4.8 Aquatic Species Habitat Actions (High and Low)

For the purpose of evaluating impacts in this EIS, high and low restoration scenarios for restoring aquatic species habitat were analyzed for river reaches within the Chehalis Basin. It is assumed that in the future, selected restoration actions would fall within this bracketed range. The main difference between the high and low restoration scenarios is the magnitude of short- and long-term impacts. In other words, the low restoration scenario would result in the same benefits and impacts, but to a lesser degree.

The goal of Aquatic Species Habitat Actions is to design and implement broad-scale restoration and protection actions to benefit and protect aquatic species and habitat throughout the Chehalis Basin. The intent of this action element is to protect, improve, and create sustainable ecosystem processes and functions that support the long-term productivity of native aquatic and semi-aquatic species at much higher levels of abundance than current conditions support.

4.8.1 Water Resources

4.8.1.1 Short-term Impacts

The potential short-term impacts on water resources are described in Table 4.1-1 and would result from construction activities, such as water diversions, excavating, clearing, filling, and using and staging heavy equipment for restoration actions in the Chehalis Basin, on the shoreline, and in the adjacent riparian areas. Impacts would primarily be due to the increased potential for turbidity, risk of contamination to surface and groundwater from construction activities, and interruptions to surface water quantity and groundwater (e.g., recharge and discharge and localized hyporheic exchange alterations) in areas of dewatering.

4.8.1.2 Long-term Impacts

4.8.1.2.1 Surface Water Quality

No adverse impacts on water quality are anticipated as a result of implementation of Aquatic Species Habitat Actions. The potential effects on surface water quality are related to the creation of cool-water habitats (i.e., deep pools) and improved riparian conditions (e.g., creation of streamside shade). Habitat could be restored in some reaches of the Chehalis River and its tributaries where temperature or DO conditions are suboptimal for fish, and water quality criteria are not presently met. Anticipated beneficial effects on water quality include the following:

- Localized improvements in water quality conditions, including lower water temperatures and associated improvements in DO
- Water quality treatment provided by restored or enhanced wetlands
- Less-frequent occurrence of violations of state surface water quality standards (WAC 173-201)

4.8.1.2.2 Surface Water Quantity

Potential impacts on water quantity from Aquatic Species Habitat Actions would result from the implementation of restoration elements that modify floodplain inundation areas or connectivity to off-channel and floodplain areas. The activation of floodplain and off-channel areas has the potential to decrease flood extents and depths in adjacent areas. Fish passage barrier and culvert removal could reduce localized flooding upstream of the barrier, and increase localized flooding downstream if the barriers and culverts were undersized for floods.

Reconnection of the floodplain to the main channel would cause flooding in the reconnected areas. These potential adverse impacts are considered minor where increased flooding has the potential to affect structures and roads due to its limited duration and extent.

There is the potential for increased water availability, resulting in a beneficial effect on water use and water rights.

4.8.1.2.3 Groundwater

The potential effects on groundwater quality and quantity are considered beneficial due to improved localized groundwater recharge (and hyporheic exchange) in the expanded or reconnected floodplain areas.

4.8.1.3 Mitigation

Potential mitigation measures for short-term impacts on water resources are included in Table 4.1-1. Because no long-term adverse impacts on surface water quality and groundwater resulting from implementation of Aquatic Species Habitat Actions are anticipated, no long-term mitigation is proposed. Potential mitigation for long-term impacts on surface water quantity include compensatory storage in locations where flood levels would increase. Where an easement or property acquisition is necessary in areas of increased flooding, the type and level of mitigation would be determined during project-level environmental review, and coordination with affected property owners.

4.8.2 Geology and Geomorphology

4.8.2.1 Short-term Impacts

4.8.2.1.1 Geology

Potential short-term impacts on geology could occur where restoration actions are built in the vicinity of existing shallow rapid or deep-seated landslides. Although activation of landslides from implementation of these restoration actions would be unlikely, there could be a short-term impact on geology, limited to the extent of the impact area, if a landslide did occur.

4.8.2.1.2 Geomorphology

Potential short-term impacts on geomorphology could occur due to dewatering or rerouting the river channel, resulting in the loss of river function through work areas, or a temporary impact on geomorphic channel and floodplain processes. Implementation of water diversion and re-routing measures could result in impacts on sediment and wood transport through the construction zones. For example, diversion of a stream or river would be necessary to build an engineered logjam. These impacts would be temporary and localized.

4.8.2.2 Long-term Impacts

4.8.2.2.1 Geology

No adverse impacts on geology are anticipated with Aquatic Species Habitat Actions.

4.8.2.2.2 Geomorphology

Implementation of Aquatic Species Habitat Actions is anticipated to have beneficial effects on geomorphology as a result of the addition of channel structure to create or restore habitat. Geomorphic benefits would result from the following improvements over current conditions:

- Improved channel complexity and geomorphic function
- Improved sediment load and transport processes
- Increased wood load and recruitment

In-water habitat restoration actions that add large wood would result in localized improvements in channel complexity (e.g., pools) and function (e.g., trap sediment). Certain elements such as large wood placement would have the potential to limit local channel migration. Reconnection of oxbows or secondary channels could increase the potential for the channel to move (migrate) across the channel migration zone. Culvert removal and replacements that improve flow would also improve sediment transport conditions locally, leading to improved geomorphic function in the long term.

4.8.2.3 Mitigation

Potential mitigation measures for additional short-term impacts on geology and geomorphology are included in Table 4.1-1. Where landslides are adjacent to construction, reconnaissance could be performed to avoid and minimize potential impacts on the potential landslide area. Construction measures, such as avoidance or stabilization, could be implemented as applicable to reduce the potential for ground movement. No long-term adverse impacts on geology and geomorphology are anticipated, so no long-term mitigation is proposed.

4.8.3 Wetlands and Vegetation

4.8.3.1 Short-term Impacts

The potential short-term impacts on wetlands and vegetation associated with both the high and low restoration scenarios would occur during construction, and could also occur with the implementation of actions that have the potential to disturb wetlands and upland and riparian vegetation communities (e.g., land clearing, excavation, fill placement, equipment access, and material storage during construction). Potential short-term impacts on wetlands and vegetation associated with these types of actions include temporary fill placement in wetlands, removal or disturbance of existing upland and wetland vegetation, and temporary modification of wetland hydrology. The overall intent of Aquatic Species Habitat Actions is to restore aquatic species habitat throughout the Chehalis Basin through such actions as the re-establishment of riparian and off-channel habitat and the reconnection of floodplains.

4.8.3.2 Long-term Impacts

No adverse impacts on wetlands and vegetation are anticipated. The potential beneficial effects on wetlands and vegetation would largely be habitat improvements and protection, and restoration of wetlands and vegetation communities that are of high value to fish and wildlife. Specific benefits would also include an increase in riparian areas and associated functions through the restoration or creation of habitat.

4.8.3.3 Mitigation

Potential mitigation measures for short-term impacts on wetlands and vegetation are described in Table 4.1-1. No long-term adverse impacts on wetlands and vegetation are anticipated during implementation of Aquatic Species Habitat Actions, so no mitigation is proposed.

4.8.4 Fish and Wildlife

4.8.4.1 Short-term Impacts

4.8.4.1.1 Fish

The potential short-term impacts on fish are described in Table 4.1-1 and would occur during construction of habitat restoration actions, including in-water work and restructuring of adjacent streambank areas with conditions planned to exceed pre-construction status and/or function following completion. The potential short-term impacts related to in-water construction primarily occur from the following:

- Reduced water quality due to by turbidity increases, pollutant-laden stormwater runoff, or pollutants entering the water
- Temporarily dewatering of part of the river channels, reducing habitat available to fish in the immediate vicinity of construction

- Construction noise in or near the stream channel and removal of bank vegetation, which would reduce the function of riparian habitat for fish (e.g., shading and input of terrestrial nutrients and food)

4.8.4.1.2 Wildlife

The potential short-term impacts on wildlife are described in Table 4.1-1 and would occur during construction, including construction activity that could disturb habitat used by native wildlife species to breed, forage, rest, and overwinter. These impacts would be temporary.

4.8.4.2 Long-term Impacts

4.8.4.2.1 Fish

The potential benefits to fish are improved fish habitat-forming processes, increased habitat area and complexity, and connectivity throughout the entire Chehalis Basin. Anticipated beneficial effects are primarily related to improvement in habitat conditions that currently limit fish survival from the following:

- Restoration of riparian vegetation, improving water quality, food and nutrient inputs, and habitat structure for fish
- Restoration of stream channels and geomorphic processes that would reduce erosion and improve habitat complexity, providing better water quality and refugia for fish
- Removal of culverts that currently block access for fish to habitat upstream

Each of these actions could affect fish survival, and numbers of fish present in the system, by providing the necessary habitat for incubation, juvenile growth, refuge, and spawning.

The goals of restoration would be to restore habitat function for native fish and amphibian species, including salmon and steelhead, by restoring river conditions and processes. Actions that do not require long-term maintenance or intervention would be made a priority, and would be buffered against the effects of climate change to create and maintain the quantity and quality of fish habitat for the future. While the restoration actions would focus on self-maintaining restoration and protection, structural habitat actions would likely require intervention during the 100-year life span of the restoration plan. As an example, culvert replacement would require periodic instream maintenance work.

Restoration of riparian vegetation that provides shade and restoration of habitat complexity, including the creation of deep pools, would improve water quality by lowering temperatures and improving DO. Locations that are of high value to native fishes (e.g., areas of high productivity, species diversity, or refugia) would be protected and restored.

The removal of more than 400 culverts that are currently rated as impassible or partially passable could reopen a minimum of 295 river miles of fish habitat. For salmon species, removing all culverts could

improve populations of salmon and steelhead from 2% (for fall-run Chinook salmon) up to 13% (for coho salmon), depending on the species. Coho salmon would experience the greatest gains because of their tendency to be distributed across many sub-basins and in smaller tributaries that are often impaired by undersized culverts (see Table 3.4-4 for existing salmon and steelhead run sizes by species).

The reconnection of off-channel habitat across large areas of the Chehalis Basin could result in a minor adverse impact if it facilitates the dispersal of invasive species, such as bass and bullfrogs, that prey on or compete with native fish species. However, reconnection of off-channel areas to main channel streams and rivers may restore seasonal flow patterns that reduce the abundance of invasive predators.

Salmon abundance would be increased by actions in two different geographic areas of the Chehalis Basin: areas that are in active timber management (managed forestland), which are generally located in the upper Chehalis Basin and fall under the Washington FPA and Habitat Conservation Plans, and areas downstream of the managed forestlands in lowland areas of the basin where active habitat restoration is proposed under the Aquatic Species Habitat Actions. Under current Forest Practice rules, changes to improve the conditions of the riparian corridor and reduce impacts from road building and fish barriers (such as culverts) have taken place on publicly and privately managed forestland. In the lowland areas, restoration measures would include active riparian restoration and other habitat actions described in Section 2.3.3.3.

There is uncertainty as to the long-term effectiveness of riparian maturation in managed forestland. As a result, the effectiveness of riparian maturation in managed forestland was reduced from 100% to a range from 20% to 60% effective in the model to account for this uncertainty. Managed forestland was studied and modeled along with the Aquatic Species Habitat Actions to account for the overall habitat improvement in the Chehalis Basin as fish use both managed forestland and downstream areas for spawning, rearing and migrating.

While other species that are as widely distributed as salmon in the Chehalis Basin are likely to benefit, the magnitude of the benefit to other native fishes will depend on restoration that focuses on restoring ecological processes that support all species, as well as the overlap of chosen restoration areas with the distributions of the other native fishes. The modeled current habitat potential for the Chehalis Basin to support each salmon species is depicted as the number of potential spawners, along with estimated total run size and escapement provided by WDFW over the past 10 years. The modeled change in salmon and steelhead abundance for the entire Chehalis Basin predicted to result from a change in habitat potential due to implementation of the low and high restoration scenarios is shown in Table 4.8-1 and Figure 4.8-1 for each species.

Table 4.8-1
Potential Response in Salmonid Abundance to Habitat Change in the Chehalis Basin from Aquatic Species Habitat Actions

SPECIES (CURRENT HABITAT POTENTIAL)	CHANGE IN ABUNDANCE IN NUMBER OF FISH (%)			
	LOW RESTORATION; 20% OF REACHES	HIGH RESTORATION; 20% OF REACHES	LOW RESTORATION; 60% OF REACHES	HIGH RESTORATION; 60% OF REACHES
Coho salmon (40,642)	22,908 (56%)	39,258 (97%)	51,785 (127%)	96,165 (237%)
Fall-run Chinook salmon (25,844)	2,781 (11%)	9,124 (35%)	5,437 (21%)	19,350 (75%)
Winter/fall-run chum salmon (190,550)	18,596 (10%)	29,080 (15%)	30,626 (16%)	56,970 (29%)
Spring-run Chinook salmon (2,146)	2,051 (96%)	4,590 (214%)	5,583 (260%)	15,357 (715%)
Winter-run steelhead (6,800)	2,147 (32%)	3,133 (46%)	4,738 (70%)	7,751 (114%)

Source: ICF 2016

The contribution of managed forestlands to salmon habitat potential varies, with a range of 5% (fall-run Chinook salmon) to 26% (steelhead) and 31% (coho salmon) benefit for the low restoration scenario, and a range of 10% (fall-run Chinook salmon) to 54% (steelhead) and 57% (coho salmon) benefit for the high restoration scenario, compared to current conditions (see Figure 4.8-2). The low restoration scenario is focused on spring-run Chinook salmon spawning reaches, with habitat potential primarily located in the upper Chehalis Basin in managed forestland, with some reaches in the middle and upper mainstem Chehalis River. The high restoration scenario would result in a larger proportion of restoration benefit from active restoration in lowland areas outside managed forestlands, due to an increased level of restoration in a wider array of reaches throughout the Chehalis Basin[1].

The response of salmon populations to habitat restoration was also modeled by sub-basin. The results assume distribution of restoration widely across sub-basins. Those sub-basins that show the largest response in numbers of increased fish tend to be those with the most river miles of stream that would be restored. The sub-basins that would provide the greatest increase in numbers of salmon and steelhead within the overall Chehalis Basin population are shown in Table 4.8-2 for each species.

[1] Refer to Draft EIS Addendum dated October 17, 2016.

Table 4.8-2

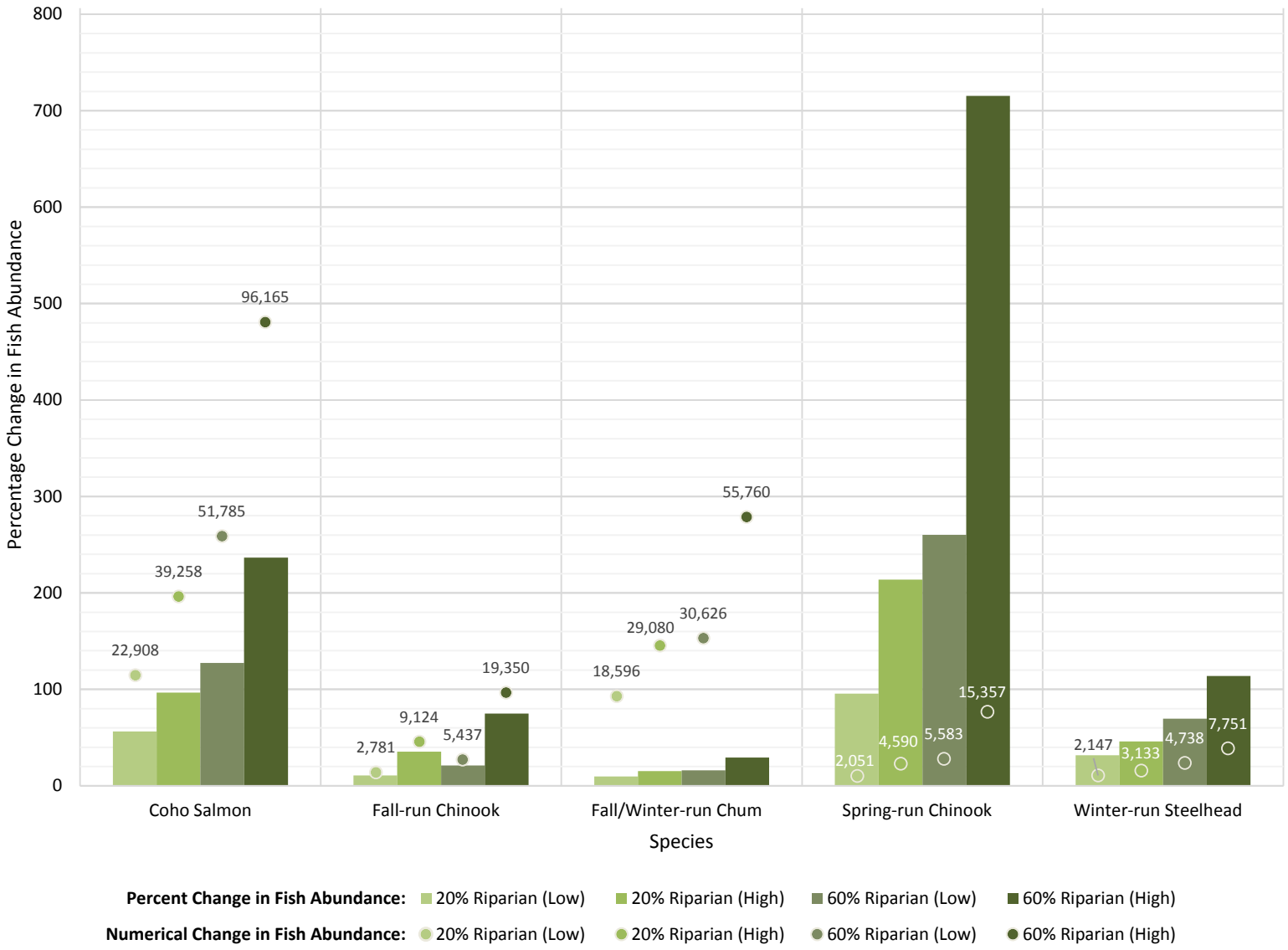
Sub-basins with the Largest Potential Increase in Chehalis Basin Salmonid Abundance by Species from Aquatic Species Habitat Actions

SPECIES	RESTORATION LEVEL[1]	SUB-BASIN	CURRENT SUB-BASIN HABITAT POTENTIAL	CHANGE IN SUB-BASIN ABUNDANCE IN NUMBER OF FISH (%)[2]
Coho salmon	Low (20%)	Mainstem Chehalis from Satsop to Skookumchuck	5,764	4,437 (77%)
	Low (60%)			8,803 (153%)
	High (20%)			6,835 (119%)
	High (60%)			16,088 (279%)
Fall-run Chinook salmon	Low (20%)	Mainstem Chehalis from Satsop to Skookumchuck	3,401	842 (25%)
	Low (60%)			1,536 (45%)
	High (20%)			2,404 (71%)
	High (60%)			5,466 (161%)
Fall/winter-run chum salmon	Low (20%)	Mainstem Chehalis from Satsop to Skookumchuck	52,103	10,261 (20%)
	Low (60%)			14,456 (28%)
	High (20%)			13,419 (26%)
	High (60%)			22,387 (43%)
Spring-run Chinook salmon	Low (20%)	Newaukum River	812	912 (112%)
	Low (60%)			2,026 (250%)
	High (20%)			2,127 (262%)
	High (60%)			6,341 (781%)
Winter-run steelhead	Low (20%)	Newaukum River	1,022	397 (39%)
		Low (60%)		**598 (59%)**
		High (20%)		**819 (80%)**
		High (60%)		**1,451 (142%)**

Notes:
1. Low and high scenarios are shown in combination with 20% or 60% of spawning reaches restored
2. Percentage change shows change in size of the given sub-basin population
Source: ICF 2016

Figure 4.8-1

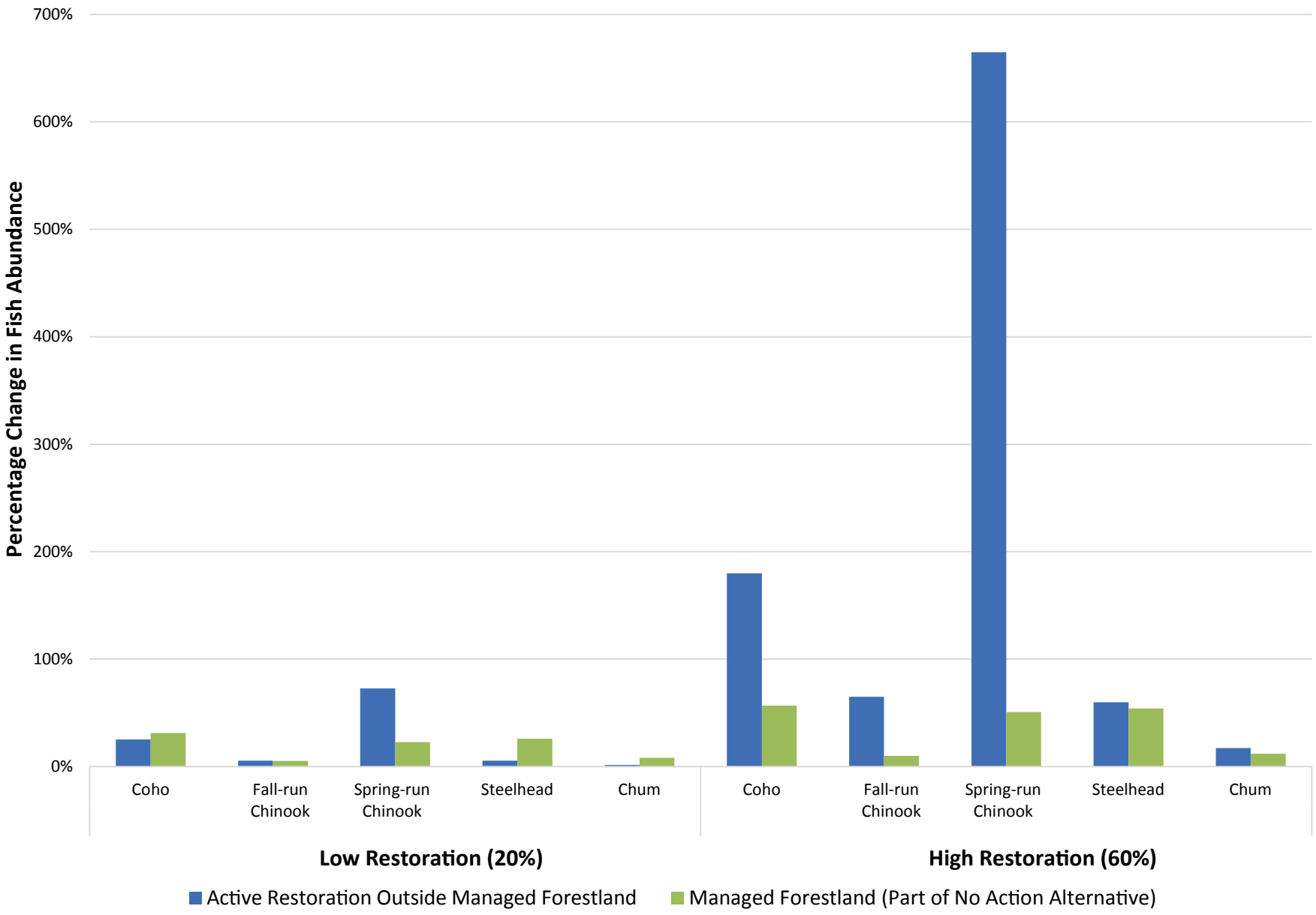
Potential Response in Salmonid Abundance to Habitat Change in the Chehalis Basin from Aquatic Species Habitat Actions



Source: ICF 2016

Figure 4.8-2

Potential Response in Salmonid Abundance to Habitat Change in the Chehalis Basin from Active Restoration Outside Managed Forest Compared to Managed Forestland



Aquatic Species Habitat Actions under the high restoration scenario would occur in 356 river miles across the entire Chehalis Basin. If the high restoration scenario were undertaken, salmonid species would benefit across the entire Chehalis Basin—ranging from an increase in abundance of 16% for fall- and winter-run chum salmon if 20% of reaches were restored, up to an increase of 715% for spring-run Chinook salmon if 60% of reaches were restored (see Table 4.8-2).

If low restoration scenario were undertaken, restoration would be focused on 104 river miles of spring-run Chinook salmon spawning reaches; however, all salmon species that use these reaches would benefit. Based on model results, increases in total Chehalis Basin abundance under the lowest restoration scenario would range from 10% for fall- and winter-run chum salmon to 11% for fall-run Chinook salmon if 20% of reaches were restored, up to 260% for spring-run Chinook salmon if 60% of reaches were restored (see Table 4.8-2).

Restoration of the Newaukum and the middle mainstem Chehalis River sub-basins between the confluences of the Skookumchuck River up to Elk Creek would increase salmon numbers the most across all five species; however, restoration of the lower Chehalis, Wynoochee, Satsop, Skookumchuck, and South Fork Chehalis River sub-basins would also provide benefits of slightly smaller magnitudes. The smallest change in salmon abundance would be observed with restoration of the South Bay, Humptulips, Hoquiam, and Wishkah rivers; however, the magnitude of change within these tributaries could still be sizeable, with sub-basin populations increasing up to nearly 200% for coho salmon in the Wishkah River.

It should be noted that the benefits described here do not take climate change in to account, which is projected to cause increases in water temperature and change seasonal precipitation patterns. The benefit of the low Aquatic Species Habitat Actions scenario would not offset losses to salmon abundance predicted under a climate change scenario (see Section 4.8.7 for further discussion).

4.8.4.2.2 Wildlife

The potential beneficial effects on wildlife include habitat improvements and protection, and restoration of vegetation communities and wetlands that are of high value to fish and wildlife. Anticipated effects are primarily related to increases in habitat quantity, quality, and connectivity from the following:

- Increase in wildlife habitat through improvements in wetland and riparian habitats and associated functions through restoration or creation of habitat
- Improved habitat connectivity and corridors for wildlife
- Increased fish production described in Section 4.8.4.2.1 would benefit mammals and predators that feed on salmon and salmon carcasses including multiple birds and mammal species in the Chehalis Basin, as well as the ESA-listed Southern Resident killer whale in the Pacific Ocean outside of Grays Harbor

Each of these actions could affect habitat quality by increasing the area of habitat functioning as it would have historically for aquatic and semi-aquatic wildlife such as amphibians, reptiles, North American beaver, and waterfowl. In the low restoration scenario, 21 to 63 river miles (1,150 to 2,900 acres) of riparian habitat could be treated with restoration or protection activities; whereas in the high restoration scenario, 71 to 214 river miles (3,900 to 9,750 acres) of riparian habitat could be restored or protected.

The potential effects on wildlife habitat and native wildlife species, in particular species that rely on aquatic habitat for multiple stages of their life cycle such as amphibians, are considered beneficial. Key restoration activities that benefit wildlife would include the following:

- Improvement of habitat processes, habitat complexity, and connectivity throughout the Chehalis Basin that is self-maintaining, high-value habitat for wildlife
- Creation, restoration, and enhancement of wetlands for use by semi-aquatic species
- Creation and improvement of habitat features achieved through increased plant species diversity and complexity, the addition of snag and woody material habitat features, increased wetland and riparian habitat functions, and the establishment of hydrologic features with diverse characteristics in depth, width, and sinuosity
- Restoration and improvement of riparian habitat features could improve connectivity between wildlife habitats, creating a benefit by connecting wildlife populations that are currently separated by human disturbances or activities and providing migration corridors that are less exposed to human disturbances (WHCWG 2010)

Establishing these features would provide quality habitat for native wildlife species of birds, amphibians, large and small mammals, and reptiles to breed, forage, rest, and overwinter.

Restoring connections among currently disconnected habitat could have an adverse impact by facilitating the spread of non-native invasive species, which could lower the quality of habitat functions; however, this would be a potentially minor adverse impact compared to the overall beneficial effect of improving connectivity between habitats for wildlife species. Invasive species dispersal could include non-native plants (e.g., reed canarygrass and purple loosestrife) or wildlife species (e.g., bullfrog) that prey on native wildlife.

4.8.4.3 Mitigation

4.8.4.3.1 Fish

Potential mitigation measures to reduce short-term impacts on fish could include those described in Table 4.1-1, as well as the following:

- Avoiding intact riparian vegetation that stabilizes banks and provides cover for fish

- Excluding fish from areas with nets or other temporary exclusion methods

No long-term adverse impacts on fish are anticipated, because Aquatic Species Habitat Actions would be beneficial to fish species in the long term, so no mitigation is proposed.

4.8.4.3.2 Wildlife

Potential mitigation measures for short-term impacts on wildlife are described in Table 4.1-1. No long-term adverse impacts on wildlife are anticipated, because Aquatic Species Habitat Actions would be beneficial to wildlife species in the long term, so no mitigation is proposed.

4.8.5 Tribal Resources

4.8.5.1 Short- and Long-term Impacts

Potential adverse impacts on tribal resources could occur during construction and would result in the following disturbances to aquatic habitat and tribal fish resources:

- Impairment or elimination of fish habitat used by adults, eggs, and juveniles
- Effect on survival of adult, eggs, and juveniles
- Affected behavior of adult or juvenile fish such that some are unable to successfully complete their life cycle and contribute to spawning for the next generation

While Aquatic Species Habitat Actions would focus on self-maintaining restoration and protection, structural habitat actions would likely require intervention during the 100-year life span of this action element. In particular, culvert maintenance would be required over the long term, which likely would involve instream work, however on a small temporal and spatial scale.

Tribal fishers could be temporarily delayed or restricted from accessing the Chehalis River or its tributaries during some construction activities. The potential to affect access depends on where and when construction would occur. Access to traditional plants and hunting of wildlife could also be affected by short-term construction activities.

The extent of potential impacts is pending additional coordination with tribes and continued government-to-government consultations. The potential impacts on tribal resources following construction of the projects implemented as part of Aquatic Species Habitat Actions are improvements to productivity and capacity of natural populations of salmon and steelhead.

Under the high restoration scenario, improvements in riparian vegetation would also provide wildlife habitat for elk and deer. These potential long-term effects are considered beneficial due to the appreciable improvement in overall population performance of all populations.

Habitat improvements are anticipated to benefit tribal fisheries by improving population productivity, abundance, and life history diversity; and proving greater resiliency to periods of adverse freshwater and marine environmental conditions. The modeled change in salmon abundance for the low and high restoration scenarios is described in Section 4.8.4.

4.8.5.2 Mitigation

The potential mitigation associated with impacts on tribal resources would be addressed directly with Quinault Indian Nation and Chehalis Tribe tribal leadership during project-level environmental review and continued government-to-government consultations.

In some cases, mitigation measures would be proposed to address the short- and long-term impacts on habitat that are important to tribal resources, including fish, wildlife, and plants. Mitigation of impacts on treaty rights is subject to consideration and agreement by the Quinault Indian Nation.

4.8.6 Air Quality

4.8.6.1 Short-term Impacts

The potential short-term impacts on air quality would vary and would likely last a few weeks to a few months depending on the scale of the individual restoration project. These impacts would be localized, limited to the construction period, and would not cause an overall decrease in regional air quality.

4.8.6.2 Long-term Impacts

No adverse impacts on air quality are anticipated because Aquatic Species Habitat Actions would not generate emissions once completed. Cleared areas would be revegetated and would not provide a source of dust.

4.8.6.3 Mitigation

Potential mitigation measures for short-term impacts on air quality would be the same as those described in Table 4.1-1. No long-term adverse impacts on air quality are anticipated with Aquatic Species Habitat Actions, so no mitigation is proposed.

4.8.7 Climate Change

4.8.7.1 Short-term Impacts

4.8.7.1.1 Effects of Aquatic Species Habitat Actions Contributing to Climate Change

The potential short-term effects of Aquatic Species Habitat Actions that could contribute to climate change would occur during construction and include additional GHG emissions from construction equipment and truck shipments of materials to and from the site, such as construction and excavated/demolished materials for fish barrier removals, and materials for vegetation re-establishment and aquatic species habitat restoration sites. Restoration activities are expected to be implemented

over a multi-year timeframe, and the anticipated GHG emission equivalents from all restorative elements are below the annual threshold for qualitative disclosure of emissions (Ecology 2011b).

4.8.7.1.2 Effects of Climate Change on Aquatic Species Habitat Actions

No short-term effects of climate change on Aquatic Species Habitat Actions are anticipated.

4.8.7.2 Long-term Impacts

4.8.7.2.1 Effects of Aquatic Species Habitat Actions Contributing to Climate Change

No adverse impacts that contribute to climate change are anticipated. However, beneficial effects could occur with increased vegetation and the associated increase in carbon storage and reduction in GHG emission equivalents, ranging between 140,000 to 350,000 MT CO_2e/year (low restoration) and 470,000 to 1.18 million MT CO_2e/year (high restoration).

4.8.7.2.2 Effects of Climate Change on Aquatic Species Habitat Actions

The potential impacts of climate change on Aquatic Species Habitat Actions could reduce the effectiveness of restoration for salmonid populations. However, these effects are considered minor adverse impacts because the improved habitat-forming processes, habitat complexity, and self-maintaining connectivity associated with implementation of Aquatic Species Habitat Actions are expected to help buffer the effects of climate change on salmonids and aquatic species.

Several actions within both the high and low restoration scenarios serve to moderate the effects that are predicted with climate change forecasts, including providing the following:

- Floodplain reconnection to moderate the effects of increased stream temperatures on aquatic species by increasing hyporheic flow, which provides cool groundwater to surface water during the summer
- Restored riparian habitat, reduced erosion and sediment delivery, and restored instream conditions to moderate the effects of climate change on stream temperatures
- An increase in thermal refugia to moderate the impacts of climate change on salmonids

The EDT model developed for the Chehalis Basin (ICF 2016) was used to predict how fish species would respond to varying effects of climate change under the high and low restoration scenarios. Table 4.8-3 and Figure 4.8-3 present these results, as compared to current conditions with climate change.

Table 4.8-3
Potential Response in Salmonid Abundance to Habitat Change in the Chehalis Basin from Climate Change and Aquatic Species Habitat Actions

SPECIES (CURRENT HABITAT POTENTIAL)	CHANGE IN ABUNDANCE IN NUMBER OF FISH (%)				
	WITH CLIMATE CHANGE ONLY	WITH CLIMATE CHANGE AND LOW RESTORATION; 20% OF REACHES	WITH CLIMATE CHANGE AND HIGH RESTORATION; 20% OF REACHES	WITH CLIMATE CHANGE AND LOW RESTORATION; 60% OF REACHES	WITH CLIMATE CHANGE AND HIGH RESTORATION; 60% OF REACHES
Coho salmon (40,642)	-22,390 (-55%)	-3,865 (-10%)	4,728 (12%)	27,684 (68%)	61,395 (151%)
Fall-run Chinook salmon (25,844)	-6,969 (-27%)	-4,602 (-18%)	-566 (-2%)	-2,236 (-9%)	8,654 (33%)
Winter/fall-run chum salmon (190,550)	-8,270 (-4%)	15,445 (8%)	28,232 (15%)	29,261 (15%)	59,272 (31%)
Spring-run Chinook salmon (2,146)	-1,869 (-87%)	-1,075 (-50%)	-452 (-21%)	1,088 (51%)	5,467 (255%)
Winter-run steelhead (6,800)	-3,741 (-55%)	-894 (-13%)	194 (3%)	2,711 (40%)	6,347 (93%)

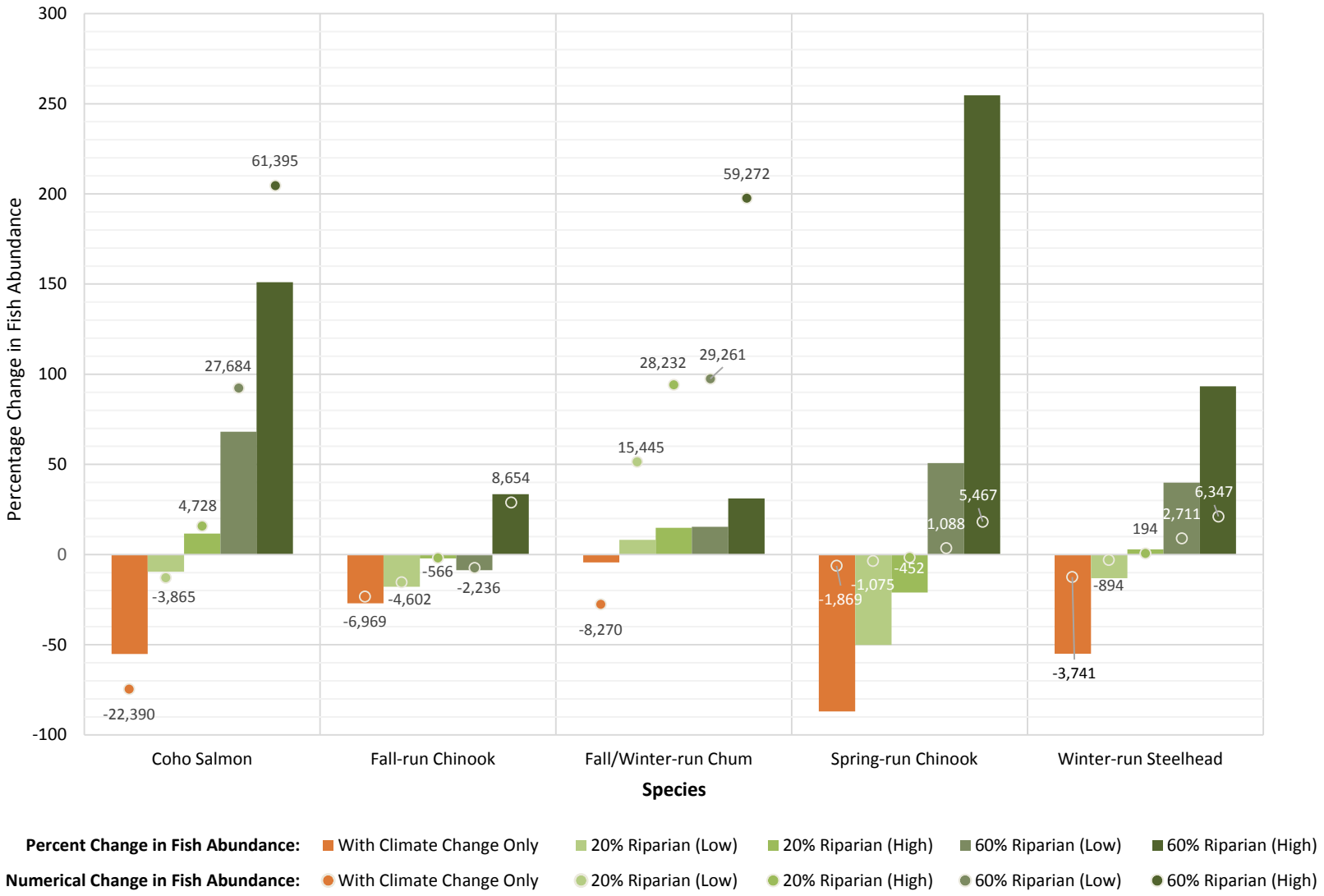
Source: ICF 2016

Future climate conditions in the Chehalis Basin are expected to appreciably reduce the habitat potential for salmon. However, active restoration in lowland areas is anticipated to moderate these changes, especially when considering the high restoration scenario. Figure 4.8-4 shows the increase in benefit from managed forestlands and active restoration in lowland areas outside of managed forestlands[2].

[2] Refer to Draft EIS Addendum dated October 17, 2016.

Figure 4.8-3

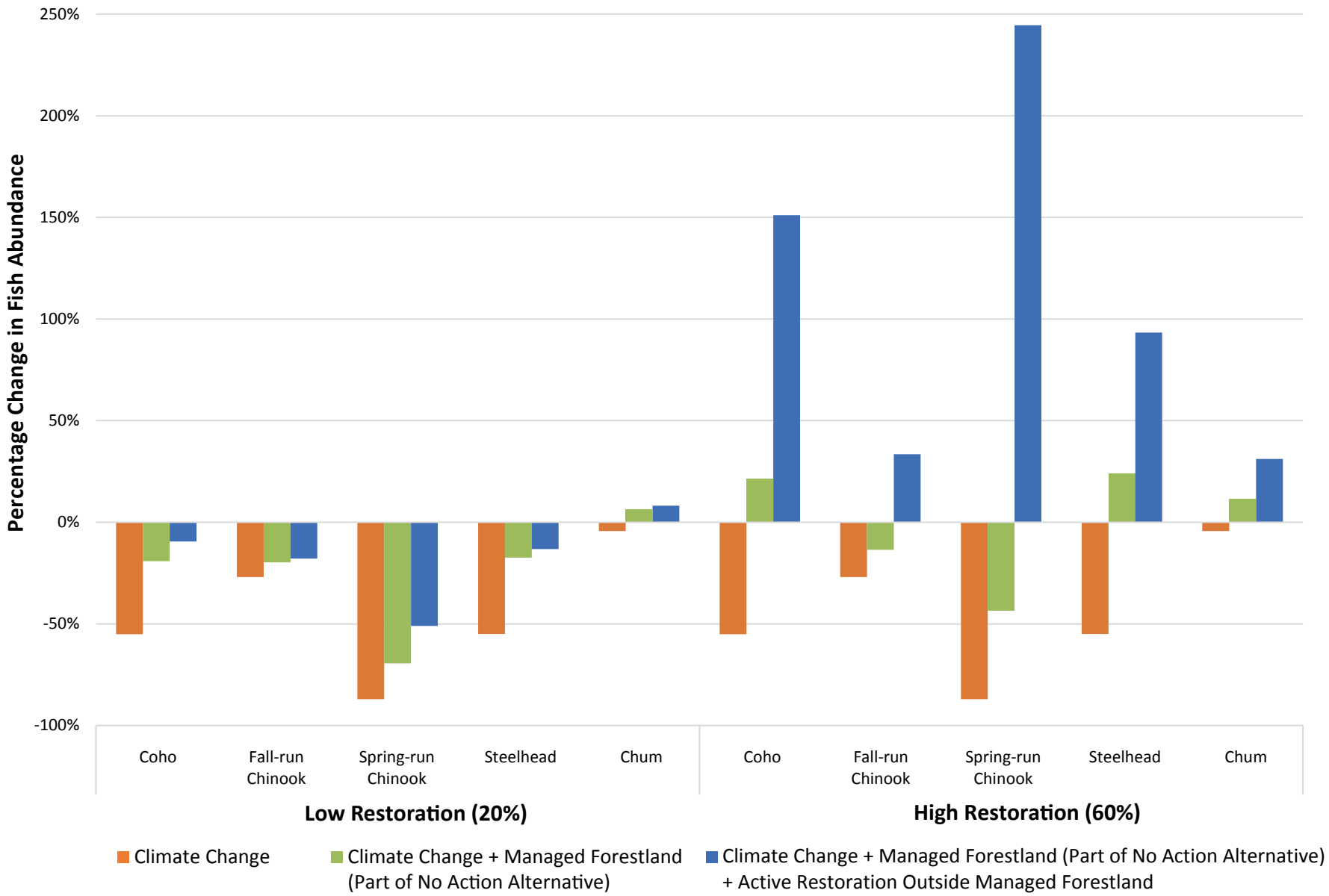
Potential Response in Salmonid Abundance to Habitat Change in the Chehalis Basin from Climate Change and Aquatic Species Habitat Actions



Source: ICF 2016

Figure 4.8-4

Potential Response in Salmonid Abundance to Habitat Change in the Chehalis Basin from Climate Change (Active Restoration Outside Managed Forest Compared to Managed Forestland)



All of the low and high restoration scenarios with climate change would result in the increased abundance of salmonids compared to climate change only.

The high restoration scenarios with climate change would result in the following:

- Significantly greater percentage increase in abundance (more than 75%) than the low restoration scenario for coho salmon and spring-run Chinook salmon when applied to either 20% or 60% of the reaches, as well as winter-run steelhead when applied to 60% of the reaches
- Exceedance of habitat potential for coho salmon and spring-run Chinook salmon with 60% of reaches addressed

The low restoration scenarios with climate change would result in the following:

- A reduction in predicted losses of salmonid abundance due to climate change only under current conditions for all species
- Avoidance of a loss in abundance for coho salmon and winter-run steelhead when applied to 60% of reaches and for winter/fall-run chum salmon when applied to both 20% and 60% of reaches

4.8.7.3 Mitigation

4.8.7.3.1 Mitigation to Address Effects of Aquatic Species Habitat Actions Contributing to Climate Change

No adverse effects of Aquatic Species Habitat Actions contributing to climate change are anticipated, so no mitigation is proposed.

4.8.7.3.2 Mitigation to Address Effects of Climate Change on Aquatic Species Habitat Actions

The design of the actions within Aquatic Species Habitat Actions are intended to moderate the effects of climate change and provide resiliency to these changing conditions. The vulnerability of specific types of restoration actions in the Chehalis Basin would be evaluated in order to identify those actions that would maintain the largest degree of effectiveness under future projected climatic and hydrologic conditions. No additional mitigation measures are anticipated.

4.8.8 Noise

4.8.8.1 Short-term Impacts

The potential short-term impacts on noise would occur during construction and would include construction equipment, such as graders and dump trucks that would have peak noise levels ranging from 79 to 89 dBA at 50 feet from the source (see Table 4.2-10). Aquatic Species Habitat Actions would range in scale, and larger actions, such as restoring off-channel habitat, would last longer and require heavier equipment. These impacts would be localized and limited to daytime hours.

4.8.8.2 Long-term Impacts

No adverse impacts are anticipated because implementation of Aquatic Species Habitat Actions would not generate noise.

4.8.8.3 Mitigation

Potential mitigation measures for short-term noise impacts would be the same as those described for the Airport Levee Improvements and I-5 Projects. No long-term noise impacts are anticipated with Aquatic Species Habitat Actions, so no mitigation is proposed.

4.8.9 Visual Quality

4.8.9.1 Short-term Impacts

The potential short-term impacts on visual quality would occur during construction and include unmanaged dust, exposed construction debris, heavy equipment, and temporary installations, depending on the individual activity, which would generally create an unattractive visual setting. These impacts would occur in relatively small areas and would be limited to the construction period.

4.8.9.2 Long-term Impacts

Aquatic Species Habitat Actions could cause changes in views in local areas toward more natural conditions and vegetation. Depending on personal preference, these changes could be considered beneficial to visual quality. All potential adverse impacts would be minimal because they would not involve large-scale changes or large structures that block views.

4.8.9.3 Mitigation

Potential mitigation measures for short-term impacts on visual quality include limiting the area of ground disturbance through appropriate site design; locating staging and stockpiling areas within previously disturbed areas or co-locating them with proposed activities; and revegetating temporarily affected areas with appropriate plantings following construction.

Long-term impacts on visual quality would be minimal and dependent on personal preference, so no mitigation is proposed.

4.8.10 Land Use

4.8.10.1 Short-term Impacts

No short-term impacts on land use are anticipated.

4.8.10.2 Long-term Impacts

The potential adverse impacts on land use are related to the conversion of land from other uses into habitat restoration areas, which could be between 1,150 and 9,750 acres. Impacts are most likely to occur on existing agricultural land, with impacts on residential, commercial, or industrial land uses

occurring to a lesser degree. The land use conversion would be completed through property acquisition or pursuing a conservation easement on the portion of the land where restoration would take place (i.e., restoration of a narrow riparian corridor would not necessitate conversion of the entire property). If implemented at the highest level, habitat restoration actions could cumulatively result in minor to moderate adverse impacts to land use.

4.8.10.3 Mitigation

No short-term impacts on land use are is anticipated, so no mitigation is proposed. Potential mitigation measures to address long-term adverse impacts on land use are associated with individual projects that permanently convert or alter the existing land use. Where an easement or property acquisition is necessary, the type and level of mitigation would be determined during project-level environmental review, and coordination with affected property owners.

4.8.11 Recreation

4.8.11.1 Short-term Impacts

The potential short-term impacts on recreation would occur during construction and include construction noise, dust, access, and transportation impacts in or adjacent to recreation areas, which could disturb recreational users. Access to recreation areas could also be restricted during construction. These impacts would be limited to the construction period, which would be a few weeks to a few months for most projects.

4.8.11.2 Long-term Impacts

The restoration actions would increase the abundance of fish species in the Chehalis Basin, improving opportunities for recreational fishing and causing beneficial effects. In-water structures (e.g., LWM) installed in the river or its tributaries could create a hazard for kayakers and other recreational boaters. This would result in a minor adverse impact because the area affected would be limited and signage would warn boaters. Restoration actions could cause some minor, localized reductions in flooding, but the effects on recreation would be limited because these reductions are unlikely to reduce flood damage at recreational facilities or agritourism sites. It is possible that some restoration sites would be closed to public access after construction. If these sites were previously used for undeveloped recreation, this would be a minor adverse impact because it is likely that other opportunities for undeveloped recreation would remain nearby.

4.8.11.3 Mitigation

In addition to restoring access to recreation areas following construction, mitigation measures for short-term impacts on recreation are described in Table 4.1-1. Potential mitigation measures for long-term adverse impacts on recreation associated with in-water structures could include signage to notify boaters of potential hazards.

4.8.12 Historic and Cultural Preservation

4.8.12.1 Short- and Long-term Impacts

The potential impacts on cultural resources are related to ground disturbance and filling to restore habitat, reduce bank erosion, and remove or improve fish passage obstructions. Potential impacts include the following:

- Destruction, damage to, or alteration of a cultural resource
- Necessary removal of a cultural resource from its original location
- Changes to the use or physical features of a cultural resource
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the significant features of a cultural resource

The resulting changes to the landscape could expose, damage, destroy, and/or alter cultural resources through the following:

- Additional, increased, or changed vehicular and foot traffic patterns
- Different flood patterns, which would cause flooding and sedimentation of submerged resources in other areas, change stream channels and cause erosion, and change the streambank locations and result in bank erosion

The extent of impacts would depend on the nature of cultural resources that could be disturbed and could range from minor to significant, depending on the location. Impacts would be determined through coordination with DAHP and affected tribes during a project-level environmental review, including continued government-to-government consultations. Potential impacts on tribal cultural resources or graves, Indian human remains, or traditional cultural properties may also occur and would be determined in coordination with tribes, and government-to-government consultations.

4.8.12.2 Mitigation

Mitigation measures for potential impacts on cultural resources could be determined during project-specific evaluations of Aquatic Species Habitat Actions, and could include consultation with DAHP, interested and affected tribes, as well as other consulting parties (see information on addressing potential impacts on cultural resources in Section 4.2.12).

The potential compensatory mitigation measures would be the same as those described for the Flood Retention Facility (see Section 4.2.12.2).

4.8.13 Transportation

4.8.13.1 Short-term Impacts

The potential short-term impacts on transportation would include limited temporary disruptions to local roadways to access construction areas and temporary road closures or detours for removal of fish passage barriers. These impacts would be limited in duration and access would be maintained to the extent possible.

4.8.13.2 Long-term Impacts

Aquatic Species Habitat Actions would not affect the duration of I-5 closures. Aquatic Species Habitat Actions could cause localized increased in flooding of some roadways, resulting in minor adverse impacts due to the limited scale.

4.8.13.3 Mitigation

Potential mitigation measures for short-term impacts on transportation include maintaining access to properties to the extent possible, installing signs, marking detour routes, flagging and providing information to the public, including notifications in advance of construction activities. Culvert replacements on state roadways would be coordinated with WSDOT and local transportation departments.

Long-term adverse impacts on transportation would be limited to small areas of increased flooding on local roadways, so no mitigation is proposed.

4.8.14 Public Services and Utilities

4.8.14.1 Short-term Impacts

The potential short-term impacts on public services and utilities would occur during construction and include temporary disruptions to roadways, delays to public services, and disruptions of utilities. These impacts are limited because services and utilities would be maintained through proper mitigation, and impacts would be limited to the construction period.

4.8.14.2 Long-term Impacts

Aquatic Species Habitat Actions would not change demand for public services and utilities, but could require localized relocation of utilities, which would result in minor adverse impacts. Aquatic Species Habitat Actions could cause minor increases in flooding, but the increases are unlikely to affect public services and utilities.

4.8.14.3 Mitigation

Potential mitigation measures for short-term impacts on public services and utilities could include measures to maintain access and public services similar to those described for the Airport Levee Improvements. Mitigation for minor long-term adverse impacts associated with utility relocation could include coordination with local service providers and property owners.

4.8.15 Environmental Health and Safety

4.8.15.1 Short-term Impacts

The potential short-term impacts on environmental health and safety would include disruptions to local roadways, causing temporary delays to emergency services during construction. These impacts would be limited to the construction duration and access would be coordinated with emergency services.

4.8.15.2 Long-term Impacts

No adverse impacts on environmental health and safety would occur with implementation of the Aquatic Species Habitat Actions. Restoration actions could cause some increased flooding in local areas, but would not increase the demand for emergency response services or increase the risk of contamination of floodwaters.

4.8.15.3 Mitigation

Potential mitigation measures for short-term impacts on environmental health and safety could include those described in Table 4.1-1 as they relate to the transport of material, as well as coordinating construction with emergency services to reduce impacts on emergency response. No long-term adverse impacts on environmental health and safety are anticipated with Aquatic Species Habitat Actions, so no mitigation is proposed.