- Protecting the safety and integrity of commercial livestock, poultry, and fish feed
- Protecting consumer health by safeguarding the state's food supply
- Integrating cultural, biological, and mechanical practices to promote ecological balance and biodiversity concerns
- Promoting climate change mitigation and strategies to increase farm resiliency to flood, fire, drought, and extreme weather

- Improving regulation of pesticides, nutrients, and fertilizers
- Safeguarding the state's residents from animal and plant diseases
- Preventing establishment of high-risk invasive insects, plant diseases, and noxious weeds
- Protecting the state's natural resources and biodiversity habitats

Activities associated with implementing these priorities could include modifications to existing agricultural practices and lands, such as changing crop types, expanding cultivated extents, changing irrigation practices, expanding agricultural buffers, changing pesticide/herbicide-use practices, and modifying livestock use, waste management, and grazing practices. Activities may also include changes in associated agricultural infrastructure (e.g., irrigation systems, fencing, drainage systems, building types/uses).

Future agricultural activities would also be affected by climate change. In the Pacific Northwest, the three main climate change effects that are expected to affect agriculture are increased air temperatures; changes in the amount, timing, and form of precipitation; and increased concentrations of carbon dioxide in the atmosphere (USDA 2024b). Increased air temperatures are expected to result in decreased plant productivity, a longer growing season (and a longer period where irrigation is needed), and more favorable conditions for agricultural pests. Such changes could affect the types of crops that are grown, the amount of water needed to irrigate those crops, and the extent and frequency of pesticide and herbicide use. With higher air temperatures, more precipitation would fall as rainfall instead of snow, resulting in higher streamflow in the fall and winter (and potential for flooding in low-lying areas) but reduced streamflow and water availability in the summer. This is expected to cause reduced soil moisture and increased potential for drought, which could affect agricultural uses. Longer growing seasons and increases in atmospheric carbon dioxide concentration both have the potential to benefit crop growth. Increased carbon dioxide makes plants more water efficient and could reduce some of the potential impact from reduced water availability caused by higher temperatures and changing precipitation (USDA 2024b). As a result of such conditions, the productivity of some crops, such as winter wheat, are expected to increase with climate change (USDA 2024b). Such conditions could encourage the expansion of existing wheat fields or conversion of less-productive crops to wheat.

In addition to changes in agricultural activities and practices, conversion of rural and agricultural lands to other uses could also continue to occur in the future. Ongoing activities and RFFAs associated with such conversions are largely driven by land values and population changes, as well as factors related to climate change. Activities associated with land use conversion could include transitioning agricultural land and undeveloped rural areas to other uses such as residential, commercial, and industrial development. Associated expansion or modification of rural road and drainage systems (e.g., culverts and storm sewers) and related infrastructure could also be included.

3.4 RFFA 4 – Federal, State, Tribal, and Local Wildlife and Habitat Projects

Within and near the PEIS geographic scope of study, there are numerous public lands managed to benefit wildlife and other public uses. Although many of those areas, including national parks, wilderness areas, wildlife refuges, and state parks, were specifically excluded from the study area, actions that occur on or adjacent to those areas could have an effect on regional natural and built resources. Activities associated with wildlife and habitat management by federal, state, local, and Tribal agencies within wildlife refuges and other public lands focus on improving habitats and ecosystem functions and species-specific conservation projects. In addition to public lands managed for the benefit of wildlife and habitat, there are programs funded and/or managed by the federal government, State of Washington, water trust, and non-profit organizations to restore habitat on privately owned lands in the state.

Activities and programs considered under this RFFA include, but are not limited to, growth management programs, stream and riparian habitat projects, estuary restoration projects, invasive species management plans, watershed planning and implementation, fish passage improvements, and climate change adaptation, among others. Examples include the following:

- WDFW Wildlife Area Management Plans
- Washington Shrubsteppe Restoration and Resiliency Initiative
- Washington State Wildlife Action Plan (WDFW 2015)
- State of Washington Natural Heritage Program
- Fish and Wildlife Habitat Conservation Areas under the Growth Management Act and Shoreline Management Act
- Washington State Conservation Commission's Voluntary Stewardship Program
- Puget Sound Partnership's Action Agenda
- Salmon Recovery Funding Board and salmon recovery lead entity plans
- WDFW's Management Recommendations for Washington's Priority Habitats
- Washington Wildlife Habitat Connectivity Working Group
- WDFW, Washington State Department of Transportation, and Conservation Northwest's Habitat Connectivity Action Plan
- Washington Conservation Strategy for Washington State Inland Sand Dunes
- Arid Lands Initiative
- Washington Water Trust habitat enhancement within private streams
- Washington State Department of Ecology (Ecology) Streamflow Restoration Grants

In general, the above activities and programs are building long-term strategies for habitat and wildlife conservation. The effect and extent of these activities varies across the state depending on other influencing factors, such as funding sources, changes in regulations, collaborative efforts, and interested parties. Examples of activities and programs anticipated to continue into the future are discussed below.

WDFW has a mission to preserve and perpetuate the state's fish and wildlife resources, and programs that support this mission are planned as funding or partnership resources become available (WDFW 2024a). WDFW manages 33 wildlife areas across the state, and each area is guided by a management plan that addresses the status of wildlife species and their habitat, habitat restoration, public recreation, weed management, and other activities to meet the department's mission (WDFW 2024a). The Washington Wildlife Habitat Connectivity Working Group's Washington Connected Landscapes Project is providing a series of scientific analyses and tools that use the best available science to identify important wildlife habitat linkage areas and inform decisions that can impact habitat connectivity in Washington and neighboring habitats (WDFW 2024b). The 2015 Washington State Wildlife Action Plan objectively assesses the status of the state's wildlife and habitats, identifies key problems, and outlines the actions needed to conserve wildlife and habitats over the long term (WDFW 2024c).

The Washington Shrubsteppe Restoration and Resiliency Initiative (WSRRI) strategy is set for a 30-year period and includes five key elements focused on community engagement, habitat protection, habitat restoration, species management, and fire management (WDFW 2024d). The Natural Heritage Program issued a 2022 State of Washington Natural Heritage Plan that identifies a number of programs to identify and conserve the state's biodiversity such as developing a map and database of sites of biodiversity significance, referred to as "Essential Conservation Areas," to guide landscape and site-scale conservation (DNR 2024).

To guide where on the landscape WSRRI and its partners should invest proactively and implement specific actions, WSRRI partners mapped habitat quality and connectivity across the landscape. They identified the following:

- **Core areas** have the highest-quality habitat, and actions targeted here should include protection, threat prevention and abatement, and restoration where disturbances occur despite protection measures.
- **Growth Opportunity Areas** still have significant amounts of habitat but are more degraded than habitat in core areas, and strategic restoration here could increase habitat quality and result in more core area.
- **Corridors** are relatively free of wildlife movement barriers and connect core areas and growth opportunity areas across the landscape; further barrier development (e.g., road construction or habitat conversion) should be avoided in corridors.
- **Other Habitat** is more degraded than the other three categories but is still important to retain and, if resources allow, its condition should be improved over time.

Spatial priority maps were developed for three conservation targets: dry (xeric) ecosystems, wet (mesic) ecosystems, and greater sage-grouse. Figure 2 shows an example of the priority maps developed.

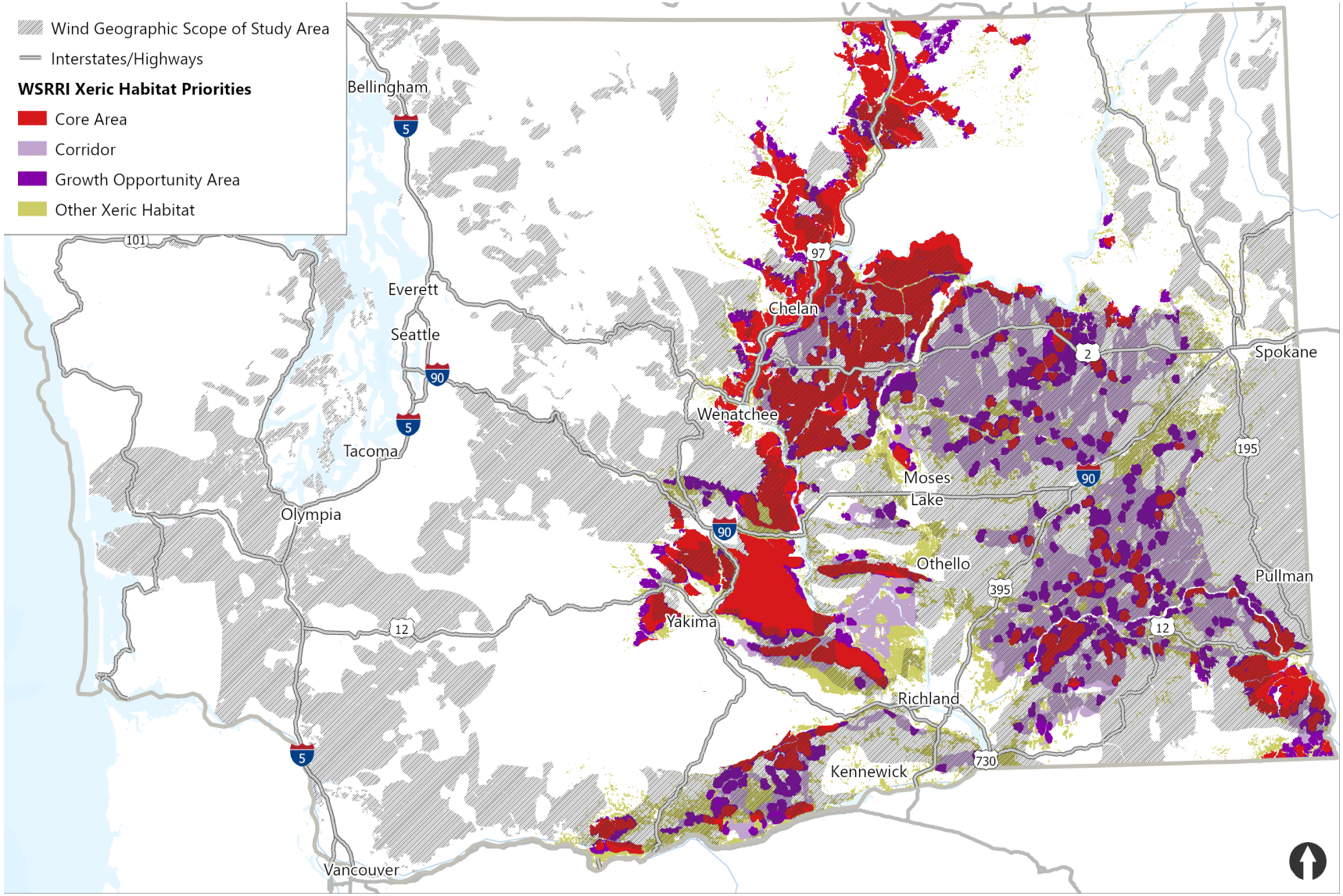

Figure 2. Example WSRRI priority map for a dry (xeric) ecosystem

Data source: WDFW 2024d

3.5 RFFA 5 – Transportation Infrastructure Development and Modification

The trend for transportation RFFAs includes activities to maintain, expand, and improve Washington's road and rail transportation systems and increase air cargo and shipping within navigable waters. An example trend influencing RFFAs in this category includes the Joint Transportation Committee's projections that air cargo will experience an average annual growth rate of 4.4% between 2016 and 2026 (JTC 2018).

Transportation Infrastructure Development and Modification includes efforts to increase the resiliency of the transportation network and expanding options to reduce reliance on single-occupancy vehicles. These efforts are typically driven by federal, state, and local transportation programs and plans such as the following:

- Federal and state highways corridor programs and improvements
- Washington Transportation Plan (WSDOT 2015, 2018)
- *Washington State Rail Plan 2019–2040* (WSDOT 2020)
- Local transportation plans
- Freight and passenger rail plans
- Highway system plans
- Lower Columbia River Channel Maintenance Plan (USACE 2024a)

Focus areas for the state's transportation system are identified in Phase 2 of the Washington State Department of Transportation's transportation plan and include maintaining and preserving assets, managing growth and traffic congestion, enhancing multimodal (e.g., road, rail, waterway, bicycle, and pedestrian) connections and choices, and aligning funding structures with the multimodal vision (WSDOT 2018). Based on these focus areas, transportation-related activities are likely to include the following:

- Improving, rehabilitating, and reconstructing existing infrastructure (e.g., roadways, intersections, bridges, rail lines)
- Expanding and realigning transportation routes to accommodate growth and reduce traffic congestion
- Restructuring existing or building new transportation systems that better support integrated use for multiple modes of transportation
- Improving or expanding existing rail systems to improve safety, freight mobility and connectivity, to better support the use of both manifest and unit trains, and to address expected changes in rail traffic
- The expansion of non-motorized transportation infrastructure (e.g., bikeways, pedestrian trails)

3.6 RFFA 6 – Timber and Forestry Management

This trend includes ongoing timber and forestry management practices at established tree farms and managed forests on both public and private lands with a focus on wildfire risk. Wildfire risk is the probability that a typical location experiences weather and fuel conditions supportive of wildfire at some time during the year. Timber and forestry areas generally occur in the western portion of the state where large areas of managed forest lands are present, in the north and northeastern portions of the state, and in the southeastern corner. Many of those areas overlap with the study area for this PEIS and have the potential to accommodate or occur in the vicinity of future onshore wind facilities considered in this PEIS. Activities under this RFFA include, but are not limited to, fire management activities, expansion/reduction in forest management areas, updates to the state's Forest Practices Rules, forest road construction and maintenance, clear-cut and selective harvesting, reforestation activities, fertilizer and herbicide use, and riparian management practices.

Washington has experienced many extreme fire events in recent years, partly attributed to climate change effects and the legacy of forest fire suppression practices. The combination of longer fire seasons, population growth, declining forest health, and other changing risk factors has made wildfire considerations a top priority in the state, as outlined in the *Washington State Wildland Fire Protection 10-Year Strategic Plan* (DNR 2019). Fire risk across the state is highly variable with location. There are also several unpredicted parameters that contribute to fire ignition and subsequent development into a wildfire. The National Oceanic and Atmospheric Administration (NOAA) Climate Mapping for a Resilient Washington data tool identifies the following climate divisions as most at risk for wildfire likelihood: East Slope Cascades, Okanogan Big Bend, Northeastern, and Palouse Blue Mountains (Climate Impacts Group 2024).

Active forest management to reduce wildfire likelihood includes using approaches such as fuel reduction and fire preparedness, prevention, and education activities in collaboration among federal land management agencies, state and local governments, Tribes, and interested parties. Among the four most at-risk climate divisions, the likelihood of weather and fuel conditions favorable to wildfire ranges from 39% to 85% depending on location and scenario. In 2075, the likelihood of conditions favorable to wildfire is 42% to 90%. For reference, likelihood of conditions favorable for wildfire in these same four climate divisions during a 1980 to 2009 reference period ranged from 11% to 63%. A marked increase in conditions conducive to wildfire is projected to occur within the operational timeframe of the onshore wind energy facilities.

Regularly updated resources available to developers for tracking and predicting wildfires in the study area include the Washington Department of Natural Resources (DNR) Wildfire Intel Dashboard, the National Interagency Fire Center, and the National Fire Information Council.

3.7 RFFA 7 – Contaminated Site Cleanup and Remediation

Onshore wind energy facility developers may site projects at or adjacent to cleanup sites where environmental remediation activities have either been completed or are ongoing. Activities in this category include ongoing and reasonably foreseeable future cleanup activities at sites known to be contaminated by hazardous or dangerous substances including petroleum, heavy metals, pesticides, persistent organic pollutants, and other types of toxic substances under the Washington Model Toxics Control Act and federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Contaminated site cleanup and remediation activities that could occur at these and other sites include initial and remedial site investigations involving excavation, soil borings, and monitoring-well installation; contaminated soil and sediment removal via excavation and dredging; capping of contaminated soils and sediments; water treatment facility construction; and leachate and gas collection system installation.

3.8 RFFA 8 – Mining Operations

As shown in Figure 3, there are a number of existing sand, gravel, rock, and stone mining operations within the state. It is possible that onshore wind facilities could be sited near or adjacent to existing or proposed mining operations. Activities from the other RFFAs could result in increased demand for aggregate and increase mining operations.

Ongoing activities related to those mining operations that could contribute to cumulative effects on the environment, when considered with effects of construction and operation of utility-scale onshore wind facilities, include mining and processing area expansions, new mine and processing facility development, modifications of mining processes and procedures (e.g., dewatering/drainage system alterations), and mine reclamation activities. Potential impacts from those activities could include vegetation removal, soil excavation, fill placement, road development, increased diesel emissions from mining equipment, drainage alterations, utility expansion, erosion, and fugitive dust generation.

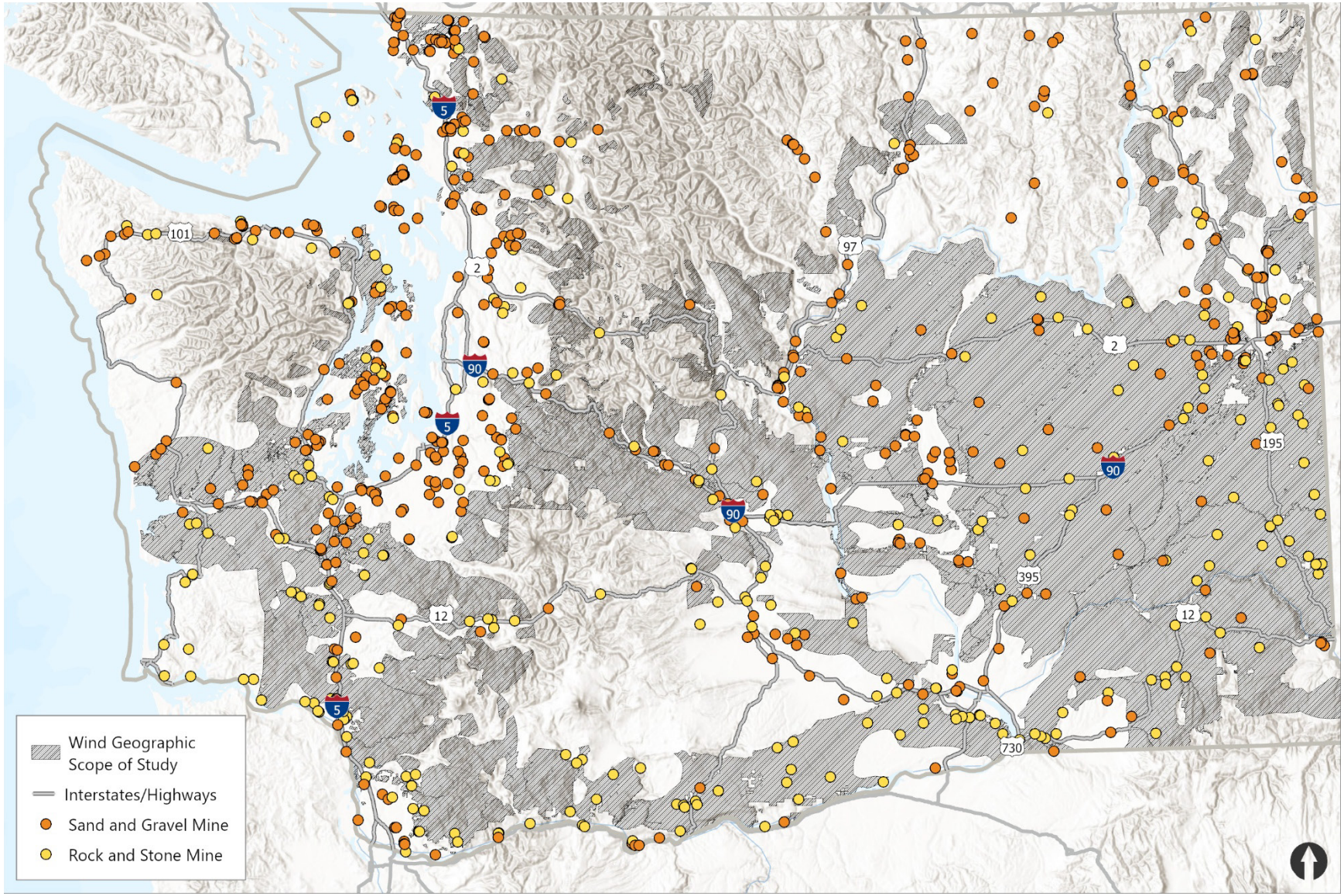

Figure 3. Aggregate resource locations
Data source: DNR 2023a

3.9 RFFA 9 – Recreation Activities on Public Lands

This trend covers ongoing and reasonably foreseeable future changes in recreation activities and programs on public lands, including increases in recreational uses reported by the Washington State Recreation and Conservation Office (RCO) and WDFW. Onshore wind facilities could be sited near or adjacent to existing or proposed publicly owned areas for recreation, including WDFW wildlife areas and other federal, state, and local managed areas in the study area.

In RCO's *2023 Washington Recreation and Conservation Plan* (RCO 2023), a review of participation trends in 45 outdoor activity categories found that participation had increased in all but two categories since a previous survey in 2017 (RCO 2023). Outdoor activities that showed the greatest increases in participation included wildlife and nature viewing, paddle sports, visiting outdoor cultural and historic sites, tent camping, backpacking, playing yard games in parks, snowshoeing, hanging out in parks, and mountain biking. WDFW's wildlife area management plans also document continued and increased use of their lands for hunting, fishing, wildlife viewing, camping, horseback riding, mountain biking, and motorized recreation (WDFW 2024e).

Potential activities associated with these trends include increased access to waterways; development, expansion, or closure of hiking, biking, and equestrian trails and trail systems; expansion of winter recreation areas; rehabilitation of existing and development of new camping and RV sites; and increased access to areas for hunting, fishing, and off-road motor vehicle use. Maintenance and repairs of recreation amenities and infrastructure (e.g., restrooms, roads, parking areas) are also included in the consideration of potential activities.

3.10 RFFA 10 – Military Use

Several military testing, training, and operating areas occur adjacent to or surrounding areas where onshore wind facilities may be located. To address the potential for clean energy facility development to affect the military's ability to operate or conduct training, the Compatible Energy Siting Assessment (CESA) was jointly developed by DOC, EFSEC, and the U.S. Department of Defense (DoD) to assess state energy trends, developers' practices, community requirements, and military missions in Washington (DOC 2024a). The outcome of CESA is a framework that promotes early and ongoing civilian and military consultation to coordinate the siting of clean energy facilities that could affect military use and/or pose a safety risk to military personnel. It includes a civilian-military compatibility needs and trends assessment, a review of energy siting policies and procedures, and a prototype web-mapping tool to support the further development of consulting tools and applications.

Primary military installations or areas near or adjacent to the study area for this PEIS include the following:

- Fairchild Air Force Base, Spokane County

- Yakima Training Center, Yakima and Kittitas counties
- Washington National Guard facilities, various counties
- Military training centers, various counties
- Military air training routes with floor elevations ranging from 200 feet to 1,500 feet, multiple contiguous counties
- Special use airspace areas with floor elevation ranging from 0 feet (surface) to greater than 1,000 feet, multiple contiguous counties

Activities associated with this RFFA in those areas that could contribute to cumulative impacts on the natural and built environment when combined with impacts from the construction and operation of utility-scale onshore wind facilities include runway resurfacing; construction, rehabilitation, and maintenance projects; expansion of exclusion areas; changes in land use and management; and changes in surface and air training routes and activities.

3.11 RFFA 11 – Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses

With the general increases in annual average and maximum summertime air temperatures, reduction of winter snowpack and summer stream flows, and increase in freshwater water temperatures predicted to occur as a result of climate change, there is higher future potential for the occurrence of drought and subsequent water shortages. Such conditions could limit the amount of water available for municipal, industrial, agricultural, and conservation uses.

This RFFA includes ongoing activities related to the development, modification, and use of water supply systems to address future water supply issues, including the expansion and development of reservoirs, well fields, water distribution systems, water treatment plants, and pump stations for municipal, agricultural, and industrial uses. This RFFA would also include projects that encourage water conservation, water storage, and flood risk reduction and that support streamflow for aquatic species, including dam removal projects and changes in water rights policy and availability. Examples of activities contributing to this trend in the study area include the following:

- Columbia River Basin projects, various counties
- Icicle Creek strategy, Chelan County
- Walla Walla Water 2050 Strategic Plan, Walla Walla County
- Switzler Reservoir Project, Klickitat County
- Yakima River Basin Projects, Yakima and Kittitas counties
- Chehalis Basin Strategy, Grays Harbor, Lewis, Thurston, Cowlitz, Jefferson, Mason, Pacific, and Wahkiakum counties
- Yakima Basin Integrated Water Management Plan, Yakima and Kittitas counties
- Columbia River Water Management Program

4 Cumulative Impacts by Resource Area

This section provides an overview of potential cumulative effects from the types of facilities considered in the PEIS and a qualitative assessment of adverse impacts as relevant to each of the resource areas analyzed in the PEIS.

The extent and magnitude of impacts on resources would vary depending on the geographical region and size of the facility relative to other RFFAs in the area. In general, when considering the contribution of future effects, the larger the facility, the greater the potential for cumulative impacts because of the larger footprint, increased need for construction materials, and increased scale of the supporting infrastructure. Conversely, smaller facilities are likely to result in less cumulative impacts on resources because they have a smaller footprint and require less supporting infrastructure. There is increased potential for multiple onshore wind and other clean energy generation facilities to be located proximate to one another. As a result, the combined impacts from construction, operation, and decommissioning of one or more of these facilities could result in cumulative impacts on the natural and built environment. Developers should consider the increasing challenges that result from multiple onshore wind energy facilities and other RFFAs being proposed in the same area that may amplify the cumulative effects on resource areas.

4.1 Tribal rights, interests, and resources

This section summarizes the Tribal rights, interests, and resources evaluated within the study area in the *Tribal Rights, Interests, and Resources Technical Report* (Appendix B) and broadly analyzes impacts from the types of facilities considered and other RFFAs. The study area for Tribal rights, interests, and resources encompasses the overall onshore wind geographic scope of study and includes large areas of land across Washington.

Tribes are recognized as unique sovereign people that exercise self-government rights that are guaranteed under treaties and federal laws. Each Tribal reservation in the state constitutes a bordering sovereign jurisdiction subject to federal and Tribal environmental laws. Onshore wind facilities and RFFAs could affect Tribal interests, treaty rights, and resources in and around the areas where facilities are built or the affected resources could extend well beyond future proposed facility footprints. Additional details are provided in the *Tribal Rights, Interests, and Resources Technical Report*.

4.1.1 Current conditions

Indigenous Tribes and populations have been in the Northwest since time immemorial. There are 32 federally recognized Tribes with lands and territories in Washington state. Each of these Tribes continues to have close connections to its aboriginal territories. Tribes in Washington have reserved rights to fish and harvest natural resources throughout much of the state. Treaty fishing may occur in small and large rivers and marine areas.

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. In addition, 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.

Resources may also include archaeological or historic sites or Traditional Cultural Properties (TCPs) associated with Tribal use and sites considered sacred by Tribes. Tribal resources, archaeological sites, historical and cultural sites, TCPs, and natural resources often can be interconnected and overlapping as Tribal resources.

All areas of Washington state are within the traditional homelands of Tribes. Prior to non-native settlement, these areas were and continue to be places of daily living, subsistence, ceremonial, and burial uses. Lands were subject to treaties, unilateral appropriation by the federal government, or negotiation between the federal government and Tribes. Tribal rights, interests, and resources exist throughout this homeland. Additional details regarding Tribal rights, interests, and resources can be found in the *Tribal Rights, Interests, and Resources Technical Report*.

4.1.2 Past and present actions

The analysis of cumulative impacts on Tribal rights, interests, and resources differs in its approach when compared to the cumulative impact analyses for other resources. As noted in Section 2.2, the current conditions in the study area were used as the baseline existing environmental condition for the resource analyses in the PEIS; therefore, past actions are not cumulatively considered again in this report for most resources. However, Tribes have noted that resources in the study area are part of a much larger integrated cultural network, and impacts can extend in space and time beyond the study area or a specific facility. To analyze the full range of consequences of potential cumulative impacts to Tribal rights, interests, and resources, some additional past and present actions are considered in this section.

Tribal communities have been connected to the places and resources of the study area since time immemorial, and Tribal and cultural resources have been repeatedly affected by past and present actions. This includes changes to the environment, the modifications of waterbodies, and building of dams and reservoirs that inundated, exposed, destroyed, or otherwise affected Tribal resources throughout Washington. Reservoir level fluctuations and flow modifications associated with these dams continue to affect cultural and archaeological sites, as well as 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.

The building of dams and associated reservoirs have historically affected Tribal resources by inundating villages and important fishing, trading, and cultural sites. Today, reservoir level fluctuations and flow modifications associated with operation of dams can increase the risk of exposure, erosion, and looting of remaining cultural sites. Dams also continue to impede native

fish and aquatic species migrations, alter water temperature and quality, and form reservoirs that can allow invasive species to prey on native species. Salmon in particular is a native species that is an important aspect of Tribal culture. Salmon and their habitat continue to be affected by human development.

The assessment of past and present human impacts on Tribal rights, interests, and resources includes these considerations as well as a variety of other past development projects that have limited Tribal access to sites for cultural practices and gathering of natural resources, contributed to visual changes in the natural state of the landscape that can interrupt Tribal cultural practices and impact the expression of Tribal spirituality, or resulted in ground disturbance that could increase the chances of exposure, erosion, and looting of Tribal resources.

4.1.3 Reasonably foreseeable future actions

RFFAs with potential to affect Tribal rights, interests, and resources in the study area are listed in Table 2 along with a summary of the potential effects of these actions.

Table 2. Reasonably foreseeable future actions relevant to Tribal rights, interests, and resources

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Potential impacts from activities that result in ground disturbance, noise impacts, degradation of visual quality, or interruption of the landscape, habitats, and species. • Potential impacts on sacred sites or TCPs from visual changes and noise. • Transmission line projects that require clearing near streams have the potential to degrade fisheries and other Tribal resources.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Impacts would be similar to those described for RFFA 1.
RFFA 3	Rural and Agricultural Activities and Development	• Impacts would be similar to those described for RFFA 1. • Potential impacts from land use changes in rural areas on species and habitats especially if the land was previously undeveloped. Impacts to habitats and species could adversely impact Tribal rights, interests, and resources. • New rural and agricultural facilities have the potential to impact Tribal resources.
RFFA 4	Federal, State, Tribal and Local Wildlife and Habitat Projects	• Habitat restoration projects could occur on sites with previously undiscovered cultural resources, resulting in potential impacts from ground-disturbing activities. • Proper management can potentially result in beneficial effects on Tribal rights, interests, and resources from projects that maintain, enhance, restore, or create habitats including wetlands.

RFFA ID	RFFA trend	Impact description
RFFA 5	Transportation Infrastructure Development and Modification	• Impacts would be similar to those described for RFFA 1.
RFFA 6	Timber and Forestry Management	• Potential adverse impacts, especially from continued or expanded timber production, to species and habitats and Tribal rights, interests, and resources.
RFFA 7	Contaminated Site Cleanup and Remediation	• Impacts would be similar to those described for RFFA 1. • Projects would likely result in long-term beneficial impacts on the environment but could result in short-term impacts from risk from spills or leaks during cleanup and remediation.
RFFA 8	Mining Operations	• Impacts would be similar to those described for RFFA 1.
RFFA 9	Recreation Activities on Public Lands	• Recreational activities could potentially disrupt, alter, or degrade habitats and species and thus adversely impact Tribal rights, interests, and resources.
RFFA 10	Military Use	• Impacts would be similar to those described for RFFA 1.
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Similar to impacts described under RFFA 1. • Projects have a high likelihood of encountering historic and cultural resources as waterways play an important role in the histories and traditions of Tribes. Waterways are also identified as high-risk areas for encountering archaeological sites due to known settlement patterns near water sources. • Projects that result in recreational opportunities, improvements to water resources, and energy provision can benefit Tribal communities. Other projects, such as dam construction or removal, can potentially disrupt, alter, or degrade habitats and species and thus impact Tribal rights, interests, and resources.

4.1.4 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable actions

The following sections summarize the cumulative impacts on Tribal rights, interests, and resources when considering the RFFAs in combination with types of onshore wind facilities considered in the PEIS.

4.1.4.1 Impacts from construction and decommissioning

Construction and decommissioning of the utility-scale onshore wind energy facilities considered in the PEIS along with other activities could result in cumulative impacts on Tribal rights, interests, and resources. Construction and decommissioning activities that could impact Tribal resources include ground disturbance, restrictions to access, degradation of visual quality, 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. Projects that are being constructed simultaneously in close proximity to each other could intensify impacts.

Impacts on traditional access and travel paths for resources could impact Tribes' spiritual practices. 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's significance. This type of impact is likely to increase based on the amount of the landscape or resource that is no longer freely accessible. This can also impact Tribes through changes in access to areas where traditional hunting, fishing, gathering, or other traditional practices occur.

Construction and decommissioning impacts to plant and animal species that are of importance to Tribes and cumulative impacts to biological resources, described in Section 4.6 of this report, could also result in cumulative impacts to Tribal resources. 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, resulting in increased alteration of vegetation, fragmentation of habitats, degradation of fisheries, or additional restricted movement of animals and migration paths due to increased fencing, roads, and other structures.

Impacts to Tribal gathering areas may affect other Tribes and surrounding non-Native American communities with which the resource is shared. Tribes have stated that impacts to Tribal members' ability to participate in, teach, learn, and share cultural practices affect the mental, spiritual, and physical health of Tribal members. Restrictions to access and removal of areas used for cultural practices could affect entire Tribal communities and multiple generations.

Sensitive viewers of some areas 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 facilities and other activities developed in close proximity to each other could intensify disruption to sacred religious and ceremonial practices.

Together, past and present projects, the RFFAs identified above, and potential onshore wind facilities represent substantial changes to culturally important landscapes, visual changes in the natural state of the landscape that can interrupt Tribal cultural practices and impact the expression of Tribal spirituality, as well as physical barriers to areas where cultural activities take place.

4.1.4.2 Impacts from operation

Operational activities that could affect Tribal rights, interests, and resources include those identified as impacts under construction, as well as changes in access to natural and cultural resources and increased human activity with associated noise, light, dust, and human presence. Visual changes associated with onshore wind energy facilities could include the presence of wind turbine structures; movement of the rotor blades; shadow flicker and blade glinting; turbine marker lights and other lighting on control buildings and other ancillary structures; 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.

Potential cumulative impacts to Tribal rights, interests, and resources during operation include disturbance of previously unrecorded archaeological sites, visual degradation of settings associated with Tribal resources, and limiting access and travel paths traditionally utilized for hunting, fishing, gathering, and other ritual and cultural activities. Multiple onshore wind facilities and other RFFAs developed in close proximity to each other could intensify impacts on Tribal resources.

4.2 Environmental justice

This section summarizes the environmental justice and overburdened community areas evaluated within the study area in the *Environmental Justice Technical Resource Report* (Appendix C) and analyzes impacts on this resource resulting from the types of facilities and other RFFAs. The study area for environmental justice and overburdened community areas includes all census tracts that overlap the geographic scope of study. Additional details can be found in the *Environmental Justice Technical Resource Report*.

4.2.1 Current conditions

People of color populations and low-income populations were identified using the U.S. Census Bureau American Community Survey 2018-2022 5-year estimate data at the census tract level. A total of 358 census tracts overlap the study area. Of these, 42 (or 12%) contain a population of people of color and 188 (or 53%) contain a low-income population.

Census tracts were also evaluated for whether or not they meet the criteria to be identified as an overburdened community area based on the Washington Environmental Health Disparities layer of the Washington Tracking Network Map, the federal Climate and Economic Justice Screening Tool, and maps of Tribal lands as recognized by the Bureau of Indian Affairs. Of the 302 census tracts that overlap the study area,[3] a total of 60 (or 20%) were identified as overburdened community areas.

4.2.2 Reasonably foreseeable future actions

RFFAs with potential to affect people of color populations or low-income populations in the study area are listed in Table 3 along with a summary of the potential effects of these actions.

[3] Census-tract data used to identify overburdened community areas were from the 2010 census, which has some differences in census-tract numbers, boundaries, and areas compared to census-tract boundaries from the 2020 census. The 2022 U.S. Census Bureau American Community Survey 5-year estimate data were used to identify people of color and low-income populations and other totals of census tracts in this report.

Table 3. Reasonably foreseeable future actions relevant to environmental justice

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• If projects are sited in or near an area with people of color or low-income populations, residents could be disproportionately affected by project activities including but not limited to increased traffic, noise, air emissions, hazards, visual impacts, and land use changes.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Similar to impacts described under RFFA 1.
RFFA 3	Rural and Agricultural Activities and Development	• Similar to impacts described under RFFA 1. • Projects would have a greater risk of disproportionate aesthetic and land use impacts on people of color or low-income populations if they degrade the visual character of a rural area or result in a conversion of land use.
RFFA 4	Federal, State, Tribal and Local Wildlife and Habitat Projects	• Projects would likely result in improvements to the environment but could result in short-term impacts on people of color or low-income populations as described under RFFA 1.
RFFA 5	Transportation Infrastructure Development and Modification	• Similar to impacts described under RFFA 1.
RFFA 6	Timber and Forestry Management	• Similar to impacts described under RFFA 1.
RFFA 7	Contaminated Site Cleanup and Remediation	• Projects would likely result in long-term beneficial impacts on the environment but could result in short-term impacts on people of color or low-income populations as described under RFFA 1.
RFFA 8	Mining Operations	• Similar to impacts described under RFFA 1. • Mining operations are also likely to result in environmental health and safety risks and adverse environmental impacts from the use of hazardous materials that could disproportionately impact people of color or low-income populations.
RFFA 9	Recreation Activities on Public Lands	• Potential beneficial impacts if they improve access to recreational activities for people of color or low-income populations.
RFFA 10	Military Use	• Similar to impacts described under RFFA 1.
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Similar to impacts described under RFFA 1.

4.2.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable actions

The following sections summarize the cumulative impacts on people of color populations and low-income populations when considering the RFFAs in combination with types of onshore wind facilities considered in the PEIS.

4.2.3.1 Utility-scale onshore wind facilities

The siting and operation of these facilities could result in the long-term and potentially permanent conversion of existing or designated future land uses to utility-related uses for the life of the facilities, with the specific impact depending on the existing use of the site where the facility would be located. The operation of utility-scale facilities would also result in changes to the visual landscape from the presence of wind turbines, with the facility visible from long distances depending on topography and other factors. These changes could result in changes to and/or perceptions of the rural character of the surrounding area. Facility activities could also lead to an increased risk of a wildfire and 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.

Onshore wind facilities and activities are most likely to have cumulative impacts on people of color populations or low-income populations from visual changes and conversion of land uses. People who live or work near onshore wind facilities and other activities could be impacted by changes in visual quality and conversion of land uses that change the perception of the rural character of surrounding areas. These impacts could occur disproportionately in areas containing low-income populations or people of color populations and result in cumulative impacts.

It is possible that facilities and other activities sited in close proximity to each other could also result in cumulative impacts on other resource areas, which could result in further cumulative impacts on people of color or low-income populations. Potentially significant impacts were identified for the resource areas listed below. While it is expected that these impacts on people of color populations and low-income populations from the types of facilities evaluated in the PEIS could be avoided or minimized through careful siting and design considerations, permitting, and implementation of mitigation measures and best management practices (BMPs), as described in the *Environmental Justice Technical Resource Report*, it is possible that they could also contribute to cumulative impacts in combination with RFFAs.

- Land use
- Aesthetics and visual quality
- Biological resources
- Historic and cultural resources
- Tribal rights, interests, and resources
- Public services and utilities

- Environmental health and safety
- Noise and vibration
- Recreation

4.2.3.2 Onshore wind facilities with battery energy storage systems

Cumulative impacts from utility-scale onshore wind facilities with co-located battery storage would closely resemble the impacts discussed under utility-scale facilities. The addition of battery energy storage system (BESS) components could result in additional environmental impacts from ground disturbance and infrastructure requirements for managing and handling hazardous materials and fire risks associated with BESS. There would also be additional land uses changes due to the industrial-type BESS components and additional operational noise. This could result in disproportionate impacts on people of color and low-income populations.

4.2.3.3 Onshore wind facilities that include agricultural uses

Cumulative impacts from utility-scale onshore wind facilities with combined agricultural uses would closely resemble the impacts discussed for utility-scale facilities. As described in the *Land Use Technical Resource Report* (Appendix K), facilities with agricultural land use could also have operational impacts on agricultural land uses such as decreases in productivity or damage to equipment. These impacts could result in changes to the rural character of the surrounding area and contribute to a cumulative impact on people of color populations and low-income populations.

4.2.3.4 No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential for impacts on people of color populations and low-income populations for future utility-scale onshore wind energy developments under the No Action Alternative when considering the RFFAs would be similar to those noted for the types of facilities evaluated in this PEIS, depending on facility size and design.

4.3 Earth

This section summarizes the earth resources evaluated within the study area in the *Earth Resources Technical Report* (Appendix D) and analyzes impacts on this resource resulting from the types of facilities considered and other RFFAs in the onshore wind study area. The study area for earth resources encompasses the overall wind geographic scope of study for the PEIS and includes large areas of land across Washington. Further details on earth resources can be found in the *Earth Resources Technical Report.*

4.3.1 Current conditions

The key features of earth resources for the cumulative analysis are as follows:

- Geology

- Soils
- Topography
- Unique physical features
- Erosion or accretion
- Geologic and seismic hazards (including tsunamis)

Factors relating to earth resources encompass both aboveground, surficial features (topography, soil types, water resources) and belowground features (geologic units, seismic and landslide hazards). Aboveground, buffer zones may be applied to certain hazard types, such as fault lines or landslide-prone areas, to mitigate potential impacts on adjacent areas related to these types of hazards. Belowground, the study area extends to the depth of the construction work activity types for the different types of facilities considered.

Washington's geology is deeply connected with the themes of continental tectonic forces, volcanism, uplift, and glaciation. Sedimentary, metamorphic, and igneous rock deposits and emplacements are found across the state. Surface soils derived from these rock deposits often form in common groupings or horizons, as a relative function of the environs in which they are present. Other soil structures, such as biological crusts or desert pavements, may also be sensitive to disturbance and play an important role in local ecology; both are unique biological and physiological conditions that are specific to the environment in which they form and may take very long periods to recover.

Soils in agricultural or forested areas may also exhibit unique attributes that may require more detailed characterization. Designated farmlands or forests may have been identified by the Natural Resources Conservation Service based on several conditions that may not be recreated in other regions. The wind study area includes agricultural and designated timber or forest land that is actively farmed, managed, or reserved. Agricultural soil and forest land types may be protected from irreversible conversion by government regulations under the Farmland Protection Policy Act (federal) and Forest Legacy Program.

Geologic hazards have the potential to affect environmental quality and change topography, habitat, vegetation, drainage patterns, and other attributes. Understanding geologic hazards—such as earthquakes, surface faults, tsunamis and seiches, liquefaction, volcanic eruptions, and landslides—is important because risks of these hazards can impact the safety and feasibility of facility construction, operation, and decommissioning.

Landslides can pose a catastrophic threat to buildings, structures, and people, and may occur in varying levels of severity ranging from fast-moving debris flows to slow soil creep. Topography, soil and rock material types, moisture conditions, precipitation, and vegetation are all factors in slope equilibrium conditions that increase or decrease landslide susceptibility on a given area.

4.3.2 Reasonably foreseeable future actions

RFFAs with potential to affect the earth resources in the study area are listed in Table 4 along with a summary of the potential effects of these actions.

Table 4. Reasonably foreseeable future actions relevant to earth resources

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Potential adverse impacts from an increase in soil compaction, mixing of soil horizons, surface erosion and runoff, sedimentation of nearby waterways, soil contamination, slope instability, changes in local drainage patterns to support development infrastructure, subsidence related to tapping and withdrawal of groundwater reserves, and borrow of local earth resources for construction, operations, and maintenance activities.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Similar to impacts described under RFFA 1.
RFFA 3	Rural and Agricultural Activities and Development	• Similar to impacts described under RFFA 1. Potential adverse impacts from pollution and degradation of soil from agricultural and rural activities.
RFFA 4	Federal, State, Tribal, and Local Wildlife and Habitat Projects	• Potential benefits to earth resources through conservation projects that stabilize soils and reduce surface erosion and runoff.
RFFA 5	Transportation Infrastructure Development and Modification	• Similar to impacts described under RFFA 1.
RFFA 6	Timber and Forestry Management	• Potential adverse impacts from an increase in soil compaction, surface erosion and runoff, sedimentation of nearby waterways, and slope instability, and changes in local drainage patterns from timber and forestry management practices.
RFFA 7	Contaminated Site Cleanup and Remediation	• Potential long-term improvements to the environment but could result in short-term impacts from risk of polluting soil from spills or leaks during cleanup and remediation, land subsidence related to withdrawal of contaminated groundwater for treatment, and the borrow of local earth resources for use as fill at remediation sites.
RFFA 8	Mining Operations	• Potential adverse impacts from an increase in surface erosion and runoff, sedimentation of nearby waterways, soil contamination, slope instability, changes in local drainage patterns from expansion of mining facilities, land subsidence related to withdrawal of groundwater for mining access, soil compaction, mixing of soil horizons, and borrow of local earth resources for reclamation work.
RFFA 9	Recreation Activities on Public Lands	• Potential adverse impacts from an increase in soil compaction, surface erosion and runoff, and sedimentation of nearby waterways from increased use of public lands and human presence.
RFFA 10	Military Use	• Similar to RFFA 1.

RFFA ID	RFFA trend	Impact description
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Similar to RFFA 1.

4.3.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable future actions

The following sections summarize the cumulative impacts to earth resources when considering the RFFAs in combination with the different types of facilities.

4.3.3.1 Utility-scale onshore wind facilities

Cumulative impacts on soil and geological resources associated with the construction, operation, and decommissioning of utility-scale onshore wind facilities would primarily occur when wind facilities and future developments in a given area involve elements that result in ground-disturbing activities. These activities may include grading for site access and development, clearing and grubbing, installation of subsurface infrastructure, borrow and stockpiling of site soils, importing and removing soils, placement and compaction of low-permeability materials, and construction of access roads and facility infrastructure.

Impacts associated with the above-described activities include the increased potential for soil compaction, mixing of soil horizons, surface erosion and runoff, sedimentation of nearby waterways, soil contamination, slope instability, landslide risks, and changes in local drainage patterns. The degree of impact from ground-disturbing activities also depends 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 of multiple onshore wind facilities across a large area or in combination with adjacent future developments and land use changes could cumulatively increase the risk of erosion, soil loss, and disruption in soil formation resulting in long-term changes in overall soil quality, soil stability, and regional drainage patterns. These cumulative impacts would be exacerbated by the presence of steep slopes. Siting several developments in a given area also magnifies the risk of multiple different types of hazardous chemicals contaminating soils, which can leach toxins into waterways. Grading, cut, and fill activities associated with facility development in combination with other nearby future developments could result in an increased risk of large-scale landslides and greater susceptibility of slope failure due to other potential geologic hazards (e.g., earthquakes).

Impacts associated with facility decommissioning activities are anticipated to be similar to those generated during construction; however, they would be of lesser intensity and duration because the use of previously developed access routes and staging areas would be available,

and site restoration activities would include re-establishing native vegetation. Cumulative impacts to soil resources following decommissioning may also include changes to agriculturally significant lands that make them less suitable for later agricultural use.

The level of contributions from utility-scale onshore wind facilities would vary depending on the size and number of other individual future actions within a given area, as well as their relative location and timing. Multiple utility-scale onshore wind facilities and other RFFAs occurring in the same area may result in greater cumulative impacts to soil and geologic resources compared to facilities and RFFAs that are more dispersed. It is anticipated that the energy projects included in RFFA 1 are likely to be located relatively near each other and near onshore wind energy facilities evaluated in this PEIS to take advantage of the same energy source conditions and infrastructure.

Cumulative impacts on soil and geologic resources could be avoided or minimized through careful siting and design considerations, permitting, and implementation of mitigation measures and BMPs as described in the *Earth Resources Technical Report*.

4.3.3.2 Onshore wind facilities with battery energy storage systems

When considering other RFFAs in the area, cumulative impacts for utility-scale onshore wind facilities with BESSs would closely resemble the impacts discussed for utility-scale facilities but with some differences. One notable difference is the increased complexity of infrastructure construction and operational requirements compared to utility-scale onshore wind energy facilities without BESSs. The addition of BESS components could result in more soil disturbance from the larger overall footprint and increased risk of hazardous materials release into the soil or nearby waterway in the event of a BESS failure.

4.3.3.3 Onshore wind facilities that include agricultural uses

When considering other RFFAs in the area, cumulative impacts for onshore wind energy facilities combined with agricultural land use would closely resemble the impacts discussed for utility-scale facilities but with some differences. The specific cumulative impacts of agricultural use would depend on the region in which a project site is co-located with other future actions and the type of agricultural use, water usage, and management requirements compared to existing land uses. If a site is already used for agricultural purposes, the cumulative impact of facility development along with future actions would be less than if an undeveloped site is converted to agricultural use. The additional impacts on soil and the associated geological hazards would occur from irrigation, dust, erosion, the usage of farming equipment or vehicles, and the risk of release of contaminants such as herbicides, fuels, hydraulic fluids, solvents, or cleaning agents.

4.3.3.4 No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential for cumulative impacts on soil and geological resources for future utility-scale onshore wind energy developments under the No

Action Alternative when considering the RFFAs would be similar to those noted for other types of facilities, depending on facility size and design.

4.4 Air quality and greenhouse gases

This section summarizes air quality and greenhouse gases evaluated within the study area in the *Air Quality and Greenhouse Gases Technical Resource Report* (Appendix E) and analyzes impacts on this resource resulting from the types of facilities considered and other RFFAs in the onshore wind study area. The study area for air quality resources encompasses the overall wind geographic study area, and surrounding areas, which could include facilities and activities with air emissions. Additional details regarding air quality and GHGs can be found in the *Air Quality and Greenhouse Gases Technical Resource Report*.

4.4.1 Current conditions

4.4.1.1 Air quality

Given the substantial geographic extent of the wind study area, the existing air pollutant concentration levels can vary from one site to another. All areas in Washington state currently meet all ambient air quality standards. However, there are some areas of concern for particulate matter and ozone within the study area. The Tri-Cities area (Kennewick, Pasco, and Richland) is an area of concern for ozone. Sunnyside, Toppenish, and Yakima in the south are areas of concern for particulate matter, along with Omak in the north and Colville in the northeast.

Any location may experience occasional severe deterioration of air quality due to wildfires (usually July through September), depending on wind patterns and the location of the fire(s). In addition, seasonal dust storms (usually during dry periods in spring and summer), particularly in eastern and central Washington, can increase levels of particulate matter in the air, which increases inhalation health risks and can cause reduced atmospheric visibility.

4.4.1.2 Greenhouse gas emissions

Per Ecology's estimates, in 2019, Washington produced about 102.1 million metric tons of carbon dioxide equivalents (Ecology 2022). Ecology found that 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 (both in state and out of state) at

21%.[4] The sources of the remaining 8% of emissions are agriculture, waste management, and industrial processes.[5]

4.4.2 Reasonably foreseeable future actions

RFFAs with potential to affect air quality and GHGs in the study area are listed in Table 5 along with a summary of the potential effects of these actions.

Table 5. Reasonably foreseeable future actions relevant to air quality and greenhouse gases

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Likely beneficial impacts from the likelihood of reduced GHG and air pollutant emissions for clean energy development.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Potential adverse impacts from population growth and development that would likely result in increased GHG and air pollutant emissions.
RFFA 3	Rural and Agricultural Activities and Development	• Potential adverse impacts from growth and development of rural activities and developments that would likely result in increased GHG and air pollutant emissions.
RFFA 4	Federal, State, Tribal, and Local Wildlife and Habitat Projects	• May result in potential adverse impacts or potential beneficial impacts depending on how local wildlife and habitat management actions influence population growth.
RFFA 5	Transportation Infrastructure Development and Modification	• Potential beneficial impacts resulting from efforts to decrease the reliance on single-occupancy vehicles, likely resulting in a decrease in emissions.
RFFA 6	Timber and Forestry Management	• Potential adverse impacts from increased occurrence or length or duration of wildland fires, resulting in GHG and air pollutant emissions (including particulate matter).
RFFA 7	Contaminated Site Cleanup and Remediation	• Potential adverse effects from activities, including initial remediation, site investigations, clean up, and monitoring that may all require operation of vehicles and machinery that would emit air pollutants and GHGs.

[4] Transportation sources include on-road vehicles, marine vessels, jet fuel and aviation gasoline, rail operations, and natural gas for transportation. Washington GHG emissions from the transportation sector have been fairly constant for several years, with on-road gasoline continuing to contribute over 50% of transportation sector emissions. Marine vessel emissions include emissions from recreational, commercial, and ocean-going vessels, but exclude marine bunker fuels consumed in international waters.

[5] The industrial sector includes fugitive GHG emissions that are released during the production, processing, transmission, and distribution of fossil fuels. These emissions are typically fugitive methane due to leakage and venting from natural gas pipelines, and petroleum systems.

RFFA ID	RFFA trend	Impact description
RFFA 8	Mining Operations	• Potential adverse impacts from conducting mining activities, requiring the use of machinery using fossil fuels that that would result in increased emissions.
RFFA 10	Military Use	• Potential adverse impacts from military infrastructure development and modification activities that would result in increased emissions. • Potential beneficial impacts from military infrastructure development and modification activities that would result in decreased emissions.
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Potential adverse effects from activities including development of water treatment plants and distribution systems that may all require operation of vehicles and machinery that would emit air pollutants and GHGs.

4.4.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable future actions

The following sections summarize the cumulative impacts on air quality and GHGs when considering the RFFAs in combination with the different types of facilities considered in the PEIS.

4.4.3.1 Utility-scale onshore wind facilities

Construction and decommissioning of utility-scale onshore wind energy facilities would require the use of on-road equipment construction machinery and on-site generators that would result in air pollutant and GHG emissions from the combustion of fuel in internal combustion engines, as well as particulate dust emissions from land-clearing activities and vehicle travel on paved and unpaved roadways. Although the operation of wind turbines themselves does not generate air emissions or GHGs, the facilities would require use of generators and vehicles associated with maintenance activities, which would result in air pollutant and GHG emissions.

The level of air pollutant contributions from utility-scale facilities would vary depending on the size and number of other individual future actions within a given area, as well as their location and timing relative to construction and operation of utility-scale facilities. Impacts from increased emissions of air pollutants are typically greatest at the emissions source, with changes to concentrations of pollutants decreasing as the distance from the emitting source increases. For this reason, pollutant emissions may not contribute to a cumulative impact on air quality unless the emissions occur relatively close to a pollutant-emitting RFFA, both in terms of time and location.

A cumulative reduction in air emissions (including particulates and pollution), as well as a cumulative reduction in GHG emissions, would be anticipated as regulatory requirements like the Clean Energy Transformation Act, the Climate Commitment Act, and Clean Fuel Standard are implemented. These would mean clean energy sources would be added to the power mix,

as coal-fired power plants would be retired and decommissioned, and the use of electric cars would increase. Likewise, as transportation infrastructure developments are implemented that decrease the reliance on single-passenger vehicle trips, air pollution and GHG would also decrease.

Increasing atmospheric levels of GHGs are resulting in global climate change. Utility-scale onshore wind energy development contributes relatively minor GHG emissions as a result of emissions from heavy equipment, primarily used during the construction phase; vehicular emissions; and vegetation removal. The operations of utility-scale onshore wind 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. For reference, comparing for a 250-megawatt (MW) facility, natural gas and coal-fired electricity release about 14 and 32 times, respectively, more life-cycle GHGs than onshore wind energy.

Urban, commercial, and industrial developments driven by population change trends are likely to result in a cumulative increase in air pollution and GHG emissions as new developments are built or existing developments are expanded. This may include the conversion of vegetated land to non-vegetated land and the conversion of agricultural land use to residential, commercial, or industrial uses with the associated expansion of road and utility systems. Mining operations and military facility development or expansion are likely to require operation of machinery that result in increases in air pollution and GHG emissions. Because many of the new energy facilities associated with RFFA 1 are anticipated to be located relatively close to each other and close to utility-scale onshore wind energy facilities evaluated in this PEIS, their air pollutant emissions would have the potential to contribute to a cumulative impact on local air quality. Federal and State Lands Management could either worsen or improve the cumulative outcomes of population growth and wildland fires, depending on the nature of the management action(s). In addition, increased wildland fires due to climate change could become an increasing source of particulate matter emissions, contributing to a degradation of air quality and also increasing GHGs.

Likewise, transportation infrastructure development and modification projects that result in a shift to mass transit adoption and away from single-occupancy vehicle trips or further adoption of electric vehicles would also contribute to a further net reduction in GHG emissions. Other RFFAs identified in Table 5 would be anticipated to contribute to new increases in GHG emissions such as development activities requiring the use of internal combustion engines in construction equipment and vehicles, mining operations, expanded military use, and potential land use changes that convert vegetated land to non-vegetated lands. The emissions for onshore wind energy facilities are expected to be able to be reduced through offsets.

4.4.3.2 Onshore wind facilities with battery energy storage systems

Cumulative impacts from utility-scale onshore wind facilities with BESSs, when considering other RFFAs in the area, would closely resemble the impacts discussed for utility-scale facilities but with some differences. For example, there is a small increased risk for a BESS fire, which would contribute to air pollutants and particulate matter in the nearby area. Accidental leakage

of refrigerants in air conditioning systems used for BESSs could result in minimal hazardous or toxic air pollutant emissions, which include emissions of chlorofluorocarbons, hydrofluorocarbons, perfluorinated chemicals, or sulfur hexafluoride. These emissions are still anticipated to be minor and the overall contribution of facilities with BESSs to GHG emissions when combined with the RFFAs is not likely to be meaningfully different than that for facilities without BESSs.

4.4.3.3 Onshore wind energy facilities that include agricultural uses

Cumulative impacts from onshore wind energy facilities combined with agricultural land use, when considering other RFFAs in the area, would closely resemble the impacts discussed for other facilities without combined agricultural use. For facilities with continued agricultural use, emissions from agricultural diesel-powered equipment would vary depending on the type of crops planted, level of activity, and the size and age of equipment but are not anticipated to generate emissions above and beyond those of existing agricultural practices. A facility with a new agricultural use would increase emissions because this would be additional. The overall emissions footprint of an agricultural operation is highly dependent on the types of crops, number of tilling operations per year, age of equipment being used, and many other variables. These emissions are still anticipated to be small and the overall contribution of facilities with combined agricultural use to GHG emissions when combined with the RFFAs is not likely to be meaningfully different than that for facilities without combined agricultural use.

4.4.3.4 No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential for impacts on air quality for future utility-scale onshore wind energy developments under the No Action Alternative when considering the RFFAs would be similar to those noted for other types of facilities, depending on facility size and design.

4.5 Water resources

This section describes the water resources evaluated within the study area in the *Water Resources Technical Report* (Appendix F) and analyzes impacts on this resource resulting from the types of facilities considered and other RFFAs. The study area for water resources encompasses the overall wind geographic scope of study for the PEIS, which covers large areas of land spread across Washington, including all of the state's major hydrologic basins. 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 Technical Report*.

4.5.1 Current conditions

The key features of water resources in the cumulative analysis discussions are as follows:

- Surface water
- Groundwater
- Wetlands
- Floodplains
- Water quality
- Water quantity (flows and levels)
- Water availability
- Water rights

Surface waters within or adjacent to the study area range from the Pacific Ocean to major rivers to small- to large-sized perennial creeks to unnamed smaller drainageways with only seasonal flow. Groundwater is the water found underground in the spaces of saturated soil and rock that recharges when water from the surface (e.g., rain or snowmelt or surface waterbodies) seeps downward into the ground.

Across the study area, water availability varies by location and is dependent on many factors, such as local hydrology and climate conditions (precipitation, air temperature, snowpack), land uses, and existing water rights, including minimum instream flows.

Water use differs substantially between western and eastern Washington. The dominant water use in the western part of the state, where most of the state's population resides, is public supply. In the drier and more sparsely populated eastern portions of the state, where much of the state's agricultural production is based, crop irrigation is by far the dominant water use category.

Wetlands are a specific type of water resource that often occur in transitional areas between terrestrial and aquatic systems. 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.

Federal Emergency Management Agency Flood Insurance Rate Maps identify flood hazard areas regulated under the National Flood Insurance Program. Special flood hazard areas are defined as areas that would be inundated by the flood event having a 1% chance of being equaled or exceeded in any given year (i.e., the "100-year" flood) and generally form the basis for state and local floodplain management regulations.

4.5.2 Reasonably foreseeable future actions

RFFAs with the potential to affect the water resources in the study area are listed in Table 6 along with a summary of the potential effects of these actions.

Table 6. Reasonably foreseeable future actions relevant to water resources

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Potential adverse impacts from increased alterations to surface water flow and quality, groundwater recharge capabilities, and from greater demand for water availability or water rights. • Potential adverse impacts on wetland boundaries and functions and reduced floodplain functions from placement or removal of material to support energy development infrastructure and from potential alteration of surface drainage patterns.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Similar to impacts described under RFFA 1. • Potential adverse impacts on water quality in wetlands and other water bodies from increases in impervious surfaces and stormwater runoff.
RFFA 3	Rural and Agricultural Activities and Development	• Potential adverse impacts from pollution and degradation of water from agricultural and rural activities, and from a greater demand for water availability or water rights. • Transition to urban, commercial, and industrial development would adversely impact water resources similar to impacts described under RFFA 1 and RFFA 2. • Potential adverse impacts on wetland boundaries and functions and floodplains from drainage activities, fill placement, and the use of herbicides and fertilizers associated with agricultural activities.
RFFA 4	Federal, State, Tribal, and Local Wildlife and Habitat Projects	• Potential beneficial effects on water resources from projects that reduce pollution and erosion and improve overall water flow and quality.
RFFA 5	Transportation Infrastructure Development and Modification	• Similar to impacts described under RFFA 2. • Potential adverse impacts from an increase in alterations to surface water flow and quality and groundwater recharge capabilities.
RFFA 6	Timber and Forestry Management	• Potential short-term adverse impacts from sedimentation of nearby waterways, alterations in riparian vegetation, and changes in local drainage patterns. • Potential adverse impacts on wetland boundaries and functions and floodplains from vegetation community conversion, drainage pattern alteration, increased erosion potential, and water quality degradation.
RFFA 7	Contaminated Site Cleanup and Remediation	• Projects under RFFA 7 would likely result in long-term improvements to the environment but could result in short-term adverse impacts on water resources from risk of pollution entering waterways and wetlands from spills or leaks during cleanup and remediation.
RFFA 8	Mining Operations	• Potential adverse impacts on water resources from pollution and changes in local drainage patterns from expansion of mining facilities.

RFFA ID	RFFA trend	Impact description
RFFA 9	Recreation Activities on Public Lands	• Potential adverse impacts on water resources from sedimentation of nearby waterways and wetlands from an increase in recreation activities. • Potential adverse impacts on wetland boundaries and functions and floodplains from increased erosion potential.
RFFA 10	Military Use	• Potential adverse impacts on water resources from a greater demand for water availability or water rights from expansion of military facilities. • Potential adverse impacts on wetland boundaries and functions from placement of fill for infrastructure improvements, alteration of surface drainage patterns, increases in impervious surfaces and stormwater runoff.
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Potential adverse impacts on water resources from a greater demand for water availability or water rights from construction of new water storage facilities and associated infrastructure. • Potential adverse impacts on wetland boundaries and functions from placement of fill and alteration of surface drainage patterns.

4.5.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable future actions

The following sections summarize the cumulative impacts on water resources when considering the RFFAs in combination with onshore wind facilities.

4.5.3.1 Utility-scale onshore wind facilities

Cumulative impacts on water resources associated with the construction, operation, and decommissioning of utility-scale onshore wind facilities could occur when wind facilities and future developments in a given area involve elements within or adjacent to streams, wetlands, and floodplains (e.g., stream crossings, culvert installations, removal, fill). Ground disturbance, vegetation clearing, soil compaction, and increased impervious surface area could impact discharge patterns, flow rates, and volumes of surface runoff. Sedimentation, spills of pesticides, fuel, vehicle fluids, transformer coolant, or other hazardous materials used or stored on a site could adversely impact water quality in wetlands and other waters that are adjacent to facility infrastructure and other developments. Multiple developments within floodplains could result in cumulative impacts on floodplain functions for flood storage, water quality, habitat, and water velocity attenuation.

Subsurface construction could locally affect shallow groundwater flows to approximately the depth of the excavation/fill. An increase in impervious surfaces would prevent infiltration of rainfall and snowmelt, resulting in a reduction in groundwater recharge capability. Groundwater extraction for construction and operation uses could result in localized water table drawdown.

Onshore wind facility construction together with other nearby future developments could increase the need for water use and obtaining water rights. However, changes in land use with some RFFAs, such as those that result in a decrease in irrigation, could cumulatively decrease the demand for water use and rights.

The level of contributions from utility-scale onshore wind facilities would vary depending on the size and number of other individual future actions within a given area, as well as their location and timing relative to construction and operation of utility-scale facilities. Multiple utility-scale onshore wind facilities and other RFFAs occurring in the same area may result in greater cumulative impacts to water resources compared to facilities and RFFAs that are more dispersed. It is anticipated that the energy projects included in RFFA 1 are likely to be located relatively near each other and near onshore wind energy facilities evaluated in this PEIS to take advantage of the same energy source conditions and infrastructure.

Cumulative impacts on water resources could be avoided or minimized through careful siting and design considerations, permitting, and implementation of mitigation measures and BMPs as described in the *Water Resources Technical Report*.

4.5.3.2 Onshore wind facilities with battery energy storage systems

When considering other RFFAs in the study area, cumulative impacts on water resources from utility-scale onshore wind facilities with BESSs would closely resemble the impacts discussed for utility-scale facilities. One notable difference is the increased complexity of infrastructure construction and operational requirements compared to utility-scale onshore wind energy facilities without BESSs. The addition of BESS components could result in more ground disturbance from the larger overall footprint and increased risk of sedimentation and hazardous materials release into a nearby waterway in the event of a BESS failure. Emergency response actions are to allow the fire to burn to prevent water contaminated with pollutants to affect surface water and groundwater quality. However, firefighting water may be used on adjacent facility components to prevent fire spread. Firefighting water and post-fire runoff may be contaminated with hazardous materials, such as lithium, cobalt, and electrolytes. Spill response measures would be included in the project's SWPPP, Emergency Response Plan, and the BESS operations and safety manual as required by NFPA 855.

4.5.3.3 Onshore wind facilities that include agricultural uses

When considering other RFFAs in the area, cumulative impacts on water resources from onshore wind energy facilities combined with agricultural land use would closely resemble the impacts discussed for utility-scale but with some differences. The demand for water would be higher for facilities combined with new agricultural use of the site. This could place a higher need for water availability and water rights issues relative to the other types of facilities and considering future actions. Substances commonly associated with farm operations such as pesticides, fertilizers, and livestock waste could also lead to increased pollutants in stormwater runoff.

4.5.3.4 No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential for cumulative impacts on water resources for future utility-scale onshore wind energy developments under the No Action Alternative when considering the RFFAs would be similar to those noted for other types of facilities, depending on facility size and design.

4.6 Biological resources

This section summarizes the biological resources evaluated within the study area in the *Biological Resources Technical Report* (Appendix G) and analyzes impacts on this resource resulting from the types of facilities considered and other RFFAs in the onshore wind study area. The study area for biological resources encompasses the overall wind geographic scope of study for the PEIS and includes large areas of land across Washington. Biological resources include terrestrial, aquatic, and wetland wildlife species, plant species, and habitats. Additional details can be found in the *Biological Resources Technical Report*.

4.6.1 Current conditions

The key features of biological resources in the study area for the cumulative analysis discussions are as follows:

- Terrestrial and aquatic species listed under the ESA; Birds of Conservation Concern identified as at-risk species by U.S. Fish and Wildlife Service (USFWS); Washington state species of concern (listed and candidate species); and those potentially identified by county-specific codes as sensitive species, species of local importance, and species of concern
- Unique, priority, and culturally important species and habitats
- Terrestrial habitat, including USFWS critical habitats; 75 National Audubon Society-defined Important Bird Areas; WDFW Priority Habitats and Species (PHS) priority habitats (e.g., Aspen Stands, Riparian, Biodiversity Areas and Corridors, Shrubsteppe); habitat features such as caves, cliffs, snags and logs, and talus; and other terrestrial habitats that support priority species such as agricultural lands or disturbed grounds
- Non-wetland terrestrial and riparian habitat regulatory buffers required by counties and municipalities for the protection of critical areas as required by the Washington Growth Management Act (GMA)
- Vertical air space aboveground that is typically used by bird, bat, and other flying species and vertical depths belowground that may be used by burrowing species
- Wildlife migration corridors and landscape-scale habitat connectivity within extensive geographic areas encompassing various ecosystems, landforms, and habitats and considering the multiple species and the interactions between different habitats within a landscape

- Freshwater or marine aquatic habitat, including critical habitat determined by NOAA Fisheries and USFWS, and the following PHS priority habitats identified by WDFW: Instream, Freshwater Wetlands and Fresh Deepwater, Open Coast Nearshore, and Puget Sound Nearshore habitat types
- Salmonid and other fish migration routes
- Wetland habitats including any wetlands and their associated regulatory buffers required by counties and municipalities for the protection of critical areas under the GMA

4.6.1.1 Terrestrial species and habitats

The study area contains a wide variety of diverse habitats for terrestrial species, such as coastal areas, inland waters, mountain ranges, forests and woodlands, deserts, canyons, shrubsteppe areas, grasslands, meadows, riparian areas, alpine, agricultural areas, and suburban areas, including air habitat for flying species. Notable habitat features include snags, trees, crevices in rocks, tunnels, buildings, bridges, caves, and mineshafts. In more developed areas, vineyards, tree farms, orchards, pastures, croplands, and parks dominate the natural landscape.

The air habitat over the study area is used by bird and bat species for flying behaviors, such as soaring, hunting, foraging, breeding, and migrating. Air habitat is also important for flying and wind-dispersing invertebrates and for wind dispersal of seeds. Waterfowl habitat includes shallow waters, such as ponds, flooded cropland, and seasonally inundated wetlands that provide habitat, food, shelter, and migration zones, as well as secluded coves and densely vegetated areas that serve as refuge from predators.

Migration routes and wildlife corridors provide important habitats for migrating species (e.g., birds and ungulates). All of Washington state, including the study area, is located in the Pacific Flyway, one of the four main north-south migratory routes in North America used by a variety of migratory game and nongame bird species. Flyway management plans are developed by the Pacific Flyway Council with an approximately 5-year planning horizon and adopted to help state and federal agencies cooperatively manage migratory birds under common goals (Pacific Flyway Council 2024). Management plans typically focus on migratory bird species populations and habitat conditions that support those populations.

Ungulates (hooved mammals) typically require temporally and spatially diverse habitat components to provide food and cover and have large home ranges across entire landscapes rather than isolated patches of habitat (Kie et al. 2003). In the study area, ungulate migration corridors occur over broad landscapes and can be found within the Northern Rockies, North Cascades, Eastern Cascades Slopes and Foothills, Cascades, and Columbia Plateau ecoregions (USGS 2022a, 2022b, 2024). The U.S. Geological Survey *Ungulate Migrations of the Western United States* reports provide detailed mapping of migration routes in Washington state (USGS 2022a, 2022b, 2024; see Figure 4 for an example of this mapping). Ungulate species found in Washington state include elk, moose, various types of deer, bighorn sheep, mountain goats, and pronghorn antelope. Many ungulate herds migrate on a seasonal basis between distinct summer and winter ranges to make the best use of various food sources and to avoid predation risks and adverse habitat conditions such as deep snow (USGS 2024). Within the study area, the

Ungulate Migrations of the Western United States reports include mapped migrations and seasonal ranges of seven herds, including Klickitat mule deer, Wenatchee Mountains mule deer, Chelan mule deer, Methow mule deer, Colockum elk, Selkirk white-tailed deer, and Pend Oreille elk (USGS 2022a, 2022b, 2024).

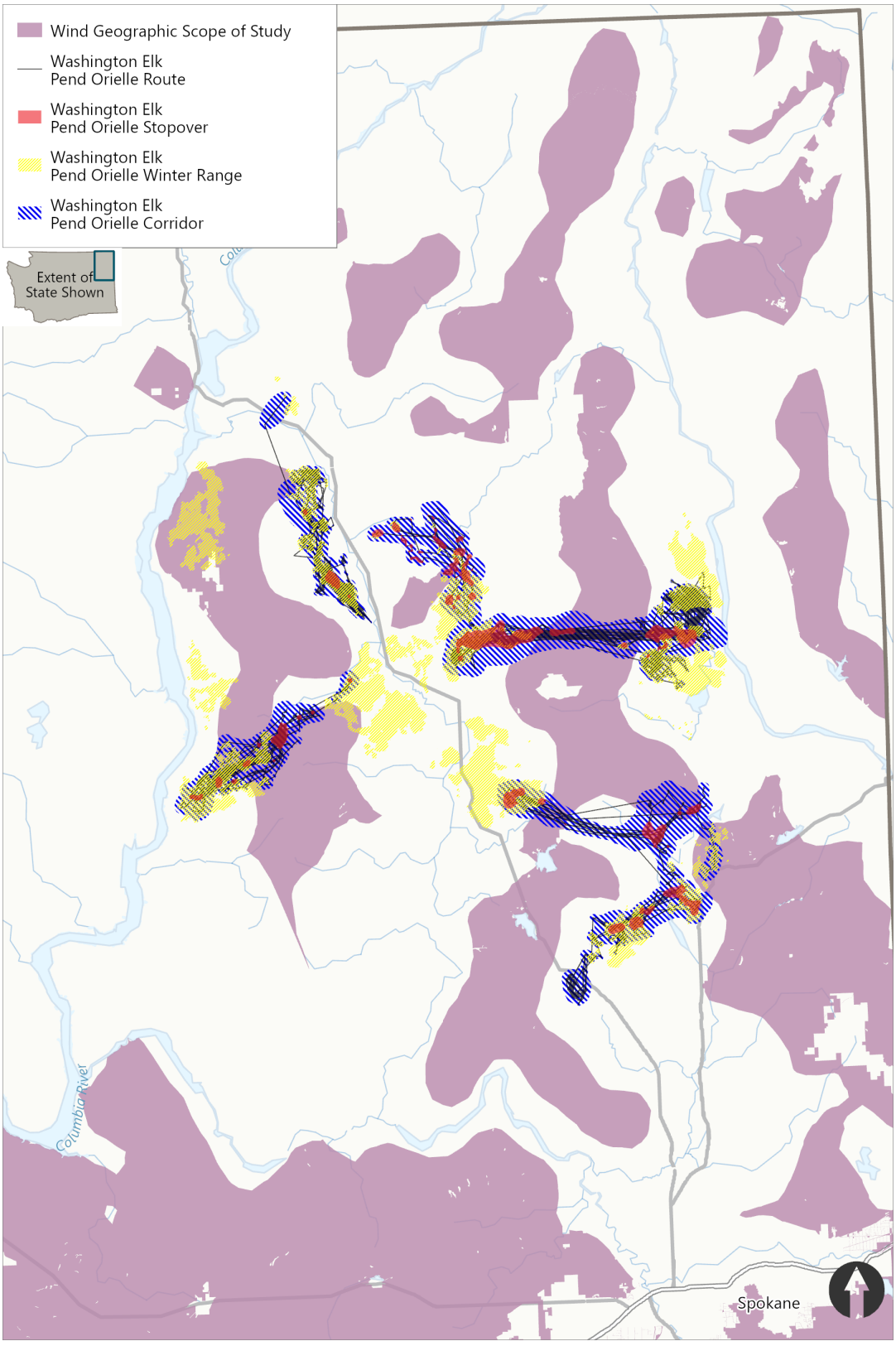

Figure 4. Example ungulate migration map for Pend Oreille elk winter range
Data source: USGS 2022b

This analysis focuses on terrestrial plants and animals that are likely to occur in areas that could be affected by new onshore wind facilities, including special-status species. Terrestrial species that could be affected in the study area include a wide variety of birds (e.g., songbirds, shorebirds, waterfowl, waterbirds, birds of prey, game birds), mammals (e.g., bats, pocket gophers, black bears, elk), reptiles (e.g., lizards, snakes, turtles), amphibians (e.g., frogs and salamanders), and invertebrates (e.g., insects, spiders), as well as a variety of upland plant community types that are further characterized by Level IV Ecoregions (USEPA 2023). A variety of native and non-native plant species occur throughout the study area and include woody trees and shrubs, and non-woody plants (e.g., forbs, grasses, sedges, rushes, and mosses). In addition, there are over 150 plant species that are classified as invasive in Washington state, and the presence of these invasive species varies by county (WSNWCB 2024). The types of onshore wind facilities being considered are likely to be sited to avoid aquatic habitat; however, potential impacts, such as changes to drainage patterns or water quality, could extend to adjacent freshwater streams and lakes, wetlands and ponds, and nearshore marine areas, which could also affect terrestrial species.

The study area also contains special-status species and habitats, which include ESA-listed species and their designated critical habitats, Washington state-listed species and habitats (including those on the WDFW PHS list), Species of Greatest Conservation Need identified in the State Wildlife Action Plan, habitats identified as rare/high quality under the DNR Natural Heritage Program, and those species and habitats potentially identified in county codes as sensitive species, species of local importance, and species of concern.

4.6.1.2 Aquatic species and habitats

The study area contains a variety of aquatic habitats, including habitats for freshwater, anadromous, and nearshore marine fish; amphibians; turtles; mollusks; urchins; crustaceans; and aquatic macroinvertebrates that could be affected by the proposed action. The WDFW Priority Habitat types within the study area include instream habitat, freshwater wetlands, fresh deepwater, and coastal nearshore habitats (WDFW 2023).

Surface waters that provide aquatic habitat can be categorized as follows based on how long water is present and flowing on land throughout the year:

- Ephemeral streams are rain and snowmelt dependent. They have flowing water during brief periods of precipitation, typically during fall and early spring rain events.
- Intermittent streams are seasonal, with flowing water only during certain times of the year based on precipitation patterns or groundwater levels.
- Perennial streams have flowing water year-round.

Critical habitat includes geographic areas containing features essential to the recovery of listed species. Many waterbodies within Washington are critical habitats for listed species such as salmon (*Oncorhynchus* spp.), bull trout (*Salvelinus confluentus*), and steelhead (*O. mykiss*). The extent of critical habitat for each ESA-listed aquatic species is determined and mapped by USFWS or NOAA Fisheries, where those analyses have been completed (87 *Federal Register* 37757, 2022; USFWS 2024).

Essential Fish Habitat (EFH) is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" and is designated for groundfish, Pacific salmon, and coastal pelagic composites (50 *Code of Federal Regulations* 600.10, 2024). For the purposes of this PEIS, EFH includes wetlands, lakes, rivers, and nearshore marine areas with bays, coral reefs, and kelp forests that are necessary for fish reproduction, growth, feeding, and shelter (NOAA 2024).

This analysis focuses on aquatic and amphibious plants and animals that are likely to occur in areas that could be affected by new onshore wind facilities, including special-status species. The types of onshore wind facilities being considered are likely to be sited to avoid aquatic habitat; however, potential impacts, such as changes to drainage patterns or water quality, could extend to adjacent freshwater streams and lakes, wetlands and ponds, and nearshore marine areas. Groups of aquatic animals that could be affected include fish, shellfish, aquatic macroinvertebrates, frogs, and turtles. In marine nearshore areas, some mammals, such as seals and sea lions, use shorelines as haul-out areas.

Aquatic vegetation in the study area grows in a variety of forms and habitat types, including shoreline plants, floating rooted and free-floating plants, and submersed plants. There are also 21 aquatic noxious weeds listed by the Washington State Noxious Weed Control Board that could be found in the study area. Alteration to aquatic habitat can promote the spread of noxious weeds, which can have negative impacts on native species distribution.

Numerous fish species occur throughout the study area in Washington including migratory species, such as native anadromous species of salmon, steelhead, bull trout, lamprey, eulachon smelt, and sturgeon. Resident freshwater fish in the study area include resident rainbow trout (*O. mykiss*), cutthroat trout (*O. clarkii*), whitefish (*Coregonus clupeaformis*), freshwater sculpins (*Cottus bairdii*), minnows (*Cyprinidae* family), and suckers (*Catostomidae* family). In coastal areas of the study area, nearshore marine fish include forage fish, groundfish, and anadromous species. Shellfish and aquatic macroinvertebrates in the study area include freshwater mussels, freshwater aquatic snails, benthic macroinvertebrates, marine mussels, marine clams, oysters, pinto abalone, urchin species, crabs, and shrimp.

Amphibians in the study area include frogs, toads, and salamanders. Amphibians and turtles rely on still water, such as ponds, wetlands, ephemeral pools, or slow-moving areas of rivers and creeks, for breeding, egg laying, and juvenile rearing. Amphibian and freshwater turtle species are found throughout the nine ecoregions of Washington.

Pinnipeds that inhabit nearshore marine areas include harbor seals (*Phoca vitulina*), California sea lions (*Zalophus californianus*), and Steller sea lions (*Eumetopias jubatus*). Seals and sea lions can be found in the Coast Range and Puget Sound Lowland regions.

Aquatic invasive species of greatest concern in the study area include the European green crab (*Carcinus maenas*), zebra mussels (*Dreissena polymorpha*), quagga mussels (*Dreissena bugensis*), and northern pike (*Esox lucius*) (WDFW 2024f). The American bullfrog (*Rana* [*Lithobates*] *catesbeiana*) is an invasive species found in lowland permanent waterbodies, such

as wetlands, ponds, creeks, rivers, and lakes. Introduced fish species include fish from the sunfish family, such as smallmouth bass (*Micropterus dolomieu*). Other invasive fish species include walleye (*Sander vitreus*), crappie (*Pomoxis* spp.), yellow perch (*Perca flavescens*), and members of the carp or bullhead family.

4.6.1.3 Wetlands

Wetlands occur throughout the study area. Freshwater wetlands are often characterized as transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface or covered by shallow water during the growing season each year. They can be dominated by forested, scrub-shrub, or herbaceous vegetation communities and have the widest range of occurrence in the study area. Ponds containing emergent vegetation may also be classified as freshwater wetlands. Estuarine wetlands also occur in limited portions of the study area. They are found in brackish water in estuaries where freshwater meets saltwater and where water levels influenced by tides. Estuarine wetlands include such areas as salt marshes, mud flats, and tidal channels and only have the potential to occur in those portions of the study area that are adjacent to Puget Sound, Grays Harbor, Willapa Bay, and other coastal areas.

Wetlands provide a number of important ecosystem functions, including habitat for terrestrial, aquatic, and amphibious species; water quality improvement; flood flow reduction/protection; shoreline stabilization; groundwater recharge; and stream flow maintenance (Ecology 2023). Many of these functions, such as flood flow reduction and shoreline stabilization, are particularly valuable to humans.

This cumulative analysis focuses on impacts on wetland functions and values associated with the provision of habitat for aquatic and terrestrial species. As part of state and local regulation of wetlands in Washington, wetlands are rated and categorized using Ecology's Washington State Rating System. The rating system includes specific regional methods for the western (Hruby and Yahnke 2023) and eastern (Hruby 2014) portions of the state. The wetland categories derived using the rating system are characterized by the following criteria:

- **Category I wetlands** represent a unique or rare wetland type, are more sensitive to disturbance, or are relatively undisturbed and contain ecological attributes that provide a high level of functions. These types and functions are very difficult to replace.
- **Category II wetlands** provide high levels of some functions. These types and functions are very difficult to replace.
- **Category III wetlands** have moderate levels of functions. They have been disturbed in some ways and are often less diverse or more isolated from other natural resources in the landscape than Category II wetlands.
- **Category IV wetlands** have the lowest levels of functions and are often heavily disturbed.

4.6.2 Reasonably foreseeable future actions

RFFAs with potential to affect the biological resources in the study area are listed in Table 7 along with a summary of the potential effects of these actions.

Table 7. Reasonably foreseeable future actions relevant to biological resources

RFFA ID	RFFA description	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Potential adverse impacts on landscape-scale habitat connectivity and wildlife migration corridors from the fragmentation, degradation, or loss of vegetation and habitat from construction and operation of new energy facilities and associated infrastructure, transmission lines, and distribution networks and from decommissioning of facilities. • Edge habitat creation from facility construction may adversely impact species. • Habitat alterations and increased use of resources (e.g., water) may affect species viability and migratory pathways. • Facility construction, operation, and decommissioning activities, including facility components (e.g., wind turbines, transmission lines, stream crossings), noise, and vehicle traffic may disturb, injure, or kill species. • Potential adverse impacts on habitats from erosion, sedimentation, and risk of contamination. • Potential adverse impacts on wetland boundaries and functions from placement or removal of material to support energy development infrastructure and from potential alteration of surface drainage patterns. • Potential adverse impacts on water quality in wetlands and other water bodies from increases in impervious surfaces and stormwater runoff.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Similar to impacts described under RFFA 1
RFFA 3	Rural and Agricultural Activities and Development	• Potential adverse impacts from pollution and degradation of soil, water, and air from agricultural and rural activities. • Transition to urban, commercial, and industrial development would adversely impact biological resources similar to impacts described under RFFA 1. • Potential adverse impacts on wetland boundaries and functions from drainage activities, fill placement, and the use of herbicides and fertilizers associated with agricultural activities.
RFFA 4	Federal, State, Tribal, and Local Wildlife and Habitat Projects	• Potential beneficial effects on biological resources from projects that maintain, enhance, restore, or create native habitats including wetlands.
RFFA 5	Transportation Infrastructure Development and Modification	• Similar to impacts described under RFFA 1.
RFFA 6	Timber and Forestry Management	• Similar to impacts described under RFFA 1.
RFFA 7	Contaminated Site Cleanup and Remediation	• Projects under RFFA 7 would likely result in long-term improvements to the environment but could result in short-term impacts from the risk of polluting terrestrial and aquatic habitats from spills or leaks during cleanup and remediation.

RFFA ID	RFFA description	Impact description
RFFA 8	Mining Use	• Similar to impacts described under RFFA 1. • Potential adverse impacts on wetland boundaries and functions from large-scale alteration of surface elevations, fill placement, and drainage pattern alterations.
RFFA 9	Recreation Activities on Public Lands	• Similar to impacts described under RFFA 1.
RFFA 10	Military Use	• Similar to impacts described under RFFA 1.
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Similar to impacts described under RFFA 1.

4.6.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable future actions

The following sections summarize the cumulative impacts to biological resources when considering the RFFAs in combination with types of onshore wind facilities considered in the PEIS.

4.6.3.1 Utility-scale onshore wind facilities

The site characterization, construction, operation, and decommissioning of utility-scale onshore wind facilities could contribute to cumulative impacts on terrestrial, aquatic, and wetland habitats, including special-status habitats, when increased residential, commercial, and industrial development occurs in adjacent or nearby areas. Increased development includes the types of actions associated with new energy facilities, additional water and wastewater treatment plants, extension of road and rail transportation systems, enlargement of mining and processing areas, expansion or modification at military facilities, and construction of new water storage facilities (e.g., reservoirs). The energy projects included in RFFA 1 may be located relatively near each other and near onshore wind energy facilities included in this PEIS to take advantage of the same energy source conditions and infrastructure.

Impacts on biological resources from those actions include habitat fragmentation, degradation, and loss affecting landscape-scale habitat connectivity and wildlife migration corridors and creating edge habitat. Habitat restoration following decommission activities could take several years, and for some habitat types such as sagebrush-dominated shrubsteppe, restoration could take decades. Land development that decreases habitat connectivity can restrict wildlife movement and alter daily, seasonal, and life cycle needs, including hunting, foraging, sheltering, breeding, rearing, and migrating. Adjoining habitats may also be affected by habitat fragmentation, degradation, or loss. The impacts on wildlife would vary based on geography, habitat, existing level of land disturbance, species presence and their assemblages, and land use and management policies.

Flying species, such as birds and bats, may better tolerate habitat fragmentation by moving into unaffected habitats; however, there are cumulative impacts associated with an increased risk of strikes if multiple onshore wind facilities are sited near each other or if military airspace training operations are also in the vicinity of onshore wind facilities. Bird or bat species that have a wide distribution or migrate long distances would be at greater risk of collisions with moving rotors if multiple onshore wind facilities are sited in the same area. The rotor-swept area poses a risk to birds and bats that move through the area, depending on their flight behaviors. Turbines are usually arrayed across the landscape, and depending on the topography of a site, there would be variable spaces between the turbines. Migratory bird species that have narrow flyways may need to pass through multiple onshore wind facilities during their migration cycle, and all or part of the species population may encounter the wind facility. Military use of air space in the vicinity of onshore wind facilities may further increase the collision strikes with aircrafts.

Other more mobile species (e.g., ungulates) may also better adapt to habitat fragmentation by dispersing into adjacent unaffected areas; however, human-caused barriers, such as facilities, fencing, and roads, may impede their movement across the landscape, which can adversely affect species viability and migration. Special-status species may be particularly vulnerable to decreases in habitat connectivity, due to their already declining populations and sensitivity to adverse alterations in their preferred habitats.

The effects of cumulative actions would depend in part on the magnitude and extent of disturbance to terrestrial, aquatic, and wetland habitats. It is assumed that construction of onshore wind facilities would primarily occur in upland areas and that most cumulative effects would be related to RFFAs that also occur in upland areas. Cumulative impacts would be greater if facilities are sited on undeveloped lands compared to lands already converted to agricultural or rural use. However, some species that are adapted to disturbed habitats in agricultural or rural areas would also be adversely affected by development.

The removal of riparian vegetation during site clearing could adversely affect aquatic and wetland habitats by reducing the area of shading over the water, leading to higher water temperatures and less dissolved oxygen. Development of onshore wind facilities and other RFFAs within a given area would further increase the potential risk of erosion, fugitive dust, spills, soil compaction, or sedimentation, as well as increase human presence. An increase in sediment loads resulting from construction or decommissioning activities could affect fish and amphibian feeding, breeding, and incubating efficiency. It is assumed that utility-scale onshore wind facilities are unlikely to be sited in aquatic and wetland areas and that most aquatic and wetland impacts can be avoided or minimized.

Habitat-related functions (e.g., biotic and abiotic functions) would also be adversely affected by the additive effects of adjacent developments. Cumulative impacts on biotic functions may include changes in the interactions between producers, consumers, and decomposers and associated food web dynamics, as well as changes to the overall flow of energy. Cumulative impacts on abiotic functions may include changes to hydrologic regimes, moisture and temperature regulation, nutrient cycling, and soil formation.

Cumulative impacts on terrestrial, aquatic, and wetland species, including special-status species associated with the RFFAs and construction and operation of utility-scale facilities, would primarily be associated with the disturbance, injury, and mortality of species. Habitat loss, degradation, or fragmentation across the landscape would adversely affect wildlife species by limiting habitats for cover, foraging, nesting, breeding, rearing, and migration activities. Cumulative impacts on landscape-scale habitat and migration and wildlife corridors would occur if multiple facilities and other RFFAs are in the same area, resulting in increased fragmentation or alteration of habitats that restrict of the movement of animals and migration paths due to increased fencing, roads, and other structures. Ungulate summer and winter migration patterns may become disrupted and affect herd viability. Cumulative impacts on migratory bird patterns may also occur if multiple onshore wind facilities are in the same area as other RFFAs affecting air space, such as wind turbines and utility lines. Habitat alterations could also result in the increased potential for invasive species colonization, which could displace native species.

The level of contributions from utility-scale onshore wind facilities would vary depending on the size and number of other individual future actions within a given area, as well as their location and timing relative to construction and operation of utility-scale facilities. Multiple utility-scale onshore wind facilities and other RFFAs occurring in the same area may result in greater cumulative impacts to biological resources compared to facilities and RFFAs that are more dispersed.

Cumulative impacts on some biological resources could be avoided or minimized through careful siting and design, permitting, and implementation of mitigation measures and BMPs, as described in the *Biological Resources Technical Report*. Cumulative impacts on special-status species may not be able to be mitigated.

4.6.3.2 Onshore wind facilities with battery energy storage systems

Cumulative impacts from utility-scale facilities with BESSs, when considering other RFFAs in the area, would closely resemble the impacts discussed for utility-scale facilities but with some differences. One notable difference is the increased complexity of infrastructure construction and operational requirements compared to utility-scale onshore wind energy facilities without BESSs. The addition of BESS components could result in more habitat disturbance from the larger overall footprint. It could also result in increased risk of sedimentation and hazardous materials being released into the air, a nearby waterway, or a nearby wetland in the event of a BESS failure.

4.6.3.3 Onshore wind facilities that include agricultural uses

Cumulative impacts from onshore wind energy facilities combined with agricultural land use, when considering other RFFAs in the area, would closely resemble the impacts discussed for utility-scale facilities but with some differences. The demand for water would be higher for facilities combined with agricultural use of the site. This could create a higher need for water availability for agricultural activities that require irrigation relative to the other types of facilities and considering future actions. This in turn could affect species and habitats that use the same

water sources. Agricultural use of a site would include an increase in noise, herbicide and pesticide use, crop rotation, and livestock activities that would impact habitats and species. The frequency and duration of human presence would also increase with agricultural land uses, introducing an additional source of disturbance to wildlife species and habitats.

Washington State Conservation Commission's Voluntary Stewardship Program (VSP) may reduce cumulative impacts by implementing voluntary, site-specific practices that help to protect critical areas (e.g., wetlands, fish and wildlife habitat conservation areas) while also promoting agricultural viability (WSCC 2024). The 27 Washington counties that are enrolled in VSP are establishing a volunteer VSP watershed work group to create and implement a countywide plan to protect critical areas and maintain viable agriculture in the watershed.

4.6.3.4 No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential for cumulative impacts on biological resources for future utility-scale onshore wind energy developments under the No Action Alternative when considering the RFFAs would be similar to those noted for other types of facilities, depending on facility size and design.

4.7 Energy and natural resources

This section summarizes the energy and natural resources evaluated within the study area in the *Energy and Natural Resources Technical Report* (Appendix H) and analyzes impacts on this resource resulting from the types of facilities considered and other RFFAs in the onshore wind study area. It analyzes primary and secondary sources of energy and non-energy natural resources that may be used during the construction, operation, and decommissioning of the types of facilities considered in this PEIS.

4.7.1 Current conditions

The study area contains substantial energy sources, including wind, sunlight, biomass, geothermal heat, electricity, gasoline, diesel fuel, fuel oil, natural gas, and liquified petroleum gas.

Washington is a net exporter of electricity, generating 98,726 million kilowatt-hours of electricity in 2023. Washington is also a net exporter of fuels for transportation and equipment, with five refineries that can process approximately 648,000 barrels of crude oil per day (EIA 2024), producing 4,200 million gallons of gasoline and 2,500 million gallons of diesel each year. Washington currently has two biofuel manufacturing facilities.

Washington produces 30.9 million metric tons of sand and gravel from 544 active permitted surface mines and produces 13.5 million metric tons of crushed stone from 298 active

permitted surface mines (USGS 2022c; DNR 2023a). For more information on aggregate resources, see the *Earth Resources Technical Report.*

4.7.2 Reasonably foreseeable future actions

RFFAs with the potential to affect energy and natural resources in the study area are listed in Table 8 along with a description of the effects of these actions.

Table 8. Reasonably foreseeable future actions relevant to energy and natural resources

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• An increased demand, generation, and delivery of energy from clean energy sources would be expected with the development of clean energy projects, including clean energy developments and changes to the existing energy system (transmission lines). • Clean energy projects are expected to add energy to the state electrical grid system.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• The upward trend in population growth would be expected to increase demand for energy and natural resources to accommodate the needs of growing urban, commercial, and industrial activities and development in the study area.
RFFA 4	Federal, State, Tribal, and Local Wildlife and Habitat Projects	• Changes in local wildlife and habitat projects would be expected to affect new energy facility siting and development if new land designations make a site suitable or unsuitable for development. • Proper management would be expected to minimize environmental impacts and promote the development and utilization of clean energy sources.
RFFA 5	Transportation Infrastructure Development and Modification	• Improved transportation infrastructure would be expected to lead to cost savings in energy transportation, distribution, and storage. The trend would be expected to potentially improve access to energy resources. • Improved road access would be expected to reduce energy consumption during construction, operations, and decommissioning. This trend can also increase the demand for energy-efficient technologies.
RFFA 8	Mining Operations	• Mining operations in the study area have the potential to adversely affect sand and gravel resources. • Siting of new and expanded areas of mining could affect the range of potential sites available for other projects.

RFFA ID	RFFA trend	Impact description
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Increases in water demand, and development of water treatment and distribution facilities, would require energy inputs. • Irrigation systems for agricultural uses could increase energy consumption. • Water treatment and pumping for industrial use (e.g., cooling, steam generation, and cleaning) contribute to energy consumption. • Conservation efforts would be expected to improve energy resources because they reduce the energy needed for extensive water treatment.

4.7.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable future actions

The following sections summarize the cumulative impacts to energy and natural resources when considering the RFFAs in combination with the types of onshore wind facilities.

4.7.3.1. Utility-scale onshore wind facilities

Utility-scale facilities would consume energy and natural resources during the construction and decommissioning phase to run construction equipment, generators, and vehicles. Construction would use concrete and steel for turbine foundations, generation-tie transmission lines (gen-tie lines), and buildings and would require aggregate and other raw materials for constructing access roads. Deployment of onshore wind facilities will require construction aggregate and gravel that would likely be used for foundations, parking areas, and equipment storage areas. Cumulative impacts to aggregate sources would increase depending on the number of facilities from other RFFAs occurring in proximity to each other. Impacts to aggregate resources during the construction of this type of facility would be cumulative if aggregate required for construction of energy infrastructure and transmission systems, urban developments, transportation projects, and water supply projects is extracted from the same source as the resources extracted for utility-scale facilities. It is anticipated that the energy projects included in RFFA 1 are likely to be located relatively near each other and near onshore wind energy facilities evaluated in this PEIS to take advantage of the same energy source conditions and infrastructure. This may lead to more aggregate extraction from the same sources.

Impacts during construction and decommissioning of this type of facility, and reasonably foreseeable infrastructure projects, include the electricity that would be needed to power construction tools and equipment and to power construction lighting, and on-road diesel fuels and gasoline would be used for construction equipment. Construction workers are also likely to drive to work, which would have additive effects in the consumption of fossil fuels during the construction period. Additionally, consumption of fuels is likely to increase during the transportation of components for onshore wind facilities and other construction materials for

future infrastructure projects, which are often transported by air, water, or rail and during the transport of aggregate resources.

RFFAs leading to operation of new energy facilities, urban and rural development projects, transportation infrastructure projects, and water development facilities would include maintenance activities that would likely require fuel for maintenance vehicles and tools; electricity for lighting, heating, and other domestic purposes at buildings; and gravel for upkeep of access roads. These impacts, although minor compared to those during the construction period, would have additive effects to the impacts of other RFFAs during the facilities' functional periods.

Electricity would be used to power operations and maintenance buildings, sensors, lights, and similar. This energy consumption may be drawn from the facility's own generation ("parasitic load") or may be drawn from the local electric utility, depending on facility specifications. Projects able to draw parasitic load electricity may still draw from the local electric utility when wind speed is low, increasing overall energy consumption in addition to the other RFFAs. Moreover, depending on site conditions and the size of a facility, an onshore wind facility may have an impact on the wind energy resource available to adjacent areas if an operating project produces a wake of reduced-velocity wind downstream of its location (Archer et al. 2018). This could reduce the ability of neighboring wind farms to produce electricity.

4.7.3.2. Onshore wind facilities with battery energy storage systems

Relative to a conventional onshore wind facility installation, wind augmented with BESS would require some additional aggregate resources during construction due to the added BESS capability and components to store and dispatch electricity. Cumulative impacts from operation and decommissioning are expected to be similar to those described for utility-scale facilities, relative to the scale of the facility. A facility with BESS, when combined with other RFFAs, would be expected to have similar cumulative effects on energy and natural resources as other types of facilities.

4.7.3.3. Onshore wind facilities that include agricultural uses

Cumulative impacts on energy consumption for facilities with agricultural land use would be like those for utility-scale facilities described above, with the addition of energy and resources consumed to operate agricultural activities in the project site.

4.7.3.4. No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential for impacts on energy and natural resources for future utility-scale onshore wind energy developments under the No Action Alternative, when considering the RFFAs, would be similar to those noted for other types of facilities, depending on facility size and design.

4.8 Environmental health and safety

This section summarizes environmental health and safety (EHS) evaluated within the study area in the *Environmental Health and Safety Technical Resource Report* (Appendix I) and analyzes impacts on this resource resulting from the types of facilities considered and other RFFAs in the onshore wind study area. EHS includes hazardous materials exposure, wildfire hazards, and worker health and safety.

4.8.1 Current conditions

Much of the study area consists of rural land uses, such as agriculture, forestry, low-density residential, and undeveloped land. EHS hazards, such as hazardous materials or occupational health and safety hazards, may be more concentrated near current or former development, while wildfire may be more prominent in undeveloped areas. Many active land uses in the study area are currently permitted to store, use, or dispose of hazardous materials or are required to document the presence of hazardous materials. A large portion of these hazardous materials are associated with agricultural land uses, including pesticides, petroleum products, and fertilizers and are regulated by the Right-to-Know Act. The study area contains cleanup sites on the National Priorities List under CERCLA, also known as Superfund sites. These sites have hazardous material contamination present in soil, surface water, or groundwater.

Washington has experienced many extreme fire events in recent years due to climate change and the legacy of forest fire suppression practices. As of 2024, wildland fires and prescribed fires account for 44% of the nation's primary emissions of fine particulate matter (USEPA 2024). Due to the relatively dry conditions, wildfires in eastern Washington are more common relative to other parts of the state. The forested central Cascade Mountain region poses a relatively higher risk for extreme wildfire events compared to other parts of the state due to topography, climate, and vegetative fuel loads. The combination of longer fire seasons, population growth, declining forest health, and other changing risk factors has made wildfire considerations a top priority in the state, as outlined in the *Washington State Wildland Fire Protection 10-Year Strategic Plan* (DNR 2019).

4.8.2 Reasonably foreseeable future actions

RFFAs with the potential to affect EHS in the study area are listed in Table 9 along with a summary of the potential effects of these actions.

Table 9. Reasonably foreseeable future actions relevant to environmental health and safety

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Construction, operation, or decommissioning of new energy projects and existing energy systems could have potential adverse effects to EHS resulting from mishandling debris and hazardous materials from construction. • Solid waste generated from decommissioned facilities would be expected to have potential adverse effects if not disposed appropriately. • Construction, operation, and decommissioning of energy facilities would be expected to pose increased risks of occupational hazards to workers.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Construction and expansion of infrastructure to meet urban, commercial, and industrial activities and development would be expected to increase the risk to occupational hazards to workers and community exposure to hazardous materials to air, water, and soils.
RFFA 3	Rural and Agricultural Activities and Development	• Changes in rural and agricultural activities and development would be expected to increase the risk to occupational hazards to workers and community exposure to hazardous materials to air, water, and soils from the use of chemicals and pesticides. • Expansion of activities could limit firebreaks and increase the risk of fires.
RFFA 4	Federal, State, Tribal, and Local Wildlife and Habitat Projects	• Overall, RFFAs in this trend would be expected to improve the health of ecosystems adjacent to habitat projects by restoring natural processes and supporting healthy ecosystems. • These projects could potentially reduce wildfire risk.
RFFA 5	Transportation Infrastructure Development and Modification	• The development or modification of transportation infrastructure would be expected to have adverse effects to EHS resulting from mishandling debris and hazardous materials from construction, and increased concentration of hazardous materials from vehicle traffic. • Better infrastructure would be expected to increase accessibility to rural areas and increase the service provided by emergency responders. • Construction, operation, and decommissioning of transportation infrastructure could have increased risks of occupational hazards to workers.
RFFA 6	Timber and Forestry Management	• Timber and forestry management would be expected to reduce risks to EHS to the extent that they can remediate fire suppression practices and decrease the risk for wildfires.
RFFA 7	Contaminated Site Cleanup and Remediation	• Ongoing cleanup activities at sites known to be contaminated by hazardous or dangerous reduce risks to EHS. • There are potential increased temporary risks from occupational hazards to workers and waste disposal.

RFFA ID	RFFA trend	Impact description
RFFA 8	Mining Operations	• Construction, expansion, and decommissioning of mines has the potential to adversely affect the health of workers, ecosystems, and adjacent communities due to the exposure to mining-related pollution.
RFFA 10	Military Use	• Military use could adversely affect air, soil, noise, and water quality in the study area, increasing exposure to hazardous materials.
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Water supply development and withdrawal has the potential to adversely affect water resources through exposure to hazardous materials and debris during construction, operation, and decommissioning. • Construction, operation, and decommissioning of water facilities could have increased risks to occupational hazards to workers.

4.8.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable future actions

The following sections summarize the cumulative impacts to EHS when considering the RFFAs in combination with the types of onshore wind facilities.

4.8.3.1 Utility-scale onshore wind facilities

Cumulative impacts from construction, operation, and decommissioning of utility-scale onshore wind facilities, other energy facilities, mines, water supply projects, transportation infrastructure, and urban and commercial activities and development could increase the risks of hazardous material spills or contamination in the study area. This can be from materials present in vehicles, construction equipment, transformers, construction materials, and in products for the control of vegetation at a site. Additionally, remediation of the substation and electrical sites may be necessary during decommissioning due to the use of oils and other hazardous materials during energy facility operation. Impacts from hazardous materials during construction, operation, and decommissioning of onshore wind energy facilities are unlikely. However, cumulative impacts from hazardous materials during construction, operation, and decommissioning could be additive and adverse when combined with impacts from multiple infrastructure projects from other RFFAs in a similar timeframe or geographic location. It is anticipated that the energy projects included in RFFA 1 are likely to be located relatively near each other and near onshore wind energy facilities evaluated in this PEIS to take advantage of the same energy source conditions and infrastructure.

Accidents or failures that could result in the release of hazardous materials for this type of facility are rare, and if they do occur, they are unlikely to happen at a scale that could result in risk of environmental contamination or an increase in threats to human health and safety. Additionally, the number of incidents that could produce EHS hazards will be greater for larger utility-scale facilities than for smaller ones. There is a limited potential for accidents from human error that could result from releases of hazardous materials after construction of utility-

scale wind facilities, other energy facilities, water developments, and other reasonably foreseeable infrastructure projects. However, degradation over time could also increase the risk of damage or failure of infrastructure and equipment. Decommissioning and repowering of these types of facilities, other energy projects, and water infrastructure development—in addition to other RFFAs, such as cleanup and mining sites—could involve a higher risk of releasing hazardous materials due to degradation of facility components or dismantling facility components. Decommissioning also creates challenges for the storage, transport, recycling, and disposal of waste, increasing potentially adverse cumulative impacts to EHS if projects are occurring in a similar timescale and geographic location. Similarly, decommissioning of larger facilities would include disposal of more solid and hazardous waste. Although the scale of the facility could result in longer decommissioning processes, this would be unlikely to result in risk of environmental contamination or an increase in threats to human health and safety.

These types of facilities, and other RFFAs in the study area involving construction, operation, and decommissioning activities, would present similar EHS risks as those that are present on other industrial construction sites. Construction, operation, and decommissioning of onshore wind energy facilities would generate ignition risks from vehicles and equipment with combustion engines and the use of flammable substances that require careful management if combined with other RFFAs that lead to and create areas with elevated fire risk. Examples of the latter include projects that require equipment for the development or decommissioning of infrastructure and changes in land use resulting from population increases, and ignition risks from invasive plant species introduced by disturbance following site clearings and developments. Local wildlife and habitat projects could potentially reduce wildfire risk by improving the health of ecosystems adjacent to the habitat projects and wildlife. The study area is likely to experience additional climate change effects by the time of decommissioning, with a projected increase in the number of high fire danger days.

4.8.3.2 Onshore wind facilities with battery energy storage systems

This type of facility would have similar cumulative impacts to those described for utility-scale facilities, depending on scale, with the addition of impacts that could occur from BESSs, which contain hazardous materials, could cause fires, and can present challenges for emergency responders. Lithium-ion, zinc hybrid, and flow batteries have lifespans that are shorter than a typical onshore wind energy facility. Facilities with co-located BESSs would have to dispose of or recycle batteries after they reach their lifespan. Decommissioning this type of facility could involve a higher risk of releasing hazardous materials due to the degradation or dismantling of facility components.

4.8.3.3 Onshore wind facilities that include agricultural uses

Cumulative impacts considered for facilities with agricultural land use would be similar to those described for utility-scale facilities, but facilities would be constructed to allow for growing crops or grazing. Facilities with agricultural land use would entail a different shared land use regime to accommodate grazing or other agricultural activities along with operation of the onshore wind energy facilities. The introduction of machinery for agricultural operations could increase fire risk from ignition sources. However, because there would be active management

of the vegetative landscape, it is assumed that fire risk would generally be reduced compared to other types of facilities.

Emergency responders could face minor delays or obstacles to accessing the facility due to the presence of livestock, fences, or multiple gates associated with agricultural operations. In addition to the cumulative impacts resulting from construction, decommissioning, and operation of onshore wind facilities; other energy facilities; mines; water supply projects; transportation infrastructure; and urban and commercial activities and development, this facilities with agricultural use could have additional adverse cumulative impacts to EHS similar to impacts from agricultural uses described for RFFA 3 in Table 9. Because this type of facility would include agricultural land use, there could be a higher risk for hazardous material concentration in water and soil.

4.8.3.4 No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential EHS impacts for future utility-scale onshore wind energy developments under the No Action Alternative when considering the RFFAs would be similar to those noted for other types of facilities, depending on facility size and design.

4.9 Noise and vibration

This section summarizes the noise and vibration conditions evaluated within the study area in the *Noise and Vibration Technical Resource Report* (Appendix J) and analyzes impacts on this resource resulting from the types of facilities considered and other RFFAs in the onshore wind study area. Chapter 1.1 of the *Noise and Vibration Technical Resource Report* defines the fundamentals of noise and vibration, and the common range of noise and vibration levels per land use.

4.9.1 Current conditions

The study area for assessment of noise and vibration impacts associated with construction, operation, and decommissioning of the potential utility-scale onshore wind energy facilities include consideration of potential sensitive human receptor locations surrounding onshore wind facility sites and along access roads associated with truck hauling of materials and supplies and along gen-tie line extensions. Ambient noise levels would vary considerably based on the specific facility siting conditions. Additionally, noise levels vary with location and time. In general, noise levels are high around major transportation corridors (highways and railways), airports, industrial facilities, and construction activities.

Utility-scale onshore wind energy facilities would typically be located in non-industrial or rural areas with low population density. The existing acoustic environment in these areas 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; and natural sounds. Sound levels in non-industrial and rural areas are typically quieter during the night than during the daytime.

Sound propagating 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 alter noise levels. Rural areas can commonly possess a range of topographical features that can serve to reduce the propagation of noise, although rural areas can be exposed to natural wind noise that can generate noise levels of up to 85 A-weighted decibels (dBA) at high windspeeds.

Some land uses are considered more sensitive to noise than others due to the amount of noise exposure (in terms of both exposure duration and insulation from noise) 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 commercial and industrial land uses. Environmental justice populations and overburdened community areas may be at increased risk to adverse impacts from noise. Sensitive wildlife and habitats, including the habitat of rare, threatened, or endangered species, can also be affected by noise.

Sensitive receptors for vibration include structures (especially older masonry structures), people (particularly residential uses during nighttime hours), and vibration-sensitive equipment (such as recording studios or magnetic resonance imaging) There are separate criteria for evaluating the potential for structural damage depending on whether the structure is of conventional (modern) construction versus older historic structures that are more sensitive to vibration. Sensitive receptors for vibration could occur within the geographic scope of study or on adjacent lands.

4.9.2 Reasonably foreseeable future actions

RFFAs with potential to affect noise and vibration in the study area are listed in Table 10 along with a summary of the potential effects of these actions.

Table 10. Reasonably foreseeable future actions relevant to noise and vibration

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• There would be possible adverse effects from increased noise and vibration levels from construction, operation, and decommissioning of new and existing energy infrastructure.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Similar to impacts described under RFFA 1. • Impacts would be expected as increased population brings potential increases in background noise from residential, commercial, industrial, and transportation development and activities.

RFFA ID	RFFA trend	Impact description
RFFA 3	Rural and Agricultural Activities and Development	• Impacts would be expected from ongoing agricultural activities and changes to land use on non-designated agricultural land, and machinery required for tilling, harvesting, livestock grazing development and expansion, and irrigation system maintenance and upgrades.
RFFA 4	Federal, State, Tribal, and Local Wildlife and Habitat Projects	• Reduced noise levels would be expected with the implementation of local wildlife and habitat projects that create natural buffers that absorb and dampen noise and vibration from surrounding human activities. • Impacts would be expected from construction activities and increased human activities in those areas.
RFFA 5	Transportation Infrastructure Development and Modification	• There would be potential adverse effects from increased noise and vibration during the construction, modification, and operation of new or improved roads and highways, mass transit projects, and rail transportation systems.
RFFA 8	Mining Operations	• There would be potential adverse effects due to development, operations, and reclamation of new and existing mining and processing area expansions.
RFFA 10	Military Use	• There would be potential additive effects from the development or modification projects at military facilities and military aircraft operations.
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• There would be potential additive effects from the development and operation of reservoirs, well fields, water distribution systems, water treatment plants, and pump stations for municipal, agricultural, and industrial uses. • There would be potential adverse effects from the construction and maintenance of new water storage and flood risk reduction projects.

4.9.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable future actions

The following sections summarize the cumulative impacts from noise and vibration when considering the RFFAs in combination with different types of facilities.

4.9.3.1 Utility-scale onshore wind facilities

Typically, noise and vibration levels for utility-scale facilities and other RFFAs listed in Table 10 are highest during site preparation when land clearing, grading, and road construction would occur and during installation of foundations. Construction and decommissioning activities would typically be temporary and of short duration and would include operation of off-road equipment, pile driving for wind turbine foundations, the potential on-site operation of a concrete batch plant, and operation of haul trucks to bring in equipment and materials and remove soil or demolition debris. If required for turbine foundations, pile driving may exceed noise criteria during construction of a small number of turbine locations and may not constitute a prolonged noise increase at receptors beyond a distance of 2,500 feet. However, recognizing

that existing ambient noise levels are commonly quiet (potentially 35 to 40 dBA or lower) in rural areas where siting of energy facilities would likely 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. These would be combined with construction, operation, and decommissioning noise and vibration impacts from other RFFAs in proximity. Additionally, construction for gen-tie lines for wind and other RFFA facilities could include noise and vibration from off-road equipment along alignments for power poles and line stringing, cut and cover trenching, and potentially pile installation, where necessary. Blasting, if required for this type of facility and other RFFAs, would also contribute to cumulative noise and vibration impacts.

The extent of a construction, operation, or decommissioning noise impact of this facility and any other RFFA would depend on the existing ambient noise level at any given receptor. The existing ambient noise levels are commonly quiet in rural areas where siting of energy facilities would likely occur, potentially 35 to 40 dBA or lower, a prolonged noise contribution of 45 to 50 dBA could also result in impacts on noise-sensitive receptors located closer than 2,500 feet, particularly during nighttime hours. Vibration from specific construction activities for all RFFAs occurring at distances closer than 350 feet from residential land uses could contribute to a potential cumulative impact with respect to human annoyance. Construction-related vibration also has the potential to result in architectural damage to nearby structures. Some types of blasting could damage historic structures within a 2,000-foot radius.

The major noise sources for onshore wind facilities are wind turbines and substations, which would generally operate 24 hours a day and would include the noise-sensitive nighttime hours for which more stringent noise standards apply under WAC. Wind turbines also generate a component of low-frequency infrasonic noise. Noise impacts from turbines will vary based on the type of model, configuration towers, wind environment, distance to nearest sensitive receptors, and presence of intervening structures or geographic features. Noise from wind turbines would be expected to have impacts on noise-sensitive receptors and add to the impacts from RFFAs located closer than 2,400 feet from a noise-sensitive receptor or closer than 5,000 feet within a quiet rural setting. In rural areas, an increase of 5 dBA over ambient noise could potentially result when turbines generate a noise level of 40 dBA at such a receptor.

Other operational noise sources may include intermittent noise from substation operations, potential corona noise from overhead connector and gen-tie lines during wet weather conditions, and intermittent noise from operations and maintenance activities of employees during daytime hours. Operational noise from substations may have impacts on noise-sensitive receptors in quiet rural areas and add to the impacts of RFFAs located closer than 650 feet from a noise-sensitive receptor or 2,000 feet from a noise-sensitive receptor in a quiet rural area. Electrical-related noise sources include pad-mounted inverters located among the modules of a photovoltaic facility and are typically located near a site boundary.

Potential cumulative impacts during operations of these and other RFFAs would depend on the activities, terrain, vegetation, and local weather conditions as well as distance to the nearest

sensitive receptors. Impacts from other RFFAs in the vicinity from urban, rural, agricultural, and commercial activities could be additive to ongoing mining operations and the operation impacts of larger transportation networks close to the study area (which would also involve more vehicle traffic), resulting in cumulative impacts from noise and vibration. Future facility developers would need to consider project-specific study areas for assessing cumulative impacts of noise and vibration for specific facilities and other RFFAs within their site footprint, including sensitive receptors for the proposed work.

4.9.3.2 Onshore wind facilities with battery energy storage systems

Cumulative impacts on noise and vibration from construction and decommissioning of onshore wind facilities with co-located energy storage systems and other RFFAs would closely resemble the impacts discussed for utility-scale onshore wind facilities but with some differences.

In addition to the operational noise sources described for onshore wind energy facilities without BESS, sources of noise for onshore wind facilities with co-located BESSs include battery storage liquid cooling units and battery storage inverters, which would likely operate 24 hours a day. The potential exists for some consolidated BESS operations to exceed the Chapter 173-60 WAC environmental designation for noise abatement (EDNA) of 50 dBA at distances ranging up to 1.5 miles from consolidated BESS equipment, depending on the design layout of the BESSs. The impacts of the BESSs, when combined with other RFFAs, may have additive effects on cumulative impacts to sensitive receptors in the vicinity.

4.9.3.3 Onshore wind facilities that include agricultural uses

Noise and vibration impacts from construction and decommissioning of onshore wind facilities combined with agricultural land use would be similar to those identified for utility-scale facilities, depending upon scale but with some differences. Seasonal noise from existing or new agricultural facilities and activities would contribute to the cumulative effects.

4.9.3.4 No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential noise and vibration impacts for future utility-scale onshore wind energy developments under the No Action Alternative when considering the RFFAs would be similar to those noted for other types of facilities, depending on facility size and design.

4.10 Land use

This section summarizes the land uses evaluated within the study area in the *Land Use Technical Resource Report* and analyzes impacts on this resource resulting from the types of onshore wind facilities considered and other RFFAs. The study area for land use encompasses the overall onshore wind geographic study area, which covers large areas of land spread across

Washington. Further details on land uses can be found in the *Land Use Technical Resource Report*.

4.10.1 Current conditions

The study area for land use encompasses the overall onshore wind geographic study area, which covers large areas of land spread across Washington. Washington's cities and unincorporated Urban Growth Areas support much of the state's population and more intensive land uses, such as high-density residential, industrial, and concentrated commercial uses. Outside of the cities and Urban Growth Areas, which are excluded from the land use study area, land uses tend more toward agricultural, rural residential, forestry, wildlife conservation, and undeveloped recreation areas. This land use pattern reflects historic settlement of the state, resource extraction uses, and associated transportation routes.

The GMA seeks to focus growth in areas that have adequate public services, protect natural resource lands and critical areas, and generally discourage urban spawl. This requires fast-growing counties in the state to develop Comprehensive Plans to manage their population growth. The counties with lower population levels and/or growth that are not required to "fully plan" must still plan for critical areas and natural resource lands under the GMA (MSRC 2024).

Approximately 11.2 million acres in Washington are used for agriculture. Agriculture is a dominant land use in eastern Washington, encompassing millions of acres within the counties included in the onshore wind study area (WSDA 2024). Pasture was the largest agricultural use by area across the state in 2022, followed by wheat. The Washington State University study *Least-Conflict Solar Siting Study for the Columbia Plateau* (WSU 2023) summarizes agricultural use on the Columbia Plateau in a large area of eastern Washington as follows:

> Crop farmland on the plateau can be categorized by irrigated land and non-irrigated land. Irrigation introduced from the creation of the Grand Coulee dam has created the most productive agricultural lands in the state. The deep fertile soils of the Palouse region produce wheat and legumes through dryland farming. The diversity of products grown in eastern Washington also includes a variety of fruits, vegetables, grains, wine grapes, and specialty crops, such as blueberries.

The 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.

WAC 365-190-050(3) provides specific information used to evaluate lands under each of these criteria. Jurisdictions required to undertake full planning under the GMA must also adopt development regulations to conserve these lands. Such regulations are often found in the local zoning code.

Forestry is another significant land use in rural areas, covering approximately 22 million acres or half of the state. Approximately 4 million acres of forestland are privately owned; these lands produce three-quarters of the timber harvested in the state (DOC 2024a). Timber harvest also occurs through permits, sales, or leases on lands managed by the U.S. Forest Service, Bureau of Land Management, and DNR. The GMA requires that counties and cities identify and classify "mineral resource lands." Mineral resources include sand, gravel, and valuable metallic substances, as well as other minerals that may be classified as appropriate. Counties and cities must designate known mineral deposits so that access to mineral resources of long-term commercial significance is not knowingly precluded. In addition, priority land use for mineral extraction should be retained for all designated mineral resource lands (WAC 365-190-070). 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 (DNR 2023a).

The GMA requires counties to include a "rural element" in their Comprehensive Plans that addresses "lands that are not designated for urban growth, agriculture, forest, or mineral resources." What makes up "rural character" can be defined differently by different people. Rural character may encompass many considerations: vegetation, views, housing, employment, fish and wildlife habitat, government services, and water. The GMA identifies rural character as patterns of land use and development as follows (WAC 365-196-425(2)(b)):

- Allow open space, the natural landscape, and vegetation to predominate over the built environment
- Foster traditional rural lifestyles, rural-based economies, and opportunities to both live and work in rural areas
- Provide visual landscapes that are traditionally found in rural areas and communities
- Are compatible with the use of land by wildlife and for fish and wildlife habitat
- Reduce the inappropriate conversion of undeveloped land into sprawling, low-density development
- Generally do not require the extension of urban governmental services
- Are consistent with protection of natural surface water flows and ground water and surface water recharge and discharge areas

The GMA defers to counties to "adopt a locally appropriate definition of rural character" and acknowledges that "rural areas are diverse in visual character and in density, across the state and across a particular county" (WAC 365-196-425(2)(c)).

4.10.2 Reasonably foreseeable future actions

RFFAs with potential to affect land use in the study area are listed in Table 11 along with a description of the effects of these actions.

Table 11. Reasonably foreseeable future actions relevant to land use

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• The development of new energy projects, including new energy facilities, transmission systems, and distribution networks, could lead to the conversion of existing land not already in use for energy facilities. Anticipated retirement, decommissioning, and demolition of existing coal-fired power plants may result in the availability of land previously used for energy facilities to be converted for other uses (e.g., recreational or agricultural).
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Higher population growth in urban/suburban areas and increased demands on housing, municipal water/sewage treatment systems, mass transit systems, urban/suburban transportation infrastructure, and related utility infrastructure may lead to changes in land uses associated with construction of new commercial and industrial developments, expansion of existing developments, and decommissioning, decontamination, and demolition of former facilities that are no longer used.
RFFA 3	Rural and Agricultural Activities and Development	• Land values, population changes, and factors related to climate change may result in transitioning non-designated agricultural land and undeveloped rural areas to other uses such as residential, commercial, and industrial development.
RFFA 5	Transportation Infrastructure Development and Modification	• Projects aiming to improve Washington state's road network may potentially induce growth by easing traffic congestion around urban centers, thereby facilitating the movement of populations into areas not otherwise used for residential developments and changing land use patterns.
RFFA 8	Mining Use	• Mine expansions and new mine and processing facility developments may require a change in the underlying land use if occurring in areas not already designated for such activities and facilities.
RFFA 9	Recreation Activities on Public Lands	• Expansions, closures, and establishment of new recreational trails, facilities, and sites may require changes to the underlying land use in the area of the activity.
RFFA 10	Military Use	• Infrastructure development or modification at military areas occurring adjacent to the study area could result in temporary disturbances that are conflicting with nearby land uses or conversion of existing land uses for military use in the case of expansion projects. However, the CESA study is intended to include tools and resources that encourage information-exchange between developers, permitting authorities, and military representatives, which could promote early and ongoing civilian-military consultation in energy siting and reduce the potential for military use to result in land use conflicts.

4.10.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable future actions

The following sections summarize the cumulative impacts on land use when considering the RFFAs in combination with the different types of facilities considered in the PEIS.

4.5.3.1. Utility-scale onshore wind facilities

As described in the *Land Use Technical Resource Report,* construction of utility-scale facilities has the potential to result in proximity impacts, such as increased dust, noise, traffic, and visual changes, that could affect other properties in the facility vicinity. The siting and operation of these facilities could result in the long-term (and potentially permanent) conversion of existing or designated future land uses to utility-related uses for the life of the facilities, with the specific impact depending on the existing use of the site where the facility would be located. The operation of utility-scale facilities would also result in changes to the visual landscape from the presence of wind turbines, with facilities visible from long distances depending on topography and other factors. These changes could result in changes to and/or perceptions of the rural character of the surrounding area.

In evaluating the significance of impacts to rural character for a proposed utility-scale onshore wind energy project, the relevant Comprehensive Plan (in particular, its rural element) should be consulted.

Installing utility-scale onshore wind facilities would result in increased development intensity at facility sites and a change to the visual landscape on and adjacent to those sites, depending on the nearby topography and other conditions, that include a greater presence of built environment elements. These changes could result in changes to and/or perceptions of the rural character of the surrounding area.

The operation of utility-scale onshore wind facilities could result in the conversion of natural resource lands of long-term commercial significance. This would be evaluated by the local jurisdiction as part of the permit review process. While it is possible that an onshore wind energy facility proposal may not be consistent with the local jurisdiction comprehensive plan and development regulations, there are several potential avenues for achieving proposal consistency, including modification of the proposal by the project developer to comply with local jurisdiction regulations, periodic amendment of the comprehensive plan and development regulations initiated by the local jurisdiction, or project-specific/site-specific comprehensive plan and development regulation amendments initiated by the project developer.

Cumulative impacts on land use may occur as a result of the construction and operation of utility-scale onshore wind energy facilities and the RFFAs identified in Table 11. The nature and extent of cumulative effects on land use in the study area would depend on whether the RFFAs and the wind energy facilities resulted in changes or conversions to the same types of land uses and designations; for example, the general trend toward urban developments and wind energy facilities could lead to a cumulative loss in other land uses not previously designated for other types of use such as agricultural use or undeveloped land. It is anticipated that the energy

projects included in RFFA 1 are likely to be located relatively near each other and near onshore wind energy facilities evaluated in this PEIS to take advantage of the same energy source conditions and infrastructure. This may lead to a cumulative impact from disturbance and conversion on the same land use types. This could also lead to a cumulative impact on the rural character of lands in the study area.

Similarly, development and/or modification of military areas for training, testing, and operation could result in disturbances that conflict with the existing uses of adjacent lands or the conversion of existing land. There is also potential for onshore wind energy facilities and other RFFAs identified in Table 11 to lead to a cumulative impact on military areas if they affected ongoing military use. However, through early notification to the DoD and using the CESA tool, impacts from clean energy developments that affect military use and facilities are not anticipated.

The potential for cumulative impacts on land use could be avoided or mitigated through site-specific mitigation actions, such as engaging interested parties early in the siting process to identify and avoid potentially significant land use conflicts.

4.5.3.2. Onshore wind facilities with battery energy storage systems

Cumulative impacts from utility-scale onshore wind facilities with co-located battery storage, when considering other RFFAs in the area, would closely resemble the impacts discussed for utility-scale facilities, with addition of the BESS to the facility.

4.5.3.3. Onshore wind facilities that include agricultural uses

Cumulative impacts from large utility-scale onshore wind facilities with combined agricultural uses, when considering other RFFAs in the area, would closely resemble the impacts discussed for utility-scale facilities for several land uses. However, facilities that include co-located agricultural land use would not contribute to a cumulative loss in agricultural lands to the same extent as facilities without co-located agricultural land use. As described in the *Land Use Technical Resource Report*, co-located facility designs may include locating an onshore wind facility on lands where there is already existing agricultural activity without changing that agricultural land use. Or it may include locating the facility on land with existing agricultural land use, but result in modifying the agricultural use (e.g., changing from crop land to livestock grazing land). It may also include adding a new agricultural use to a site. Agricultural uses that are contemplated for co-located facilities include crop land, livestock grazing land, and pollinator habitat. The 2024 *Rural Clean Energy Economics and Community Engagement Study and Report* (DOC 2024b) found that onshore wind energy facilities tend to occupy a relatively small percentage of agricultural parcels where they are located, allowing crop harvest and other agricultural uses to continue around the energy structures.

As noted above, co-located facilities would not contribute to a cumulative loss in agricultural lands to the same extent as other onshore wind energy facilities; however, they could result in a cumulative change in the amount of specific types of agricultural lands if the underlying agricultural use at the facility site was modified.

4.5.3.4. No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential for impacts on land use for future utility-scale onshore wind energy developments under the No Action Alternative when considering the RFFAs would be similar to those noted for other types of facilities, depending on facility size and design.

4.11 Aesthetics/visual quality

This section summarizes the aesthetics and visual quality evaluated within the study area in the *Aesthetics/Visual Quality Technical Resource Report* (Appendix L) and analyzes impacts on this resource resulting from the types of facilities considered and other RFFAs in the onshore wind study area. The study area for aesthetic and visual resources includes the overall onshore wind geographic study areas, 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 Technical Resource Report.*

4.11.1 Current conditions

The study area includes diverse landscapes, such as the Columbia River basin, the Cascade Range, the Palouse, the Coastal Ranges, and the southern Olympic Peninsula. Overall, the study area is relatively evenly divided between level terrain with long viewing distances and hilly/mountainous topography consisting of valleys and ridgelines.

Overall, the region has a rural character, with many widely scattered small towns. Within these smaller urban areas, the built environment consists primarily of commercial, public service, and residential development, with industrial development serving the local economy. Outside of these small urban areas, other built features could include energy infrastructure, including hydroelectric dams, power generating facilities, substations, transmission lines, and towers, etc.; highway services; and facilities supporting the various agricultural activities throughout the study area. The undeveloped areas in the hilly and mountainous terrain are primarily forested up to the tree-line elevation. In more level undeveloped areas where lands are not in agricultural use, the landscape is dominated by sparsely vegetated plains and plateaus. The visual diversity of the landscape in the western portion of the study area is generally higher than in the central and eastern portions of the study area, and visual quality generally is also higher in the western portion because of the greater topographic relief and diversity of vegetation and the presence of mountains, buttes, rock outcroppings, and mountain streams. In some areas within or near the study area, particularly in areas with national/state parks, forests, and other outdoor recreational opportunities, visual quality is very high, making these sites extremely attractive to tourists and other recreational users.

There are five National Scenic Byways that traverse or are near portions of the study area (USDOT 2024). There are also state-designated Scenic Byways distributed across every region of the state. Parts of the six waterways in the state designated as National Wild and Scenic Rivers also traverse portions of the onshore wind study area (National Wild and Scenic Rivers System 2024).

4.11.2 Reasonably foreseeable future actions

RFFAs with potential to affect aesthetics/visual quality in the study area are listed in Table 12 along with a summary of the potential effects of these actions.

Table 12. Reasonably foreseeable future actions relevant to aesthetics/visual resources

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Visual effects due to the permanent change in the viewshed from construction or decommission of energy infrastructure (e.g., wind turbines, photovoltaic arrays, and transmission lines) would be expected. • Temporary adverse effects would be expected from machinery during construction, maintenance, and decommissioning activities.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Cumulative viewshed effects would be expected due to population changes, which bring potential permanent modifications to residential, commercial, and industrial activities and development. • Impacts include glare from artificial light sources and from the reflective quality of glass used in commercial and residential buildings.
RFFA 3	Rural and Agricultural Activities and Development	• There could be effects resulting from changes in land use and expansion or modification of rural roads and utility systems.
RFFA 4	Federal, State, Tribal, and Local Wildlife and Habitat Projects	• Visual impacts could be reduced from new wildlife and habitat projects.
RFFA 5	Transportation Infrastructure Development and Modification	• There could be visual impacts due to the permanent change in the viewshed from the development or modification of transportation infrastructure projects. • Temporary adverse effects would be expected during construction activities.
RFFA 6	Timber and Forestry Management	• Impacts to viewshed would be expected from forest road construction and maintenance, clear-cut and selective harvesting, reforestation activities, fertilizer and herbicide use, riparian management practices, and fire management actions.
RFFA 8	Mining Operations	• Impacts to viewsheds would be expected from expansion or decommission of active mining sites. • Temporary additive effects to viewsheds would be expected during construction, operation, and decommissioning activities.

RFFA ID	RFFA trend	Impact description
RFFA 10	Military Use	• There could be potential adverse effects from aerial military exercises in the study area.
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• There could be potential permanent visual effects due to the permanent change in the viewshed from development or decommission of reservoirs, well fields, and water treatment plants. • Temporary adverse effects would be expected during construction and maintenance of below-surface infrastructure.

4.11.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable future actions

The following sections summarize the cumulative impacts to aesthetics/visual quality when considering the RFFAs in combination with the different types of onshore wind facilities.

4.11.3.1 Utility-scale onshore wind facilities

Construction of utility-scale onshore wind energy facilities and other RFFAs described in Table 12 would involve a range of activities associated with potential cumulative visual impacts on existing landscape and landscape features, including the removal of vegetation; dust generation; the introduction of buildings or roads; modifying or installing residential, industrial, and commercial facilities; and increasing human and vehicular activities from construction crews in the landscape. Decommissioning of an onshore wind energy facility would involve the dismantling and removal of infrastructure associated with each wind turbine, the removal of aboveground and buried ancillary structures, road redevelopment, temporary fencing, and restoration of the decommissioned site to pre-facility conditions. As such, expected visual impacts of decommissioning activities would be similar to construction activities.

Typically, vegetation-clearing activities for facilities, forestry management, and roads would create additive cumulative visual impacts primarily by changing the color and texture of the cleared areas. The presence of materials and equipment in these areas would introduce temporary changes in form, line, color, and texture to the visible landscape, and additional visual contrasts could be introduced by any vegetation clearing or grading required. Restoration activities following decommissioning would typically include recontouring, grading, scarifying, seeding and planting, and stabilizing disturbed surfaces. Newly disturbed soils would create a visual contrast that could persist for several seasons before revegetation would begin to mature and restore the pre-facility visual landscape. Complete restoration of vegetation to pre-facility conditions may take much longer and would be dependent on location, weather patterns, soil fertility, surrounding land uses, and the type of vegetation planted or recruited. Additionally, replacing aging turbines or components (repowering) is becoming a common practice and involves decommissioning and removing existing turbines and replacing them with newer turbines at the same facility site. If a facility were repowered instead of

decommissioned, repowering activities would require work crews, vehicles, and equipment similar to construction, but reduced in scope and duration.

The various construction, decommissioning, or site modification activities described previously require work crews, vehicles, and equipment that would add to the temporary visual impacts of construction. Small-vehicle traffic for worker access and large-equipment traffic (e.g., trucks, graders, excavators, and cranes) for road and building construction, site preparation, and installation would be expected. Additionally, any lighting used during construction activities for any of the RFFAs in the vicinity have potential additive effects to the aesthetics and visual resources in the area. Cumulative impacts from construction or decommissioning would be greater if multiple onshore wind facilities and other RFFAs are occurring at the same time and in proximity in the study area.

The primary visual impacts associated with onshore wind energy facilities would result from the introduction of the numerous vertical lines of wind turbines into the generally strongly horizontal landscapes (e.g., plains, agricultural fields, high desert) found in most of the study area or the placement of turbines on ridgelines where they would be "skylined" in an area of greater topographic relief. Larger numbers of wind turbines would have increased visibility, which would be expected to increase perceived visual impact. For viewers close enough to fall within the cast shadows of the turbines, shadow flicker might be observed. Other RFFA facilities, such as other wind energy facilities and solar energy facilities, land use changes, and the development of water reservoirs or major transportation infrastructure projects could also introduce visual contrasts in the study area and glare from artificial light sources required for nighttime operations. The visible structures from onshore wind facilities and other RFFAs in the vicinity, such as urban, commercial, and industrial development, would potentially produce visual contrasts by virtue of their design attributes.

The presence of FAA-required aircraft warning lights on wind turbines could increase visibility of the turbines at night, because the synchronized flashing red warning lights or strobes could be visible for long distances. In the dark nighttime sky conditions typical of the predominantly rural setting within the study area, the warning lights could potentially cause significant visual impacts, especially if few similar light sources were present in the area. RCW 70A.550.020 requires developers, owners, or operators of new utility-scale wind energy facilities of five or more turbines to apply to the FAA for the installation of a light-mitigating technology system that complies with FAA lighting requirements and mitigations. This includes installing an aircraft detection lighting system (ADLS) with FAA approval. An ADLS utilizes sensors and radar to track aircraft operating in proximity to the wind facility and activates the obstruction lighting system when aircraft enter the ADLS coverage area, for safety purposes. The lights are turned off when aircraft are no longer present in the coverage area. With this regulatory requirement and implementation of other mitigative actions facility lights would not introduce new, substantial sources of light that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people.

Additionally, the geographic area where the project is sited could influence the magnitude of impacts to the viewshed. For example, new development is more noticeable in rural plainlands, high deserts, or agricultural fields. Developers should consider the increasing challenges that result from multiple onshore wind energy facilities being proposed in the same area. The addition of additional facilities to areas that already have wind energy facilities would likely contribute to cumulative impacts, because there would be increased likelihood of seeing multiple wind farms from one location, or multiple wind farms in succession when traveling on area trails or roads. This could be likely in the open and relatively flat landscapes of the state, which have few screening features and generally good air quality that favors long-distance views. A larger number of wind turbines in close proximity would have increased perceived visual impacts from the introduction of more geometrical shapes to the visual landscape, the movement of rotor blades, shadow flicker and blade glinting, and lighting from turbine markers or other ancillary structures. It is anticipated that the energy projects included in RFFA 1 are likely to be located relatively near each other and near onshore wind energy facilities evaluated in this PEIS to take advantage of the same energy source conditions and infrastructure.

The addition of additional facilities to areas that already have energy facilities would likely contribute to cumulative impacts because there would be increased likelihood of seeing multiple turbines from one location or multiple in succession when traveling on area trails or roads. This may lead to a cumulative visual impact on the same nearby receptors.

4.11.3.2 Onshore wind facilities with battery energy storage systems

Visual cumulative impacts from facilities with BESS and other RFFAs are expected to be similar to those for facilities without a BESS for construction, operation, and decommissioning. If a facility with a BESS were repowered instead of decommissioned, repowering activities would generate similar light and glare as construction activities but with a shorter duration. Like for facilities without BESSs, if a facility were repowered, activities would not introduce new, substantial sources of light that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people.

4.11.3.3 Onshore wind facilities that include agricultural uses

The construction and operation activities for facilities combined with agricultural use would be similar to those occurring under other types of facilities. Some construction activities, such as earthmoving, may appear similar to certain cultivating or other farming activities that also require use of large mechanical equipment. For sites that are already in agricultural use, the presence of an onshore wind facility where none existed would change the visual character of the site. For sites not already in agricultural use, the conversion to agricultural use, in addition to the presence of an onshore wind facility, would also change the visual character of the site. Decommissioning of an onshore wind energy facility with combined agricultural use would involve similar activities to construction. Moreover, if a facility with co-located agricultural use were repowered instead of decommissioned, repowering activities would require work crews, vehicles, and equipment similar to construction, but reduced in scope and duration.

4.11.3.4 No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential visual and aesthetics impacts for future utility-scale onshore wind energy developments under the No Action Alternative when considering the RFFAs would be similar to those noted for other types of facilities, depending on facility size and design.

4.12 Recreation

This section summarizes the recreation resources evaluated within the study area in the *Recreation Resources Technical Report* (Appendix M) and analyzes impacts on this resource resulting from the types of facilities considered and other RFFAs. The study area includes parks, formal and informal recreational opportunities, public lands, and public amenities such as trails within or adjacent to the study area.

4.12.1 Current conditions

The study area provides vast opportunities for recreation within various landscapes including mountains, deserts, lakes, and rivers. Designated recreation areas within or near the geographic scope of the PEIS include local parks, national forest land managed by the U.S. Forest Service, and other lands open to public use including DNR-, WDFW-, Bureau of Land Management-, Bureau of Reclamation-, and USFWS-managed lands. Additional recreational lands and trails are likely present within the study area but may not be included in currently available recreational databases. Recreational opportunities include hiking, biking, backcountry driving, hunting, birdwatching, wildlife and wildflower viewing, foraging, camping, paragliding, hang gliding, dispersed target shooting, backcountry winter sports (such as skiing, snowboarding, and snowshoeing), swimming, rafting, kayaking, other paddle sports, and fishing. These activities occur in areas designated for recreation, privately owned lands, and lands open for public use. Hunting and fishing seasons vary throughout the year by the species of animal (WDFW 2024g, 2024h). Tribal hunting and fishing also occur throughout the state at various times during the year. For more detailed information on Tribal hunting and fishing, see the *Tribal Rights, Interests, and Resources Technical Report*.

Although recreational trails are found throughout the state, most designated trails near the study area are located on federally managed land within the Cascade Range in the central portion of the state (RCO 2024). Recreational opportunities are also present on private lands. WDFW works with private landowners in the state to provide hunting access and other recreational opportunities to the public through the Private Lands Program (WDFW 2024i). Informal recreation on public lands also occurs throughout the study area. Informal recreation refers to activities that take place on public lands without a formal designation. Public lands can also contain leases for other uses besides recreation including grazing stock, mining energy development, and logging (RCO 2024; DNR 2023b). Agritourism opportunities may also be present on agricultural lands within the study area.

Similar to the recreational activities described above, opportunities for water-based recreation are available in designated areas, on private property, and on public lands. The onshore wind study area includes coastal areas like the Puget Sound and Pacific Coast and parts of multiple wild and scenic designated rivers including the Middle Fork Snoqualmie River, Skagit River, Suk River, White Salmon River, Klickitat River, and Snake River. Other major rivers used for recreation in portions of the study area include the Columbia River, Chehalis River, Wenatchee River, and non-designated wild and scenic portions of the Snake River.

Based on counts for trail-based recreation at 519 trails, parks, and recreation facilities, ECONorthwest reports that day use is the highest on the western side of the state, with King and Pierce counties having the highest number of annual day use trips within the state. King County had an estimated 48.5 million annual day use visitors, and Pierce County had an estimated count of 17 million annual day use visitors. Annual day trips were lowest in counties on the state's eastern side, with most counties in this area having less than 3.5 million annual day users reported. Spokane County had the highest annual day use rate of the eastern Washington counties with 11.6 million users. Because these data do not capture data for all trails in Washington, it was supplemented with information from the 2017 Outdoor Recreation Survey (ECONorthwest 2019).

4.12.2 Reasonably foreseeable future actions

RFFAs with potential to affect the recreation topics in the study area are listed in Table 13 along with a summary of the potential effects of these actions.

Table 13. Reasonably foreseeable future actions relevant to recreation

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Increased demand for power could result in additional development of facilities that could affect recreation sites. • Development of energy projects and changes to existing energy systems could alter existing recreational opportunities in the study area. • There could be potential for new recreational opportunities from the decommissioning of existing energy facilities.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Interest and participation in recreation activities would likely continue to increase in the future with urban population growth. • Increased population in the region may result in increased demand for recreational sites and increased overall visitation and associated regional economic activity. • Residential, commercial, and industrial development have the potential to degrade the quality of recreation areas and/or cause congestion at recreation areas.

RFFA ID	RFFA trend	Impact description
RFFA 3	Rural and Agricultural Activities and Development	• Increased demand for agricultural production could result in additional development of facilities that have the potential to degrade recreation sites due to habitat loss and fragmentation, and soil erosion and degradation from stressed agricultural lands. • Development of rural and agricultural activities would be expected to create recreational opportunities in agricultural lands, such as agrotourism.
RFFA 4	Federal, State, Tribal, and Local Wildlife and Habitat Projects	• Changes in land use could alter some recreational opportunities in the future. • New federal, Tribal, state, and local fish and wildlife improvement projects would be expected to restore, maintain, create, or enhance fish and wildlife habitat and could have the potential to increase recreational fishing opportunities and improve recreational experiences.
RFFA 5	Transportation Infrastructure Development and Modification	• Transportation infrastructure development could provide better accessibility to recreation resources, which has the potential to create overcrowding. • Transportation infrastructure development projects could have potential adverse effects to existing recreational areas resulting from habitat fragmentation or destruction, noise, air and water pollution, and disruption of already existing recreation areas.
RFFA 6	Timber and Forestry Management	• Timber and forestry management could have potential adverse effects on recreation due to access limitations, safety concerns, habitat alteration, and visual impacts that could detract from the scenery of the recreation area. • Timber and forestry management could also create opportunities for the creation of trails and recreational facilities and could reduce the risk of wildfires.
RFFA 8	Mining Operations	• Potential adverse effects from the expansion of mining operations include land use changes, impacts on visual resources, and noise and vibration that could affect the recreational experience.
RFFA 9	Recreation Activities on Public Lands	• Expansion or closure of multimodal trails, camping sites, and areas available for hunting or fishing could affect recreation in the project area. Land use change in public lands could have the potential to adversely affect recreation activities.
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Water supply development and withdrawals for municipal, agricultural, industrial, and conservation would be expected to affect recreational opportunities through increased opportunity for reservoir-based recreation or by disrupting existing recreational opportunities. • Water withdrawal projects can also have possible adverse effects through reduction of recreation practices in areas where withdrawals for water supply reduce water levels.

4.12.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable future actions

The following sections summarize the cumulative effects to recreation when considering the RFFAs in combination with different types of facilities.

4.12.3.1 Utility-scale onshore wind facilities

Potential construction and decommissioning cumulative impacts from energy facilities, new commercial and industrial development, mining operations, transportation projects, and water supply projects could increase noise, dust and visibility, and traffic and result in temporary changes in access to recreation resources. Recreationists within sight and sound of the construction or decommissioning area for an onshore wind facility or other RFFAs could experience disruption or impairment of their recreational experience because of noise and dust. The magnitude of these impacts would be related to the distance from the facility construction area and local conditions. Impacts to traffic described in Section 4.14 of this report could create longer travel times for recreationists. In addition, access to recreational sites could be restricted or limited during the construction and decommissioning period, and during operations. Perimeter fencing for the RFFAs could also result in loss of recreational opportunities.

If an onshore wind facility; other energy facilities; new urban, rural, commercial, and industrial development; mining operations; transportation projects; and water supply projects are sited nearby in an area used and valued for its recreational opportunities, operations of such facilities could adversely impact those recreational opportunities due to access limitations, noise, and visual cumulative impacts, resulting in impairment or loss of recreational opportunities. Operation of larger transportation networks would also involve more vehicle traffic, resulting in more sources of noise and vibration and air pollution near recreation areas. Elimination of recreational opportunities may result in higher use of similar recreational opportunities or segmentation from overcrowding or overuse of resources, adversely affecting the recreational experience. In addition, operations of onshore wind energy facilities and other RFFAs could have cumulative impacts on vegetation, displacement of wildlife species, and changes in wildlife habitats, reducing opportunities for hunting and wildlife viewing.

When siting a facility, developers should consider the challenges resulting from multiple utility-scale onshore wind facilities being proposed in the same area and near the RFFAs listed in Table 13. It is anticipated that the energy projects included in RFFA 1 are likely to be located relatively near each other and near onshore wind energy facilities evaluated in this PEIS to take advantage of the same energy source conditions and infrastructure. This may lead to a cumulative impact on the same recreational resources.

4.12.3.2 Onshore wind facilities with battery energy storage systems

Cumulative impacts to recreational opportunities from construction, operation, and decommissioning of onshore wind energy facilities co-located with a BESS would be similar to those discussed for utility-scale facilities.

4.12.3.3 Onshore wind facilities that include agricultural uses

In addition to the cumulative impacts to recreational opportunities within or adjacent to the study area described for other types of facilities, development of an onshore wind facility that is combined with farming or ranching, when considered along with other infrastructure-related RFFAs, would be expected to result in cumulative impacts on opportunities for agrotourism, depending on the facility and landowner. Development within existing agricultural areas would be expected to have similar effects as other facilities with the addition of access, noise, and visual effects from agricultural, farming, and livestock activities.

4.12.3.4 No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential impacts to recreation resources from future utility-scale onshore wind energy developments under the No Action Alternative when considering the RFFAs would be similar to those noted for other types of facilities, depending on facility size and design.

4.13 Historic and cultural resources

This section summarizes the cultural resources evaluated within the study area in the *Historic and Cultural Resources Technical Report* (Appendix N) and analyzes impacts on this resource resulting from the types of facilities considered and other RFFAs. The study area for historic and cultural resources encompasses the overall onshore wind geographic scope of study for the PEIS and includes large areas of land across Washington. For projects on Tribal reservation lands, each federally recognized Tribe would determine use of their lands. Tribal reservation lands are not included in the PEIS geographic scope of study. Additional details can be found in the *Historic and Cultural Resources Technical Report*.

4.13.1 Current conditions

Throughout the study area, there are lands, shorelines of major waterways, and their tributaries where Tribes have lived for thousands of years before present and continue to live and utilize these areas. 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.

Cultural resources addressed in the cumulative impact analysis include the following:

- Archaeological resources, both recorded and unrecorded
- Historic architectural buildings and structures listed or eligible for listing in a historic register
- Human remains and cemeteries
- Sacred sites
- Documented and undocumented TCPs

Archaeological resources are typically identified through archaeological survey work. Although many archaeological and ethnographic studies have been conducted in the study area and have inventoried archaeological sites and TCPs, the Washington State Department of Archaeology and Historic Preservation (DAHP) points out that only a small percent of the state (approximately 5%; DAHP 2020) has been surveyed for cultural resources at any level. Therefore, it should not be assumed that sites have been intensively surveyed. Additionally, past surveys and studies are often developed with project-specific research designs that may not account for all cultural resources present within a particular area. Ethnographic studies may provide information on specific types of traditional practices or on practices and locations consideration.

Historic architectural buildings, sites, structures, objects, or districts that have reached a particular age threshold to be considered eligible for listing in the National Register of Historic Places (NRHP) or the Washington Heritage Register. Many of these resources are present in the study area.

In Washington state, non-forensic human remains and cemeteries on private and state land are recorded as archaeological sites. Human remains may be encountered in a variety of contexts and landforms and are under the jurisdiction of federal or state agencies. Sites with human remains are most often considered to be NRHP eligible. Lands with these types of resources typically cannot be developed without an adverse effect determination requiring additional mitigation. Sacred sites can be considered cultural resources when a historic property is also considered a sacred site by a Tribe. Sacred sites are also discussed in the *Tribal Rights, Interests, and Resources Technical Report*. The treatment of impacts on sacred sites is guided by federal policy.

A TCP is a property or a place that is inventoried or determined to be eligible for inclusion on the NRHP or the Washington Heritage Register because of its association with cultural practices and beliefs that are: 1) rooted in the community's history; and 2) are important to maintaining the continuing cultural identity of the community's traditional beliefs and practices. DAHP maintains a database of TCPs within Washington state, 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. TCPs are often associated with cultural practices that groups may not wish to become widely known, such as spiritual practices.

4.13.2 Past and present actions

The analysis of cumulative impacts on historic and cultural resources differs in its approach when compared to the cumulative impact analyses for other resources. As noted in Section 2.2, the current conditions in the study area were used as the existing environmental condition for the resource analyses in the PEIS; therefore, past actions are not cumulatively considered again in this report for most resources. However, Tribes have noted that cultural resources in the study area are part of a much larger integrated cultural network, and impacts can extend in space and time beyond the study area or a specific facility. To analyze the full range of

consequences of potential cumulative impacts to cultural and historic resources, this assessment includes consideration of past developments that have changed the culturally important landscape or resulted in ground disturbance that could increase the chances of exposure, erosion, and looting of archaeological sites.

Historic and cultural resources have been repeatedly affected by past and present impacts associated with all the RFFA trends in the study area. For example, these actions include the modifications of waterbodies and building of dams and reservoirs that inundated, exposed, destroyed, or otherwise affected historic and cultural resources throughout Washington. They also include the urban, commercial, and industrial developments that resulted in visual and noise impacts on TCPs and sacred sites and the development of agricultural land to other uses that may lead to encounters with previously undiscovered historic and cultural resources.

4.13.3 Reasonably foreseeable future actions

RFFAs with potential to affect the historic and cultural resources in the study area are listed in Table 14 along with a summary of the potential effects of these actions.

Table 14. Reasonably foreseeable future actions relevant to historic and cultural resources

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Potential impacts from ground-disturbing activities that could result in damage or destruction of historic and cultural resources. • Potential impacts from the alteration of topography, alteration of hydrologic patterns, removal of soils, erosion of soils, runoff into and sedimentation of adjacent areas, and oil or other contaminant spills. • Potential adverse impacts on sacred sites or TCPs from visual changes and noise.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Similar to impacts described under RFFA 1.
RFFA 3	Rural and Agricultural Activities and Development	• Similar to impacts described under RFFA 1. • Transition of rural and agricultural land to other uses such as residential, commercial, and industrial development could increase risk of encountering previously undiscovered historic and cultural resources.
RFFA 4	Federal, State, Tribal and Local Wildlife and Habitat Projects	• Habitat restoration projects could occur on sites with previously undiscovered historic and cultural resources, resulting in potential impacts from ground-disturbing activities.
RFFA 5	Transportation Infrastructure Development and Modification	• Similar to impacts described under RFFA 1.
RFFA 6	Timber and Forestry Management	• Similar to impacts described under RFFA 1.

RFFA ID	RFFA trend	Impact description
RFFA 7	Contaminated Site Cleanup and Remediation	• Similar to impacts described under RFFA 1.
RFFA 8	Mining Operations	• Similar to impacts described under RFFA 1.
RFFA 9	Recreation Activities on Public Lands	• Similar to impacts described under RFFA 1.
RFFA 10	Military Use	• Similar to impacts described under RFFA 1.
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Similar to impacts described under RFFA 1. • Projects have a high likelihood of encountering historic and cultural resources as waterways play an important role in the histories and oral traditions of Tribes. Waterways are also identified as high-risk areas for encountering archaeological sites due to known settlement patterns near water sources.

4.13.4 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable actions

The following sections summarize the cumulative impacts on historic and cultural resources when considering the RFFAs in combination with types of onshore wind facilities considered in the PEIS.

4.13.4.1 Impacts from construction and decommissioning

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 onshore wind energy facilities. Construction and decommissioning of the utility-scale onshore wind energy facilities considered in the PEIS along with other activities could result in cumulative impacts on, or inadvertent discoveries of, 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. Tribes' spiritual practices could be interrupted by impacts on land areas and cultural or sacred sites, including degradation of visual quality, noise, and interruption of access (Tribes' sacred sites and spiritual practices are also discussed in Section 4.1).

Ground disturbance is likely to impact unrecorded 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. Decommissioning activities would include the dismantling and removal of all aboveground structures, as well as some underground structures.

Degradation and destruction of cultural resources could result from the alteration of topography, alteration of hydrologic patterns, removal of soils, erosion of soils, runoff into and sedimentation of adjacent areas, and oil or other contaminant spills.

Other cumulative impacts that may result from onshore wind energy facilities along with the activities identified above 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.

Development of multiple onshore wind facilities and other activities within a given area could further increase the risk of impacts to cultural resources. Together, past and present projects, the RFFAs identified above, and potential onshore wind facilities could result in changes to culturally important landscapes. Archaeological sites and TCPs are non-renewable resources; impacts to these resources could contribute to substantial cumulative impacts from past and future projects.

Decommissioning activities for utility-scale onshore wind energy facilities would include the dismantling and removal of all aboveground structures as well as some underground structures. If onshore wind energy facilities are repowered at the end of their useful life, the cumulative impacts would include some of those associated with facility construction and would also result in a longer period of facility operation.

4.13.4.2 Impacts from operation

Operational activities that could affect historic and cultural resources include those ongoing from construction, as well as changes in access to cultural resources, increased human activity, and potential ongoing ground disturbance. Visual changes associated with onshore wind energy facilities could include the presence of wind turbine structures; movement of the rotor blades; shadow flicker and blade glinting; turbine marker lights and other lighting on control buildings and other ancillary structures; 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.

Potential cumulative impacts to historic and cultural resources during operation include disturbance of previously unrecorded archaeological sites, visual degradation of settings associated with historic and cultural resources, and limiting access and travel paths traditionally utilized for cultural resources. Additional facilities in areas that already have clean energy facilities would likely contribute to cumulative impacts because there would be increased likelihood of seeing multiple wind farms from one location or in succession when traveling on area trails or roads. Multiple onshore wind facilities and other RFFAs developed in close proximity to each other could intensify impacts on historic and cultural resources.

4.14 Transportation

This section summarizes the transportation resources evaluated within the study area in the *Transportation Resources Technical Report* (Appendix O) and analyzes impacts on this resource resulting from the types of facilities considered and other RFFAs in the onshore wind study area. Transportation resources include transportation systems (roads, air travel, radar and

airport facilities, and waterway freight corridors), traffic (transit, water, and rail), parking, and movement/circulation of people and goods.

4.14.1 Current conditions

The *Transportation Resources Technical Report* presents detailed information about existing transportation in the study area, including roadways, railways, air travel, and navigable waterways, existing travel and commuting patterns, and movement of goods and services.

Washington's road network spans more than 80,000 miles, with 764 interstate miles and 1,602 miles of U.S. highways connected by state routes, county roads, city streets, and other roadways (WSDOT 2022). I-5 is the major north-south route through the state in western Washington. I-90 is the major east-west route and primary transportation corridor through Washington state. I-82 begins at I-90 near Ellensburg and extends south/southeast to Oregon. These corridors are principal freight arterials for regional and international cargo, as well as commute and recreation routes, providing access to nearby cities, employment centers, rural towns, and outdoor recreational areas. The study area contains a few larger cities and several small towns and communities, and the road system is vital to these communities and their economies.

Federally managed roads in the study area include those crossing national forests and scenic areas. Some federally managed roads are open for public access, while others are for administrative use only (FHWA 2024).

Two Class I railroads and 9 Class III railroads currently operate in the study area (WSTC 2006; WSDOT 2022). There are 39 intermodal facilities in Washington allowing for the transfer of cargo between rail and other methods of transport. Eleven intermodal facilities exist within 2 miles of the study area: the ports of Quincy, Pasco, Ritzville, Clarkston, Vancouver, Bellingham, Longview, and Kennewick; Spokane Intermodal Terminal; Spokane International Airport; and Tri-Cities Airport.

Two hundred and thirty-four FAA-designated general aviation airports are located within 2 miles of the study area. Air cargo in Washington state is primarily generated by activity at Seattle-Tacoma International Airport, Boeing Field International Airport, and Spokane International Airport. Non-hub and small commercial passenger airports within the state account for only 4% of the total air cargo volumes moved in 2016 (JTC 2018).

The U.S. Army Corps of Engineers provides a navigational channel along the Columbia River that follows the Oregon-Washington border and extends 106.5 miles from the mouth of the Columbia River to Vancouver, Washington, as well as along the lower 11.6 miles of the Willamette River. Columbia River navigation accommodates the current fleet of international bulk cargo and container ships as part of the Columbia and Lower Willamette Federal Navigation Channel, which in 2017 was used to transport 47.5 million tons of cargo (USACE 2024b). Additionally, the U.S. Department of Transportation has designated two marine highways that serve Washington. There are 18 public ports, 158 marine terminals,

11 deepwater marine ports, and 57 inland ports in Washington. Thirty-four ports are located within 2 miles of the study area.

4.14.2 Reasonably foreseeable future actions

RFFAs with the potential to affect transportation in the study area are listed in Table 15 along with a summary of the potential effects of these actions.

Table 15. Reasonably foreseeable future actions relevant to transportation

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• There would be expected impacts from truck, rail, and barge delivery of equipment, materials, and project components during the construction and decommissioning of clean energy facilities. • There could be impacts to traffic patterns, volumes, hazards, or risks to other users resulting from road closures during development and maintenance of transmission lines.
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• There could be effects to traffic patterns, volumes, hazards, or risks to other users resulting from changes in population growth patterns and in urban, commercial, and industrial activities and development, including expansion of areas designated for parking.
RFFA 3	Rural and Agricultural Activities and Development	• There could be impacts to traffic patterns, volumes, hazards, or risks to other users resulting from changes in population growth and in rural and agricultural activities and development, including expansion of areas designated for parking. • Increased demands for agricultural production could result in additional development of facilities and transport of products.
RFFA 4	Federal, State, Tribal, and Local Wildlife and Habitat Projects	• There could be impacts to traffic patterns, volumes, hazards, or risks to other users resulting from changes to land ownership and road use by federal, state, Tribal, and local wildlife and habitat projects that may create more opportunities for recreation or limit public access to existing roads.
RFFA 5	Transportation Infrastructure Development and Modification	• There could be adverse impacts to traffic patterns, volumes, hazards, or risks to other users resulting from long-term road closures or interruptions to traffic patterns or volumes during construction and maintenance of transportation infrastructure projects in the study area, including culverts, bridges, highways, rail, and transit, among others. • There could be improvements to traffic patterns resulting from the development of transportation plans and projects.
RFFA 8	Mining Operations	• There could be impacts to traffic patterns, volumes, hazards, or risks to other users resulting from changes in the expansion of mining sites, including road closures and the production and transport of aggregate and other minerals required to develop major infrastructure projects in the region.
RFFA 10	Military Use	• There could be impacts on air traffic in the navigable airspace from military use.

4.14.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable future actions

Transportation issues related to utility-scale onshore wind energy facilities and other RFFAs that involve construction and maintenance activities relate primarily to transporting equipment, supplies, materials, and workers to and from the study area.

The following sections summarize the cumulative impacts to transportation when considering the RFFAs in combination with the different types of facilities.

4.14.3.1 Utility-scale onshore wind facilities

Transporting resources and workers during construction and decommissioning of onshore wind energy facilities, other energy facilities, transportation infrastructure and mining sites, and to develop infrastructure projects for urban, commercial, and industrial purposes contribute to cumulative impacts on transportation and traffic. Transporting resources and workers could rely on road, rail, air, or water transport. Construction and decommissioning activities for different RFFAs also have the potential to contribute to a temporary increase in demand for shipping services if they occur at the same time and location.

Cumulative impacts from RFFAs include construction and decommissioning worker trips from larger cities in and near the study area, cities along the I-5 corridor between approximately Everett and Vancouver, and cities near the coast, such as Aberdeen. The establishment of new infrastructure development for energy facilities or urban, industrial, recreational, and rural uses in the study area could also elevate the need for designated parking areas in the vicinity, which would increase traffic associated with construction and could have potential adverse effects to other resources described in the PEIS. Transportation of wind turbine tower components (turbine sections and blades) and large equipment for infrastructure development projects would require oversize or overweight shipments, which would affect local traffic in the short term. These efforts would be needed during construction and decommissioning of onshore wind facilities, and for turbine repowering activities, when applicable.

Cumulative impacts from facility construction and decommissioning for RFFAs may also include fortifying local road bridges, reconstructing turning radii, adding acceleration or deceleration lanes on highways, or removal of obstructions to move the shipments. Such modifications would be determined on a site-specific basis. Depending on the number and complexity of required road modifications or new roads at a particular site, construction could be temporarily but potentially highly disruptive to communities. Additionally, service roads may be removed or could remain in place depending on agreements with the new or existing landowners.

Operation of utility-scale facilities would include a small increase in vehicle trips due to employees traveling to and from the site. On-site operations would likely include travel to various locations within the site for repairs and maintenance and could include the implementation of dust suppression and cleaning operations. Air and marine transport could be needed during operations if large components require replacement. If on-site water is not available for dust suppression and cleaning, water would need to be dispatched to the facility

location. Impacts on transportation during operations of onshore wind facilities are expected to be negligible, but they could have additive cumulative effects if combined with impacts from construction, decommissioning, or operations of mining projects and other reasonably foreseeable future infrastructure projects. Additionally, increases in traffic from transportation infrastructure projects and urban, rural, industrial, agricultural, and commercial facilities within or near the study area could increase the potential of cumulative impacts in the long term. Alternatively, there could be potential improvements to traffic patterns resulting from the development of transportation plans and projects.

In addition, there could be adverse effects to air traffic in the navigable airspace from military use and airspace restrictions for recreational or personal uses resulting from the presence of wind turbines. These cumulative impacts would depend on facility location and size of the turbines.

4.14.3.2 Onshore wind facilities with battery energy storage systems

Cumulative impacts would be similar to those described for utility-scale facilities, except that more truck trips would be required to transport the battery systems during construction and decommissioning. Some of the additional trips can be expected to be oversized or overweight loads. BESSs are typically constructed in gravel areas, meaning that additional gravel may need to be transported.

4.14.3.3 Onshore wind facilities that include agricultural uses

Cumulative impacts during construction would be similar to those described for utility-scale facilities, except that more materials or components could be required due to different arrangement or turbine heights to accommodate agricultural use below. More material or components for agricultural uses and products from agricultural activities could require more truck trips.

4.14.3.4 No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential impacts to transportation from future utility-scale onshore wind energy developments under the No Action Alternative when considering the RFFAs would be similar to those noted for other types of facilities, depending on facility size and design.

4.15 Public services and utilities

This section summarizes the public services and utilities evaluated within the study area in the *Public Services and Utilities Technical Resource Report* (Appendix P) and analyzes impacts on this resource resulting from the types of facilities considered and other RFFAs in the onshore wind study area.

4.15.1 Current conditions

The study area covers a broad area and includes multiple types of public service and utility 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 in the study area include public schools, fire departments, emergency medical services, and law enforcement, described in additional detail in the *Public Services and Utilities Technical Resource Report*. Coordination and emergency alert communications are conveyed through subscriber-based text alerts via cell phone and email; radio and other media are used to communicate with the public about hazard conditions and natural disasters. Emergency management services are provided at the county level and consist of various divisions that carry out dispatch services to all law enforcement, and fire and emergency management and response services through centers within their respective divisions.

Utilities in the study area, as described in the *Public Services and Utilities Technical Resource Report*, 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. In general, utility infrastructure often correlates to the size of the population it serves. As a result, population levels, coupled with any topographic or other constraints on where utilities can be provided, often dictate how well a community is served by utility systems.

4.15.2 Reasonably foreseeable future actions

RFFAs with potential to affect public services and utilities in the study area are listed in Table 16 along with a summary of the potential effects of these actions.

Table 16. Reasonably foreseeable future actions relevant to public services and utilities

RFFA ID	RFFA trend	Impact description
RFFA 1	Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Development and operation of new energy projects and decommissioning of existing energy systems could increase the demand of public services and utilities associated with labor force movements and relocation, and utility lines needed to support operation of construction and maintenance equipment. • Water used to support construction activities could temporarily adversely affect water quality and could require wastewater treatment prior to disposal. • Disposal of clean energy facility materials (photovoltaic [PV] panels, batteries, turbines) would need to meet regulatory requirements. Recycling materials, such as PV panels, is required. Future regulations or economic drivers are expected to support recycling for other clean energy components.

RFFA ID	RFFA trend	Impact description
RFFA 2	Urban, Commercial, and Industrial Activities and Development	• Public service and utility infrastructure often correlates to the size of the population it serves. Changes in urban, commercial, and industrial activities and development could increase the demand and availability of public services and utilities. • Water use for industrial activities could adversely affect water quality and require wastewater treatment prior to disposal.
RFFA 3	Rural and Agricultural Activities and Development	• Like RFFA 2, changes in population and rural and agricultural development would be expected to affect the demand and availability of public services and utilities. • Water use for agricultural activities could adversely affect water quality and require wastewater treatment prior to disposal.
RFFA 5	Transportation Infrastructure Development and Modification	• There could be a potential increase in demand for public services and utilities during construction activities of transportation infrastructure development and modification. • Water used to support construction activities could temporarily adversely affect water quality and require wastewater treatment prior to disposal. • Operations of transportation infrastructure actions could potentially increase accessibility to public services and utilities statewide.
RFFA 6	Timber and Forestry Management	• Fire response plans may influence siting and jurisdiction of utility services, including aerial fire and medical response systems.
RFFA 11	Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Water withdrawals for conservation purposes would be expected to limit availability of the resources for other uses. • Increase in industrial use could adversely affect water resources by limiting alternative use and requiring wastewater treatment prior to disposal. • Agricultural and municipal water use could place additional demands on existing utility infrastructure. • Operations of water supply development projects would be expected to increase overall resource availability and accessibility for various use types.

4.15.3 Cumulative impacts from the types of facilities evaluated in the PEIS and other reasonably foreseeable future actions

The following sections summarize the cumulative impacts to public services and utilities when considering the RFFAs in combination with onshore wind facilities.

4.15.3.1 Utility-scale onshore wind facilities

Cumulative impacts would occur if a facility and any of the RFFAs would result in increased demand for public services during construction or decommissioning that would exceed existing capacities of public service providers, significantly increased demand for public services during

operations, the relocation of new or modified utilities or service systems, or the obstruction of aerial emergency response capabilities. Construction and decommissioning would likely occur over a short time period, so impacts would be temporary. It is anticipated that the energy projects included in RFFA 1 are likely to be located relatively near each other and near onshore wind energy facilities evaluated in this PEIS to take advantage of the same energy source conditions and infrastructure. This may lead to increasing demands on some of the same public service and utility resources.

Cumulative impacts from construction, repowering, and decommissioning of onshore wind facilities and other RFFAs described in Table 16 would entail employment of a temporary workforce that could result in an increased demand for public services, including law enforcement, fire departments, solid waste providers, and emergency medical service response. If developments of utility-scale facilities and other RFFAs occur in a similar timeframe and in the same districts for public service providers, there would be higher potential for cumulative impacts to public services and utilities during that period.

Cumulative impacts to public schools are expected to be temporary as construction workers could relocate their families to school districts within or adjacent to the study area. There could also be cumulative impacts from changes in land management and activities during the development and operation of energy facilities, water supply projects, and rural and urban developments from the introduction of ignition sources, which would increase the risk of fire. These issues during construction and operation activities could place demands on emergency response services and personnel, especially in remote areas. Operation of onshore wind facilities and other energy projects in the same geography may also increase the potential for interference with communications systems.

Additionally, interference with communications systems may occur due to the height and nature of wind turbines affecting existing electronic and microwave communications infrastructure, including emergency response-related communications capabilities, AM broadcast stations, and television receiver locations. This is because rotating electrical machines generate a certain amount of electrical noise as a combination of various frequencies, resulting in potential interferences to existing signals from each wind energy generator and its associated system (Angulo et al. 2014).

Cumulative impacts related to fire protection and response services involve consideration of fire risks during facility operation caused by onshore wind energy facility equipment or operational activities and fires started outside of facilities that have altered behavior (i.e., spread, movement, or ability to suppress) due to the presence of an onshore wind energy facility. Depending on location, the presence of wind turbine towers has the potential to limit an aerial response to fire within an onshore wind facility. Depending on the site layout, turbine spacing, and topography, surrounding lands may also be affected. These impacts would be expected to be additive to those of RFFAs being developed and operating nearby. Statewide fire response plans and practices described in RFFA 6, when considered for siting of onshore wind energy projects, may alleviate some impacts to aerial fire and medical emergency responses.

During the operation and maintenance period of onshore wind facilities and infrastructure projects, water may be needed for dust control, irrigation of on-site vegetation, fire water supply, and plumbed facilities such as sinks or toilets, if installed. If consistent with public health requirements and available supply, reclaimed water may supply some of these water demands, or on-site wells would be used. Demand for potable water is expected to change based on changes in urban, commercial, and industrial development, rural and agricultural development, and during construction and operation of RFFAs that may need on-site drinking water.

Waste resulting from urban, rural, commercial, agricultural, and industrial activities and development and from the construction, operation, or decommissioning from reasonably foreseeable infrastructure projects in the same geography and landscape could result in a considerably increased use of local or regional disposal facilities. A substantial portion of the materials that make up energy facilities are recyclable, such as steel, aluminum, glass, copper, and plastic. Washington has a PV Module Stewardship and Takeback Program that requires manufacturers of PV modules to provide the public with a clean and environmentally sound way to recycle all modules purchased after July 1, 2017. The regulation includes provisions for funding, performance goals, and reporting. The program requires manufacturers to develop and submit a stewardship plan to Ecology with the intent to facilitate recycling and provide a mechanism to limit the release of hazardous substances into the environment. Beginning January 1, 2031, PV manufacturers not participating in an approved stewardship plan may not sell their modules in or into Washington state (Ecology 2025). If onshore wind facilities and other wind facilities are decommissioned in the same area, they may require the same disposal facilities. There are no industrial-scale recycling options for wind turbine blades or batteries available in Washington currently. There are recent developments in recycling or upcycling of turbine waste materials and batteries; however, with each of the methods, there are tradeoffs in terms of energy use and transportation challenges. It is expected that federal or state regulations for recycling clean energy components will be enacted; however, this would vary based on available technology and the timeframe is not known. If cumulative waste is not managed appropriately, it could exceed capacities for utility providers such as landfills and transfer stations in the study area, as discussed in the *Public Services and Utilities Technical Resource Report*.

4.15.3.2 Onshore wind facilities with battery energy storage systems

Co-location of the BESS(s) introduces additional fire risk management, emergency response, and solid waste considerations when compared to facilities without a BESS. Although rare, battery storage may pose a risk of fire and explosion if the batteries or their systems were to overheat. Depending on the technology selected, lithium-ion batteries and lead acid batteries contain hazardous materials, which pose potential risks for environmental release if not handled correctly and could introduce hazards for first responders (ACP 2023). Additionally, the operator or decommissioner would need to coordinate with local solid waste providers for recycling or disposal of zinc-hybrid batteries. For detailed discussion regarding public health and safety related to BESSs, refer to the *Environmental Health and Safety Technical Resource Report*. When combined with other RFFAs in the same district, facilities with BESSs would be

expected to have cumulative effects to first responders if multiple demands arise at the same time.

4.15.3.3 Onshore wind facilities that include agricultural uses

Facilities with agricultural land use would entail a different fencing system to potentially accommodate grazing or other agricultural activities, which could be more restrictive or have fewer gates. Cumulative impacts are expected to be similar to those identified for facilities without co-located agriculture. However, emergency responders could face minor delays or obstacles to accessing the facility due to the presence of livestock, fences, or multiple gates within agricultural operations. Because facilities with agricultural land use would include active management of the vegetative landscape (e.g., grazing, crop production, pollinator habitat), it is assumed that fire risk for the facilities with agricultural use would generally be reduced compared to facilities without.

4.15.3.4 No Action Alternative

Under the No Action Alternative, the agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. As such, the potential for impacts on public service and utilities for future utility-scale onshore wind energy developments under the No Action Alternative when considering the RFFAs would be similar to those noted for other types of facilities, depending on facility size and design.

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