

February 2020

Proposed Chehalis River Basin Flood Damage Reduction Project
SEPA Draft Environmental Impact Statement

Appendix 2

Cumulative Impacts Analysis

Publication No.: 20-06-002



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About this Document

This discipline report has been prepared as part of the Washington Department of Ecology's (Ecology's) State Environmental Policy Act (SEPA) Environmental Impact Statement (EIS) to evaluate a proposal from the Chehalis River Basin Flood Control Zone District (Applicant).

Proposed Action

The Applicant seeks to construct a new flood retention facility and temporary reservoir near Pe Ell, Washington, and make changes to the Chehalis-Centralia Airport levee in Chehalis, Washington. The purpose of the Applicant's proposal is to reduce flooding originating in the Willapa Hills and improve levee integrity at the Chehalis-Centralia Airport to reduce flood damage in the Chehalis-Centralia area.

Time Frames for Evaluation

If permitted, the Applicant expects Flood Retention Expandable (FRE) facility construction would begin in 2025 and operations in 2030, and the Airport Levee Changes construction would occur over a 1-year period between 2025 and 2030. The EIS analyzes probable impacts from the Proposed Action and alternatives for construction during the years 2025 to 2030 and for operations from 2030 to 2080. For purposes of analysis, the term "mid-century" applies to the operational period from approximately 2030 to 2060. The term "late-century" applies to the operational period from approximately 2060 to 2080.

Scenarios Evaluated in the Discipline Report

This report analyzes probable significant environmental impacts from the Proposed Action, the Local Actions Alternative, and the No Action Alternative under the following three flooding scenarios (flow rate is measured at the Grand Mound gage):

- **Major flood:** Water flow rate of 38,800 cubic feet per second (cfs) or greater
- **Catastrophic flood:** Water flow rate of 75,100 cfs
- **Recurring flood:** A major flood or greater that occurs in each of 3 consecutive years

The general area of analysis includes the area in the vicinity of the FRE facility and temporary reservoir; the area in the vicinity of the Airport Levee Changes; and downstream areas of the Chehalis River to approximately river mile 9, just west of Montesano.

SUMMARY

Table 2-1 summarizes environmental resources for which the Proposed Action could potentially contribute to indirect or direct impacts resulting from other projects (cumulative impacts).

Table 2-1
Summary of Cumulative Impacts

RESOURCE	POTENTIAL FOR CUMULATIVE IMPACT?	CUMULATIVE IMPACT
Water	Yes	Water quality
Earth	Yes	Sediment transport and deposition, limited channel migration
Fish Species and Habitats	Yes	Water quality, habitat degradation, habitat fragmentation, fish injury or stranding
Wildlife Species and Habitats	Yes	Tree cover removal
Wetlands	Yes	Water quality, sediment transport, habitat removal
Tribal Resources	Yes	Tribal resources (as discussed in the <i>Tribal Resources Discipline Report</i>)
Land Use	Yes	Critical areas, increased development
Recreation	Yes	Recreational fishing
Cultural Resources	Yes	Cultural and historic resources (as discussed in the <i>Cultural Resources Discipline Report</i>)
Environmental Health and Safety	Yes	–Increased development downstream could increase risk of hazardous material releases during flood events
Air Quality	Yes	Increased greenhouse gas emissions
Environmental Justice	Yes	Increased development downstream would increase impacts from potential breach of the FRE facility, which would be disproportionate to environmental justice populations
Noise and Vibration	No	Not applicable
Public Services and Utilities	Yes	Increased development and increased demand on resources
Transportation	Yes	Increased traffic congestion
Visual Quality	No	Not applicable

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ACRONYMS AND ABBREVIATIONS

Applicant	Chehalis River Basin Flood Control Zone District
ASRP	Aquatic Species Restoration Plan
CEQ	Council on Environmental Quality
CFAR	Community Flood Assistance and Resilience
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
DAHP	Department of Archaeology and Historic Preservation
Ecology	Washington Department of Ecology
EIS	Environmental Impact Statement
FRE	Flood Retention Expandable
GHG	greenhouse gas
I-5	Interstate 5
NEPA	National Environmental Policy Act
RCO	Recreation and Conservation Office
RCW	Revised Code of Washington
RM	river mile
SEPA	State Environmental Policy Act
SR	State Route
UGA	Urban Growth Area
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WRIA	Water Resource Inventory Area
WWTP	Wastewater Treatment Plant
WSDOT	Washington State Department of Transportation

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1 INTRODUCTION

Cumulative impacts are effects that would result from the incremental addition of the Proposed Action to the impacts from past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions that occur over time. The purpose of the cumulative impacts analysis is to ensure that decision-makers consider the full range of consequences for the Proposed Action, including the Proposed Action's incremental contribution to cumulative impacts on the environment.

This report describes the scope of the cumulative impacts analysis, including the regulatory setting and analysis methods. This report describes how the effects of the Proposed Action may contribute to the environmental effects of other past, present, and reasonably foreseeable future actions. Cumulative effects are those that could result in the combination of effects from individual project actions occurring over time. Potential cumulative impacts are summarized for each resource area with the potential to be adversely affected by the Proposed Action as determined in this EIS.

1.1 Regulatory Context

This cumulative impacts analysis has been prepared in accordance with the Washington State Environmental Policy Act (SEPA; Chapter 43.21C Revised Code of Washington [RCW]), the SEPA Rules (Chapter 197-11-060 Washington Administrative Code [WAC]), and the *State Environmental Policy Act Handbook* (Ecology 2017a). SEPA requires cumulative impacts to be evaluated as part of environmental review per WAC 197-11-060 and 197-11-792.

Additional guidance developed by the Council on Environmental Quality (CEQ) in the handbook entitled *Considering Cumulative Effects under NEPA* (1997) was also considered where SEPA requirements are consistent with requirements of the National Environmental Policy Act (NEPA).

2 METHODOLOGY

2.1 Study Area

The cumulative impacts study area is specific to each resource that would be adversely affected by construction and operation of the Proposed Action. The study area for cumulative impacts may extend beyond the study areas for direct and indirect impacts if necessary to assess the incremental contribution to impacts on each resource.

2.2 Technical Approach

This analysis follows the guidance developed by CEQ for assessing cumulative effects. Based on CEQ guidance, the following guidelines were used to evaluate the cumulative impacts of construction and operation of the Proposed Action:

- Identify the resources with the potential to be adversely affected by the Proposed Action, as discussed in resource discipline reports prepared for the SEPA EIS.
- Consider other actions in relation to the geographic scope of the Proposed Action (i.e., those actions that would have effects in the same area as the Proposed Action).
- Consider other actions in relation to the temporal period of the Proposed Action (i.e., those actions that would have effects during the same time as the Proposed Action).
- Rely on the best available data at the time of analysis.

Defining Cumulative Effects

SEPA requires cumulative effects to be considered in an EIS (WAC 197-11-792). Although SEPA does not specifically define “cumulative effects,” the term is defined under NEPA as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.” (40 Code of Federal Regulations 1508.7)

The cumulative impact analysis extends to the year 2080 in considering reasonably foreseeable future actions and conservatively accounts for future actions that may only be in the planning stages now but can reasonably be expected to be operational in the future.

Projected changes in climate have been included in the impact analyses through 2080 to evaluate probable impacts on resource areas from the Applicant’s Proposed Action and the alternatives. Climate change projections were incorporated throughout the analyses as part of the future conditions in mid- and late-century for major and catastrophic flood scenarios. For example, under future conditions with

climate change, more intense heat waves and higher flood risks are predicted, along with the indirect effects of increased wildfire frequency, shortage of summer water supply, shifting infectious disease dynamics, and decreased air quality. Additionally, decreased abundance in fish species are predicted under the mid- and late-century conditions with the potential extirpation of some fish species in the upper Chehalis Basin (from Rainbow Falls to Crim Creek Subbasin; see Appendix E, *Fish Species and Habitats Discipline Report*).

2.3 Potential Cumulative Impacts from Proposed Action

Table 2-2 identifies the resource areas studied in the SEPA EIS and whether the Proposed Action would result in adverse impacts on the resource area and potentially contribute to cumulative effects.

Assessments of cumulative impacts for these resources were conducted qualitatively and are discussed in Section 3. If the Proposed Action would not result in adverse impacts on a particular resource area, then it would not have the potential to contribute to cumulative impacts in that resource area and no cumulative analysis for the resource area is warranted.

Table 2-2

Resources for Which the Proposed Action Potentially Contributes to Cumulative Impacts

APPENDIX NO.	RESOURCE	POTENTIAL FOR SIGNIFICANT ADVERSE IMPACT?
A	Air Quality and Greenhouse Gases	Yes
B	Cultural Resources	Yes
C	Environmental Health and Safety	Yes
D	Environmental Justice	Yes
E	Fish Species and Habitats	Yes
F	Geology and Geomorphology	Yes
G	Land Use	Yes
H	Noise and Vibration	No
I	Public Services and Utilities	Yes
J	Recreation	Yes
K	Transportation	No
L	Tribal Resources	Yes
M	Visual Quality	No
N	Water Resources	Yes
O	Wetlands	Yes
P	Wildlife Species and Habitats	Yes

2.4 Past and Present Actions

The description of existing resources in the EIS and Discipline Reports includes the cumulative impacts of these past and present actions as the baseline condition. The Chehalis River has been connected to Native Americans from precontact-era through historic-era to the present day. The Chehalis Basin was

traditionally inhabited by the Upper and Lower Chehalis, Cowlitz, and Suwal peoples, and Grays Harbor at the Chehalis River mouth was traditionally used by the Quinault people. The Chehalis Basin and its tributaries are an area traditionally occupied by Salish, Athapaskan, and Chinookan speakers.

Descendants of these groups are now members of five federally recognized Tribes: the Confederated Tribes of the Chehalis Reservation (Chehalis Tribe), Quinault Indian Nation (Quinault), Cowlitz Indian Tribe, Nisqually Indian Tribe, and Shoalwater Bay Indian Tribe of the Shoalwater Bay Indian Reservation, as well as the non-federally recognized Chinook Indian Nation.

Traditional economy along the river and throughout the watershed was tied to seasonal hunting, fishing, and resource gathering. The river was used as a travel corridor to connect to neighboring tribes in the region. The salmon runs have been a significant source of food for Native Americans in the area (Shannon et al. 2019:10). Fishing was conducted seasonally using weirs, hooks, spears, and traps along rivers and smaller streams as well as hunting for deer, elk, and other small game and birds.

Starting in the mid-1800s, the Chehalis Basin began to be settled by emigrants from points east. Key activities included converting prairie and other habitats to farms, timber harvesting, and construction of roads and buildings. Large wood was removed to facilitate navigation and transport of wood and other materials along the rivers. Splash dams were used to block channels and pond water for the temporary storage of logs; splash gates were then opened to release water and rapidly carry wood downstream. The sudden release of water, combined with active practices to clear the channel of any logjams that could trap the logs en route to the mill, resulted in bed scour and channel incision. Other activities, including agriculture, ranching, logging, gravel mining, dredging, and the installation of dams and diversions, have changed the landscape.

The Aquatic Species Restoration Plan (ASRP) assessed historical conditions and found that extensive floodplain wetlands and sloughs existed. Floodplains were dominated by a wide variety of plant communities including mature forests consisting primarily of maple, cedar, Douglas fir, willow, cottonwood, alder, or Oregon ash; shrub communities consisting of willows, dogwood, vine maple, or spirea; beaver ponds and marshes with grasses, sedges, rushes, and aquatic plants; and both wet and dry prairies with sparse oak woodland. River and stream channels were more winding, with multiple channels, compared to current conditions. River and stream channels were generally narrower and had lower banks than current conditions. Minor flooding occurred more frequently in most floodplain areas, and groundwater levels were higher. River and stream channels had large volumes of wood material and logjams, which split channels into smaller, narrower channels separated by forested islands. These historical conditions differ from current conditions.

Over the past 200 years, numerous changes have occurred to watershed processes and functions. In general, the watershed still retains some connectivity with its floodplain. Existing anadromous fish and shellfish resources of the Chehalis Basin and Grays Harbor are of regional and national significance to tribal, commercial, and recreational fishing. Farming, forestry, harvesting of shellfish, and fishing

continue to be central to the Chehalis Basin economy, and the loss and degradation of habitat have resulted in declines in salmon, steelhead, and other fish, affecting both tribal and non-tribal people of the Chehalis Basin (Ecology 2017b).

From 1938 to 2013, land cover in the Chehalis River floodplain had an overall increase in agriculture (+1.8%), decrease in tree canopy (-2.4%), and increase in development (+1.2%; Pierce et al. 2017). While land cover change varied by location within the Chehalis River floodplain, the segment of the Chehalis River floodplain that includes Chehalis and Centralia and their Urban Growth Areas (UGAs) had the largest increase in development from 1938 to 2013 (approximately 45% of the total increase in development). Much of this development was associated with construction of Interstate 5 (I-5) in Chehalis and Centralia (1954 to 1960) and the Chehalis-Centralia Airport (expanded in the 1940s; Anchor QEA 2017).

Much research has been conducted to understand how forest management practices influence the extent of flooding in the Chehalis Basin. In general, there is consensus that timber harvesting results in an increase in rain-induced, channel-forming flows up to 20 or more years post-harvest (Perry et al. 2016). Many studies have also documented increases in landslides and surface erosion resulting from timber-harvesting and road-building practices (Dragovich et al. 1993; Dyrness 1967; Guthrie and Evans 2004; Jakob 2000; Ketcheson 1977; Montgomery et al. 2000; Robison et al. 1999; Swanson and Dyrness 1975; Swanson et al. 1987; Swanston 1974). Although it is not clear how effective Forest Practices Rules are at reducing landslides and erosion during extreme storm events, such as the 2007 flood, it is clear that practices have improved the management of areas to reduce the potential for landslides during less severe floods (Ecology 2017b).

In the last few decades, the Chehalis Basin has experienced extreme flooding (see Table 2-3), which is damaging to human land uses and habitat stability, and extreme drought conditions (low streamflows during summer months), which has affected both water quality and flow. In areas dominated by agricultural lands that lack riparian forest cover, in cities, and in towns, water quality is impaired in many areas, and generally moderate to poor (Ecology 2017b; ESA 2020; Anchor QEA 2014). Many miles of the mainstem Chehalis River have eroded below the channel's former riverbed elevation. As a result, the river is less frequently connected to its floodplain in many areas. Incision (down-cutting of the river) is a naturally occurring process of erosion and stream evolution; however, it can also be exacerbated by land use actions that constrain the river's natural meandering process such as bank protection and levees, concentration of flow into a single channel with higher velocities, or from the removal of fallen trees and wood from the channel that tend to slow velocities and erosion.

Table 2-3
Historical Record of Major Floods on the Chehalis River

DATE	STREAMFLOW AT USGS GAGE AT GRAND MOUND (CFS)
December 11, 1933	38,800
December 19, 1933	42,900
January 23, 1935	38,000
December 29, 1937	48,400
February 10, 1951	38,000
January 26, 1971	40,800
January 21, 1972	49,200
December 5, 1975	44,800
November 25, 1986	51,600
January 10, 1990	68,700
February 11, 1990	40,700
November 25, 1990	48,000
April 6, 1991	42,800
February 9, 1996	74,800
December 30, 1996	38,700
December 4, 2007	79,100
January 8, 2009	50,700

Most large wood that helps reduce channel incision and maintain floodplains (Abbe and Montgomery 1996; Collins et al. 2012) would be supplied from local bank erosion and channel migration; however, with fewer and smaller trees in the riparian zone and floodplain, much less wood is currently supplied from these sources (Beechie 2018), and the wood is not large enough to remain in the channel during high flows. Recent flood events recruited wood from landslides and debris torrents in the upper Chehalis Basin and tributaries, but much of this was deposited in farm fields and other areas of the floodplain or was removed from the channel to minimize hazards to bridges and other infrastructure. Land drainage (ditching, diking, and tiling), beaver trapping, and logjam removal vastly diminished the extent and quality of floodplain wetlands.

Table 2-4 includes a list of recently completed projects on the Chehalis River Basin Flood Authority project list and Table 2-5 describes Chehalis River Basin Flood Authority farm pad projects completed in 2019. Additional projects and studies are planned or underway within the resource study areas that are relevant to reducing flood damage, many of which are described in Appendix 1, *Proposed Project Description and Alternatives* under the No Action Alternative description and discussed further in Section 2.5.

Table 2-4

Chehalis River Basin Flood Authority Project List (Completed)

PROJECT	SPONSOR	STATUS	START/END
Sickman-Ford Overflow Bridge and Harris Creek Culvert Replacement	Confederated Tribes of the Chehalis Reservation	Complete	March 2013 to December 2013
Oakville, Grays Harbor County, WSDOT Flood Relief Analysis	City of Oakville	Complete	May 2016 to December 2017
Flow-Through Farm Pads for Floodwater Protection	Thurston Conservation District	Complete	November 2016 to April 2018
Home Elevations Pilot	Thurston County	Complete	February 2017 to November 2017
Wellhead Protection Levee	City of Bucoda	Complete	September 2012 to June 2017
Main Street Regrade Project (BNSF Right-of-Way Evacuation Route)	City of Bucoda	Complete	October 2015 to July 2017
Public Information Program (Community Rating System 330, 370)	Lewis County	Complete	August 2018 to December 2018
Chehalis-Centralia Airport Pump	City of Chehalis	Complete	October 2015 to January 2018
Airport Levee Phase I	Lewis County	Complete	September 2012 to July 2014
Dillenbaugh Creek Culvert	City of Chehalis	Complete	May 2016 to May 2017
Adna Levee	Lewis County	Complete	September 2012 to September 2013
Wastewater Treatment Plant Flood Prevention Dike Project	City of Pe Ell	Complete	September 2013 to January 2015
Kirkland Road Flood Study	City of Napavine	Complete	November 2016 to March 2018

Table 2-5

Chehalis River Basin Flood Authority Livestock Pad Projects (Completed)

CITY, COUNTY	FARMER	PARCEL NUMBER	TYPE
Elma, Grays Harbor	Glick	180723420000	Farm pad
Montesano, Grays Harbor	Shaffner	180834210020	Equipment pad
Montesano, Grays Harbor	Crowley	170813310010	Farm pad
Centralia, Lewis	Nailon	9842000000	Farm pad

2.5 Reasonably Foreseeable Future Actions

Table 2-6 summarizes the reasonably foreseeable future actions identified as part of the cumulative impacts analysis that could impact flood damage in the study area, including a qualitative description of potential cumulative impacts from each action. The actions in Table 2-6 are expected to reduce damage from floods; therefore, no additional hydrologic modeling was required.

The applicant for each of these projects would be required to conduct a separate, project-specific SEPA environmental review, as appropriate. Figure 2-1 indicates the approximate location of these actions where applicable. Many of these actions are also identified under the No Action Alternative.

Table 2-6
List of Reasonably Foreseeable Future Actions

NO.	PROJECT	PROPONENT	LOCATION	DESCRIPTION	CONTRIBUTING ACTIVITY	SCHEDULE OR STATUS
1	Aquatic Species Restoration Plan (ASRP) (Implementation)	Office of the Chehalis Basin and Washington Department of Fish and Wildlife	Chehalis Basin-wide (Water Resource Inventory Areas [WRIAs] 22, 23)	The goal of the ASRP is to create a comprehensive restoration plan that improves and protects habitats, ecosystem processes, and populations of aquatic species. Under three potential restoration scenarios, the ASRP would include a long-term strategy to restore between 220 and 450 river miles; restore 9,600 to 15,000 acres of riparian and floodplain areas; and remove between 200 and 450 barriers within the Chehalis Basin.	Implementation of this plan over 20 years (through 2040) is anticipated to result in positive outcomes for salmonid and other aquatic species and natural processes, including reconnection of floodplains, by the end of the century even with anticipated climate change conditions (ASRP Steering Committee 2017).	Ongoing; ASRP Phase 1 Draft Plan anticipated in 2019; final plans in 2020
2	Berwick Creek Flood Reduction, Restoration	Port of Chehalis	WRIA 23, southeast of Chehalis	This project will restore habitat and stabilize the streambank along a stretch of Berwick Creek in the Chehalis Industrial Park.	This project is anticipated to result in localized positive outcomes for fish habitat and flood damage reduction.	2020
3	Chehalis Basin Partnership Watershed Plan Update	Chehalis Basin Partnership	WRIAs 22, 23	The Watershed Management Plan provides a framework for water resource management in the Chehalis Basin. The update will focus on planning, public involvement, water quality, water quantity, and habitat.	Implementation of this plan is anticipated to result in basin-wide improvements to streamflows, water conservation, and aquatic species habitat.	Anticipated in early 2020
4	Chehalis-Centralia Airport Property Master Plan (Implementation)	Chehalis-Centralia Airport	Chehalis-Centralia Airport	This plan identifies a conceptual program for future commercial development at the airport property, focused on its northeast portion. The master plan identifies future commercial, retail, airport expansion, and recreational development in the focus area (WH Pacific 2018).	Implementation of the master plan is anticipated to result in development that could result in wetland fill impacts. New commercial and retail development within the floodplain would increase potential for flood damage to the new structures during a late-century catastrophic flood. New recreation opportunities would be provided if the Trailhead Park identified in the master plan were developed.	Schedule not available
5	Chehalis Flood Storage and Habitat Enhancement Master Plan (Implementation)	City of Chehalis	156-acre basin between the Chehalis River and Louisiana Avenue, and between Highway 6 and Airport Road in Chehalis	The master plan evaluates flows and storage volumes to inform final design of a flood storage facility for controlling floodwaters. The master plan will include evaluation of the potential flood storage volume within the project area to determine the resultant reduction of the flood stage nearby.	Implementation of the master is anticipated to result in localized flood damage reduction. New recreation opportunities may be provided with a new interpretive area with trails. Impacts are anticipated to wetlands, shorelines, and critical areas. Land use impacts are anticipated from property acquisitions.	Master Plan Phase II is scheduled to be completed by June 30, 2020
6	Chehalis River Basin Comprehensive Flood Hazard Management Plan (Implementation)	Applicant (Chehalis River Basin Flood Control Zone District)	Portions of WRIA 23 within Lewis County	The comprehensive management planning goal is to coordinate all community floodplain management and mitigation activities to a single comprehensive, cohesive, and implementable planning document. The update will also include a capital improvement program with an improved prioritization process to move projects from planning level to “shovel ready” in a more comprehensive manner.	Implementation of the updated plan is anticipated to result in localized flood damage reduction from individual projects. Implementation of the Proposed Action, which is anticipated to be included in the updated plan, is intended to result in flood damage reduction from Pe Ell to Centralia and Chehalis.	December 2020
7	China Creek Flood Habitat Enhancement Master Plan (Phase II) (Implementation)	City of Centralia	Centralia	Upstream storage will be created with natural stream fish habitat features and raise the levels of Agnew mill ponds to reduce the intensity of flooding downtown.	This project is anticipated to result in localized positive outcomes for fish habitat and flood damage reduction.	Construction is anticipated for completion in 2021
8	Community Flood Assistance and Resilience (CFAR) Program (Implementation)	Office of the Chehalis Basin	WRIAs 22, 23	The CFAR program will provide technical and financial assistance to local communities and landowners to protect lives and property from river flooding and channel migration.	This project is anticipated to result in community-level flood damage reduction.	In planning stages
9	Forest Practices Analysis	Washington State Department of Natural	Chehalis Basin	The analysis will evaluate the relationship between contemporary forest practices and streamflow in the Chehalis Basin.	This analysis could inform future forest practices to improve fish and aquatic habitat and water quality; however, until the	2021

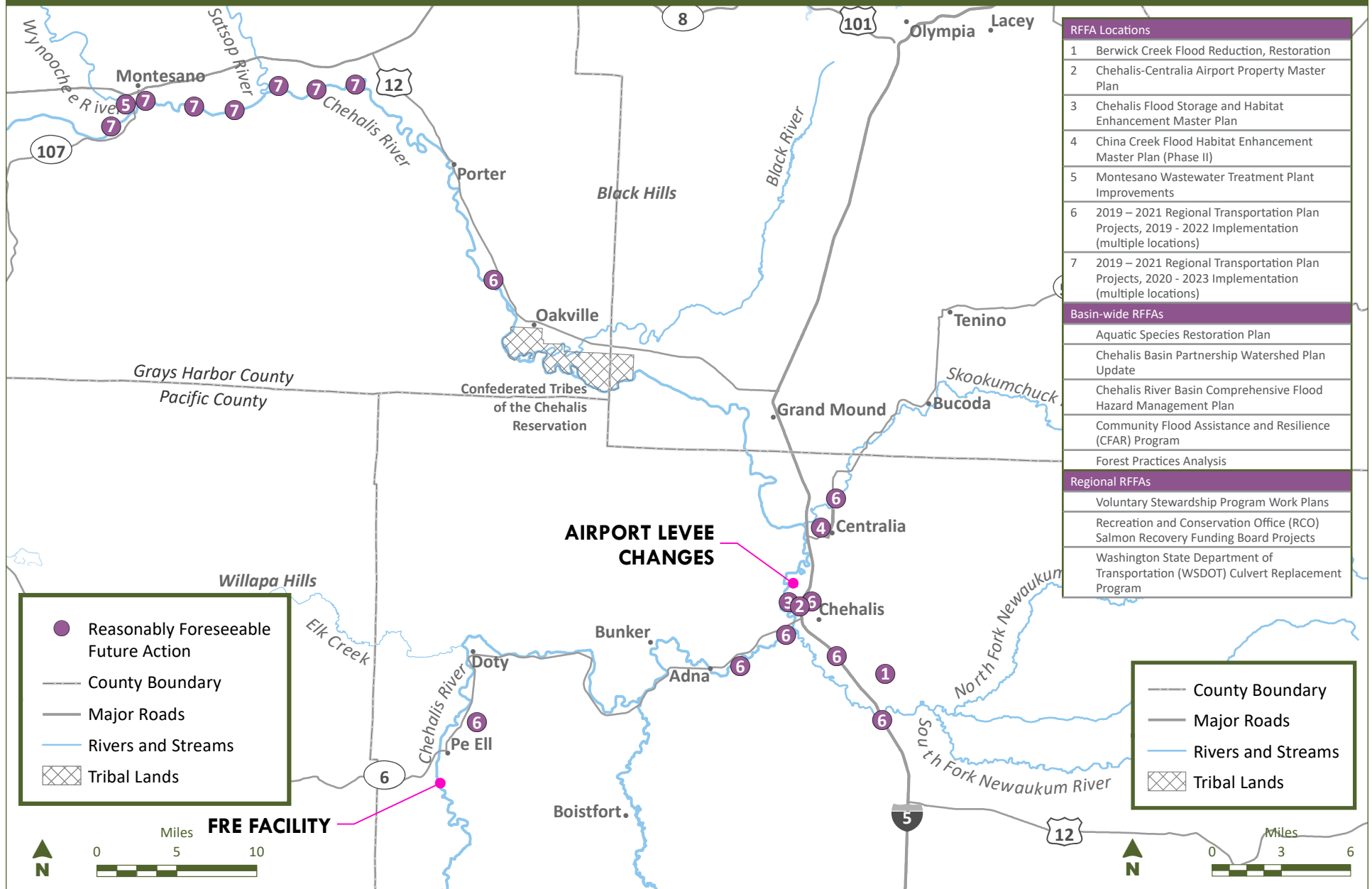
NO.	PROJECT	PROPONENT	LOCATION	DESCRIPTION	CONTRIBUTING ACTIVITY	SCHEDULE OR STATUS
		Resources and Office of the Chehalis Basin			analysis is complete, not enough is known at this time to identify a cumulative contributing activity.	
10	Montesano Wastewater Treatment Plant (WWTP) Improvements	City of Montesano	Southwest Montesano on Wynoochee River north of confluence with Chehalis River	Addressing Wynoochee River channel migration threatening integrity of WWTP; streambank protection and stabilization to re-direct river away from treatment plant as well as aquatic habitat improvements.	Avoidance of further channel migration and potential sewage from WWTP entering waterbodies help to protect water quality in this area; fish habitat improvements from natural river stabilization methods.	Ongoing
11	Recreation and Conservation Office (RCO) Salmon Recovery Funding Board Projects	RCO, Chehalis Basin Lead Entity	Statewide	RCO provides grants for select projects and monitoring efforts that protect or restore salmon habitat.	Continued implementation of these projects over current projections of 20 years (through 2040) is anticipated to result in positive outcomes for fish habitat in the Chehalis Basin.	Ongoing
12	Voluntary Stewardship Program Work Plans (<i>Implementation</i>)	Washington State Conservation Commission and Lewis, Thurston, and Grays Harbor counties	Lewis, Thurston, and Grays Harbor counties	Counties that opt into the Voluntary Stewardship Program use a watershed-based, incentive-based process to protect critical areas and promote agricultural viability, as an alternative to typical critical areas regulations. While landowner participation is purely voluntary, failure to meet the work plan goals would trigger a regulatory approach to protecting critical areas under the Growth Management Act.	Implementation of work plans through 2080 (unless a county fails out of the Voluntary Stewardship Program) is anticipated to maintain or enhance existing critical area functions on agricultural lands, including fish and wildlife habitat, wetlands, and frequently flooded areas, based on the plans' goals to maintain or increase forest and native vegetation cover on agricultural lands in floodplains and maintain or reduce acreage of impervious surfaces.	Ongoing
13	Washington State Department of Transportation (WSDOT) Culvert Replacement Program	WSDOT	Statewide	WSDOT is required to correct 818 WSDOT-owned culverts in western Washington. Culvert corrections will be prioritized by those projects that provide the highest benefit to fish.	This program is anticipated to result in positive outcomes for fish habitat.	By 2030
14	2019 – 2021 Regional Transportation Plan	Southwest Washington Regional Transportation Planning Organization – WSDOT Southwest Region and local jurisdictions	Lewis, Grays Harbor, Pacific, Wahkiakum, and Cowlitz counties	The regional transportation plan identifies urban and rural projects from local agencies' comprehensive transportation programs that are ready for implementation in 2019 to 2022 for which federal funding has been secured, are WSDOT projects, or are regionally significant with secured funds from any source.	<p>The regional transportation plan includes the following transportation improvement projects, which could include benefits to fish habitat and passage:</p> <ul style="list-style-type: none"> a. SR 6/South Branch Fronia Creek and Fronia Creek - Fish Passage (north of Pe Ell): 2019 b. SR 6/Two Tributaries to Chehalis River - Fish Passage (downstream of Mill Creek confluence): 2019 c. US 12/Fish barrier removal projects Unnamed Tributary to Wynoochee River <p>Other projects identified in the Proposed Action study area include the following projects that may include contributing construction activities:</p> <ul style="list-style-type: none"> d. SR 6/Mill Creek Bridge - Replace Bridge: 2022 to 2024 e. SR 6/Chehalis River Bridge to I-5 – ADA: 2020 f. SR 6/Chehalis River Riverside Bridge - Deck Overlay g. I-5/Chamber Way - Interchange Improvements h. I-5 Over Railroad Bridge - Replace Expansion Joints: 2023 to 2024 i. I-5/Rush Road Interchange - Interchange Improvements: 2019 j. SR 507/I-5 to Skookumchuck River Bridge Including Couplet - ADA Upgrades: 2020 to 2021 	2019 to 2024

NO.	PROJECT	PROPONENT	LOCATION	DESCRIPTION	CONTRIBUTING ACTIVITY	SCHEDULE OR STATUS
					k. SR 507/Skookumchuck River Bridge - Replace Bridge: 2020 to 2024 l. SR 507/Skookumchuck River to Thurston County Line - ADA Upgrades: 2019-2021 m. US 12/Cedar Creek Bridge - Scour Repair: 2021-2024	
15	2019 – 2022 Regional Transportation Plan	Southwest Washington Regional Transportation Planning Organization – WSDOT Southwest Region and local jurisdictions	Lewis, Grays Harbor, Pacific, Wahkiakum, and Cowlitz counties	The regional transportation plan identifies urban and rural projects from local agencies’ comprehensive transportation programs that are ready for implementation in 2020 to 2023 for which federal funding has been secured, are WSDOT projects, or are regionally significant with secured funds from any source.	<p>The regional transportation plan includes the following transportation improvement projects, which could include benefits to fish habitat and passage:</p> <ul style="list-style-type: none">a. US 12/Fish barrier removal project at unnamed tributary to Vance Creekb. US 12/Fish barrier removal project at Wenzel Sloughc. US 12/Fish barrier removal project at Unnamed Stream 991528, 2024d. US 12/Fish barrier removal project at Camp Creeke. SR 107/Preachers Slough Road culvert replacement, 2024 <p>Other projects identified in the Proposed Action study area include the following projects that may include contributing construction activities:</p> <ul style="list-style-type: none">f. US 12/Satsop River Bridge improvements, 2024g. US 12/SR 107 Interchange - Railroad Crossing Improvementsh. US 12/Wynoochee River Bridge - Bridge Deck Repair	

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Figure 2-1

Map of Locations of Reasonably Foreseeable Future Actions



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Note: See Table 2-6 for a description of each action.

3 CUMULATIVE IMPACTS BY ELEMENT OF THE ENVIRONMENT

This section evaluates the potential cumulative impacts on environmental resources analyzed in the EIS. This analysis discusses the potential impacts from the Proposed Action that could result in significant adverse impacts and could contribute to cumulative impacts. If the Proposed Action would not result in adverse impacts in a particular resource area, then it would not have the potential to contribute to cumulative impacts in that resource area, and no cumulative analysis for the resource area is warranted. There is a possibility that, while the Proposed Action would result in a minor impact on a resource, cumulative actions could cause substantial impacts.

This section includes a description of the following for each resource with the potential to have cumulative impacts:

- Review of probable significant adverse impacts on the resource from the Proposed Action
- The reasonably foreseeable future actions and the specific individual impacts on the resource that may contribute to cumulative impacts
- Any cumulative impacts

While the analysis focuses on the resources that would be substantially affected by the Proposed Action, consideration of the overall health of a resource was also made to identify particularly vulnerable resources.

3.1 Water

Water refers to water quantity, water quality, and water uses and rights in the Chehalis River and its tributaries, and in groundwater. The water study area includes the Chehalis River and its floodplain within the upper Chehalis Basin and the lower portions of major tributaries, such as the South Fork Chehalis, Newaukum, Skookumchuck, and Black rivers as well as smaller tributary streams.

3.1.1 Review of Impacts from the Proposed Action

The construction of the FRE facility would have moderate to minor impacts on surface and groundwater quantity and water uses and rights. Construction and operation of the Airport Levee Changes would have moderate to minor impacts on surface and groundwater quality and quantity. Significant adverse environmental impacts on water quality from operation of the FRE facility include the following:

- Increased temperatures exceeding water quality criteria in the Chehalis River and its tributaries in the temporary reservoir and downstream because of a loss of riparian cover and stream shading.

- Decreases in dissolved oxygen levels below the minimum water quality criteria in the Chehalis River within the temporary reservoir in summer.
- Exceedances of turbidity water quality criteria after major floods or larger events when the reservoir is inundated and water is released, and during subsequent storms or high flows, which could resuspend sediment stored in the riverbed.
- The FRE facility and temporary reservoir could significantly affect an existing water supply line for the Town of Pe Ell water supply line from Lester Creek.

Mitigation is proposed for the Applicant to develop and implement a Surface Water Quality Mitigation Plan and other management and mitigation plans to address these impacts, but at this time it is not certain the plans are technically feasible or economically practicable.

3.1.2 Contributing Activities and Cumulative Impacts

In the vicinity of the FRE facility and temporary reservoir and the Chehalis River where significant impacts are anticipated, managed forest practice operations, mainly commercial logging, would continue that are regulated through the Forest Practices Act (Chapter 76.09 RCW). Recent studies show that the current Forest Practices Rules (Title 222 WAC) limiting harvesting activities or improving conditions (i.e., existing forest roads) on unstable landforms may be effective at reducing mass wasting during large storm events (Dube 2016). It is anticipated that erosion and sediment delivery impacts on water quality from timber harvest activities would be minimized through the application of Forest Practices Act regulations. The Forest Practices analysis described in Table 2-6 is planned to further evaluate impacts of forest practices on water quality and streamflow. See Section 3.2 for additional discussion on the potential for cumulative impacts related to soils.

In the airport levee area, future development associated with implementation of the Chehalis-Centralia Airport Property Master Plan is anticipated to result in wetland impacts and increased impervious surface area, which could contribute to water quality, quantity, or water use impacts. However, these impacts would be minimized through compliance with applicable local, state, and federal permit requirements.

Implementation of restoration or stewardship activities under ASRP, the Chehalis Basin Partnership Watershed Plan Update, and Voluntary Stewardship Program would likely result in improved water quality conditions for in-stream temperature, dissolved oxygen levels, and turbidity throughout the Chehalis Basin.

The Proposed Action, in combination with the activities described above, would contribute to cumulative impacts on water resources.

3.2 Earth

The earth analysis includes geology and geomorphology. Geology includes the study of the materials that make up the earth such as soils, and the processes that act upon them such as earthquakes.

Geomorphology includes the study of the earth's surface processes including landslides, erosion, sediment transport, and channel migration in streams and rivers.

The earth study area includes the FRE facility area including the temporary reservoir, quarry sites and access roads, the airport levee area, and the Chehalis River from river mile (RM) 117 to RM 33.3. The analysis also includes slopes adjacent to the temporary reservoir.

3.2.1 Review of Impacts from the Proposed Action

The construction and operation of the Proposed Action would have moderate to minor impacts from erosion and sedimentation from clearing of the temporary reservoir area, use of unpaved roads during construction, and soil and rock excavation for the foundations of the FRE facility, including spoils from the temporary bypass tunnel. Local alteration to sediment transport would also occur when river flow is routed through the bypass tunnel. Additional moderate impacts would occur during operation of the Proposed Action from changes in channel migration and channel incision or changes at tributary junctions downstream of the confluence with the South Fork Chehalis River.

The following probable significant adverse impacts would occur as part of construction and operation of the FRE facility:

- Alteration of the river channel at the FRE facility site.
- A breach of the FRE structure when water is impounded in the temporary reservoir. The risk of a breach is extremely low, even during a major earthquake, because the FRE structure would be designed to contain water under current dam design standards. However, if a breach of the FRE facility did occur when the temporary reservoir was holding water, the impact would be a significant and unavoidable adverse environmental impact.
- Water quality impacts, including fine sediment input, due to higher turbidity levels downstream of the FRE facility than upstream when the temporary reservoir drains.
- Water quality impacts due to increased turbidity from deep and shallow landslides in the temporary reservoir caused by fluctuating water level.
- Changes to sediment transport and substrate in the river channel within the temporary reservoir.
- Decreased large woody material levels within and downstream of the FRE facility to the South Fork confluence.
- Decreased channel formation downstream of the FRE facility to the South Fork confluence from reduced flow, large woody material, and sediment.

3.2.2 Contributing Activities and Cumulative Impacts

In the vicinity of the FRE facility and temporary reservoir and the Chehalis River, managed forest practice operations would continue under the Forest Practices Act regulations. It is anticipated that erosion and potential sediment delivery to waterbodies from timber harvest activities would be minimized through the application of Forest Practices Act regulations.

The potential for impacts on people, structures, and infrastructure from a FRE facility breach at the same time the reservoir is holding water would be expected to increase as new development occurs within Pe Ell, Centralia, and Chehalis and in areas downstream of the FRE facility along the Chehalis River mainstem. Development is expected to increase in urban, agricultural, and rural areas. Indirect impacts from the Proposed Action could include the potential for increased development in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Action (see Section 3.7). This increase in development would result in increased impacts on environmental health and safety, life, and property in the unlikely event of a breach when water is impounded.

Downstream of the FRE facility and in the airport levee area, stewardship activities on agricultural lands under the Voluntary Stewardship Program, Berwick Creek Flood Reduction and Restoration, Chehalis Flood Storage and Habitat Enhancement Master Plan, China Creek Flood Habitat Enhancement Master Plan, and any activities to reconnect off-channel and floodplain habitats under the ASRP within the Chehalis River mainstem would provide environmental services that could help reduce turbidity and fine sediment deposition. Therefore, these activities are not likely to contribute to cumulative impacts on fine sediment loading and turbidity.

The Proposed Action, in combination with the activities described above, would contribute to cumulative impacts on earth.

3.3 Fish Species and Habitats

Fish species and habitats refers to aquatic species including fish, shellfish, aquatic macroinvertebrates, and marine mammal species in the study area, instream fish habitat, and nearby freshwater floodplain wetlands that are connected to the Chehalis River and allow fish to access the habitat from the river. The study area for fish species and habitats includes the area of the proposed FRE facility, the area of predicted maximum inundation for the temporary reservoir, and the area downstream of the proposed FRE facility including areas near the airport levee.

3.3.1 Review of Impacts from the Proposed Action

The construction and operation of the Proposed Action would have moderate to minor impacts on fish species habitat upstream of the temporary reservoir. Construction of the Proposed Project would have a moderate adverse impact on resident fish because they could continue to use habitat upstream and

downstream of the construction site; however, they would still be affected by impacts on the aquatic habitat and disconnection from habitats on either side of the construction site.

Fish passage during construction would significantly affect the survivability of Chinook salmon, coho salmon, steelhead, lamprey, and other native fish. Spring-run Chinook salmon, fall-run Chinook salmon, coho salmon, and steelhead would be significantly impacted by construction and operation of the FRE facility. The following probable significant adverse impacts would occur as part of construction and operation of the FRE facility:

- Construction Impacts on Aquatic Habitats:
 - Dewatering and diversion of the river around the construction site and removal of nearly all trees in 600 acres of the temporary reservoir area would reduce water quality and critical riparian habitat for fish species.
 - Vegetation removal during construction would degrade the quality of habitat for rearing juvenile salmon and steelhead in the temporary reservoir area.
 - Reduced fish survival from the temporary trap-and-transport system at the FRE facility site to move fish upstream during construction would result in fewer nutrients available from salmon carcasses.
- Construction Impacts on Salmonids:
 - Spring-run and fall-run Chinook salmon would be most affected by a decline in habitat quality in the temporary reservoir area because their spawning is concentrated in this area.
 - Coho salmon and steelhead would be more affected by the trap-and-transport process to move fish above the construction site. These fish migrate and spawn during winter when trapping would be more challenging due to turbid (cloudy) water and high water flows.
 - Fish abundance would reduce significantly for all salmonids during construction.
- Construction Impacts on Other Aquatic Species:
 - Passage upstream and downstream around the FRE facility construction site on the Chehalis River would be limited for non-salmon fish with impacts largely due to uncertainty about transport to upstream habitat. Freshwater shellfish and aquatic macroinvertebrates would be impacted by in-water construction activities because of their inability to move away from the activity and their reliance on specific substrate types, water velocity, and water quality to survive.
 - The reduction of salmon and steelhead, in particular spring-run Chinook salmon, from the Chehalis River, would present a moderate adverse impact on Southern Resident killer whales, with a minor adverse impact on other marine mammals because they have a more diverse prey base.

- Operation Impacts on Aquatic Habitats:
 - Impacts on aquatic habitat would result from physical changes to river flows, water quality, stream channel width, sediment transport, large wood inputs and transport, riparian vegetation, and floodplain off-channel areas and wetlands.
 - Between floods, habitat in the temporary reservoir area would be permanently degraded due to tree and wood removal, sedimentation, and the long-term effects from flood retention events that inundate (fill) all or portions of the temporary reservoir.
 - Changes in riparian vegetation as a result of tree removal would result in less shade, increased water temperatures, reduced inputs of fish prey such as insects entering the river channel from the riparian zone, and less large wood supplied to the river channel.
 - Sediment deposition between flood retention events, increased bed scour, and a reduction in large wood supply would change the structure and complexity of the river channel habitat and would reduce the quality of spawning and rearing habitat for salmon and steelhead.
 - During flood retention events, aquatic habitat would be rapidly converted from stream-type to lake-type habitat for up to 35 days, which would lead to loss of riparian zone function, elimination of salmon spawning habitat, an increase in deepwater habitat that would be unsuitable for some stream-adapted fish species, an increase in turbidity, a loss of food supply for fish, and a loss of salmonid and other species' eggs due to suffocation.
 - Aquatic habitat downstream would have a reduction in large wood would change and simplify the structure of in-channel habitat, reduce pool areas and shelter for fish from flows and predators.
 - A reduction in wood supply would result in more bed scour, reduced habitat complexity, and less spawning area for fish.
 - Water temperatures would increase downstream of the FRE facility for 20 miles.
 - Controlling the peak flows associated with major or larger floods would reduce the forces and inundation extents downstream and eliminate channel-forming flows.
 - Flushing of some off-channel and floodplain areas may no longer occur, and beneficial changes to the aquatic habitat that only occur with major or larger floods would be eliminated.
- Operation Impacts on Salmonids:
 - Operation of the FRE facility would have significant adverse impacts on salmon and steelhead in both the Above Crim Creek Subbasin and the Rainbow Falls to Crim Creek Subbasin. In addition to reduced abundance of salmon species, operation of the FRE facility is expected to reduce the species' productivity, diversity, and spatial structure.
 - The Proposed Action would decrease the spatial structure of populations in the basin by eliminating spring-run Chinook salmon, coho salmon, and steelhead populations in the Rainbow Falls to Crim Creek Subbasin by late-century; significantly impacting spring-run Chinook salmon in the Above Crim Creek Subbasin in both the mid-century and late-century

- periods; and impacting fall-run Chinook salmon in the Above Crim Creek and Rainbow Falls to Crim Creek subbasins in both the mid-century and late-century periods.
- The reduction or loss of salmon or steelhead from one population (subbasin) would also result in a loss of genetic diversity within and among populations of each species across the Chehalis Basin.
 - Operation Impacts on Other Aquatic Species:
 - Permanent adverse impacts on native fish would occur within the temporary reservoir area and downstream from the FRE facility to the confluence with Elk Creek due to lower summer flows caused by climate change and warmer water temperatures that would be worsened by the FRE facility.
 - Spawning habitat for most native fish, including Pacific lamprey, largescale sucker, mountain whitefish, and speckled dace, would be reduced or eliminated, summer rearing area would be greatly reduced, and non-native predators like smallmouth and largemouth bass may expand their range year-round.
 - Over the long term, the FRE facility would create a significant to moderate adverse impact on aquatic macroinvertebrates due to loss of habitat, loss of food sources, and changes to water temperature, flow, and substrates.

Mitigation is proposed for the Applicant to develop and implement a Fish and Aquatic Species and Habitat Plan and other management and mitigation plans to address these impacts, but at this time it is not certain the Fish and Aquatic Species and Habitat Plan is feasible.

3.3.2 Contributing Activities and Cumulative Impacts

Indirect impacts from the Proposed Action include the potential for increased development in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Action (see Section 3.7). The potential for future expansion of agriculture, rural, residential, and commercial development in the floodplain could contribute impacts on fish habitat and species from pollution, habitat degradation, and habitat disconnection.

A number of projects throughout the Chehalis Basin are anticipated to improve conditions for fish species and aquatic habitats in the study area. These projects include the ASRP, Berwick Creek Flood Reduction and Restoration, Chehalis Basin Partnership Watershed Plan Update, Chehalis Flood Storage and Habitat Enhancement Master Plan implementation, China Creek Flood Habitat Enhancement Master Plan, RCO Salmon Recovery Funding Board Projects, Voluntary Stewardship Program implementation, and WSDOT culvert replacement and fish barrier removal projects. While operation of these projects is anticipated to improve conditions for fish habitat and species, construction-related activities could contribute to short-term cumulative impacts. These activities could involve water diversions, cut and fill, vegetation disturbance, and elevated sound and vibration. These could lead to temporary increases in turbidity or sedimentation, fish injury or stranding, or disruption of fish behavior.

The Proposed Action, in combination with the activities described above, would contribute to cumulative impacts on aquatic species and habitats.

3.4 Wildlife Species and Habitats

Wildlife species and habitats refers to wildlife species including amphibians, reptiles, birds, terrestrial insects, mollusks, and mammals, and natural habitats within the study area, which include different combinations of shrubs, trees, and other vegetation that provide habitat for wildlife species. The study area for wildlife species and habitats includes the area of the proposed FRE facility, the area of predicted maximum inundation for the temporary reservoir, the floodplain downstream of the proposed FRE facility, and the area of the proposed Airport Levee Changes.

3.4.1 Review of Impacts from the Proposed Action

The construction and operation of the Proposed Action would have moderate to minor impacts on wildlife habitat related to noise, changes in wetland vegetation in the vicinity of the Airport Levee Changes, reductions in water quality downstream of the FRE facility, fragmentation of migratory routes through the temporary reservoir area, and reduction in recruitment of cottonwood downstream of the FRE facility.

The following probable significant adverse impacts would occur as part of construction and operation of the FRE facility, specifically associated with the temporary reservoir inundation area:

- Construction:
 - Removal of tree cover in the temporary reservoir footprint in large areas (approximately 600 acres) of upland, riparian, and wetland habitats; tree removal would occur in stages over several years prior to inundation of the reservoir; riparian tree removal would occur in later stages of tree removal.
 - Species mortality from loss of breeding, foraging, resting, and overwintering habitat associated with tree removal and decrease in habitat functions from loss of tree cover in the temporary reservoir footprint.
 - Noise and disturbance of marbled murrelets from FRE facility construction.
- Operation:
 - Permanent and reoccurring impacts on 847 acres of vegetation communities including upland, wetland (89 Category II and III wetlands, more than 10 acres), and riparian areas during recurring inundation events.
 - Species mortality associated with permanent habitat impacts and reoccurring impacts on species and habitats during inundation. Low-mobility species (e.g., amphibians) would be more vulnerable than more mobile species (e.g., many bird and large mammal species).
 - Long-term changes to quality and quantity of downstream aquatic habitats from reduced flooding hydrology that creates side-channel, oxbow, and other aquatic habitats.

Mitigation is proposed for the Applicant to develop and implement a Vegetation Management Plan and Wildlife Species and Habitat Plan, Riparian Habitat Mitigation Plan, and other management and mitigation plans to address these impacts, but at this time it is not certain the plans are technically feasible or economically practicable.

3.4.2 Contributing Activities and Cumulative Impacts

Indirect impacts from the Proposed Action include the potential for increased development in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Action (see Section 3.7). The potential for future expansion of agriculture, rural, residential, and commercial development in the floodplain could contribute impacts on wildlife habitat and species from pollution, habitat degradation, and habitat disconnection.

In the vicinity of the FRE facility and temporary reservoir, continued surrounding forest practice activities would result in the removal of tree cover and impacts on upland wildlife species and habitat. These activities could contribute to cumulative impacts in the vicinity of the temporary reservoir and surrounding forest resource lands.

A number of projects throughout the Chehalis Basin are anticipated to improve conditions for wildlife species and terrestrial habitats. These projects include the ASRP, Berwick Creek Flood Reduction and Restoration, Chehalis Basin Partnership Watershed Plan Update, Chehalis Flood Storage and Habitat Enhancement Master Plan implementation, China Creek Flood Habitat Enhancement Master Plan, and Voluntary Stewardship Program implementation. While operation of these projects is anticipated to improve conditions for wildlife habitat and species, construction-related activities could contribute to short-term cumulative impacts. River restoration activities under the ASRP upstream of the FRE facility would improve in-channel and floodplain habitat conditions; therefore, these activities would not contribute to cumulative impacts on wildlife species and habitats. Construction of these activities could involve water diversions, cut and fill, vegetation disturbance, and elevated sound and vibration. This could lead to temporary increases in turbidity or sedimentation, or disruption of wildlife.

The Proposed Action, in combination with the activities described above, would contribute to cumulative impacts on wildlife species and terrestrial habitats.

3.5 Wetlands

Wetlands refers to the zone between land and water that provides important ecosystem functions by improving water quality, providing fish and wildlife habitat, protecting lands from flooding, stabilizing shorelines, and recharging groundwater. The wetlands analysis also considers waterbodies such as streams and rivers that can be permanent or temporary and may or may not have fish. The wetlands study area includes the proposed FRE facility (including roads, quarries, construction, and maintenance areas), the temporary reservoir area expected to be inundated in a catastrophic flood, plus an additional

500-foot area to identify wetlands near the inundation area, and the floodplain area downstream of the proposed FRE facility including areas near the airport levee.

3.5.1 Review of Impacts from the Proposed Action

The construction and operation of the Proposed Action would have moderate to minor impacts from reduced water quality from recurring loss of canopy cover, and changes in hydrology, groundwater recharge, and vegetation that would not eliminate wetlands or change wetland status and function downstream of the FRE facility.

The following probable significant adverse impacts would occur as part of construction and operation of the FRE facility and Airport Levee Changes:

- Construction:
 - Impacts on wetlands (6.5 acres) and wetland buffer habitats within Zones 1 and 2 of the temporary reservoir area (213.8 acres) due to removal of trees during construction of the FRE facility.
 - Impacts along 11.44 miles of rivers/streams in the temporary reservoir and on 18.2 miles of stream buffers (counting length along each bank) and 312.8 acres of stream buffers from removal of trees during construction of the FRE facility.
 - Permanent impacts on Category II and III wetlands (6.6 acres) and wetland buffer habitats (44.2 acres) for construction of the Airport Levee Changes.
 - Permanent fill of 0.32 acre of the Chehalis River at the FRE facility site and disturbance or elimination of 10.79 acres of stream buffers during construction.
 - Impacts on water quality, quantity, and stream buffer function from removal of tree cover in stream buffers (312.8 acres) in the temporary reservoir during construction.
- Operation:
 - Permanent and recurring impacts on 85 Category II and III wetlands (9.76 acres) and wetland buffer habitats (303.15 acres) during inundation of the temporary reservoir.
 - Permanent and recurring impacts on 116 regulatory waterbodies and stream buffers (25.5 miles counting length along each bank and 441.3 acres) from sediment deposition, channel widening, and channel migration during and following inundation in the temporary reservoir.
 - Impacts on mainstem Chehalis River between Pe Ell and the South Fork Chehalis River due to reduced peak flows from operation of the FRE facility. Sediment and wood transport would be reduced and similarly reduce channel formation, leading to a narrower and simpler channel over time.

Mitigation is proposed for the Applicant to develop and implement a Wetlands and Wetland Buffers Mitigation Plan, Stream and Stream Buffers Mitigation Plan, and other management and mitigation

plans to address these impacts, but at this time it is not certain the plans are technically feasible or economically practicable.

3.5.2 Contributing Activities and Cumulative Impacts

In the vicinity of the FRE facility and temporary reservoir, continued surrounding forest practice activities would result in the removal of tree cover and impacts on wildlife species and habitat. These activities could contribute to minor cumulative impacts in the vicinity of the temporary reservoir and surrounding forest resource lands. It is anticipated that sediment delivery impacts on water quality from timber harvest activities would be minimized through the application of Forest Practices Act regulations.

In the vicinity of the airport levee, future development associated with implementation of the Chehalis-Centralia Airport Property Master Plan would likely result in additional wetland impacts and increased impervious surface area that could contribute to water quality impacts. However, these impacts would be minimized through compliance with applicable local, state, and federal permit requirements and compensatory mitigation.

River restoration activities under the ASRP upstream of the FRE facility would improve in-channel and floodplain habitat conditions; therefore, these activities would not contribute to cumulative impacts on wetlands and associated waterbodies.

The Proposed Action, in combination with the activities described above, would contribute to cumulative impacts on wetlands.

3.6 Tribal Resources

For the purposes of this document, tribal resources refers to the collective rights and access to traditional areas and times for gathering resources associated with a tribe's sovereignty or formal treaty rights. These resources may include plants, wildlife, or fish used for commercial, subsistence, and ceremonial purposes. Tribal resources also include cultural, historic, spiritual, and archaeological places and artifacts. The study area for tribal resources includes the FRE facility and associated areas including the temporary reservoir and upstream tributaries, and the area downstream of the FRE facility including the airport levee area.

3.6.1 Review of Impacts from the Proposed Action

Construction and operation of the Proposed Action could result in impacts on tribal resources in the following ways:

- Restricting or reducing access of tribal members to tribal resources
- Altering vegetation in the temporary reservoir and in riparian and flood-affected areas due to periodic inundation, which could affect water, habitat, fish, and wildlife
- Loss of fish habitat within the Chehalis River, including loss of salmon spawning habitat

- Loss of fish that would otherwise be available for tribal harvest, as well as wildlife and plants that are identified as a tribal resource
- Impacts on cultural and historic resources important to tribes (see Section 3.9)

Resource-specific discipline reports identify probable significant impacts on fish and wildlife species, aquatic and terrestrial habitat, water resources, and geomorphology that could impact tribal resources, including wildlife, vegetation, and fish. The *Cultural Resources Discipline Report* discusses cultural and historic resources.

3.6.2 Contributing Activities and Cumulative Impacts

Making a determination of the probable significance of adverse impacts or cumulative impacts related to treaty-reserved rights is not part of this EIS.

Contributing activities and cumulative impacts discussed in Sections 3.1 through 3.5 for impacts on various natural resources, including plants, wildlife, fish, and shellfish, would contribute to cumulative impacts on tribal resources. Projects that could benefit fish and wildlife habitat include the ASRP, Berwick Creek Flood Reduction and Restoration, Chehalis Basin Partnership Watershed Plan Update, Chehalis Flood Storage and Habitat Enhancement Master Plan implementation, China Creek Flood Habitat Enhancement Master Plan, and Voluntary Stewardship Program implementation. Contributing activities and cumulative impacts discussed in Sections 3.7 through 3.12 for impacts on the built environment, including land use, recreation, cultural resources, environmental health and safety, environmental justice, and public services and utilities, would contribute to cumulative impacts on tribal resources. These contributing activities include the following:

- Fish species and habitat impacts resulting from the potential for increased development in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Action
- Temporary fish species and habitat impacts resulting from the construction of floodplain and habitat restoration projects (see Section 3.3.2)
- Wildlife habitat and species impacts resulting from continued forest practice activities

The Proposed Action, in combination with the activities described above, could contribute to cumulative impacts on tribal resources.

3.7 Land Use

Land use refers to how land is developed for various human uses or preserved for natural purposes. Land use is managed through regulations, land use plans, and policies such as comprehensive plans, shoreline master programs, floodplain regulations, and critical areas ordinances. The study area for land use is largely along the mainstem Chehalis River and its floodplains and tributaries from south of Pe Ell in Lewis County, to Porter in Grays Harbor County. The study area also includes the proposed FRE facility

and temporary reservoir as well as the area associated with construction equipment and materials, quarries, and construction access routes.

3.7.1 Review of Impacts from the Proposed Action

The construction and operation of the Proposed Action would have significant to minor impacts on shoreline ecological functions and critical areas as a result of ongoing vegetation removal and periodic inundation within the temporary reservoir extent, land use changes, and land use conversion and loss of commercial forestry near the FRE facility. A limited amount of agricultural land near the airport levee would be converted to roadway or levee. Indirect land use impacts could include the potential for increased development in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Action. In the future, there is the possibility that the full extent of the buildable area could be utilized if it were removed from the threat of a catastrophic flood.

The following probable significant adverse impacts would occur as part of construction and operation of the FRE facility:

- Inconsistency with land use plans, policies, and regulations for construction of the FRE facility due the impacts on shoreline ecological functions in the study area and within the temporary reservoir extents; impacts on riparian areas, habitat, and critical areas from the FRE facility would be inconsistent with land use policies and regulations to maintain no net loss of ecological function
- Inconsistency with the current forest resource land use and zoning designations as a result of land use changes from commercial forestry to the FRE facility and temporary reservoir

Compliance with laws and implementation of mitigation measures would reduce and compensate for land use inconsistencies (through a rezone or conditional use permit) and impacts on ecological functions. Mitigation is proposed for the Applicant to develop and implement management and mitigation plans to address impacts on ecological functions, but at this time it is not certain the plans are technically feasible or economically practicable.

3.7.2 Contributing Activities and Cumulative Impacts

Indirect impacts from the Proposed Action include the potential for increased development in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Action. New construction in the study area is expected to be concentrated in UGAs and incorporated areas, such as Chehalis and Centralia. Potential for future expansion of agriculture, rural, residential, and commercial development in the floodplain could contribute cumulative impacts on riparian areas, habitat, and critical areas. However, compliance with permit requirements and implementation of required mitigation measures are anticipated to minimize these impacts. While the potential expansion of development within the floodplain would increase the intensity or density of land use from current

conditions, consistency with comprehensive plans and zoning would help decrease the potential for adverse impacts.

A number of projects throughout the Chehalis Basin are anticipated to address critical areas and land use, including Chehalis River Basin Comprehensive Flood Hazard Management Plan, Community Flood Assistance and Resilience (CFAR) Program, and Voluntary Stewardship Program Work Plans.

The Proposed Action, in combination with the activities described above, would contribute to cumulative impacts on land use.

3.8 Recreation

Recreation provides people with the opportunity to engage with and enjoy the natural and built environment. In the Chehalis Basin, outdoor recreation is an important aspect of life, and it provides economic benefits to communities like Chehalis, Centralia, and Pe Ell. Recreational opportunities include fishing, boating (including kayaking and whitewater boating), hiking, hunting, birdwatching, camping, and agritourism. Recreation resources are governed by state, regional, and local laws, plans, and policies. The study area for recreation consists of areas that are used for recreation near the FRE facility and airport levee sites and in the Chehalis Basin that could be directly or indirectly affected by the construction or operation of the Proposed Action. This includes the area associated with the FRE facility site and construction activities and the area of maximum inundation extent for the temporary reservoir.

3.8.1 Review of Impacts from the Proposed Action

The construction and operation of the Proposed Action would have moderate to minor impacts from closure of the Pe Ell South Permit to recreational activities, reduction in recreational experience caused by noise from construction of the FRE facility, and temporary disruption to the Riverside Golf Course and RV Park associated with noise during the construction of the Airport Levee Changes.

The following significant adverse impacts would occur as part of construction and operation of the FRE facility:

- Permanent loss of a 13.8-mile reach for kayaking and 12.8 miles of riverbank fishing on the Chehalis River within the FRE facility site and temporary reservoir
- Impacts on recreational fishing by reducing the number of fish available to be caught
- Significant impacts on fish from the Chehalis River headwaters to Rainbow Falls could impact recreational fishing by reducing the number of fish available to be caught.

Mitigation is proposed for the Applicant to develop and implement a Recreation Mitigation Plan and other management and mitigation plans to address these impacts, but at this time it is not certain the plans are technically feasible or economically practicable.

3.8.2 Contributing Activities and Cumulative Impacts

A number of projects throughout the Chehalis Basin are anticipated to improve conditions for fish and wildlife species and habitats which is likely to impact recreational activities like fishing, hunting, and hiking. These projects include the ASRP, Berwick Creek Flood Reduction and Restoration, Chehalis Basin Partnership Watershed Plan Update, Chehalis Flood Storage and Habitat Enhancement Master Plan implementation, China Creek Flood Habitat Enhancement Master Plan, RCO Salmon Recovery Funding Board Projects, Voluntary Stewardship Program implementation, and WSDOT culvert replacement and fish barrier removal projects. While operation of these projects is anticipated to improve conditions for fish habitat and species, construction-related activities could contribute to short-term cumulative impacts.

Future development activities associated with the actions identified in Table 2-6 are not anticipated to decrease or result in the loss of recreational access in the area. Development activities under the Chehalis Flood Storage and Habitat Enhancement Master Plan may increase recreational access in some areas. Therefore, these activities would not contribute to cumulative impacts on recreation.

The Proposed Action, in combination with the activities described above, would contribute to cumulative impacts on recreation.

3.9 Cultural Resources

Historic and cultural resources include archaeological sites and isolates, historic properties, human remains and cemeteries, and Traditional Cultural Properties. In general, impacts on historic and cultural resources were identified based on the potential for construction or operation to result in their removal, disturbance, grading, burial, erosion, contamination, or other ground-disturbing effects; changes in setting; and temporary and/or permanent exposure to noise, dust, and vibration.

3.9.1 Review of Impacts from the Proposed Action

The U.S. Army Corps of Engineers (Corps) is carrying out Section 106 of the National Historic Preservation Act of 1966 (Section 106) review concurrent with the Proposed Action's compliance with SEPA and NEPA. As a result, cultural resources studies prepared for the Proposed Action are being used to support each of these review processes, and the SEPA process will reflect the outcomes of the Section 106 and NEPA reviews, as they are available. The eligibility of historic and cultural resources sites to be included in the National Register of Historic Places is being discussed through the separate Section 106 process. If eligible, potential impacts will be reviewed, significance determined, and mitigation agreed upon through the Section 106 process. If there are adverse effects on cultural resources, a Memorandum of Agreement would be negotiated among the Corps, Department of Archaeology and Historic Preservation (DAHP), potentially affected Native American tribes, the Applicant, and other Section 106 parties. Construction and operation of the Proposed Action could

affect nine archaeological sites and Traditional Cultural Properties that are potentially eligible for listing on the National Register of Historic Places.

3.9.2 Contributing Activities and Cumulative Impacts

Future development has the potential for ground disturbance, which could impact cultural, archaeological, or historic resources. Future development activities associated with the actions identified in Table 2-6, or associated with the potential for increased development in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Action, could contribute to cumulative impacts on historic and cultural resources. However, it is anticipated that potential impacts on these resources would be mitigated through consultation with the Corps, DAHP, and affected tribes, as applicable to the type of impacted resource and as required by federal and state law.

The Proposed Action, in combination with the activities described above, could contribute to cumulative impacts on cultural resources.

3.10 Environmental Health and Safety

Environmental health and safety concerns include those associated with FRE facility safety, structural or gate failure, potential contamination from hazardous material sites, and flood warning systems.

3.10.1 Review of Impacts from the Proposed Action

The construction of the Proposed Action would have temporary moderate to minor impacts on environmental health and safety due to the potential for introducing high-pH discharges to surface waters during concrete production, potential for workers to come into contact with solvents and petroleum products, potential of spills of oil or hazardous material, or potential for temporary increased traffic during construction.

Although the likelihood is extremely low that a catastrophic FRE facility failure resulting from an earthquake would occur while the reservoir is storing water, there are no mitigation measures that could completely eliminate the possibility of an incident or the resulting impacts. Therefore, the potential for a catastrophic FRE facility failure in the event of an earthquake while the reservoir is full is considered a significant and unavoidable adverse impact on people, infrastructure, and structures downstream.

3.10.2 Contributing Activities and Cumulative Impacts

Development in areas predicted to experience no flooding or less severe flooding could increase. New development in Pe Ell, Chehalis, Centralia, and areas downstream of the FRE facility along the Chehalis River mainstem is expected to occur. Development is expected to increase in urban, agricultural, and rural areas. This would increase the impacts on environmental health and safety, life, and property in the unlikely event of an FRE breach when water is being held in the temporary reservoir. This would also

likely increase the number of hazardous material sites or hazardous materials present in the study area. The Proposed Action, in combination with the activities described above, would contribute to cumulative impacts on environmental health and safety.

3.11 Air Quality and Greenhouse Gases

Air quality refers to the condition of the breathable air and the presence of pollutants. Pollutants can be local and affect a small area, and regional, such as ozone. These are regulated under state and federal laws. Gases that trap heat in the atmosphere are referred to as greenhouse gases (GHGs) because they capture heat radiated from the sun as it is reflected back into the atmosphere, like a greenhouse does. The accumulation of GHGs contributes to global climate change, which affects people and the environment.

3.11.1 Review of Impacts from the Proposed Action

The construction and operation of the Proposed Action would have significant impacts on GHG emissions and carbon monoxide and moderate to minor impacts on other air quality pollutants and diesel particulate matter. Mitigation is proposed to address 100% of GHG emissions from construction and operation of the Proposed Action. With proposed mitigation, no significant adverse impacts on air quality and GHGs would occur as part of construction and operation of the Proposed Action.

3.11.2 Contributing Activities and Cumulative Impacts

Construction of other projects that occur at the same time as the construction of the Proposed Action or within the vicinity of the FRE facility may contribute to cumulative effects. Tree removal from commercial timber harvests within the vicinity of the FRE facility could contribute to increased emissions of GHG, carbon monoxide, and diesel particulate matter. Construction of projects in the Chehalis-Centralia Airport Master Plan that occur at the same time as construction of the Airport Levee Changes could also contribute to the same increased emissions. Increased emissions of GHGs and pollutants could increase as new development occurs within Pe Ell, Centralia, Chehalis, and areas downstream of the FRE facility along the Chehalis River mainstem. Development is expected to increase in urban, agricultural, and rural areas.

The Proposed Action, in combination with the activities described above, would contribute to cumulative impacts on air quality.

3.12 Environmental Justice

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The environmental justice analysis considers the potentially significant environmental impacts on all elements of the environment and the potential for those impacts to disproportionately affect environmental justice populations.

3.12.1 Review of Impacts from the Proposed Action

The operation of the Proposed Action would have disproportionate impacts on environmental justice populations in the event of a catastrophic FRE facility failure from an earthquake during a time when the reservoir is storing water. While the likelihood of this occurring is extremely low, there are no mitigation measures that could completely eliminate the possibility of an incident or the resulting impacts on environmental justice populations.

3.12.2 Contributing Activities and Cumulative Impacts

The potential for impacts from a breach of the FRE facility while the reservoir would be holding water would be expected to increase as new development occurs within Pe Ell, Centralia, Chehalis, and areas downstream of the FRE facility along the Chehalis River mainstem. Development is expected to increase in urban, agricultural, and rural areas. The Proposed Action, in combination with the activities described above, would contribute to cumulative impacts disproportionately affecting environmental justice populations.

3.13 Noise and Vibration

Noise is unwanted sound that can affect people, fish, and wildlife. Vibration is motion through something solid, like the ground, which can affect living creatures or damage buildings.

3.13.1 Review of Impacts from the Proposed Action

The construction of the Proposed Action would have minor impacts on the environment from noise and vibration associated with truck trips, pile driving, drilling, and blasting at quarry areas and the temporary diversion tunnel. These impacts are below federal thresholds for disturbance to humans and residential uses. No significant impacts from noise and vibration would occur during operation of the Proposed Action.

3.13.2 Contributing Activities and Cumulative Impacts

Development is expected to increase in urban, agricultural, and rural areas. Future development activities associated with the actions identified in Table 2-6 could contribute to cumulative impacts on noise and vibration.

Based on the location and distance from other activities, the Proposed Action, in combination with other development activities, would not contribute to cumulative impacts from noise and vibration.

3.14 Public Services and Utilities

Public services and utilities include basic services and facilities that support development and protect public health and safety. Public services include law enforcement, fire and emergency response services, hospitals, emergency management, solid waste services, and public schools. Utilities include water, water supply, wastewater, electrical power, natural gas, and telecommunications.

3.14.1 Review of Impacts from the Proposed Action

The construction and operation of the Proposed Action would have moderate to minor impacts on traffic on roadways during FRE facility and Airport Levee Changes construction, temporary disruptions of service during utility relocation, and increased energy use for FRE facility operation, resulting in less than 1% increase in overall electrical load for Lewis County Public Utility District.

The FRE facility and temporary reservoir could significantly affect a water supply line for the Town of Pe Ell water supply line from Lester Creek. If the water line requires improvement or relocation and the Applicant does not provide funding for this work, this would be a significant impact to Pe Ell's water service. Mitigation is proposed for the Applicant to work with the City of Pe Ell to study if the line would require moving or improvement to avoid damage from construction or inundation, and would provide funding. Compliance with laws and implementation of mitigation measures would reduce impacts on public services and utilities.

3.14.2 Contributing Activities and Cumulative Impacts

Development is expected to increase in urban, agricultural, and rural areas. Future development activities associated with the actions identified in Table 2-6 could contribute to cumulative impacts on public services and utilities. Development, if it occurred in proximity to the Town of Pe Ell's water supply system, has the potential to affect Pe Ell's water service. Disruption of utilities lines can be predicted and involves coordination with service providers, local agencies, and the entities affected. Therefore, these activities would not likely contribute to cumulative impacts on Pe Ell's water service. Indirect impacts from the Proposed Action include the potential for increased development in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Action. Increased development would increase the demand on existing capacity of public services and utilities. Consistency with comprehensive plans and zoning would ensure that adequate capacity for public services and utilities is available.

The Proposed Action, in combination with the activities described above, would contribute to cumulative impacts on public services and utilities.

3.15 Transportation

The term "transportation" refers to the system of roads, transit routes, railroads, and airport facilities that move people and goods. In the past, flooding in the study area closed roads, rail, and airports for multiple days. Access for local communities, the Chehalis Tribe Reservation, and traffic on I-5 and State Route (SR) 6 was greatly affected.

3.15.1 Review of Impacts from the Proposed Action

The construction of the Proposed Action would have temporary moderate to minor impacts on transportation from increased traffic on local roadways, including SR 6 to Pe Ell and S 3rd Street/Muller

Road. Increased traffic during construction within managed forests could impact streams, wetlands, unstable slopes, and other sensitive sites. Road improvement activities in managed forests would be required to meet Forest Practices Act standards.

No adverse impacts on transportation would occur as part of operation of the Proposed Action.

3.15.2 Contributing Activities and Cumulative Impacts

Construction of other projects that occur at the same time as the construction of the Proposed Action or within the vicinity of the FRE facility may contribute to cumulative effects. Tree removal from commercial timber harvests within the vicinity of the FRE facility could contribute to increased congestion on roadways within the managed forest lands or access roads to Pe Ell and SR 6. Construction of projects in the Chehalis-Centralia Airport Master Plan that occur at the same time as construction of the Airport Levee Changes could also contribute to temporary increases in congestion.

The Proposed Action would result in minor impacts and, together with actions by contributing activities, would contribute to cumulative impacts.

3.16 Visual Quality

Visual quality, or aesthetics, refers to natural and human landscapes and how people see them. It is based on the type of view, such as rural or forested. To evaluate impacts, this EIS analyzes how the Proposed Project would change the landscapes and how many people would be affected by the changes.

3.16.1 Review of Impacts from the Proposed Action

The construction and operation of the Proposed Action would have moderate to minor impacts on visual quality from removal of trees in the temporary reservoir footprint and the change in visual setting from construction of the FRE facility.

No significant impacts on visual quality would occur with the Proposed Action.

3.16.2 Contributing Activities and Cumulative Impacts

The Proposed Action, in combination with the activities described above, would not contribute to cumulative impacts on visual quality.

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