5.8 Cumulative Impacts

This cumulative impacts analysis is prepared in accordance with SEPA (Chapter 43.21C RCW), the SEPA Rules (WAC 197-11-060), and the SEPA Handbook. Additional guidance developed by the Council on Environmental Quality in the handbook entitled *Considering Cumulative Effects under NEPA* (1997) was also considered where SEPA requirements are consistent with requirements of NEPA.

Cumulative impacts are the effects that may result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions (40 Code of Federal Regulations [CFR] 1508.7). "Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7). Generally, an impact can be considered cumulative if: (a) effects of several actions occur in the same locale; (b) effects on a particular resource are similar in nature; and (c) effects are long term in nature.

5.8.1 Past Actions

Beginning in the mid-1850s, various activities, including agriculture, ranching, logging, gravel mining, dredging, and the installation of dams and diversions, have exacerbated flooding, caused channel incision, and degraded aquatic species habitat in the Chehalis Basin.

One of earliest documented floods, occurring in 1887, inundated most of the area between Centralia and Chehalis (*The Chronicle* staff 2007). In the past 60 years, major floods have occurred in eight separate events, with flood levels rising and flood damage in the Chehalis Basin increasing. The 1996, 2007, and 2009 floods are the three largest floods on record and resulted in widespread environmental damage, including threats to public health and safety; losses to homeowners, agriculture, and commercial businesses; damage to public infrastructure; and emotional and psychological costs. The primary cause of flooding in Western Washington has been found to be atmospheric rivers which funnel large quantities of precipitation in a short time span, typically during a period of a few hours to a few days (Neiman et al. 2011). Winter storms associated with atmospheric rivers produce twice the amount of precipitation as storms not associated with atmospheric rivers (Ralph et al. 2008). The influence of urbanization on flooding has generally been muted; overall, residential, commercial, and industrial land use collectively comprise a small portion (7%) of the overall land cover in the Chehalis Basin, and impervious surfaces are less than 2%.

In preparation of one of the actions evaluated in the EIS (Restorative Flood Protection action element), research determined that significant areas of channel incision (down-cutting of the river) and loss of floodplain storage have also occurred in portions of the Chehalis Basin. Channel incision and floodplain forest clearing can reduce floodplain connectivity and capacity for flood storage, as well as influence flood timing and extents (Dixon et al. 2016; Watson et al. 2016). This can result in more rapid downstream conveyance of high flows, which directly affects the magnitude and timing of downstream flooding. In the Chehalis Basin, one of the historical practices contributing to channel incision was the

use of splash dams to transport logs (see Section 3.2.4). Current land use also contributes to continued down-cutting of the river channels in some locations. Legacy agricultural practices of removing wetlands, straightening and armoring riverbanks, and removing floodplain forests increase flooding downstream (see Section 1.2).

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). However, as stated previously under the No Action Alternative, the balance of evidence suggests changes to forest management practices would not reduce the frequency of extreme flooding in a watershed the size of the Chehalis Basin (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). New Forest Practices Rules have been implemented through the Adaptive Management Program; however, there are conflicting conclusions on how effective the current rules are during an extreme storm event, such as the 2007 flood (see Appendix E).

Overall, agricultural and residential uses in the Chehalis Basin have also led to reduced habitat complexity and function over baseline pre-European settlement conditions (Mobrand 2003). Beginning in the mid-1850s, agriculture and ranching, followed by logging in the 1880s, have shaped habitat in a number of ways. These include loss of riparian vegetation, increased erosion, reduced water quality, increased stream temperature, and overall reduced aquatic habitat function. Gravel mining and dredging activities have also led to the loss of wetlands and tidelands that are important rearing habitats for aquatic and semi-aquatic species. Dams and diversions constructed for agricultural and municipal water uses have also adversely affected habitat conditions, including reduced flows, increased stream temperatures, and barriers to fish passage. Farming, forestry, harvesting of shellfish, and fishing continue to be central to the Chehalis Basin economy, and the loss and degradation of habitat, estimated to be between 54% and 87% (ASEPTC 2014a), has resulted in declines in salmon, steelhead, and other fish, affecting both tribal and non-tribal people of the Chehalis Basin.

5.8.2 Present and Reasonably Foreseeable Future Actions

Present and reasonably foreseeable future actions that are anticipated in the Chehalis Basin that are relevant to the Chehalis Basin Strategy include the following:

- New residential and commercial development
- Expansion of agricultural uses
- Local programs and activities (many of which are described under the No Action Alternative and Local Projects action element in Sections 2.3.4.1 and 2.3.3.2)

- Predicted increases in heavy precipitation and storms as a result of climate change

While many Chehalis Basin communities have regulations that prohibit development in the floodplain, current regulations in both Lewis and Grays Harbor counties allow for continued subdivision and development in the floodplain, although additional development standards apply. Under current floodplain land use management regulations, future growth potential is primarily centered around opportunities for residential development in incorporated and UGA areas in Lewis County—many of which are in Chehalis and Centralia—followed by residential development in unincorporated areas of all three counties (Lewis, Grays Harbor, and Thurston). Residential opportunities are followed by opportunities for growth on agricultural parcels (21% of the overall development potential), and much more limited commercial and industrial development (11%; see Appendix L). Future growth would be constrained to an extent by water availability because issuance of new water rights within the basin are limited in part to maintain minimum instream flows for fish and to minimize potential impacts on groundwater. However, agricultural expansion is anticipated to continue, supported in part by the continued work of the Chehalis Basin Partnership to improve water use and irrigation efficiency and to develop partnerships for shared water rights and more localized systems for food processing, storage, transport, and sales.

A number of specific present and future actions have been identified that are relevant to reducing flood damage or restoring habitat for aquatic species, many of which are included in the No Action Alternative. For example, by 2030, WSDOT is required to correct 818 WSDOT-owned culverts in the western Washington (WSDOT 2016). Individual culvert corrections would be prioritized to provide the highest benefits to fish, including improving fish passage and stream function. Near-term aquatic species habitat restoration projects have been funded and will be implemented in the Chehalis Basin by 2017. Other present and future actions that will are relevant to the Chehalis Basin Strategy include continuation of SRFB-funded habitat projects, the CREP, USFWS' CFRP, and DNR's FFFPP.

With regard to reducing flood damage, local projects that protect structures by elevating and floodproofing them, protect critical properties and infrastructure like WWTPs and roads from flood damage, provide safe harbor for farm animals and equipment, or improve floodplain storage, are anticipated to continue in the Chehalis Basin under the No Action Alternative, though at levels of historic (pre-2011) funding. Additionally, various projects are also planned along the I-5 corridor to retrofit stormwater runoff facilities to minimize potential adverse impacts on water quality.

With respect to Forest Practices, although it is not clear how effective current Forest Practices rules are at reducing landslides and erosion during extreme storm events, it is clear that practices have improved the management of areas to reduce the potential for landslides during less severe floods (see Appendix L).

With respect to climate change, research has shown that although the mechanisms driving heavy rain events within the Chehalis Basin are not expected to change substantially in the future, atmospheric rivers are projected to increase across the region, resulting in higher moisture transport and rainfall associated with these storms. The risk of winter flooding is also anticipated to increase, and summer low flows are anticipated to further decrease (Mauger et al 2016).

5.8.3 Cumulative Effects of the Alternatives

To some degree, identifying the cumulative effects of the action alternatives is inherent in the analyses described in this chapter, because many local programs and initiatives anticipated to continue in the future are part of the impact evaluation (e.g., the Local Projects action element). More localized differences in cumulative effects could occur where other developments and actions would be in close proximity to elements of the alternatives. However, these differences would generally be further identified at the project-level environmental review as compared to the programmatic-level analysis conducted in this EIS.

The cumulative effects of the Chehalis Basin Strategy are expected to be beneficial, although some cumulative adverse impacts could occur as a result of individual actions.

The action elements comprising the Chehalis Basin Strategy are intended to substantially contribute to reducing flooding damage and improving aquatic species habitat in the Chehalis Basin. While the action alternatives all include Local-scale Flood Damage Reduction Actions and Aquatic Species Habitat Actions, they differ in the incorporation of Large-scale Flood Damage Reduction Actions and the degree to which they would contribute to cumulative impacts on water resources and aquatic habitat in the Chehalis Basin.

Of the action alternatives, Alternative 1 would result in the broadest flood damage reduction benefits, associated primarily with the construction of the Flood Retention Facility, which is unique to this alternative. Construction of the Flood Retention Facility would cumulatively add to existing impacts on fisheries in a river basin that has already been extensively dammed and where habitat has been adversely affected by development, climate change, and other modifications to the system. Construction of the Flood Retention Facility could also contribute to existing and ongoing water quality problems in the Chehalis River, including elevated temperatures and low DO. Aquatic Species Habitat Actions under Alternative 1, while not intended to mitigate for the effects of the Flood Retention Facility, would build on other habitat restoration efforts currently occurring in the Chehalis Basin. These efforts may decrease the potential for adverse impacts from the Flood Retention Facility to accumulate and contribute to conditions that have negatively affected water resources and fish in the Chehalis Basin. Local Projects that include bank stabilization could cumulatively adversely affect flood flows and velocity in armored reaches, and therefore affect habitat and aquatic conditions for fish, depending on site-specific conditions. If land use management recommendations do not limit future floodplain development and a dam increases development pressure in the floodplain, continued floodplain

development could cumulatively affect water resources, fish and wildlife habitat, and increase the future risk of flood damage.

Alternative 2 would also result in the potential for cumulative impacts due to Aquatic Species Habitat Actions and Local-scale Flood Damage Reduction Actions, such as Local Projects including bank stabilization. Large-scale Flood Damage Reduction Actions would cumulatively result in reductions to flood damage in the Chehalis River floodplain, which is a beneficial cumulative impact, particularly when combined with Aquatic Species Habitat Actions and the other ongoing habitat restoration efforts in the Chehalis Basin.

Compared to Alternatives 1 and 2, Alternative 3 is most likely to result in cumulative beneficial contributions to aquatic species habitat function due to the lack of structural components; and is least likely to contribute to cumulative adverse impacts on water resources, fish and wetlands for the sake of reducing flood damage. Alternative 3 would result in the same potential for cumulative impacts due to Aquatic Species Habitat Actions and Local-scale Flood Damage Reduction Actions (Local Projects including bank stabilization) as Alternatives 1 and 2, and continued floodplain development could cumulatively affect water resources, fish and wildlife habitat, and increase the future risk of flood damage.

Alternative 4 would reduce flood damage more broadly than Alternatives 2 and 3, and in different locations than Alternative 1. Of the action alternatives, Alternative 4 would result in the least potential for cumulative adverse impacts on aquatic species habitat due to the lack of structural elements and the inclusion of Restorative Flood Protection treatments. Alternative 4 would cumulatively help to improve aquatic species habitat functions in a basin that as noted above, has been adversely affected by dams, development, climate change, and other modifications to the system. In locations where both Alternatives 1 and 4 reduce flood damage, Alternative 4 does not reduce flood extents or depths, and therefore flood damage, as much as Alternative 1. However, Alternative 4 increases flooding in tributary areas of the Chehalis River—the North and South Fork Newaukum rivers; South Fork Chehalis River; and Stearns, Bunker, Deep, Lake, Stillman, and Elk creeks. Cumulatively, increased flooding has an adverse impact on land uses in the floodplain. The potential for cumulative impacts on land uses and structures in the floodplain resulting from increased flooding under Alternative 4 is likely to be minimized through supporting relocation and adaptation of at-risk land uses under existing conditions. Alternative 4 would result in the same potential for cumulative impacts due to Aquatic Species Habitat Actions and Local-scale Flood Damage Reduction Actions (Local Projects including bank stabilization) as the other action alternatives, except it would reduce the potential for cumulative impacts on aquatic species habitat as a result because of the inclusion of Restorative Flood Protection actions

Implementation of actions that disrupt access to tribal resources associated with a tribe's sovereignty or formal treaty rights, or reduce or limit access to plants, fish, or wildlife used for commercial, subsistence, and ceremonial purposes, have the potential to cumulatively affect tribal resources. Potential impacts could also include direct impacts on or loss of natural resources protected by tribal treaties for fishing,

hunting, or gathering during construction or implementation of the action elements or combined alternatives considered in this EIS.

While reduced flooding potential could result in increased population growth and land use development within the Chehalis Basin, flood damage reduction would also result in cumulatively significant improvements related to public health and safety and reduced disruptions to industry, commercial businesses, and public services.