USDA United States Department of Agriculture

Pearson Eddy WRP Restoration Project
Final Environmental Assessment

Snohomish County, WA

Prepared by
USDA Natural Resources Conservation Service

August 2017

List of Acronyms and Abbreviations

ACOE	US Army Corps of Engineers
BMPs	Best Management Practices
BiOp	Biological Opinion
BGEPA	Bald and Golden Eagle Protection Ac
CERCLA	Comprehensive Environmental Response, Compensation, and Liability
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMP	Corrugated Metal Pipe
CUA	Compatible Use Authorization
CWA	Clean Water Act
CY	Cubic Yards
CZMA	Coastal Zone Management Act
DAHP	Washington Department of Archeology and Historic Preservation
DIA	Diameter
DOD	Department of Defense
DOE	Department of Ecology
DPS	Distinct Population Segment
EA	Environmental Assessment
EE	Environmental Evaluation
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EL	Elevation
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESUs	Evolutionary Significant Units
FT	Feet
FONSI	Finding of No Significant Impact
JARPA	Joint Aquatic Resource Permit Application
MOU	Memorandum of Understanding
MTR	Muted Tidal Regulator
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
USDA	United States Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WRP	Wetland Reserve Program
WRPO	Wetland Restoration Plan of Operations
WED	Warranty Easement Deed

Executive Summary

The Natural Resource Conservation Service (NRCS) plans to implement the Pearson Eddy Wetland Restoration Plan of Operation (WRPO), and hereafter referred to as the Pearson Eddy WRP Restoration Project). This project includes habitat improvements on 267 acres located within Pearson Eddy channel and the adjacent floodplain of the Snoqualmie River in Snohomish County, WA. Project implementation would occur on lands encumbered by two permanent Wetland Reserve Program (WRP) easements owned by the United States and administered by NRCS. The project would restore floodplain connectivity, improve fish passage from Pearson Eddy to rearing and refuge areas on the floodplain, and restore surface hydrology and native vegetation. The goals are to improve habitat for salmonids, amphibians and other aquatic organisms along with providing a diverse wildlife habitat for migratory birds.

The purpose of this Environmental Assessment (EA) is to describe the potential impacts anticipated from implementation of the Pearson Eddy WRP Restoration Project.

A third alternative action was added to the evaluation in response to concerns raised during the public comment period following the release of the *Pearson Eddy WRP Restoration Project Draft Environmental Assessment*. In addition to the No Action Alternative and the former Preferred Alternative (now Alternative #1: Floodplain Vegetation Restoration), a new Preferred alternative (referred to Alternative #2: Floodplain Vegetation Modification) has been evaluated in this Final EA. The No Action Alternative involves no modifications made to the existing water control structure in Pearson Eddy and no active construction and management of the floodplain vegetation and other wetland plant communities on the easement.

Alternative #1: Floodplain Vegetation Restoration involves replacement of a water control structure in Pearson Eddy channel, restoration of a floodplain channel, restoration of wetland hydrology, restoration of native plant communities, and enhancement of short grass habitat for waterfowl and wildlife forage.

Alternative #2: Floodplain Vegetation Modification is the Preferred Alternative, containing the original planned actions in Alternative #1, with modification of the planned tree and shrub planting, along with a plan to manage existing floodplain trees and shrub vegetation. NRCS is willing to remove existing trees and shrubs from the Snoqualmie River floodway and would develop a vegetation restoration and management plan in cooperation with the Snoqualmie Valley Watershed Improvement District, King County Environmental Program, Snohomish County Planning, and the easement landowners.

Project implementation under Alternative #2: Floodplain Vegetation Modification is planned to occur in phases, with construction of the replacement water control structure in Pearson Eddy in late summer 2017. The NRCS would complete the Vegetation Restoration and Management plan in cooperation with the entities listed above and then plans to proceed with the floodplain earthwork during summer of 2018.

The following is a summary of the project actions:

1. Replace the failing water control structure with a structure that is designed to improve the exchange of water from Pearson Eddy slough onto lands within the easement and onto the adjacent wetland mitigation bank.
2. The existing natural swale channel on the floodplain would be restored to a configuration more closely resembling an original floodplain channel present prior to active agriculture (~38,000 CY of excavation)
3. "Deep Ditch" (large constructed ditch) would be filled with native soil from the swale restoration (~10,000 CY of fill)
4. Fill a portion of constructed drainage ditches associated with Treen Lake (~500 CY of fill)
5. Plant native trees and shrubs on up to 30 acres in areas outside the Snoqualmie River floodway. Final quantity and location of any additional planting would be outlined in the vegetation restoration and management plan.
6. Remove earthen grass sod from ~20 acres by de-leveling the area along with optional disking operations to maintain moist soil and native emergent wetland vegetation
7. Six large wood structures consisting of anchored logs and root wads would be installed in the restored floodplain channel and along the margins of seasonally ponded wetlands to provide fish and wildlife habitat such as hunting perches, hiding cover, and basking sites.
8. Approximately 60 acres of reed canarygrass would be managed as wildlife forage for waterfowl and other wildlife.
9. Develop a vegetation restoration and management plan in cooperation with the Snoqualmie Valley Watershed Improvement District, King County Environmental Program, Snohomish County Planning, and the easement landowners. The plan would evaluate options to remove and/or replace up to 20 acres of existing tree/shrub plantings on the WRP and up to 74 acres on the floodplain easement that are currently within the floodway of the Snoqualmie River.
10. Commitment to issue Compatible Use Authorization (CUA) for surface water drainage on the WRP and FPE properties.

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Chapter 1: Introduction

This environmental assessment (EA) has been prepared by the United States Department of Agriculture Natural Resources Conservation Service (NRCS) to comply with the requirements of the National Environmental Policy Act (NEPA) of 1969 and implementing regulations at 40 CFR Parts 1500-15081508 and 7 CFR Part 650. The EA would assist NRCS in determining whether the action would have a significant impact on the quality of the human environment and would therefore require preparation of an Environmental Impact Statement (EIS).

The NRCS plans to implement the Pearson Eddy Wetland Restoration Plan of Operation (WRPO, and hereafter referred to as the Pearson Eddy WRP Restoration Project). This project would involve activities in and along Pearson Eddy Slough (hereafter referred to as Pearson Eddy) and on the floodplain of the Snoqualmie River. The goals of the project are to ensure flood risk reduction for upstream landowners is maintained, improve salmonid access to floodplain channels and wetlands, restore wetland hydrology, restore and mange native floodplain forest vegetation, and enhance habitat for migratory birds.

NRCS is not required to automatically develop and EIS for this floodplain, stream, and wetland restoration project. The agency policy requiring an EIS be developed for stream projects is for channelization projects or when the project is designed to deepen a stream in order to covey water more quickly. This policy does not apply to this restoration as per discussions with Regional and National Environmental Compliance Specialists.

The NRCS is the lead agency under the National Environmental Policy Act (NEPA), The NRCS has authorization under 16 United States Code (U.S.C.) 590 a-f; and the Wetlands Reserve Program (WRP) 16 U.S.C. 3837-3837F, and 7 Code of Federal Regulations (C.F.R.) Part 1467 (CFDA 10.072) to be a cost-share partner with Forterra[1] on the restoration project.

Title XII of the Food Security Act of 1985, as amended (16 U.S.C. Section 3837 et. seq.) for the WRP authorizes the Natural Resources Conservation Service to purchase easements for the purposes of completing wetland restoration. The Wetlands Reserve Program purpose is to preserve, protect, and restore the nation's valuable wetlands. The project would occur on lands encumbered by WRP easements held by NRCS and located on property owned by Forterra[1].

NRCS holds two WRP easements on the project site that were effective 7/28/2004. According to the Warranty Easement Deeds (WED) Part V-Rights of the United States

"The United States shall have the right to enter unto the easement area to undertake, at its own expense or on a cost-share basis with the Landowner or other entity, any activities to restore, protect, manage, maintain, enhance, and monitor the wetland and other natural values of the easement area."

The US Army Corps of Engineers (ACOE) also has authority under Section 404 of the Clean Water Act (CWA) and, through its regulatory permitting process, the obligation to evaluate the potential impacts of this project as they relate to fill in waters of the U.S.

A list of project entities and their roles can be viewed in Table 1.1 and a list of preparers and

reviewers of this Environmental Assessment can be found in Appendix A.

[1] Forterra (formerly Cascade Land Conservancy) was established as a local land trust in 1989 to "Secure Places – Urban, Rural, and Wild-that are keystones of a sustainable future." Forterra is the primary owner of the WRP easement and would partner with NRCS to complete the restoration activities.

Table 1.1 List of action agencies/organizations under additional project entities, and their respective involvement.

Project Entities	Role	Comment
NRCS	WRP Easement Holder/Lead Agency	Easement holder and lead agency for the Environmental Assessment. Also a cost-share partner with Forterra for the restoration project.
US Army Corps of Engineers	Authorizing Agency	Reviewed and issued permit application for fill in water of the U.S. under CWA Section 404.
Forterra	WRP Easement Owner, Permit Applicant, Restoration Contract Holder, Project Proponent	Project Partner who applied for permits and would implement the restoration contract which is funded by NRCS.
Landowners	Two landowners on whose property the WRP conservation easements are located.	Two landowners own fee title to properties that contain the restoration project. Two private landowners placed WRP easements on their property in 2004. Forterra purchased fee title to ~93% of the easement acres with the balance of the easement owned by family of one of the original easement sellers.
Habitat Bank LLC	Adjacent landowner who has granted permission to allow additional controlled flows to flow onto the ~200 acre wetland mitigation bank. Approx. 130 acres of wetland would benefit with additional flow with replacement WCS.	
WDFW	Authorizing Agency	Reviewed and issued Hydraulic Project Approval (HPA) allowing work in waters of the state.
WDOE	Authorizing Agency	Reviewed need for 401 Water Quality Certification and Coastal Zone Management Act Consistency under NWP #27. Determined no further action needed. Issued the Stormwater Construction General Permit.
Snohomish County Planning and Development Services	Authorizing Agency	Reviewed and issued the following: Shoreline Management Act Exemption; Land Disturbing Activity Permit; Flood Hazard Permit
WA Department of Archeology and Historic Preservation	Authorizing Agency	Section 106 Compliance Coordination

Snoqualmie Tribe	Consulting Nation	Reviewed project during Section 106 compliance process
National Marine Fisheries Service	Consulting Agency	Reviewed the project under ESA Section 7
USFWS	Consulting Agency	Reviewed the project under ESA Section 7
Snoqualmie Valley Watershed Improvement District	Cooperating entity representing agricultural viability in the Snoqualmie Valley (King County geography)	Provided NRCS with input during development of the new preferred alternative (Alternative #2)
King County Environmental Programs (DNRP/WLRD/RRS -Agriculture)	Cooperating agency representing King County interest in flood hazard, surface drainage, and farmland preservation program	Peer reviewed NRCS hydrologic model (HEC-RAS two dimensional model). Provided NRCS with input during development of the new preferred alternative (Alternative #2)

1.1 Project Description

The USDA NRCS is proposing to implement habitat improvements on 267 acres located within Pearson Eddy channel and the adjacent floodplain of the Snoqualmie River in Snohomish County, WA. Project implementation would occur on lands encumbered by two permanent Wetland Reserve Program (WRP) easements owned by the United States and administered by NRCS. The project would restore floodplain connectivity, improve fish passage from Pearson Eddy to rearing and refuge areas on the floodplain, and restore surface hydrology and native vegetation. The goals are to improve habitat for salmonids, amphibians and other aquatic organisms along with providing a diverse wildlife habitat for migratory birds.

The actions that would later be discussed and evaluated in the Preferred Alternative section include the following:

1. Replace the failing water control structure with a structure that is designed to improve the exchange of water from Pearson Eddy slough onto lands within the easement and onto the adjacent wetland mitigation bank.
2. The existing natural swale channel on the floodplain would be restored to a configuration more closely resembling an original floodplain channel present prior to active agriculture (~38,000 CY of excavation)
3. "Deep Ditch" (large constructed ditch) would be filled with native soil from the swale restoration (~10,000 CY of fill)
4. Fill a portion of constructed drainage ditches associated with Treen Lake (~500 CY of fill)
5. Plant native trees and shrubs on up to 30 acres in areas outside the Snoqualmie River floodway. Final quantity and location of any additional planting would be outlined in the vegetation restoration and management plan.
6. Remove earthen grass sod from ~20 acres by de-leveling the area along with optional disking operations to maintain moist soil and native emergent wetland vegetation
7. 6 large wood structures consisting of anchored logs and root wads would be installed in the restored floodplain channel and along the margins of seasonally ponded wetlands to provide fish and wildlife habitat such as hunting perches, hiding cover, and basking sites.
8. Approximately 60 acres of reed canarygrass would be managed as wildlife forage for waterfowl and other wildlife.
9. Develop a vegetation restoration and management plan in cooperation with the Snoqualmie Valley Watershed Improvement District, King County Environmental Program, Snohomish County Planning, and the easement landowners. The plan would evaluate options to remove and/or replace up to 20 acres of existing tree/shrub plantings on the WRP and up to 74 acres on the floodplain easement that are currently within the floodway of the Snoqualmie River.
10. Commitment to issue Compatible Use Authorization (CUA) for surface water drainage on the WRP and FPE properties.

1.2 Project Location

The Pearson Eddy WRP Restoration Project site is located in Snohomish County Washington (SW ¼ of Section 25 & SE ¼ of Section 26 & NE ¼ of Section 35 & NW ¼ of Section 36, Township 27 North, Range 6 East, Willamette Meridian) approximately 5 miles south of the city of Monroe. The site is east of High Bridge Road and lies in the 100-year floodway of the Snoqualmie River. Pearson Eddy enters the Snoqualmie River at approximately River Mile (RM) 4.4. Project lies on the left bank and floodplain of the Snoqualmie River approximately 3 miles upstream from the point at which the Snoqualmie River joins the Skykomish River to form the Snohomish River. The site is a combination of abandoned farmland previously used for dairy farming (hay, grass/corn silage, livestock grazing) with areas previously planted to native trees and shrubs. See Figure 1-1 for the project location.

Vicinity Map
Pearson Eddy Slough WRP Project

USDA NATURAL RESOURCES CONSERVATION SERVICE

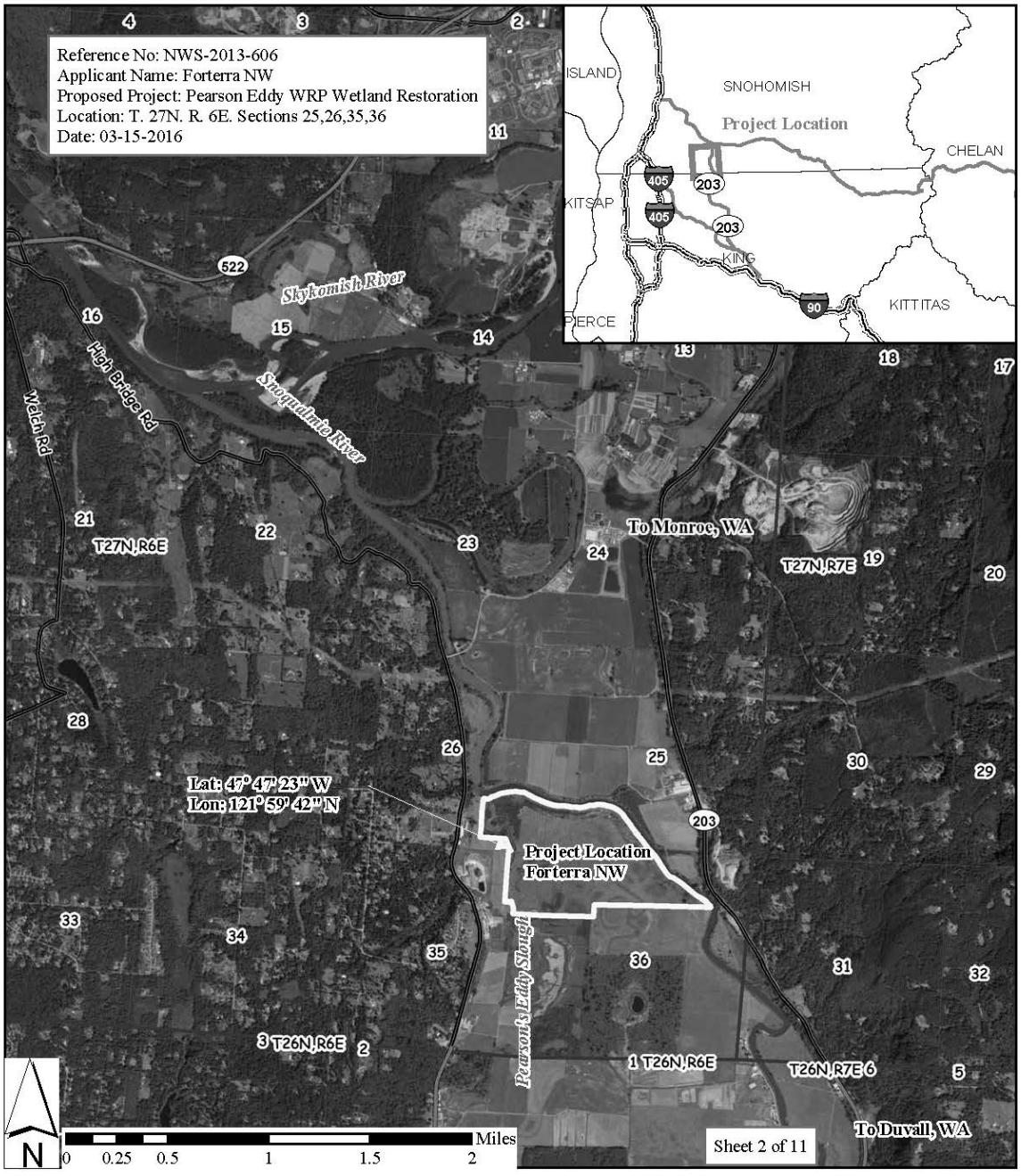


Figure 1-1 Pearson Eddy Project Location

1.3 Scope and Nature

The WRPO goal for both NRCS WRP easements, totaling 267 acres, is to improve habitat for salmonids, amphibians, and other aquatic organisms along with providing diverse wildlife habitat for migratory birds. Implementation of the restoration project is intended to compliment restoration actions on adjacent lands which would restore fish and wildlife habitat and floodplain function on over 600 acres. Figure 1-2 shows the project footprint.

1.3.1 Background - Scoping Process and Project Timeline

NRCS conducted scoping of the Pearson Eddy WRP project at several intervals since the WRP easements were acquired in 2004. Three levels of scoping occurred: intra-agency, interagency, and from the public. Various opportunities to solicit comments and input from the public as well as from local, state, and federal regulatory agencies were completed.

Intra-agency collaboration began at the time of evaluation, ranking and preliminary planning prior to easement acquisition 2004. NRCS followed agency NEPA guidelines and prepared an Environmental Evaluation (EE) which tiered to the Programmatic WRP EA for the activities in the preliminary WRPO. The initial 55 acres of tree/shrub planting moved forward under this FONSI prior to acquisition of an adjacent FPE and the opposition to the tree planting that occurred. Further information on the FPE to follow below.

Intra-agency scoping on hydrology restoration activities occurred beginning in 2008 before the WRPO was finalized. An Interdisciplinary Team (IDT) was formed consisting of a forester, engineer, biologist, and cultural resources specialist. The IDT determined that hydrologic modeling was needed to analyze alternatives for the existing WCS, including the feasibility of total removal and risk of adverse off site impacts along with potential locations for a replacement water control structure. Tetra Tech was hired to complete the initial hydraulic analysis (See Appendix C).

Inter-agency scoping occurred via communication leading up to the first Joint Aquatic Resource Project Approval (JARPA) submission in May 2013 and ended with the receipt of permits from Snohomish County, WDFW, and the ACOE. Consultation with the NMFS resulted in concurrence with a No Effect determination. Cultural Resources consultation with DAHP and the Snoqualmie Tribe has been completed with concurrence to proceed with on-site project monitoring during construction. See Appendix B for compliance documentation and permits.

During the time that restoration alternatives for the WRP easements were being developed, NRCS acquired a separate Floodplain Easement (FPE) adjacent to the two WRP easements. Purpose of the FPE is to restore, protect, maintain, and enhance function of the floodplain. NRCS completed an EE for the vegetation restoration work and found the federal action was categorically excluded from further environmental analysis and that there were no extraordinary circumstances. The FPE closed in 2009 and native floodplain forest vegetation was planted in winter 2010. Beginning in spring 2010, NRCS received written and verbal complaints from agricultural landowners across the King County line, just south of the FPE and WRP easement areas. See Figure 1-3 Ownership Map.

Further comment was solicited from adjacent landowners in March 2015 before NRCS made a

small repair to the existing water control structure. Letters were mailed to adjacent landowners, including those that had expressed concerns over floodplain re-vegetation activities on the adjacent FPE.

Following receipt of comments regarding this WCS repair, a meeting was held near the project location August 21, 2015 with several local private landowners and their invited advocates, NRCS State and Regional leadership, Staff from Congresswoman Del Bene's office, King County Water Resources and Farmland Preservation staff. During the meeting each organization stated their concerns, which included flooding on access roads to the private hunt club along with inability to plant food plots due to wetness, flooding on fields and farm access roads, NRCS response to previous Freedom of Information Act requests, damage on agricultural lands from increased waterfowl population on wetland mitigation bank, lack of pump at the WCS, loss of ag land to restoration efforts, and tree planting on the adjacent FPE. NRCS committed to temporary repair of the flap gate, to conduct a drainage assessment of lands under easements, and to write an EA for the full WRP restoration plan.

The most recent scoping opportunity for public comment was held on December 15, 2016 when NRCS held a public meeting to present the planned project and accept public comment. Written comments were also accepted until December 31, 2016. NRCS incorporated comments received through December 31, 2016, using them to inform the planning process. The information provided in the EA is intended to clarify the federal action.
A copy of all comments received, including a transcript of verbal public comments provided at the meeting is located in Appendix F of this document. Comments received prior to December 31, 2016 from six individuals and two organizations were combined into the following general categories and summarized in the table below.

Comment Subject	**Summary of Comments**
Fisheries	There are no fish in Pearson Eddy channel and it needs to remain that way. Do not place habitat logs in ditches.
Drainage/Flooding	Drainage ditches on the floodplain need to be maintained. Pump at WCS needs to be restored. Water is now flowing from the easements south across the county line and then to the Snoqualmie River. Flooding is now occurring on access road to hunt club prohibiting access and establishment of food plots. NRCS needs to assess new discharge point of restored floodplain channel versus current deep ditch.
WCS function	Replace WCS gates with hinged gates and no MTR.
Loss of farmland	Easements and mitigation bank are causing flow of water to move southward from conservation lands creating standing water and lost productivity on upstream agricultural lands.
King Co. Farmland Preservation Easements	King County holds Farmland Protection Program easements on over 4,100 ac in Snoqualmie Valley, including two farms directly south of the County line. These lands need to remain farmable.
Drainage Assessments	Report does not address issue of long term chronic discharge of water from the north onto farmlands in King County. Discharge is more important than rate of drainage following flood events. NRCS needs to study surface water levels on habitat bank, hunt club, and adjacent

	farmland to assess consequences of proposed actions.
Waterfowl Damage	Mitigation bank has increased number of waterfowl and many forage on adjacent farmland at night. Increased soil saturation and excessive waterfowl foraging in greatly affecting farmland.
Beaver Potential	NRCS should conduct an assessment of beaver expansion into the area following restoration.
Tree Planting	Assess tree planting (completed and proposed) with respect to zero rise standard and to understand how plantings may impede flow and drainage during floods.
Permit Jurisdiction	Shoreline Management, critical areas and waters are jurisdictions that need to be coordinated with regulatory agencies during permitting. Project requires permits from WDFW, Snohomish Co., SEPA, NEPA, EIS,
Easement Ownership	NRCS did not publically speak about the WRP easement until the Dec. 2016 Public Meeting.
Inadequate Public Process	NRCS did not follow public process rules regarding NEPA (comment timeframe, facilitated meeting, and proper notice of Dec. 2016 public meeting, no notice for Duvall, Carnation, Falls City, government agencies not notified). No public process for restoration on FPE.
FPE	FPE has impacted drainage in the floodway causing backwater onto neighboring farmland. Effects were revealed following significant 2009 flood event. NRCS does not plan to address drainage problems on the FPE and this could cause damage to infrastructure, livestock death, and possible human fatalities.
Hydrology	NRCS has not met best available science when conducting studies and has not allowed peer review. HEC-RAS model can be influenced by bias and output cannot produce reliable output without valid data input into model. Questions on vegetation input into model.
Fish Screen	NRCS stated at a public meeting that the replacement WCS would have a fish screen.

A draft EA was published on April 3, 2017 with a 30-day public comment period which ended May 2, 2017. Comments from 4 individuals and/or organizations were received. The comments can be found in their entirety in Appendix G. NRCS' response to these comments can be found in Appendix H. The comments can be summarized into the following categories:

Comment Category	**Concern(s)**
1. Floodway Impacts	County Jurisdiction & Permit Requirements
2. Restoration	Determination of target plant community & historic versus artificial channels
3. Washington State Laws	SEPA & Water Quality
4. Prime Farmland	Conversion
5. Stormwater Conveyance	Point Source Pollution, Clean Water Act, Turbidity
6. Threatened and Endangered Fish	Historic use of site, Water Quality, Section 7 consultation, Stranding
7. Nuisance Wildlife	Crop Damage, water quality, beaver
8. Hazardous Materials	Phase I environmental screening
9. Economics	Maintenance costs, weeds (RCG)
10. Fluvial Geomorphology	Increase in flood elevation
11. Regulatory Compliance	NEPA (mandatory EIS for stream projects), ESA, CWA, WA state law, County floodway regulation
12. Surface Drainage Maintenance	Responsibility

Following development of the new Preferred Alternative (Alternative #2: Floodplain Vegetation Modification) the proposal was presented to representatives of the Snoqualmie Valley Watershed Improvement District (WID) and King County Environmental programs staff on June 15, 2017. The group felt that proceeding with the full amount of vegetation removal needed in order to achieve the zero rise standard would present a regulatory challenge and may cause negative impacts to environmental resources such as ESA listed fish and culturally significant natural resources for area Tribal Nations. As such, the project would benefit from a collaborative planning effort which would result in vegetation restoration and management plan that would reduce flood elevations by strategically modifying existing vegetation, consider alternatives to complete removal such as replacing trees with shrubs, thinning areas, and clearing smaller areas in a systematic manor over time. This planning effort is described in Alternative #2: Floodplain Vegetation Modification in Section 3.4.

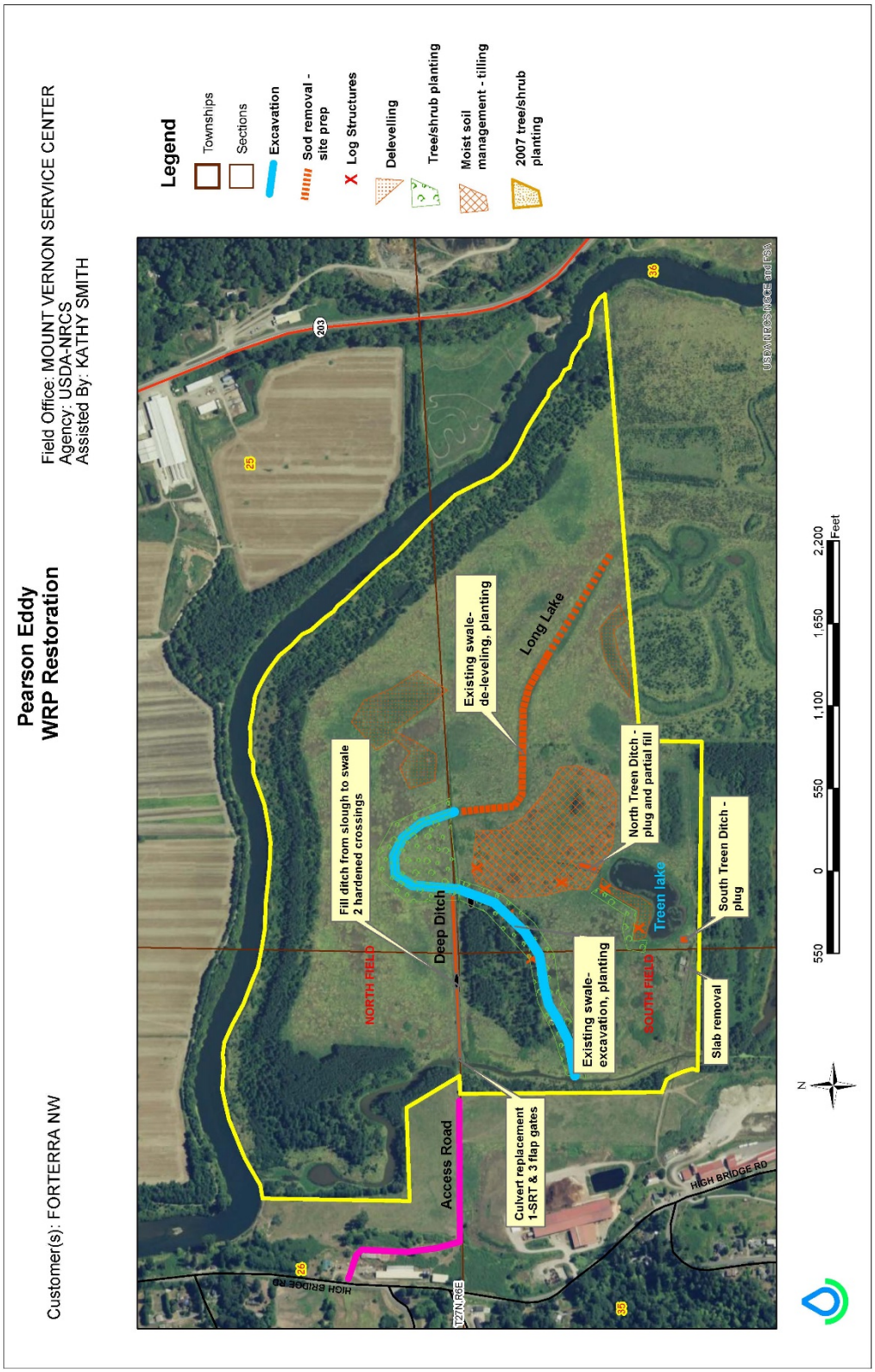


Figure 1-2. Aerial View of the Pearson Eddy Project Site with Restoration Plan Map

1.3.2 Background – Site History

The Pearson Eddy watershed is approximately 10 square miles. The site is relatively flat and is drained by a network of ditches and modified natural channel, the largest of which is Pearson Eddy. Pearson Eddy drains from the south to north through the project site toward the Snoqualmie River, and has an average longitudinal slope of approximately 0.07 percent. Two un-named tributaries come from the uplands into Pearson Eddy. The majority of the watershed is agriculture. The project is adjacent to Habitat Bank LLC, a wetlands mitigation bank to the south, a private hunting club to the southeast, a USDA floodplain easement to the east, the Snoqualmie River to the north, and farm buildings on private land to the west. See Figure 1-3 Ownership map.

Historically, Pearson Eddy slough may have been a small, off-channel slough of the Snoqualmie River, however, the slough was dredged and expanded through a series of ditches to form the current channel. Historically the primary sources of moisture or floodwater at the project site included: 1) flooding by the Snoqualmie River, 2) groundwater flow parallel to the river, 3) lateral groundwater flow from the watershed surrounding the site, 4) surface water inflow, and 5) direct precipitation. Currently surface drainage ditches continue to drain the majority of the project area, thereby greatly reducing wetland hydrology. A water control structure (WCS) with four culverts and flap gates was constructed in Pearson Eddy channel in to preclude flooding of the site by the river, except during Snoqualmie River flows exceeding 34 feet in elevation. The WCS constructed in Pearson Eddy channel serves to prevent floodwater from backing up onto farmland located upstream. Floodplain streams were in the vicinity and were relocated and converted to drainage ditches during agricultural development of the site. Flow within these ditches or channels is augmented by groundwater discharge, seeps and springs. For a detailed description of the drainage features present on the WRP easement, see Appendix D -Lower Snoqualmie River, WA WRP/FPE Drainage Assessment (February 2016).

The project site was previously managed as farmland, used for dairy farming (hay, grass/corn silage, livestock grazing). The area was enrolled into the WRP program in 2004 and approximately 55 acres along the banks of the Snoqualmie River and Pearson Eddy have been planted with native trees and shrubs (see Figure 1-2).

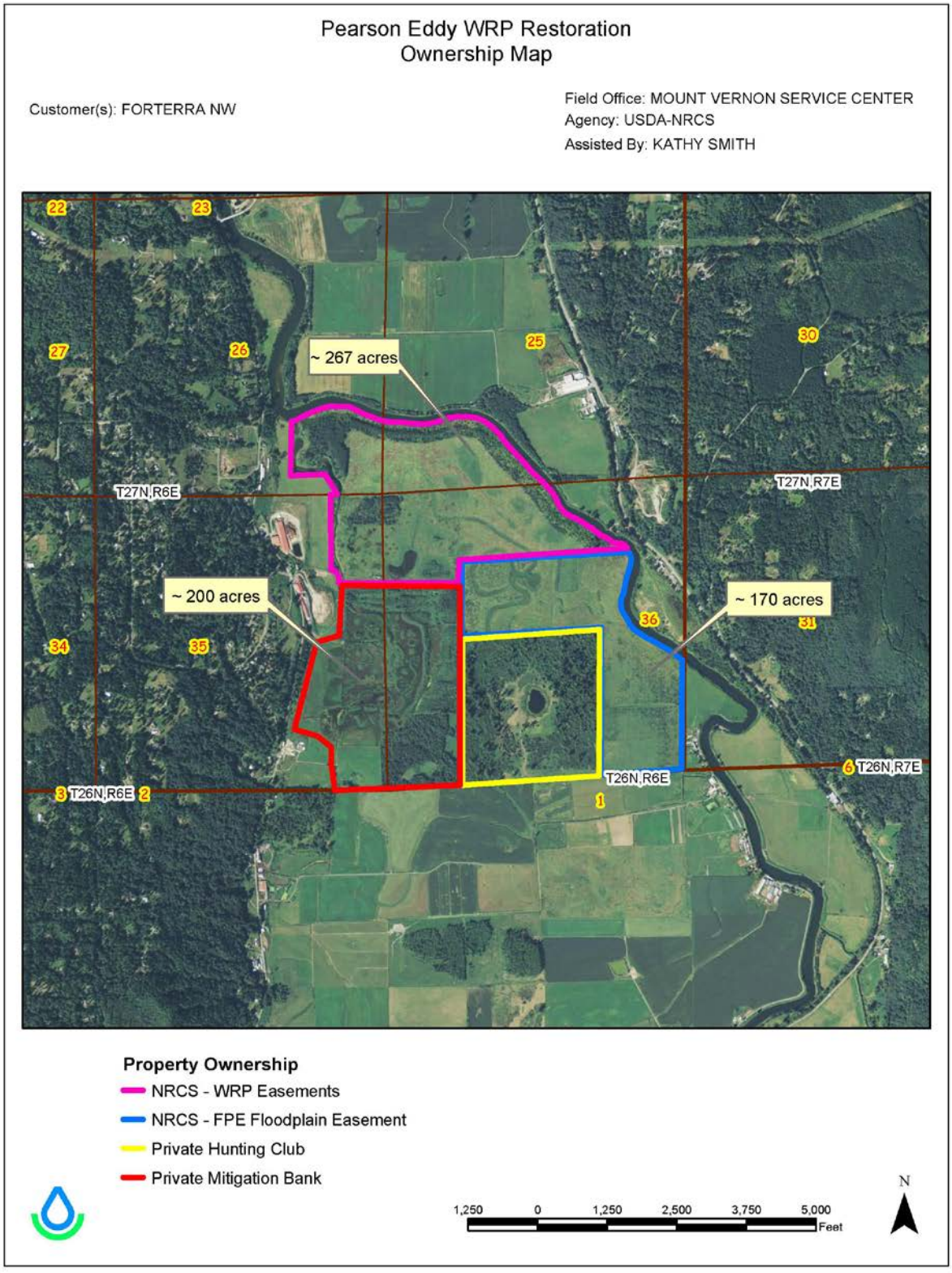


Figure 1-3. Ownership Map

Chapter 2: Purpose and Need

2.1 Purpose

The purpose of the Pearson Eddy WRP Restoration Project is to restore habitat for salmonids, amphibians and other aquatic organisms along with providing diverse habitat for migratory birds while ensuring continued flood risk reduction to upstream landowners.

2.2 Need

An existing water control structure consisting of 4 culverts and flap gates has begun to fail and is no longer fully serving to reduce the impact of flood events backing up from the Snoqualmie River to lands located upstream of the WRP easement. The channel is beginning to cut around the end of the fill surrounding the culverts and a large scour area and head-cut is occurring where flood flows return to Pearson Eddy. Lastly, there is evidence of the culverts being rusted out and water piping through the fill, outside of the culverts. This structure also precludes passage of fish (primarily salmonids) and other aquatic species upstream in the slough and into floodplain channels and wetlands that provide low velocities and ample forage, collectively known as refugia and rearing habitat.

Figure 2-1. Water control structure in Pearson Eddy at high flow. Three additional culverts are located below the water line.

Past management practices have altered the natural hydrology on the floodplain, primarily through the creation of a network of surface drainage ditches and filling and relocating of natural floodplain channels and wetlands. These past alterations have greatly decreased wetland hydrology by reducing the frequency and duration of water on the floodplain.

Figure 2-2. Deep Ditch draining east to west. Invasive reed Canarygrass and blackberry dominate ditch bank.

Vegetation on the project site has been converted from native wetland and forestland species to non-native invasive herbaceous vegetation and blackberry through past agricultural practices. Dominant species include reed Canarygrass and non-native blackberry.

Figure 2-3. Freshwater wetland in middle of project area showing dominance of invasive reed Canarygrass.

Chapter 3: Project Alternatives*

*A third alternative action was added to the evaluation as a result of concerns raised during the public comment period following the release of the *Pearson Eddy WRP Restoration Project Draft Environmental Assessment*. In addition to the No Action Alternative and the former Preferred Alternative (now Alternative #1: Floodplain Vegetation Restoration), a new Preferred alternative (referred to Alternative #2: Floodplain Vegetation Modification) has been evaluated in this Final EA.

3.1 No Action Alternative

Under the No Action Alternative, the conditions at the Pearson Eddy WRP easements would not be altered and NRCS would fail to enhance the quality of natural resources.

NRCS would not expend Wetlands Reserve Program (WRP) restoration funds to restore habitat on the easement and to replace the failing water control structure in Pearson Eddy. The channel has begun to cut around the existing WCS and water is piping through the structure outside of the culverts, with eminent total failure of the WCS when culverts and associated earth fill are completely bypassed. Fish passage from Pearson Eddy to floodplain channels and wetlands would continue to be blocked. Surface drainage features would remain and continue to reduce floodplain wetland quality and provide low quality habitat for fish and wildlife, including listed fish species. Invasive reed Canarygrass and non-native blackberry would continue to dominate vegetation on the easement, providing poor wildlife habitat.

NRCS WRP regulatory requirements at 7 CFR 1467, 16 U.S.C. 3837 and Pearson Eddy Warranty Easement Deed objectives of restoring the site to historic conditions, to the extent practicable, would not be met in the No Action Alternative.

3.2 Other Alternatives Considered but Rejected or Not Discussed in Detail

During development of the final WRPO, NRCS considered three alternatives related to the WCS in Pearson Eddy. Tetra Tech was hired in 2008 to complete a Hydraulic analysis. Objective of the analysis was to compare alternatives for removal and/or replacement of the existing tide gate structures on Pearson Eddy in order to inform planning decisions for wetland restoration at the Pearson's Eddy site. Study considered 3 alternatives: (1) Remove North crossing flood gates and replace the South crossing with a bridge (2) Remove the North crossing flood gates and replace the South crossing with a self-regulating flood gate structure with an access road on top of it (3) Remove the North Crossing flood gates, replace the South Crossing with a bridge, and install flood gates at the upstream end of the mitigation bank property. Report concluded that "In general, model results show that it would be feasible to manage backwater from the Snoqualmie River propagating upstream through Pearson's Eddy Slough while limiting high water levels in regions further upstream. Removal of the existing flap gates at the North Crossing would increase local flood elevations significantly, but relocating the flap gates (at the south crossing or further upstream) can limit the potential increases to flood elevations in this regime."

NRCS used this information to determine that a replacement WCS was needed to prevent off site impacts but develop a 4th alternative that replaced the WCS at the current northern location. The southern culvert crossing was removed in 2011 after the fill significantly eroded and the culvert

was a severe risk of failure. Decision to remove the crossing was made due to lessor cost and easier removal before the structure failed.

The decision to replace the WCS in its current location has been incorporated into the Alternatives.

3.3 Alternative #1: Floodplain Vegetation Restoration

The alternative involves active restoration methods to restore floodplain connectivity, replace a failing water control structure, improve fish passage, restore wetland hydrology, and restore native vegetation.

Designs for the alternative were completed on March 15th, 2016 and are located in Appendix E.

The following is a summary of the project actions:

1. Replace the failing water control structure with a structure that is designed to improve the exchange of water from Pearson Eddy slough onto lands within the easement and onto the adjacent wetland mitigation bank.
2. The existing natural swale channel on the floodplain would be restored to a configuration more closely resembling an original floodplain channel present prior to active agriculture (~38,000 CY of excavation)
3. "Deep Ditch" (large constructed ditch) would be filled with native soil from the swale restoration (~10,000 CY of fill)
4. Fill a portion of constructed drainage ditches associated with Treen Lake (~500 CY of fill)
5. Planting native trees and shrubs on 30 acres in areas adjacent to Long Lake, the restored swale channel, the right bank (east bank) of Pearson Eddy, and on low elevation earthen spoils piles from wetland de-leveling.
6. Remove earthen grass sod from ~20 acres by de-leveling the area along with optional disking operations to maintain moist soil and native emergent wetland vegetation
7. Six large wood structures consisting of anchored logs and root wads would be installed in the restored floodplain channel and along the margins of seasonally ponded wetlands to provide fish and wildlife habitat such as hunting perches, hiding cover, and basking sites.
8. Approximately 60 acres of reed canarygrass would be managed as wildlife forage for waterfowl and other wildlife.

All provisions of local and state permits would be implemented (See Appendix B for regulatory compliance permits). The disturbed areas would be seeded with native and introduced herbaceous species of plants as soon as is practical following construction to prevent erosion. Construction would be accomplished primarily with a large track hoe excavator and rubber tire dump trucks. Netting would be placed at the upstream and downstream ends of the project reach to prevent fish from entering the area of channel construction. During construction, streamflow through the project site would be managed in such a manner as to minimize erosion and sediment problems. The project site would be dewatered as well so the inflow to the site would have to be routed around the construction site. A floating turbidity barrier would be placed in Pearson Eddy downstream of the project site to prevent turbidity reaching the Snoqualmie River.

Under the alternative, the excavation work for the restoration activities would be completed using

a large-track excavator. Project construction would occur during the Washington Department of Fish and Wildlife (WDFW) approved in-water work window (July 1 to October 1st). This window minimizes impacts to fisheries resources including fewer effects to fish in the project area, less in-water activity during sensitive life stages, and less turbidity. A temporary access road west of the easements would be constructed to provide ingress and egress to large equipment during the construction phase of the project. This access road would be decommissioned once the construction work was completed, and the area would be restored to prior conditions. The total disturbance area for the project is 4.1 acres including the access road and staging/stockpile areas. This number also includes 3.04 acres of wetland disturbance. See Figure 3-1.

3.3.1 Replacement Water Control Structure

The existing water control structure is composed of four corrugated metal pipe (CMP) culverts – three 5-ft diameter culverts set at el. 20 and one 4-ft diameter culvert set at el. 27 ft. Flap gates are present on all culvert outlets. The existing structure would be removed and replaced in the same location with a new structure. The new structure is composed of four 5-ft diameter CMP culverts each 75 ft. in length set at el. 23. The new structure would increase drainage capacity with addition of one larger culvert than currently exists. Three of the new culverts would be fitted with flap gates hung on the downstream outlets. Fish passage and floodplain connectivity would be increased on the fourth culvert by installing a muted tidal regulator (MTR) which would be set to close at el. 28 ft. (Note: The manufacture refers to the flap gate designed to increase fish passage as a MTR despite this project location outside of tidal influence.) The MTR would increase frequency and duration of water exchange from Pearson Eddy Slough onto the Snoqualmie River floodplain which would increase fish access into floodplain channels and wetlands for rearing and refuge from high velocities.

In order to ensure structure integrity and function to serve in flood risk reduction to upstream landowners, the crossing elevation would be raised from el. 37ft. to el. 38 ft. This increase in height is to counteract buoyancy and ensure the structure remains in place. In addition, 1500 CY of 30-inch rock riprap would be placed on the right (east) bank of Pearson Eddy to prevent bank erosion during return flows from the floodplain.

3.3.2 Floodplain Channel Restoration

A floodplain channel 2700 ft. long would be dug beginning at the north end of "Long Lake" crossing the Deep Ditch and following historic channel alignments north, west, and south, crossing the Deep Ditch again and heading south to outlet into Pearson Eddy upstream of the water control structure (See Figure 3-1 Engineering Plan View). Dimensions of the new channel would range from 60-90 ft. wide (top width) with bottom width of 2-6 ft. Depth would vary by ground surface starting elevation, ranging from 0-14 ft. deep. Side slopes would be gentle with the majority at 3:1. Approximately 38,000 CY of excavated material would be generated and used to fill existing ditches with offsite disposal of excess material. A hardened rock crossing would be installed across the channel to facilitate access to the project site in order to conduct management and maintenance activities. An earth plug would be left at the western-most connection between the old and new channel so that water and fish cannot enter the new channel during construction and would be removed following construction.

3.3.3 & 3.3.4 Wetland Hydrology Restoration

Surface drainage features on the WRP easement would be filled to restore wetland hydrology, primarily by increasing the duration of soil saturation and to maintain open water in Treen Lake for longer in the year.

Deep Ditch (large constructed ditch flowing east to west to Pearson Eddy) would be filled with native soil from the floodplain channel restoration (~10,000 CY of fill). The ditched outlet south of Treen Lake, 135 ft. long, would be filled with ~100 CY of fill and 670 ft. of the North Treen ditch would be filled with ~400 CY of fill. The fill for both Treen Lake ditches would be generated from the floodplain channel excavation. A hardened rock crossing would be installed across the channel to facilitate access to the project site to conduct management and maintenance activities.

3.3.5 Native Tree/Shrub Planting

Native trees and shrubs would be planted in multiple areas totaling 30 acres in areas adjacent to Long Lake, the restored swale channel, the right bank (east) of Pearson Eddy, and on low elevation earthen spoils piles from wetland de-leveling. Most of the areas to be planted would prepared for planting by removal of non-native blackberry and other undesirable invasive vegetation during construction.

3.3.6 Emergent Wetland Enhancement

Approximately 20 acres of reed canarygrass dominated wetland would be enhanced by using a tracked bulldozer or tracked excavator to scrape reed canarygrass sod or "de-level" the area to allow for natural re-colonization of native wetland emergent species such as sedge, rush, and bulrush. The depth of sod removal would extend 18-inches below ground surface with the sod and associated native soil placed in designated adjacent areas. The maximum height of the sod fill is 18-inches above ground surface. Native emergent wetland species would be planted if desired native species do not re-establish.

3.3.7 Large Wood Structures

Six log structures would be installed in multiple locations within the easement to provide fish and wildlife habitat such as raptor perches, hiding cover for aquatic organisms, and basking areas for waterfowl and other wildlife. Two structures would be placed in the restored floodplain channel to provide hiding cover for fish and other aquatic organisms. Four structures would be installed along the margins of Treen Lake and along the emergent wetland enhancement area for wildlife basking and resting cover. Each log structure would be composed of five conifer surface logs, ~2-ft. diameter x ~15 ft. long with ~8 ft. avg. root wads. The structures would be anchored to log piling driven a minimum of 10 ft. into the ground and secured with stainless steel cable and clamps.

3.3.8 Wildlife Forage Management

Wildlife Forage Management would take place via Compatible Use Authorization to create short grass habitat for waterfowl such as Canada geese, widgeon, mallards, and pintail along with forage improvements for deer and improved raptor foraging. Approximately 60 acres of reed canarygrass would be reseeded with a non-native pasture forage mix and the area would be hayed or mowed annually. See Figure 3-0 for location of the area for wildlife forage management.

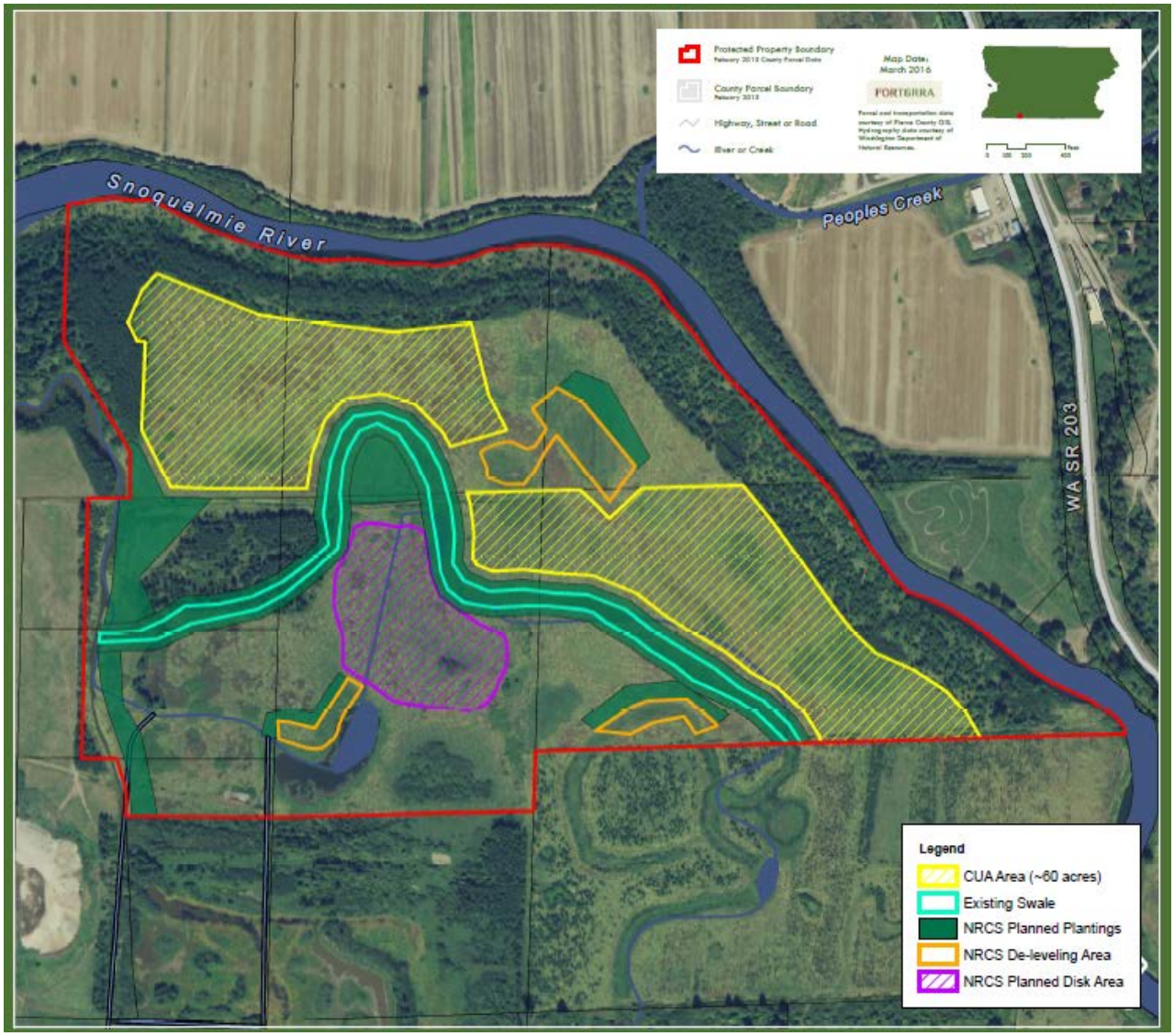


Figure 3-0. Compatible Use Authorization Map showing location of Wildlife Forage Management Area

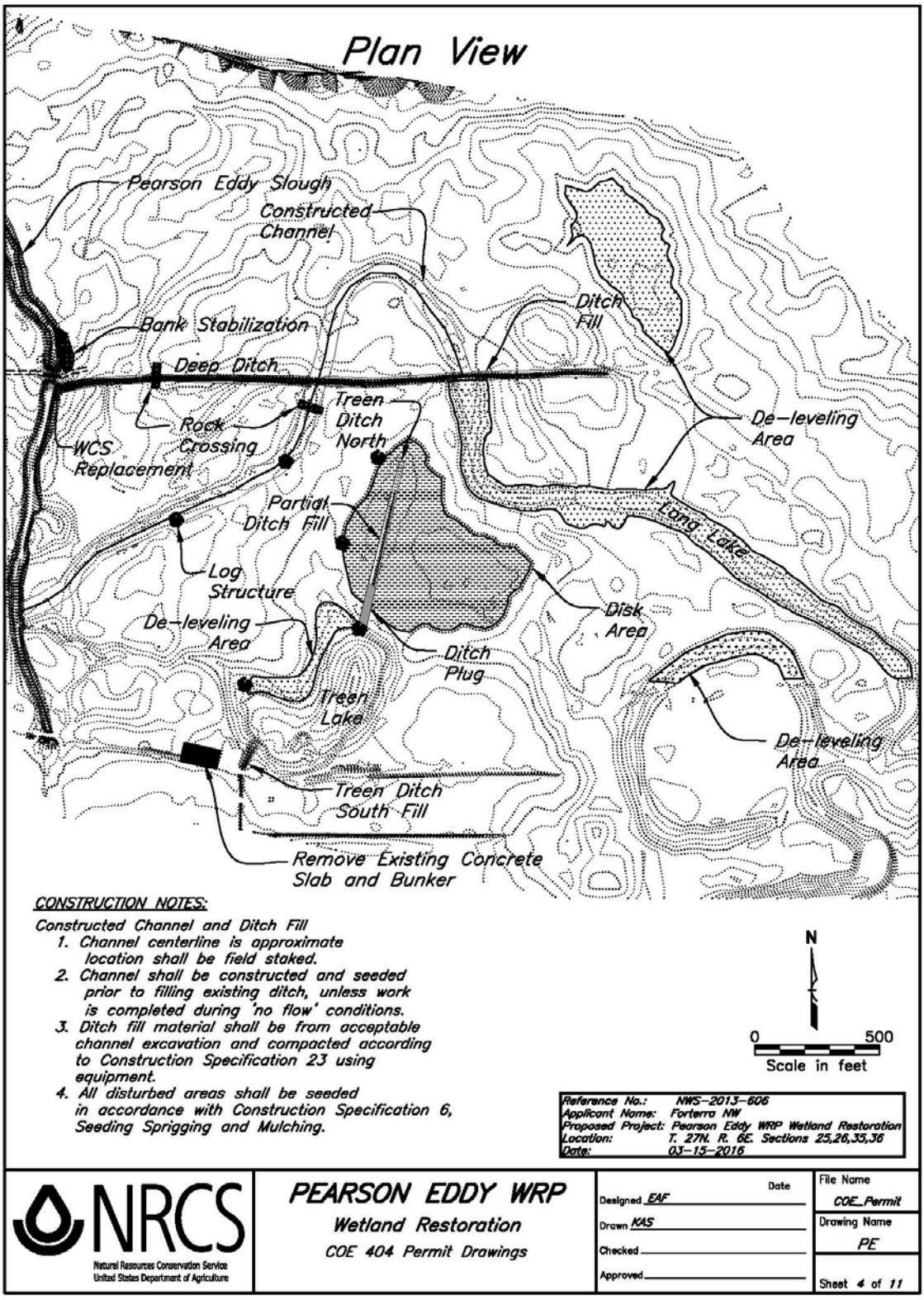


Figure 3-1. Engineering Plan View

3.4 Alternative #2: Floodplain Vegetation Modification (Preferred Alternative)

The preferred alternative includes actions described in Alternative #1, with changes in tree/shrub planting intended to reduce impacts to agricultural land located on the Snoqualmie River floodplain in King County. This alternative would reduce the negative impacts from increased flood elevations during large flood events when the Snoqualmie River exceeds its banks. Modifications to the planned actions in Alternative #1 include:

1. **Implementation Phasing:** The project would be installed in phases, with the first phase constructing the replacement WCS in Pearson Eddy during late summer 2017 and management of wildlife forage. The structure's functionality is rapidly declining and is increasing damaging scour erosion on adjacent private land along with limiting flood protection on upstream agricultural land. Phase two would include earthwork on the floodplain including floodplain hydrology and channel restoration, emergent wetland enhancement, large wood structures, and continued management of wildlife forage. Native tree/shrub planting would follow after completion of the Vegetation Restoration and Management plan (see below).

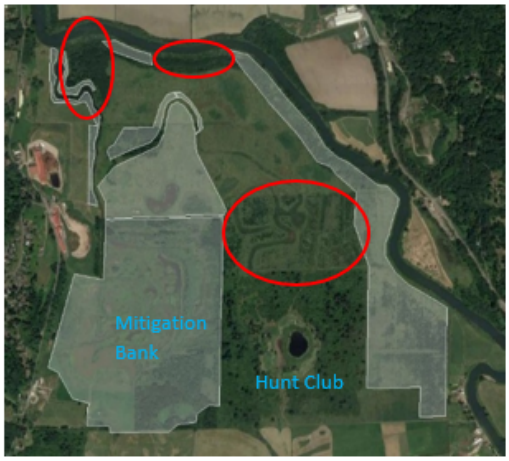
2. **Develop Vegetation Restoration and Management Plan**: NRCS would work in cooperation with the Snoqualmie Valley Watershed Improvement District, King County Environmental Program, Snohomish County Planning, and the easement landowners to develop a plan for floodplain vegetation restoration and management. NRCS supports the collaborative effort of the Snoqualmie Watershed Fish, Farm, and Flood Agreement that was signed June 2017 and is willing to modify the active planting and manage existing tree/shrub plantings as modeled in this agreement.

   The plan would inventory the existing plant communities, outline the location, species, and planting density of any new tree/shrub planting and would avoid new plantings in areas within the active Snoqualmie River floodway. In addition, NRCS has utilized the Hydrologic Engineering Center's River Analysis System (HEC-RAS), a two dimensional model, to identify two primary return flow paths used by receding floodwater following overbank river floods. The plan would evaluate options to remove and/or replace up to 20 acres of existing tree/shrub plantings on the WRP and up to 74 acres on the floodplain easement that are currently within the floodway of the Snoqualmie River. The plan would be completed prior to implementation of the floodplain restoration actions in Phase 2 in summer 2018.

Figure 3-2. Comparison of Vegetation Options

Alternative #1 Vegetation Restoration Existing or planned tree/shrub planting within portions of the area with white shading.

vs.



Alternative #2 Vegetation Modification NRCS will consider removing existing trees/shrubs located within areas outlined in red that are within return flood flow path. No work planned on private hunting club or mitigation bank property.

3. **Surface Drainage Maintenance:** NRCS would commit to issuance of Compatible Use Authorizations (CUA) for surface water drainage on the WRP and FPE properties at the request of and with willing participation of the easement landowners. NRCS cannot commit to long term financial contributions for surface water drainage outside of management and maintenance of the WCS in Pearson Eddy. However, NRCS has submitted a request to National Headquarters (NHQ) as to availability of FPE funding to maintain surface drainage on the FPE in the short term. If authorized by NHQ, NRCS would work with easement landowners and other Partner organizations to implement short term drainage maintenance activities within FPE boundaries.

The Preferred Alternative is Alternative #2: Floodplain Vegetation Modification based on its ability to satisfy the WRP statute (16 U.S.C. Section 3837, et seq.), regulation (7 C.F.R. Part 1467), program (Program Manuals Title 440 Part 514 WRP) requirements, meets the project goals and have minimal foreseeable adverse impacts on adjacent properties.

3.5 Best Management Practices

NRCS, Forterra and their contractors would incorporate the Best Management Practices (BMPs) required by the WDFW HPA and the WDOE Construction Stormwater General Permit. Additionally, restoration activities are required to be performed within the approved WDFW in-water work window (July 1 to October 1st of any year). The project would also comply with conditions in the ACOE Section 404 Nationwide permit. BMPs would include:

1. FISH KILL/ WATER QUALITY PROBLEM NOTIFICATION: If a fish kill occurs or fish are observed in distress at the job site, immediately stop all activities causing harm. Immediately notify the Washington Department of Fish and Wildlife of the problem. If the likely cause of the fish kill or fish distress is related to water quality, also notify the Washington Military Department Emergency Management Division at 1-800-258-5990. Activities related to the fish kill or fish distress must not resume until the Washington Department of Fish and Wildlife gives approval. The Washington Department of Fish and Wildlife may require additional measures to mitigate impacts.
2. IN-WATER WORK AREA ISOLATION USING A TEMPORARY BYPASS
   Isolate fish from the work area by using either a total or partial bypass to reroute the stream through a temporary channel or pipe. Or close the tidegates and de-fish the area to remove as many fish as possible from the work area working during low flows.
   - Sequence the work to minimize the duration of dewatering.
   - Use the least-impacting feasible method to temporarily bypass water from the work area. Consider the physical characteristics of the site and the anticipated volume of water flowing through the work area.
   - During all phases of bypass installation and decommissioning, maintain flows downstream of the project site to ensure survival of all downstream fish.
3. FISH LIFE REMOVAL
   - All persons participating in capture and removal must have training, knowledge, and skills in the safe handling of fish life.
   - If electrofishing is conducted, a person with electrofishing training must be on-site to conduct or direct all electrofishing activities.
   - Place block nets upstream and downstream of the in-water work area before capturing and removing fish life.
   - Capture and safely move fish life from the work area to the nearest suitable free-flowing water.
4. DEMOBILIZATION AND CLEANUP
   - To prevent fish from stranding, backfill trenches, depressions, and holes in the bed that may entrain fish during high water or wave action.
   - All disturbed areas of the project would be seeded after construction is complete to prevent erosion and sedimentation.

See Regulatory Compliance Section for complete BMP measures that would be implemented during and after construction.

3.7 Long-Term Monitoring

The NRCS is responsible for the perpetual maintenance and operation of the structures built within the WRP easements and funded by NRCS. A long term O&M plan has been developed between Forterra and NRCS for regular maintenance, inspection, and reporting to NRCS. Inspections must be performed once every year between March and May and after each major storm event. Routine maintenance shall be performed immediately after each inspection and after each major storm event.

Channel morphology and site geomorphic function would also be observed and monitored by NRCS on the WRP easements by recorded at the Pearson Eddy site following project implementation. Operation of the MTR gate would vary based on site hydrology.

The easement landowners are responsible for noxious weed control and emergency control of pests as required by all Federal, State, and local laws.

NRCS monitoring policy for all Stewardship Lands, including WRP easements, is contained in the agency Manual Title 440 – Programs, part 527 – Easement Common Provisions Subpart P- Monitoring. The policy described in the manual applies to the Pearson Eddy Wetland Restoration Project. The manual and policy requires that NRCS monitor easements on-site at least annually during and for three years post restoration construction. This on-site monitoring includes evaluation of both ecological functions as well as regulatory and environmental compliance (e.g. checking for presence of hazardous materials). Subsequently, NRCS would, at a minimum, monitor easements on-site at least once every five years as well as remotely (called off-site monitoring in the manual) on an annual basis. Monitoring protocols and tools typically used to carry out the NRCS overall monitoring program may include on-site visits, photo points, landowner contact, aerial photography, Annual Monitoring Worksheets, etc. as applicable to the site.

NRCS is responsible for short and long term maintenance, including replacement, of structures installed as part of the WRPO. WRP Manual 440 Part 514 Sub-part G Maintenance, Management, Monitoring and Enforcement states:

> G. For all easement enrollments and for 30-year contracts on non-Tribal trust lands, the landowner is required to obtain a CUA (see section 514.62) before implementing management or maintenance actions identified in the WRPO or actions requested by the landowner that are prohibited under the terms of the WRP easement or 30-year contract.
>
> > (1) NRCS is responsible for maintenance and management activities on easement enrollments, but may authorize the landowner or someone other than the landowner to perform maintenance and management activities through a CUA.
> > (2) If cost-share payments for management or maintenance activities are necessary, NRCS may enter into a conservation program contract (CPC) with the landowner or a contribution agreement, a cooperative agreement, an interagency agreement, or a Federal contract. Cooperating partners may include other Federal agencies, State agencies, conservation districts, technical service providers, or other individuals or entities NRCS has determined have the expertise and capacity to implement the required items.

Chapter 4: Affected Environment

This chapter describes the environment expected to be affected by the actions in this assessment. The resource descriptions provided in this chapter serve as a baseline with which to compare the potential effects of the project alternatives considered in this Final environmental assessment (EA).

NRCS Washington - Environmental Evaluation: NRCS policy in Title 190 – National Environmental Compliance Handbook (May 2016) requires NRCS to conduct an environmental evaluation (EE) for all planning and financial assistance, including, but not limited to development of individual conservation plans and for all NRCS conservation programs, including program approvals where there is no financial assistance. The EE is used to determine the need for an EA or EIS. The EE is a form of scoping that identifies environmental components present in the planning area that have the possibility to be impacted by the action.

Natural and social resource concerns (or problems) are analyzed and compared to planning criteria, which have been developed by State Specialists. Resource concerns in the project area were identified that currently do not meet planning criteria, these include:

WATER, Water Quantity (Excessive Runoff, Flooding, or Ponding)
PLANTS, Adaptability (Plants Not Adapted or Suited to Site)
PLANTS, Condition (Noxious and Invasive Plants)
ANIMALS, Fish and Wildlife (Inadequate Cover/Shelter)
ANIMALS, Fish and Wildlife (Habitat Fragmentation)
ANIMALS, Fish and Wildlife (Inadequate Food)
ECONOMIC/SOCIAL, Risk Concern from landowners upstream of project for increased flooding upstream of project area

The resource concerns were analyzed and resulting alternatives were developed to treat these resource concerns using specific NRCS Conservation Practice Standards.

In addition, Special Environmental Concerns (those protected by law, having guidance issued under Executive Order, or specific requirements in NRCS policy) that could be impacted from project implementation were identified.

4.1 RESOURCES CONCERNS

4.1.1 WATER, Water Quantity (Excessive Runoff, Flooding, or Ponding)

Pearson Eddy slough is highly influenced by conditions on the Snoqualmie River during large, regional flood events. A period of critical hydrologic and hydraulic conditions in Pearson Eddy and its vicinity occurs commonly during spring months when high water levels in the Snoqualmie River 'back up' into the slough. The high water levels in the Snoqualmie often occur due to flooding from either the Snoqualmie or Skykomish watersheds. Both can experience snowmelt, but the Skykomish is generally more snowmelt-dominated, with a later runoff than the more precipitation-dominated Snoqualmie. NRCS has utilized the two-dimensional HEC-RAS model to identify two primary return flow paths used by receding floodwater following overbank river floods. As flood water recedes during lessor overbank events (i.e 10-year floods), the flood water can be slowed by vegetation on the floodplain which can cause temporary increases to flood water elevations on the floodplain.

Figure 4-0. Primary flood flow return paths following Snoqualmie River overbank flood events

In addition to regional flood events, Pearson Eddy Slough may also experience local flood events, which may or may not coincide with regional flood events on the Snoqualmie/Skykomish/Snohomish River main stems.

4.1.2 PLANTS, Adaptability (Plants Not Adapted or Suited to Site) and Noxious and Invasive Plants

An aerial photo from 1948, Figure 4-1, show a diverse wooded plant community on the floodplain adjacent to the project site prior to complete clearing and drainage for agriculture. Several different plant communities would likely have been present, such as floodplain forestland dominated by a mixture of deciduous tree species with conifer on the highest elevations. Areas with longer periods of inundation supported a shrub wetland community. Emergent wetland species such as sedge, rush, and bulrush would have been expected in swale channels and along edges of open water areas at the

lowest elevations and those resulting from beaver dams. The project area cleared for agriculture in the early 1900's is now dominated by invasive reed canarygrass and non-native blackberry. (Talasaea 2004). The target plant community does not replicate the conditions describe in the Government Land Office (GLO) survey conducted in the 1880's due to changes in watershed hydrology and in presence of invasive species.

Figure 4-1. Snoqualmie River Floodplain, 1948

Figure 4-2. Snoqualmie River Floodplain, 2016 (Source: Google Earth)

4.1.3 ANIMALS, Fish and Wildlife (Inadequate Cover/Shelter)

Pearson Eddy currently exists as an incised linear drainage ditch that runs through a farmed pasture. Currently, there is limited fish habitat in that there are no discernible habitat features: no large wood, lack of sinuosity and pools, no riparian vegetation, lack of gravels, lack of a diverse aquatic insect community and no riffles. In its straightened and scoured state, the capacity of Pearson Eddy to provide refuge for anadromous fish during winter floods is questionable. The floodplain of the project area was cleared and drained to facilitate active agriculture. Restoration of native floodplain vegetation began in 2007 with 55 acres of native trees and shrubs planted on the bank of the Snoqualmie River and in a patch located south of Deep Ditch (See Figure 1-2). Removal of native woody vegetation and construction of a drainage network have led to increased water velocities across the floodplain, incision of the natural channel bed and increased streambank erosion processes. These hydro-modified stream channels do not provide hydraulic or pool complexity, refuge or off-channel habitat. Nesting habitat for migratory songbirds has been lost across the majority of the floodplain with hiding and basking cover for other wildlife greatly reduced.

4.1.4 ANIMALS, Fish and Wildlife (Habitat Fragmentation)

The water control structure constructed in Pearson Eddy channel serves to prevent floodwater from backing up onto farmland located upstream. The flap gate structures prevent movement of fish upstream into Pearson Eddy as well as into floodplain channels and wetlands. Fish access to these refuge areas during high-river flows and for foraging and rearing is no longer available outside of larger overbank floods from the Snoqualmie River.

4.1.5 ANIMALS, Fish and Wildlife (Inadequate Food)

Modifications to native floodplain vegetation and changes in wetland hydrology though surface ditches and the water control structure in Pearson Eddy have reduced the plant diversity and subsequently the amount of food and forage available on the WRP easements. Loss of floodplain forest through past conversion to agriculture has caused conditions now dominated by unmanaged reed canarygrass and non-native blackberry, non-preferred vegetative forage for migratory waterfowl, shorebirds, small mammals, and aquatic mammals. Loss of diverse plant communities reduces availability of macroinvertebrate and insect populations preferred by some migratory bird species, salamanders, reptiles, and fish.

The Snohomish River Basin Salmon Conservation Plan recommends several priority items for salmon recovery focus. "Watershed process restoration focused on restoring forests, increasing floodplain connectivity, and increasing channel complexity. The greatly diminished quantity and quality of the rearing habitat, particularly along the channel margins, is thought to be the primary bottleneck". (Snohomish Basin Salmon Recovery Forum 2005). The Preferred alternative supports the Basin recovery plan; improving floodplain connectivity, increasing channel complexity on the floodplain and improving quantity and quality of rearing habitat on the floodplain. Access to the floodplain would increase access to food sources and offer escape cover from predators in the river.

4.1.6 ECONOMIC/SOCIAL, Risk and Public Concern

An existing water control structure consisting of 4 culverts and flap gates has begun to fail and is no longer fully serving to reduce the impact of flood events from the Snoqualmie River to lands located upstream of the WRP easement. Concerns have been expressed from landowners located upstream of the project and other members of the public with regard to increased flooding and the potential for the project to increase flooding on off-site properties. Several studies and investigations have been conducted during the planning process since 2009. Only the Tetra Tech study and the March 2017 Hydraulic Impact Analysis are included in Appendix C because the information contained in the latest 2d modeling report supersedes the information presented in prior NRCS modeling reports. The most recent HEC-RAS analysis compares the current baseline vegetation on the project area to the conditions in the preferred alternative.

1. Pearson Eddy WRP Hydraulic Analysis; dated March 6th, 2009, by Tetra Tech;
2. Hydraulic Offsite Impacts Analysis related to the Establishment of Vegetation on the Pearson Eddy WRP Easement and Jenson FPE; date 5-2-2011, by Daniel Moore, P.E. NRCS Hydraulic Engineer
3. Hydraulic Impact Analysis of WRP Project features along Pearson Eddy Slough, date July 2012, by Daniel Moore, P.E. NRCS Hydraulic Engineer
4. Addendum to the Hydraulic Impact Analysis of WRP Project features along Pearson Eddy Slough, date November 2015, by Daniel Moore, P.E. NRCS Hydraulic Engineer
5. Hydraulic Impact Analysis of WRP project features along Pearson Eddy Slough, ADDENDUM, two-dimensional hydraulic analysis, dated March 2017, by Daniel S. Moore, P.E, Hydraulic Engineer.

In February 2016, NRCS re-evaluated these studies to gain perspective on the day-to-day drainage characteristics of the project site. A report was developed to detail drainage features that are present on the WRP and FPE, focusing on three areas where NRCS has received complaints and opposition. Results are published in "USDA NRCS Lower Snoqualmie River, WA WRP/FPE Drainage

Assessment – Report of Findings" located in Appendix D. The model confirms previous studies and provides evidence about the drainage behavior of the slough area. Five different flood magnitudes were evaluated with results tabulated at 12 different location on the floodplain (See Figure 5-1 for data location points). For example, at Point #6 SE of the FPE, floodwater depths range from 2.67 feet during a local event when the River remains within its banks to 12.85 feet during a 10-year Snoqualmie River out-of-bank event, and increase to 17.38 feet during a 100-year flood. The area is mildly sloped, and the downstream end of the slough functions like bathtub drain, which indicates that when the River flows out of its banks, the flow velocities are slow. This leads to a conclusion that during local flood events when the Snoqualmie River does not exceed its banks, floodplain vegetation on the WRP and FPE has no effect on flood levels.

During larger floods when the Snoqualmie River does exceed its banks, floodplain vegetation can cause a small rise in peak flood levels, as shown in the output tables in Table 5-1, adding generally less than two inches to floodplain water depths of many feet. Additional HEC-RAS model runs were completed following receipt of several comments on the Draft Environmental Assessment that expressed concerns with the project causing any increase in flood elevations on properties outside the easement area. A series of model runs evaluated existing and planned vegetation within the WRP, FPE, and Mitigation Bank properties that identified critical areas within the floodway where trees and shrubs temporarily increase flood water elevations during overbank flood events from the Snoqualmie River. See Figure 4-0 for location of key areas.

4.2 SPECIAL ENVIROMENTAL CONCERNS

4.2.1 Prime and Unique Farmland

Existing WRP easement precludes active agricultural production on project area. The majority of the project area is mapped as Puget silty clay loam. This soil is rated as a prime farmland soil series when it is both drained and either protected from flooding or not frequently flooded during the growing season. Since the farmland is not diked and does flood frequently during the spring growing season, it does not meet conditions of prime farmland in this location. There are areas within the larger project area that are located adjacent to the Snoqualmie River and the banks of Pearson's Eddy that are mapped as Sultan silt loam and Puyallup fine sandy loam. All areas of Sultan and Puyallup are mapped as prime farmland. The soils mapped as Sultan and Puyallup make up approximately 20% of the planning unit.

4.2.2 Water Quality/Clean Water Act

Temperature – No surface waters on the WRP, including Pearson Eddy, are listed for exceeding any state water quality standards. The project is located upstream from an impaired reach of the main stem Snoqualmie River for Bacteria (including fecal coliform; specifically E. coli) and Temperature (Listing ID 6646 & 6570). See Figure 4-3. The WRP easement is lacking riparian vegetation and professional judgment suggests that stream temperatures may be elevated in Pearson Eddy due to lack of stream shading. This is likely to be a contributing factor in the downstream water quality listings on the Snoqualmie River just downstream of the confluence with Pearson Eddy. All manure application associated with the prior agricultural production on the easement has ended.

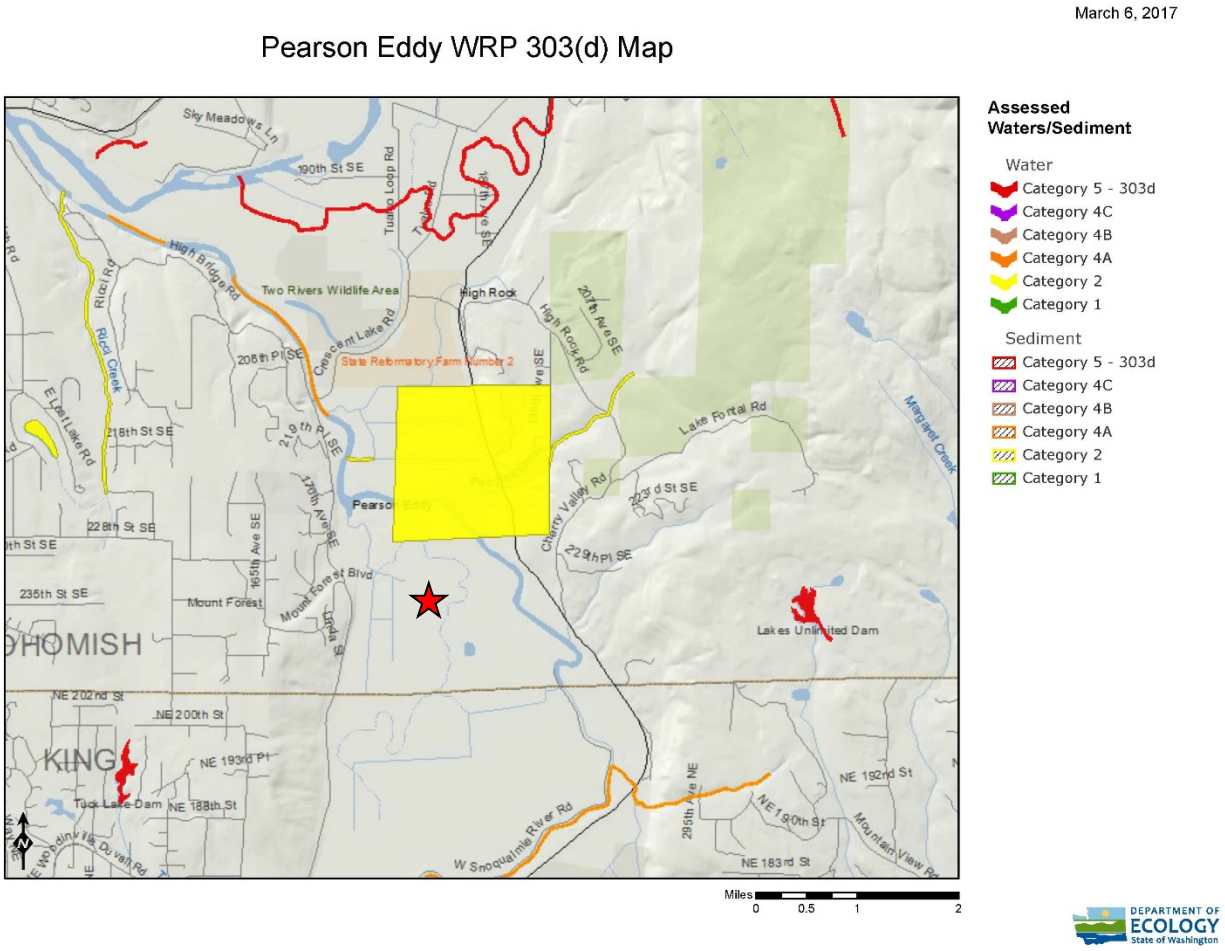


Figure 4-3. Map of 2016 Washington Department of Ecology 303(d) search for water quality limited streams. Area focus was on the Pearson Eddy WRP (Red star) and surrounding area upstream and downstream in the Snoqualmie River. Orange line denotes Category 4A waterbody (bacteria and temperature listing) in the main stem Snoqualmie River.

Sediment – The major soil of the project area is Puget silty clay loam, which is moderately erodible. According to the Web Soil Survey (NRCS 2012), this soil has a slow infiltration rate when thoroughly wet. The majority of the soil within the project area is moderately fine in texture with a restrictive layer at greater than 80 inches. Erosion by water is a potential within the project site. Pearson Eddy is a deep, silt bottomed channel with little to no gravels.

Nutrient and chemical contaminants – The Snoqualmie River Watershed has a multi-parameter Total Daily Maximum Load (TMDL) in place for bacteria and temperature, developed in 1996. A TMDL is a numerical value representing the highest amount of a pollutant a surface water body can receive and still meet water quality standards. Fecal coliform rates were exceeded in the sampling area downstream of the confluence with Pearson Eddy (Listing ID 07D050) in the late 1980's and again in 2003.

Hazardous Materials

A limited hazardous substance field examination was conducted by NRCS staff for the project area during the WRP easement acquisition process in 2002. The on-site examination did not reveal any hazardous substances. The Office of General Council reviewed the hazardous substance checklist

and other All Appropriate Inquiry documents and approve moving forward with WRP easement closing.

The ACOE has authority under Section 404 of the Clean Water Act and, through its separate regulatory permitting process, has evaluated the potential impacts of this project as they relate to fill in waters of the U.S. See Appendix B for regulatory compliance documents.

4.2.3 Floodplain Management

The Snoqualmie River floodplain was cleared and drained to facilitate agriculture in the past. For many years, the WCS and a small pump was maintained and operated by the local landowners. Surface ditches on the easement area were maintained by the landowners and no formal drainage district was ever formed.

NRCS has researched the applicability of a drainage agreement that was written in 1901 and filed with Snohomish County in 1903. The USDA Office of General Council has confirmed that this agreement was a contract among the landowners at the time, and not a property interest that runs with the land. Thus, the successors-in-interest have no rights under the 1901 agreement.

Prior to the NRCS WRP easement acquisition (2004) there was a pumping facility that was utilized to help evacuate flood water from within the northern most floodplain area immediately west of the Snoqualmie River. The pump facility was located at the site of the existing WCS. After NRCS easement acquisition, use of the pumping facility (property of the landowner) was no longer needed and was removed from the site by the landowner that sold the WRP easement to NRCS.

NRCS confirmed with King County Environmental Program's staff that the County's Zero Rise standard for impacts to floodplain/floodway drainage capacity does not apply to vegetation restoration. Regardless, efforts to reduce impacts to agricultural lands located on the Snoqualmie River floodplain in King County have been incorporated into the Preferred Alternative (Alternative #2: Floodplain Vegetation Modification).

4.2.4 Riparian Areas/Invasive Vegetation

Modifications to native floodplain vegetation and changes in wetland hydrology though surface ditches and the water control structure in Pearson Eddy have reduced the plant species and community diversity on the WRP easements. Loss of floodplain forest through past conversion to agriculture led to the present condition now dominated by unmanaged reed canarygrass and non-native blackberry.

4.2.5 Wetlands

Wetlands are present within the project area and are noted on the National Wetland Inventory Map, Figure 4-4. NRCS completed a wetland investigation and identified a total of 22.8 acres that would be impacted by the project; refer to Figure 4-5 –Wetland Area Map for approximate locations of wetlands that would be disturbed by the project. A total of 22.8 acres would be excavated or filled, with 267 acres improved. A summary of the 22.8 acres of disturbed wetlands is shown in Table 4-1 below.

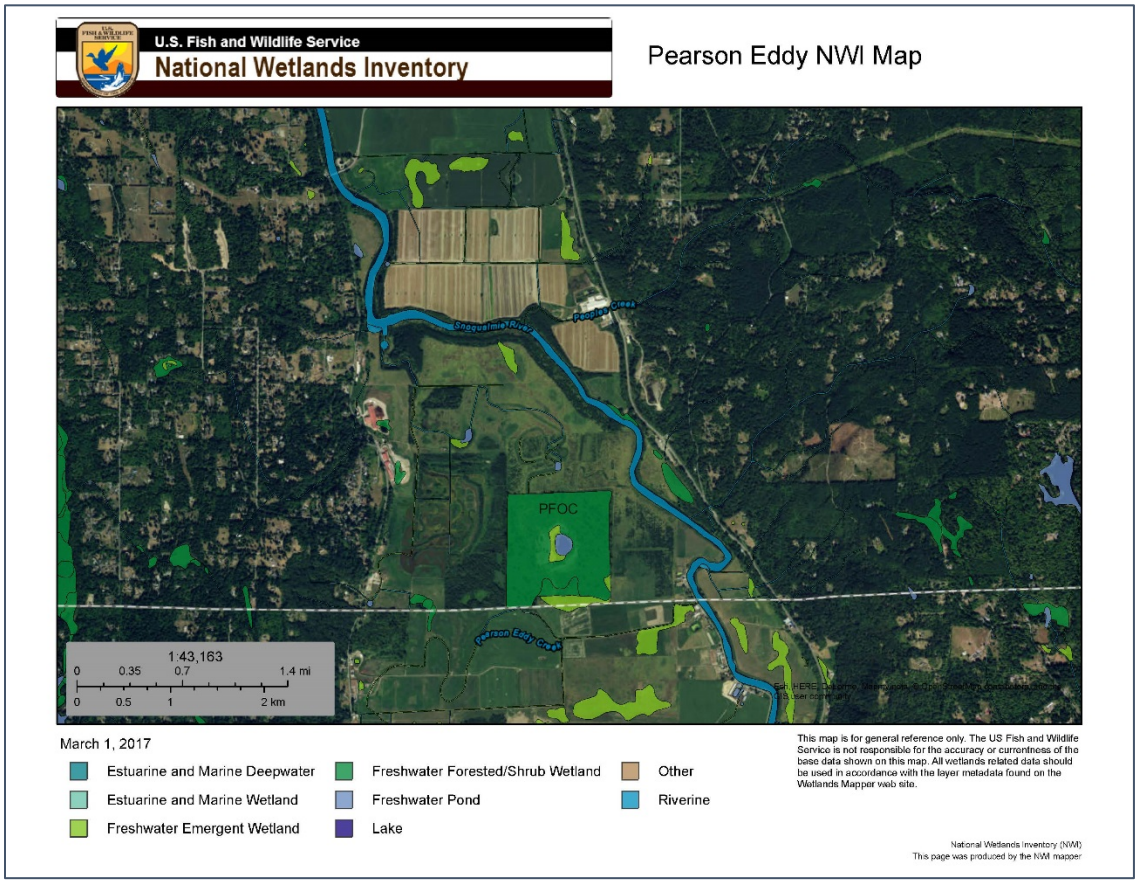


Figure 4-4. NWI Map

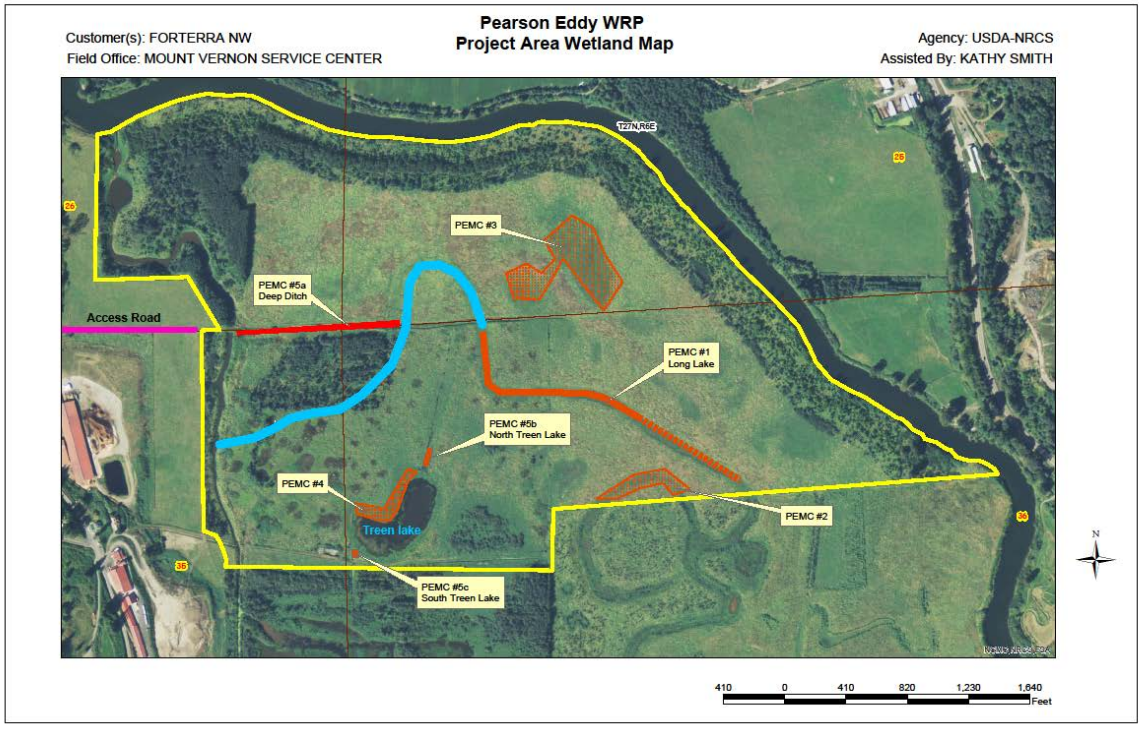


Figure 4-5. Wetland Area Map

	Wetland Area	Area Impacted and Activity	Type/Description	Wetland Benefits	Area Benefitted
1	Long Lake	2.5 ac De-leveling	PEMC/Historic floodplain swale-channel	Flood flow improvement, Native emergent vegetation allowed to naturally recolonize swale, native tree/shrub planting	6.5 ac
2	SE De-level	0.7 ac De-leveling	PEMC/Historic floodplain swale-channel	Native emergent vegetation allowed to naturally recolonize swale, native tree/shrub planting	2.3 ac
3	NE De-level	5.0 ac De-leveling	PEMC/Isolated floodplain wetland	Native emergent vegetation allowed to naturally recolonize, native tree/shrub planting	6.8 ac
4	West Treen Lake	1.0 ac De-leveling	PEMC/West lake edge	Native emergent vegetation allowed to naturally recolonize, native tree/shrub planting	2.0 ac
5a	Deep Ditch	0.5 ac ditch fill	PEMC/Drainage ditch	Hydrology restoration	267 ac
5b	North Treen Lake	0.1 ac ditch fill & 13.0 ac tilled	PEMC/Drainage ditch and reed canarygrass	Hydrology restoration, Native emergent vegetation allowed to naturally recolonize	13.1 ac
5c	South Treen Lake	800 sq. ft. ditch fill	PEMC/Lake Edge	Increased hydrology duration in Treen Lake	1 ac along edge of Treen Lake
		~22.8 acres			~267 acres

Table 4-1. Summary of Wetland Impacts

4.2.6 Threatened & Endangered Species/Species of Concern

The WDFW Priority Habitats and Species database (February 2016) shows federal listed bull trout utilizing Pearson Eddy. The adjacent Snoqualmie River is utilized by Puget Sound steelhead and Puget Sound Chinook, both listed as Threatened under the ESA. Other fish species utilizing the Snoqualmie River include coho, chum and pink salmon, as well as Dolly Varden/bull trout and resident cutthroat trout. Personnel communication with WDFW confirmed there is no federally listed species utilizing Pearson Eddy (2012 and 2017). NRCS contacted the National Marine Fisheries Service (NMFS) for early consultation on the proposal and NRCS obligations under Section 7 of the ESA. NMFS confirmed there are no listed species in Pearson Eddy. NRCS contacted USFWS and confirmed that there are no bull trout in Pearson Eddy. See Appendix B for NMFS & USFWS correspondence.

The Snohomish River Basin Salmon Conservation Plan recommends several priority items for salmon recovery focus. “Watershed process restoration focused on restoring forests, increasing floodplain connectivity, and increasing channel complexity. The greatly diminished quantity and quality of the rearing habitat, particularly along the channel margins, is thought to be the primary bottleneck”. (Snohomish Basin Salmon Recovery Forum 2005). The Preferred alternative support the Basin recovery plan; improving floodplain connectivity, increasing channel complexity on the floodplain and improving quantity and quality of rearing habitat on the floodplain.

Snohomish Watershed Salmon Recovery Plan:
http://snohomishcountywa.gov/1127/Snohomish-Watershed-Salmon-Recovery-Plan

Following publication of the Draft EA, the Snoqualmie Fish, Farm, Flood Agreement (June 2017) was signed. The Plan contains the recommendations of the Snoqualmie Fish, Farm, and Flood (FFF) Advisory Committee and is the culmination of a 3-year watershed planning process. The Committee was comprise of thirteen individual of diverse backgrounds and perspectives, including local farmers as well as representatives of the Tulalip and Snoqualmie tribes, the King Conservation District, the Wild Fish Conservancy, the City of Duvall, the Snoqualmie Watershed Forum, the Snohomish Basin Salmon Recovery Forum, Futurewise, and the WDOE. The Plan contains a unanimously endorsed package of 34 recommendations to address specific watershed goals and actions that will improve the watershed for people, businesses, and fish and wildlife. The NRCS decision to phase implementation of the preferred alternative and to allow time to work in a collaborative nature to develop a Vegetation Restoration and Management Plan will mirror the example of cooperative planning outlined with the FFF Plan.

Snoqualmie Fish, Farm, Flood Agreement:
http://your.kingcounty.gov/dnrp/library/water-and-land/watersheds/snoqualmie-skykomish/fish-farms-flooding/king-county-fish-farm-flood-final-agreement-pkg-june-2017.pdf

4.2.7 Cultural Resources

NRCS conducted cultural resources review in two phases. The first phase occurred in 2010 with the NRCS Cultural Resources Specialist conducting a literature review and field survey resulting in a determination that there were no cultural resources or historic properties within the area of potential affect. NRCS consulted with the Snoqualmie Indian Tribe in 2016 and received confirmation from the tribe that the project could proceed; NRCS and the tribe would share on-site cultural resources monitoring duties during construction activities involving earthwork. See Appendix B for consultation documentation.

Salmon are considered to be a culturally important resource for two local tribal nations. Both the Tulalip and Snoqualmie Tribes participated in development of the FFF Plan outlined in Section 4.2.6 above and NRCS will strive to balance the need to limit flood impacts and provide fish, wildlife, and floodplain function on the WRP and FPE as the Vegetation Restoration and Management Plan is developed.

Chapter 5: Environmental Consequences

This section describes the impacts that the action is expected to have on the affected resources at the Pearson Eddy site. Three alternatives were evaluated in detail, the No Action Alternative, Alternative #1: Floodplain Vegetation Restoration and Alternative #2: Floodplain Vegetation Modification (Preferred Alternative). This chapter is organized to correspond to elements in the "Affected Environment" section of the EA, and presents the potential impacts to each alternative.

Three categories of effects, or impacts, are considered and analyzed: (1) direct effects, which occur at the same time and in the same place as the action; (2) indirect effects, which occur later or at a location away from the action; and (3) cumulative effects, which are additive and include those that occur in the past, present, and foreseeable future. Direct, indirect, and cumulative effects (addressed in Chapter 6) are addressed for each affected resource under the alternatives.

5.1 Approach for Evaluating Alternatives

The impact analyses were based on professional judgment using information provided by project designs, regulatory compliance documents, hydrologic model results, and subject matter experts. A summary table of the Environmental Consequences for the No Action Alternative, Alternative #1: Floodplain Vegetation Restoration, and Alternative #2: Floodplain Vegetation Modification can be found in Table 5-3.

The effects summary in Table 5-2 discusses effects at three different scales, duration, intensity, and type (Beneficial or Adverse) and defined below. The analysis includes impact minimization measures that may be employed to offset or avoid potential adverse impacts.

Scale:

Regional	Snohomish River Watershed
Floodplain	Snoqualmie River Floodplain
Local	Pearson Eddy WRP Easements

Duration:

Short-term effects	Temporary, during construction or less than one year
Long-term effects	Persist more than one year to permanent following construction

Intensity:

Negligible	No effect or effects would be below or at the lower levels of detection. Any effects would be slight and no long-term effects would occur at all.
Minor	Beneficial and/or adverse effects to the resources would be detectable at the specified scale.
Moderate	Beneficial and/or adverse effects on the affected environment would be readily apparent at the specified scale.
Major	Beneficial and/or adverse effects on the affected environment would substantially change the character of the specified scale.

Mitigation for Short Term Adverse Effects
Short term potential adverse effects to water quality that could occur during and post-construction include increased sediment discharge resulting from project implementation. This would be minimized and/or avoided through implementation of BMPs and erosion control methods required by local, state, and federal permits. In addition, fish handling and water management BMPs during construction would minimize and avoid adverse impacts.

Regional Scale Effect Evaluation: The Snohomish River watershed is the second largest basin that drains to the Puget Sound. NRCS considered effect of implementing the No Action and Alternatives #1 and #2 at the regional Snohomish River basin scale and determined that due to the small size of the WRP easements (267 ac total) compared to the large watershed size of 1,978 square miles, any short or long term effects would be negligible. The one exception is the effects of the project with respect to Threatened and Endangered fish species. See section 5.3.6 Threatened & Endangered Species/Species of Concern below.

5.2 RESOURCE CONCERNS

5.2.1 WATER, Water Quantity (Excessive Runoff, Flooding, or Ponding)

No Action Alternative
Impact Analysis: The failing water control structure in Pearson Eddy would not be replaced which would have a major adverse effect on flooding private land located upstream. Structure failure has begun with eminent total failure of the culverts and associated earth fill. Scour erosion would continue around the structure with flows in Pearson Eddy eventually by-passing the structure. Mitigation bank property would experience continued erosion which would threaten the integrity of the prior installed restoration elements at risk of failure. Farmland located upstream in King County would be without flood risk protection that is provided by the current structure.

Alternative #1: Floodplain Vegetation Restoration
Impact Analysis: The failing water control structure in Pearson Eddy would be removed and replaced in the same location with a new structure having a major beneficial effect to flood risk reduction for private farmland located on the floodplain upstream of the WRP easement. In order to ensure structure integrity and function to serve in flood risk reduction to upstream landowners, the crossing elevation would be raised from el. 37ft. to el. 38 ft. The increase in structure height was needed to insure the culverts do not float. Placement of bank protection rock on the east bank of Pearson Eddy would significantly reduce bank erosion caused by large volumes of flood water from out-of-bank river flood events returning to the river via the Pearson Eddy channel.

Existing floodplain woody vegetation (trees & shrubs) will not be modified and additional vegetation will be planted within the floodway, causing short term moderate to major negative impacts by increasing flood water elevations during some overbank flood events from the Snoqualmie River.

Alternative #2: Floodplain Vegetation Modification

Impact Analysis: Replacement of WCS in Pearson Eddy has same beneficial effect as in Alternative #1. Development of collaborative Vegetation Restoration & Management Plan will reduce negative impacts from short term increases in flood water depths during out-of-bank floods. For example during a 10-year flood, flood water depth at Point #6 can be reduced from 12.85 feet deep to 12.72 feet (reduction of 0.9 inch) by removal of ~24 ac of vegetation near the mouth of Pearson Eddy and in the floodway on the FPE. Flood water depth can be further reduced to 12.66 feet (reduction of 0.1) to meet the King County zero rise standard by including an additional 30 acres of tree/shrub removal on the FPE and by removing ~ 8 acres of existing riparian trees on the riverbank. The collaborative Vegetation Restoration & Management Plan will determine a compromise between meeting the zero rise standard and an environmentally acceptable vegetation plan that will reduce the negative impacts to wildlife, salmon, and floodplain function.

5.2.2 PLANTS, Adaptability (Plants Not Adapted to Site) & (Noxious and Invasive Plants)

No Action Alternative

Impact Analysis: Under the No Action Alternative, the WRP easements would not experience changes in vegetation communities related to active tree and shrub planting or from restoration of wetland hydrology and invasive reed canarygrass removal (de-leveling and disking). The WRP easement would continue to be dominated by non-native and invasive plants in the short term and into the foreseeable future. Passive restoration (allowing natural regeneration) versus active planting would continue to have a moderate adverse impact on native plant community restoration on the WRP easements due to high levels of competition from non-native invasive plants.

Alternative #1: Floodplain Vegetation Restoration

Impact Analysis: Active restoration activities during construction and planting 30 additional acres of native trees and shrubs would restore multiple historic floodplain plant communities over time. Restoration activities on a small portion of the easement acres would re-establish a diversity of plant species which should expand over time. Following the initial de-leveling activity during construction, long term management of reed canarygrass, including but not limited to mowing, disking, spot spray with herbicide, on ~20 acres would allow native emergent wetland species (i.e. sedge, rush, bulrush, etc.) to re-colonize the site from the existing seed bank. Active seeding of native species may occur if the initial response does not meet project objectives. Implementation of the compatible use authorization by the landowner would establish higher quality short grass habitat for waterfowl and deer forage. The CUA includes mowing/haying of the forage for 2 years, and can be extended by NRCS at landowner request.

Alternative #2: Floodplain Vegetation Modification

Impact Analysis: The location of any new tree/shrub planting will be moved outside of the floodway. The amount may be decreased from 30 acres to an amount agreed upon during the development of the Vegetation Restoration and Management Plan. The option of complete removal of woody vegetation (up to 94 acres total) will be explored as well as removal and replacement with smaller diameter woody species (i.e. cottonwood to willow). This will have moderate to major short term negative impacts to the native plant community development due to the loss of existing hiding, thermal, and nesting cover along with forage resources for wildlife. Habitat for fish and other aquatic species will be reduced from removal of overhanging cover, insect habitat (forage species for fish and amphibians), and shade resources that cool water temperatures and provide hiding cover. Long term,

the site will move toward a woody plant community through natural re-colonization by early successional tree and shrub species. Invasive reed canarygrass will slow natural plant community recolonization and will dominate the plant community in the short and long term due to removal of tree/shrub resources that reduce vigor.

5.2.3 ANIMALS, Fish and Wildlife (Inadequate Cover/Shelter)

No Action Alternative

Impact Analysis: No action would be taken to restore a natural channel morphology to the floodplain swale. The deep, steep sided drainage ditch (Deep Ditch) would remain in its current configuration, providing little cover and refuge areas for salmonids, other fish, and their prey sources. Deep Ditch would continue to provide little plant diversity and cover for fish, amphibians, and dabbing waterfowl. Little or no large wood on the floodplain would be present, leaving physical cover for amphibians and small mammals limited and basking/perching sites for reptiles and birds lacking. Non-native and invasive vegetation would continue to persist outside of the previously planted areas, providing little nesting, roosting, and hiding cover for migratory songbirds and small mammals.

Alternative #1: Floodplain Vegetation Restoration

Impact Analysis: Action taken to restore the floodplain channel to morphology more similar to historic conditions (wider, more shallow side slopes, with gentle sinuosity) would result in a major long term beneficial improvement to the quality of plant communities, increase macroinvertebrate density, and provide slower water velocities preferred as refuge and rearing areas for salmon and other fish. Hydrology restoration through ditch filling would increase the period of soil saturation and extend ponding longer into the summer months. Increases in surface water would have moderate beneficial impacts on wetland plant community development, further increasing the number and type of native plant communities growing on the easement. Installation of large wood structures in the floodplain channel and along the edges of wetland areas would increase physical cover for aquatic species, perching sites, and hiding cover for amphibians and small mammals. Active planting of native trees and shrubs would have moderate long term beneficial effects to nesting, hiding, roosting, and perching cover for birds and other wildlife. Long-term management of areas currently dominated with reed canarygrass with shallow de-leveling and periodic disking would improve the plant diversity and resulting cover for macroinvertebrates, wading birds, waterfowl and other wildlife. Amphibian breeding cover would have major long term beneficial effects with the increase in native plant community cover and increases in shallow water cover.

Restoration actions would have beneficial long term impacts at the river basin scale. The Snohomish River Basin Salmon Conservation Plan recommends several priority items for salmon recovery focus. “Watershed process restoration focused on restoring forests, increasing floodplain connectivity, and increasing channel complexity. The greatly diminished quantity and quality of the rearing habitat, particularly along the channel margins, is thought to be the primary bottleneck”. (Snohomish Basin Salmon Recovery Forum 2005). The Preferred alternative supports the Basin recovery plan by improving floodplain connectivity, increasing channel complexity on the floodplain and improving quantity and quality of rearing habitat on the floodplain.

Alternative #2: Floodplain Vegetation Modification

Impact Analysis: Active removal of past restoration plantings will have moderate to major negative effects to the quantity and quality of native plants available to provide cover and shelter at the local and floodplain scale. Reduction in native plant community extent will have minor negative impacts at the regional river basin scale due to the size of the restoration area compared with the watershed size and the action would not conform to the Snohomish Basin Salmon Recovery plan or the newly signed Fish, Farm, and Flood Agreement. Impacts from the other restoration activities will remain the same as in Alternative #1, providing moderate to major beneficial effects to wetland plant community development, increased physical cover, and increases in shallow seasonal water on the WRP easement.

5.2.4 ANIMALS, Fish and Wildlife (Habitat Fragmentation)

No Action Alternative

Impact Analysis: Fish access to and from Pearson Eddy to floodplain channels and wetlands for refuge and rearing would continue to be cut-off with the existing WCS in place. The structure would fail in the long term, with an alternative channel forming around the WCS. Fish access upstream of the WCS and onto the floodplain would occur once the channel completely by-passes the water control structure. Seasonal access may still be compromised if a head cut elevation drop exists in the Deep Ditch that blocks fish passage.

Alternative #1: Floodplain Vegetation Restoration

Impact Analysis: Installation of the replacement WCS would restore partial fish passage from Pearson Eddy to floodplain channels and wetlands. One of four new culverts would be fitted with a muted tidal regulator (MTR) that would allow a controlled volume of flow to back up into the adjacent wetland mitigation bank and onto the easement until flow reaches the 28 ft. elevation, at which time the flap gate would close and prevent further water from flowing upstream of the WCS. The MTR would increase the frequency and duration of water exchange between Pearson Eddy upstream into floodplain habitats. This action would provide major short term and long term beneficial impacts to salmon and other fish species, including federally listed species.

NRCS completed several hydrology modeling exercises and investigations to study the impact of the restoration activities on surrounding and neighboring properties. Investigations included consideration of any adverse impacts to upstream landowners with the design of the replacement WCS including a MTR. When operated and maintained properly, the structure would not cause adverse impacts to upstream landowners. See O&M discussion in Section 5.2.6 below.

Restoration actions would have beneficial long term impacts at the river basin scale. The Snohomish River Basin Salmon Conservation Plan recommends several priority items for salmon recovery focus. “Watershed process restoration focused on restoring forests, increasing floodplain connectivity, and increasing channel complexity. The greatly diminished quantity and quality of the rearing habitat, particularly along the channel margins, is thought to be the primary bottleneck”. (Snohomish Basin Salmon Recovery Forum 2005). The Preferred alternative supports the Basin recovery plan by improving floodplain connectivity, increasing channel complexity on the floodplain and improving quantity and quality of rearing habitat on the floodplain.

Alternative #2: Floodplain Vegetation Modification

Impact Analysis: Effects will be the same as Alternative #1 since because the same actions would be taken to increase salmonid access to floodplain habitats through installation of a replacement WCS in Pearson Eddy and floodplain channel and wetland restoration.

5.2.5 ANIMALS, Fish and Wildlife (Inadequate Food)

No Action Alternative

Impact Analysis: No action would be taken to restore a natural channel morphology to the floodplain swale. The deep, steep sided drainage ditch (Deep Ditch) would remain in its current structure, providing little cover and habitat complexity for foraging salmonids and other fish. The streambanks of Deep Ditch would continue to provide limited plant diversity which would serve as forage for macroinvertebrates and thus remaining as poor forage opportunities for fish, amphibians, and dabbling waterfowl. Surface ditches would remain and continue to have adverse impacts on wetland hydrology and plant community formation. Non-native and invasive vegetation would continue to persist outside of the previously planted areas, providing poor quality and quantity of forage for waterfowl, songbirds, and mammals.

Alternative #1: Floodplain Vegetation Restoration

Impact Analysis: Implementation of restoration actions to restore a natural floodplain channel, filling of constructed drainage ditches, de-leveling of reed canarygrass wetlands, and planting of native trees and shrubs would have moderate long term beneficial impacts on floodplain and wetland plant community development. Restoring forested, shrub, and emergent plant communities would increase forage quantity and quality for wildlife. Improving aquatic habitat in the restored floodplain channel and wetlands would increase the prey base used by juvenile salmonids for rearing along with increases in forage availability for amphibians, shorebirds, and most waterfowl. The CUA would allow the landowner to replace poor quality reed canarygrass with higher quality and preferred herbaceous forage mix (primarily non-native pasture grasses and legumes) across areas that would not be actively planted with trees/shrubs or disked. Long-term management of areas currently dominated by reed canarygrass with shallow de-leveling and periodic disking would improve the plant diversity and resulting vegetative resources (stems, seeds, detritus) for macroinvertebrates, wading birds, waterfowl and other wildlife. NRCS would continue to work with the landowner to conduct long term management actions to improve early successional grass and emergent wetland habitat using future NRCS financial assistance and/or additional CUAs.

It is the intention of NRCS to allow management of short grass habitat and moist soil areas in order to increase quantity and quality of waterfowl forage on the WRP easement to attract migratory waterfowl to use the project area instead of agricultural lands located on the Snoqualmie River floodplain. Should damage to cropland occur off the easement, Federal programs are in place to provide financial relief. A USFWS Federal Migratory Bird Depredation Permit authorizes landowners “to capture or kill birds to reduce damage caused by birds or to protect other interests such as human health and safety or personal property. A depredation permit is intended to provide short-term relief for bird damage until long-term, non-lethal measures can be implemented to eliminate or significantly reduce the problem.” See the fact sheet titled “What you should know about a Federal Migratory Bird Depredation Permit”: https://www.fws.gov/forms/3-200-13.pdf

Alternative #2: Floodplain Vegetation Modification

Impact Analysis: The primary difference in effect with Alternative #2 is due to the planned modifications to existing native tree/shrub plantings. Reducing the quantity of native woody vegetation will have a short term moderate to major negative effects on wildlife food resources for songbirds, ungulates, and small mammals. Loss of woody vegetation and its insect habitat will further reduce forage for wildlife as well as reduce available food for fish, amphibians and other aquatic species. Long term improvements will come from active replacement of plant communities with smaller diameter species and natural re-colonization of native species.

5.2.6 ECONOMIC/SOCIAL, Risk and Concern

No Action Alternative

Impact Analysis: Concerns regarding increased flooding of private lands upstream of the WSC would worsen as the structure continues to lose function. The failing water control structure in Pearson Eddy would not be replaced which would have major short and long term adverse effect on flooding private land located upstream. The mitigation bank property would experience continued erosion which would threaten the integrity of the prior installed restoration elements at risk of failure. Farmland located upstream in King County would be without flood risk protection.

Alternative #1: Floodplain Vegetation Restoration

Impact Analysis: The failing water control structure in Pearson Eddy would be removed and replaced in the same location with a new structure having a major beneficial effect to flood risk reduction for private farmland located on the floodplain upstream of the WRP easement. In order to ensure structure integrity and function to serve in flood risk reduction to upstream landowners, the crossing elevation would be raised from el. 37ft. to el. 38 ft. to prevent the culverts from floating. Placement of bank protection rock on the east bank of Pearson Eddy on the WRP easement would provide major beneficial impacts that significantly reduce bank erosion and head cutting of Deep Ditch from returning flood flows back into the Pearson Eddy channel.

Several studies and investigations have been conducted during the planning process since 2009 which evaluated potential for offsite effects of the planned and completed restoration activities on the WRP and FPE. Of six hydrologic investigations, only the Tetra Tech study and the March 2017 Hydraulic Impact Analysis are included in Appendix C because the information contained in the latest 2d modeling report supersedes the information presented in prior NRCS modeling reports. The most recent HEC-RAS analysis compares the current baseline vegetation on the project area to the conditions in the preferred alternative.

Interpretation of the HEC-RAS Model

Five different flood magnitudes were evaluated with results tabulated at 12 different location on the floodplain (See Figure 5-1 below for data location points). The ground conditions analyzed are labeled 2007, 2010, and 2017, with all runs assumed to have mature vegetation. Details of the vegetation conditions (labeled ground conditions in Table 5-1 are 5-2) as follows:

2007: The 2007 ground conditions assume that the wetland mitigation bank property has been fully vegetated with non-woody plants, 55-acres of trees/shrubs were established on the WRP, and the tree/shrub planting on the FPE has not yet occurred.

2010: The 2010 ground conditions assume that NRCS FPE has been planted with a majority of woody species, such as cottonwood and alder.

2017: The 2017 ground conditions assume an additional 30 acres of tree/shrub plantings on the WRP.

The output tables shown in Table 5-1 and 5-2 show the results of five different runs or flood size (run numbers 1-5) which increase in peak flood flowrate and area described as follows:

Run 1: 12,000 cfs peak flow on the Snoqualmie River (exceeding banks only briefly), along with a 5-year flood even on Tuck Creek, the local drainage to the west, and a 5-year precipitation event on the Snoqualmie floodplain area of Pearson Eddy.

Run 2: 34,000 cfs peak flow on the Snoqualmie

Run 3: 55,000 cfs peak flow on the Snoqualmie, a 10-year event

Run 4: 78,000 cfs peak flow on the Snoqualmie a 50-year event

Run 5: 87,000 cfs peak flow on the Snoqualmie a 100-year event

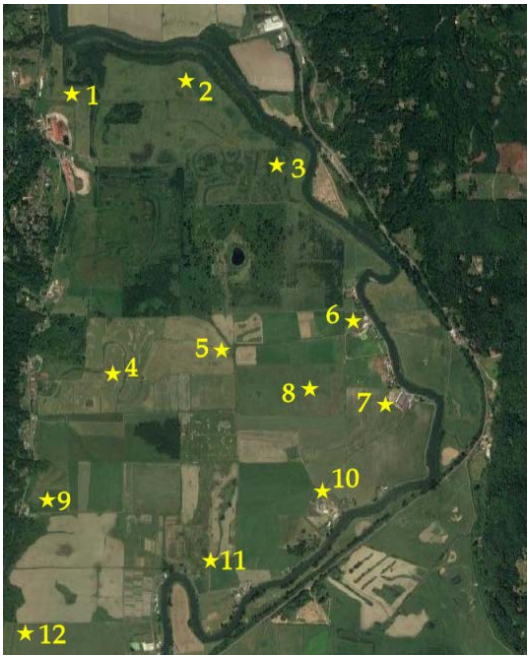


Figure 5-1 HEC-RAS output locations for Table 5-1and 5-2

run: / ground conditions	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	point #1					point #2					point #3				
2007 (depth, ft.)	0.85	7.71	11.31	14.71	16.08	5.97	12.48	15.78	19.06	20.38	4.29	10.86	14.16	17.44	18.76
2010 (depth, ft.)	0.86	7.81	11.35	14.73	16.06	5.98	12.83	15.92	19.14	20.44	4.30	11.20	14.30	17.52	18.83
rise (2010-2007 inches)	0.0	1.2	0.5	0.3	-0.2	0.1	4.2	1.7	1.0	0.8	0.1	4.2	1.6	1.0	0.8
2017 (depth, ft.)	0.86	7.80	11.35	14.73	16.06	5.97	12.83	15.92	19.14	20.44	4.29	11.23	14.32	17.54	18.84
rise (2017-2010, inches)	0.0	-0.1	0.0	0.0	0.0	-0.1	0.1	0.0	0.0	0.0	-0.1	0.3	0.3	0.2	0.2
	point #4					point #5					point #6				
2007 (depth, ft.)	1.22	7.92	11.22	14.50	15.81	6.29	12.97	16.27	19.55	20.86	2.67	9.36	12.65	15.93	17.24
2010 (depth, ft.)	1.23	8.29	11.39	14.62	15.92	6.30	13.34	16.44	19.67	20.97	2.67	9.72	12.82	16.05	17.33
rise (2010-2007 inches)	0.1	4.4	2.0	1.4	1.3	0.1	4.4	2.1	1.5	1.3	0.1	4.3	2.1	1.5	1.1
2017 (depth, ft.)	1.23	8.32	11.42	14.65	15.94	6.29	13.37	16.47	19.70	20.99	2.67	9.75	12.85	16.06	17.38
rise (2017-2010, inches)	-0.1	0.3	0.3	0.3	0.3	-0.1	0.3	0.3	0.3	0.3	-0.1	0.4	0.3	0.1	0.6
	point #7					point #8					point #9				
2007 (depth, ft.)	3.44	10.13	13.43	16.70	18.02	4.54	11.23	14.52	17.80	19.11	1.16	7.90	11.19	14.46	15.77
2010 (depth, ft.)	3.45	10.50	13.70	16.83	18.13	4.55	11.60	14.69	17.92	19.22	1.17	8.26	11.36	14.58	15.87
rise (2010-2007 inches)	0.1	4.4	3.2	1.5	1.3	0.1	4.4	2.1	1.5	1.3	0.1	4.2	2.0	1.4	1.3
2017 (depth, ft.)	3.45	10.53	13.62	16.85	18.14	4.54	11.63	14.72	17.95	19.25	1.16	8.29	11.38	14.60	15.90
rise (2017-2010, inches)	-0.1	0.3	-1.0	0.3	0.1	-0.1	0.3	0.4	0.3	0.3	-0.1	0.3	0.3	0.3	0.3
	point #10					point #11					point #12				
2007 (depth, ft.)	4.96	11.66	14.95	18.24	19.54	1.25	7.17	10.48	13.75	15.06	3.15	8.30	11.46	14.67	15.95
2010 (depth, ft.)	4.97	12.03	15.13	18.35	19.65	1.25	7.54	10.65	13.87	15.17	3.15	8.59	11.61	14.78	16.05
rise (2010-2007 inches)	0.1	4.4	2.1	1.4	1.3	0.0	4.4	2.1	1.5	1.3	0.0	3.5	1.8	1.3	1.2
2017 (depth, ft.)	4.97	12.06	15.16	18.38	19.68	1.25	7.57	10.68	13.90	15.19	3.15	8.61	11.63	14.81	16.07
rise (2017-2010, inches)	-0.1	0.3	0.4	0.3	0.3	0.0	0.3	0.3	0.3	0.3	0.0	0.3	0.3	0.3	0.3

Table 5-1. HEC-RAS output flood depths at locations in Figure 5-1

The model confirms previous studies and provides evidence about the drainage behavior of the slough area. Five different flood magnitudes were evaluated with results tabulated at 12 different location on the floodplain (See Figure 5-1 below for data location points). For example, at Point #6 SE of the FPE, floodwater depths range from 2.67 feet during a local event when the River remains within its banks to 12.85 feet during a 10-year Snoqualmie River out-of-bank event, and increase to 17.38 feet during a 100-year flood. The area is mildly sloped, and the downstream end of the slough functions like bathtub drain, which indicates that when the River flows out of its banks, the flow velocities are slow. This leads to a conclusion that during local flood events when the Snoqualmie River does not exceed its banks, floodplain vegetation on the WRP and FPE has no effect on flood levels.

During larger floods when the Snoqualmie River does exceed its banks, floodplain vegetation can cause a small rise in peak flood levels, as shown in the output tables in Table 5-1, adding generally less than two inches to floodplain water depths of many feet. A series of model runs evaluated existing and planned vegetation within the WRP, FPE, and Mitigation Bank properties and identified critical areas within the floodway where trees and shrubs temporarily increase flood water elevations during overbank flood events from the Snoqualmie River. See Figure 4-0 for location of key areas. While these effects are considered beneficial at the local scale by providing water on the floodplain for critical salmon refuge habitat and wetland restoration within the easement areas, adding any amount of additional surface water to existing flood levels off of the easement area is considered by some upstream landowners to have moderate to major negative effects to lands within the Snoqualmie River floodplain. The concern is that adding floodwater onto agricultural land will decrease viable farming, crop production, and that restoration projects receive greater latitude in

meeting the King County zero rise standard than requests for structures located in the floodway on private land.

Alternative #2: Floodplain Vegetation Modification

The King County "zero rise" regulatory standard (defined as 0.1 inch) applies only to structures constructed within the floodway. While the structural or constructed features on the site will not cause a rise in the flood waters and would meet this regulation, the floodplain vegetation would cause a rise that would exceed the zero rise standard. To determine the necessary modifications that would be needed to meet zero rise, NRCS evaluated two additional vegetation configurations within the WRP and FPE area. In order to reduce the impacts from increased flood water depth caused by restoration plantings, the existing and planned vegetation quantity and species composition would need to be modified. These model runs are added to Table 5-2 and labeled as follows:

2017alt2: Remove ~12 acres of existing trees/shrubs at the confluence of Pearson Eddy and the Snoqualmie River and remove ~44 acres of trees/shrubs in the floodway on the FPE; Retain ~330 foot wide buffer of cottonwood, western red cedar, and shrubs along the Snoqualmie River

2017alt3: Remove tree/shrub vegetation restoration plantings from WRP and FPE easements (~20 ac on WRP; ~74 ac across FPE)

The final decision between vegetation options modeled (2017alt2 and 2017alt3) will be made during the development of the Vegetation Restoration and Management Plan.

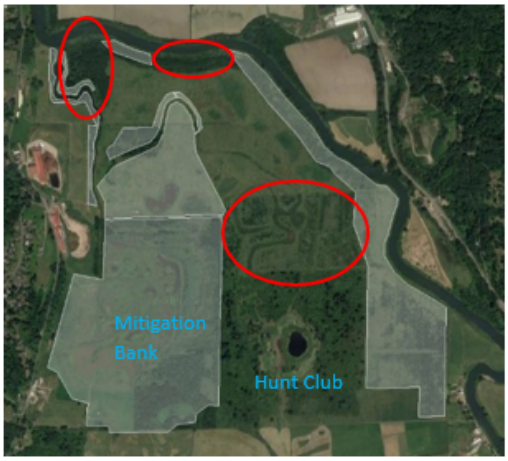
Figure 3-2 has been repeated below for ease of the reader.

Figure 3-2. Comparison of Vegetation Options

Alternative #1 Vegetation Restoration

Existing or planned tree/shrub planting within portions of the area with white shading.

vs.



Alternative #2 Vegetation Modification

NRCS will consider removing existing trees/shrubs located within areas outlined in red that are within return flood flow path. No work planned on private hunting club or mitigation bank property.

run:	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
ground conditions															
	point #1					point #2					point #3				
2007 (depth, ft.)	0.85	7.71	11.31	14.71	16.08	5.97	12.48	15.78	19.06	20.38	4.59	11.16	14.46	17.74	19.05
2010 (depth, ft.)	0.86	7.81	11.35	14.73	16.06	5.98	12.83	15.92	19.15	20.44	4.60	11.50	14.59	17.82	19.12
rise (2010-2007 inches)	0.0	1.2	0.5	0.3	-0.2	0.1	4.2	1.7	1.0	0.8	0.1	4.1	1.6	0.9	0.8
2017 (depth, ft.)	0.86	7.81	11.35	14.73	16.06	5.97	12.83	15.92	19.14	20.44	4.59	11.52	14.61	17.84	19.14
rise (2017-2010, inches)	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	-0.1	0.3	0.3	0.2	0.2
2017alt2 (depth, ft.)		7.84	11.39	14.76	16.09		12.53	15.82	19.07	20.39		11.20	14.49	17.75	19.06
rise (2017-2007, inches)		1.5	0.9	0.6	0.1		0.6	0.5	0.1	0.1		0.6	0.4	0.1	0.1
2017alt3 (depth, ft.)		7.81	11.37	14.75	16.08		12.44	15.76	19.05	20.36		11.12	14.45	17.73	19.04
rise (2017-2007, inches)		1.2	0.7	0.5	0.0		-0.5	-0.2	-0.2	-0.2		-0.4	-0.2	-0.1	-0.1
	point #4					point #5					point #6				
2007 (depth, ft.)	1.22	7.96	11.26	14.54	15.85	6.29	12.97	16.27	19.55	20.86	2.67	9.36	12.65	15.93	17.25
2010 (depth, ft.)	1.28	8.32	11.43	14.66	15.95	6.30	13.34	16.44	19.67	20.97	2.67	9.72	12.82	16.05	17.34
rise (2010-2007 inches)	0.7	4.4	2.0	1.4	1.3	0.1	4.4	2.1	1.5	1.3	0.1	4.3	2.1	1.5	1.1
2017 (depth, ft.)	1.27	8.35	11.46	14.68	15.98	6.29	13.37	16.47	19.70	20.99	2.67	9.74	12.85	16.07	17.38
rise (2017-2010, inches)	-0.1	0.4	0.3	0.3	0.3	-0.1	0.3	0.3	0.3	0.3	-0.1	0.3	0.3	0.2	0.4
2017alt2 (depth, ft.)		8.03	11.33	14.58	15.89		13.05	16.34	19.59	20.90		9.43	12.72	16.00	17.28
rise (2017-2007, inches)		0.9	0.8	0.5	0.5		0.9	0.9	0.5	0.5		0.8	0.9	0.8	0.4
2017alt3 (depth, ft.)		7.94	11.27	14.55	15.86		12.96	16.28	19.56	20.87		9.34	12.66	15.94	17.26
rise (2017-2007, inches)		-0.2	0.1	0.1	0.1		-0.1	0.1	0.2	0.2		-0.2	0.1	0.2	0.1
	point #7					point #8					point #9				
2007 (depth, ft.)	3.44	10.13	13.43	16.70	18.02	5.03	11.72	15.01	18.30	19.61	1.76	8.51	11.79	15.06	16.36
2010 (depth, ft.)	3.45	10.50	13.70	16.83	18.13	5.04	12.09	15.19	18.42	19.72	1.77	8.86	11.96	15.18	16.47
rise (2010-2007 inches)	0.1	4.4	3.2	1.5	1.3	0.1	4.4	2.1	1.5	1.3	0.1	4.2	2.0	1.4	1.3
2017 (depth, ft.)	3.45	10.53	13.53	16.86	18.15	5.04	12.12	15.22	18.45	19.74	1.77	8.89	11.99	15.20	16.50
rise (2017-2010, inches)	-0.1	0.3	-2.1	0.4	0.3	-0.1	0.3	0.4	0.4	0.3	0.0	0.3	0.3	0.3	0.3
2017alt2 (depth, ft.)		10.21	13.50	16.75	18.06		11.80	15.09	18.34	19.65		8.58	11.87	15.10	16.41
rise (2017-2007, inches)		0.9	0.8	0.6	0.5		0.9	0.9	0.5	0.4		0.9	0.9	0.5	0.5
2017alt3 (depth, ft.)		10.12	13.42	16.72	18.03		11.71	15.03	18.31	19.62		8.49	11.80	15.07	16.38
rise (2017-2007, inches)		-0.1	-0.1	0.2	0.1		-0.1	0.2	0.2	0.1		-0.1	0.1	0.2	0.1
	point #10					point #11					point #12				
2007 (depth, ft.)	5.39	12.09	15.38	18.66	19.97	0.62	5.65	8.96	12.23	13.54	2.50	7.65	10.81	14.03	15.31
2010 (depth, ft.)	5.40	12.45	15.56	18.78	20.08	0.62	6.01	9.13	12.35	13.64	2.50	7.94	10.97	14.14	15.41
rise (2010-2007 inches)	0.1	4.4	2.1	1.5	1.3	0.0	4.4	2.1	1.5	1.3	0.0	3.5	1.8	1.3	1.2
2017 (depth, ft.)	5.40	12.48	15.59	18.81	20.11	0.62	6.04	9.15	12.38	13.67	2.50	7.96	10.99	14.17	15.43
rise (2017-2010, inches)	-0.1	0.3	0.3	0.3	0.3	0.0	0.3	0.3	0.3	0.3	0.0	0.3	0.3	0.3	0.3
2017alt2 (depth, ft.)		12.16	15.46	18.70	20.02		5.72	9.02	12.27	13.58		7.71	10.91	14.07	15.35
rise (2017-2007, inches)		0.9	0.9	0.5	0.5		0.9	0.8	0.5	0.5		0.7	1.2	0.5	0.5
2017alt3 (depth, ft.)		12.08	15.40	18.67	19.99		5.64	8.97	12.24	13.55		7.64	10.82	14.04	15.32
rise (2017-2007, inches)		-0.1	0.2	0.2	0.2		-0.1	0.1	0.1	0.1		-0.1	0.1	0.2	0.1

Table 5-2. HEC-RAS output flood depths at locations in Figure 5-1

Drainage Concerns

In February 2016, NRCS re-evaluated these studies to gain perspective on the day-today drainage characteristics of the project site. A report was developed to detail drainage features present on the WRP and FPE, focusing on three areas where NRCS has received complaints and opposition. Results of the report related specifically to Site 1 at the WCS planned for replacement are presented in this chapter. Results involving the FPE would be discussed in the Cumulative Effects section of this EA in Chapter 6. See Figure 5-2 for location of the three focal areas. The drainage study results are published in "USDA NRCS Lower Snoqualmie River, WA WRP/FPE Drainage Assessment – Report of Findings" (Appendix D).

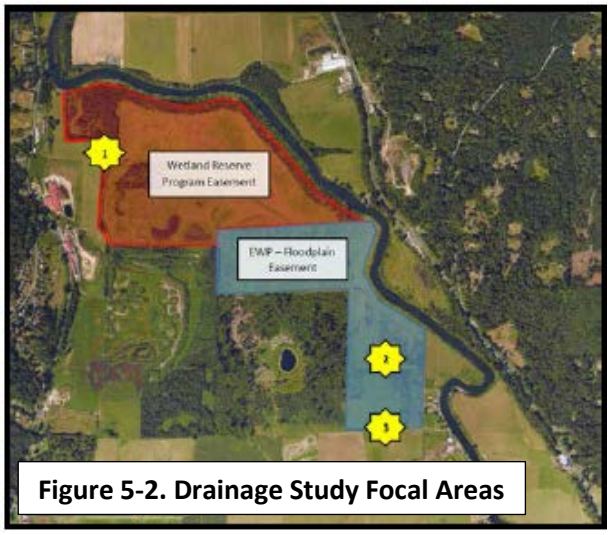


Figure 5-2. Drainage Study Focal Areas

Site 1: The planned project at this location would replace a failing WCS as described in section 3.3.1.

The project would not adversely affect the hydraulic characteristics of the existing crossing. NRCS hydraulic modeling demonstrates that the pre and post construction hydraulic impacts remain unchanged for the modeled flood events.

Operation and Maintenance

The NRCS is responsible for the perpetual maintenance and operation of the structures built within the WRP easements and funded by NRCS. A long term O&M plan has been developed for replacement WCS between Forterra and NRCS for regular maintenance, inspection, and reporting to NRCS. Inspections must be performed once every year between March and May and after each major storm event. Routine maintenance shall be performed immediately after each inspection and after each major storm event.

5.3 SPECIAL ENVIRONMENTAL CONCERNS

5.3.1 Prime and Unique Farmland

The existing WRP easement precludes active agricultural production on project area. The majority of the project area is mapped as Puget silty clay loam. This soil is rated as a prime farmland soil series when it is both drained and either protected from flooding or not frequently flooded during the growing season. Since the farmland is not diked and does flood frequently during the spring growing season, it does not meet conditions of prime farmland in this location. There are areas within the larger project area that are located adjacent to the Snoqualmie River and the banks of Pearson's Eddy that are mapped as Sultan silt loam and Puyallup fine sandy loam. All areas of Sultan and Puyallup are mapped as prime farmland. The soils mapped as Sultan and Puyallup make up approximately 20% of the planning unit.

No Action Alternative

Impact Analysis: Previous landowners willingly and voluntarily enrolled prior agricultural land into the WRP easements. Agricultural uses are prohibited by the WRP warranty deed unless authorized

as a compatible use by NRCS to improve wetland and wildlife habitat on the easement. Compatible use authorizations are subject to WRP program policy requirements. Regardless of restoration action or inaction, the small portion of prime farmland located on the easement would be removed from agricultural production. However, wetland restoration is not considered permanent loss of prime farmland and the land could be returned to farming at some point in time, if legal and regulatory requirements are changed.

At the floodplain scale, much of the private farmland located in King County upstream of the WCS is considered prime farmland if drained and either protected from flooding or does not flood frequently during the growing season. Inaction and not replacing the failing WCS would have major short and long term adverse effects on the amount of water flowing onto the farmland from local flooding and backwater up the Pearson Eddy Channel.

Alternative #1: Floodplain Vegetation Restoration
Impact Analysis: There is no local effect of implementing restoration actions on Prime and Unique farmland due to the WRP warranty easement deed prohibiting agricultural activities. See above. Replacement of the WCS would reduce flood risk to King County farmland mapped as Prime if drained and protected from flooding, having major beneficial effect at the floodplain scale in the short and long term.

NRCS does not consider conversion of prime farmland to wetlands and wildlife habitat to be irreversible. In the future, should production of food and fiber become more critical than providing habitat, National policy and WRP regulations could be altered to restore prior prime farmland to production. Though unlikely, the effects of restoration could be altered to drain and manage the easement for farming.

Alternative #2: Floodplain Vegetation Modification
Impact Analysis: No difference from Alternative #1

5.3.2 Water Quality/Clean Water Act

No Action Alternative
Impact Analysis: No action would be taken to replace the existing WCS, excavate a natural floodplain swale channel, fill drainage ditches, or restore native floodplain vegetation; these would continue to cause minor adverse effects to the Snoqualmie River temperature impairment. The floodplain on the WRP easement would remain with minimal tree/shrub cover in the short term, with natural recolonization possible over the long term.

Alternative #1: Floodplain Vegetation Restoration
Impact Analysis: Implementation of the preferred alternative would improve native floodplain cover. While short term effects would be negligible, long term effects would have minor beneficial effects. Shade on surface water channels on the WRP easement should lead to cooler flow out of Pearson Eddy during the summer months, which may have minor beneficial effects to the temperature TMDL in the main stem Snoqualmie. During construction, streamflow through the project site would be managed in such a manner as to minimize erosion and sediment problems. Turbidity would also be elevated for a short period of time during construction; however, the floating turbidity barrier in Pearson Eddy should reduce this enough to not cause injury to salmonids

and other aquatic species.

The ACOE has authorized the project under Nationwide Permit (NWP) 27, Aquatic Habitat Restoration, Establishment, and Enhancement Activities. NRCS would follow the NWP 27 Terms and Conditions specified on the cover letter dated September 13, 2016. The WDOE has determined that the project meeting the requirements for Washington State 401 Water Quality Certification and Coastal Zone Management Act Consistency under NWP #27. Therefore, an individual 401 certification would not be required for this project.

Alternative #2: Floodplain Vegetation Modification
Impact Analysis: Effects would be the same is in Alternative #1 with exception the amount of shade/cover provided over newly restored floodplain channel and along Pearson Eddy Channel would be reduced. Reduction in riparian plantings along the waterways will have moderate long term negative impacts on water temperature and dissolved oxygen levels.

According to a comment received following the public comment period on the Draft EA, a permitted point source discharge is located upstream of the project area. Any pollutants discharged into surface water that subsequently flows onto the project area will have negligible impacts to priority salmon species because the fish are expected to utilize the Pearson Eddy channel and adjacent floodplain area during periods of high flow when pollutants would be diluted.

5.3.3 Floodplain Management
Terms and prohibitions of the WRP warranty easement deed limit the level of management that can occur on the floodplain. NRCS has the authority to authorize management actions on the easement when they promote WRP objective, further improve wetlands and wildlife habitat, and reduce adverse off site effects. NRCS would issue Compatible Use Authorizations (CUA) at the request of the easement landowner.

No Action Alternative
Impact Analysis: Adverse effects are expected in the short and long term if no action is taken. No replacement of the WCS and subsequent management of the WCS would occur. The ultimate failure of the WCS would lead to an inability to control water and an increased flood risk to off-site properties. In addition, the WCS is used for vehicle and equipment access to the easement. If the earth fill in the WCS continues to erode, access may be totally lost.

Alternative #1: Floodplain Vegetation Restoration
Impact Analysis: Replacing the WCS and NRCS authorization of structure management would have major beneficial impacts to the drainage capacity and flood risk reduction on the floodplain upstream of the WRP easements. Vehicle and equipment access to conduce management activities is maintained.

Alternative #2: Floodplain Vegetation Modification
Impact Analysis: No difference from Alternative #1

5.3.4 Riparian Areas/Invasive Vegetation
Modifications to native floodplain vegetation and changes in wetland hydrology though surface ditches and the water control structure in Pearson Eddy have reduced the plant species and

community diversity on the WRP easements. Loss of floodplain forest through past conversion to agriculture led to the present condition now dominated by unmanaged reed canarygrass and non-native blackberry.

No Action Alternative

Impact Analysis: No action would be taken to restore a natural channel morphology to the floodplain swale. The streambanks of Deep Ditch would continue to provide limited plant diversity which would serve as forage for macroinvertebrates and thus remaining as poor forage opportunities for fish, amphibians, and dabbling waterfowl. Surface ditches would remain, continue to remove surface water from wetlands on the project area continuing to have adverse impacts on wetland hydrology and plant community formation. Non-native and invasive vegetation would continue to persist outside of the previously planted areas, providing little nesting, roosting, and hiding cover for migratory songbirds and small mammals. NRCS has conducted similar restoration efforts to re-establish native tree/shrub plant communities in riparian areas across the Puget Sound which have resulted in restoring ecological functions of riparian areas such as soil stabilization, increased shade over surface water (water temperature moderation), increased input of small organic material (leaves, twigs, branches) into surface water for use a food base for macro-invertebrates and other wildlife, along with improved nesting and roosting habitat for migratory songbirds.

Alternative #1: Floodplain Vegetation Restoration

Impact Analysis: Implementation of restoration actions to restore a natural floodplain channel, filling of constructed drainage ditches, de-leveling of reed canarygrass wetlands, and planting of native trees and shrubs would have moderate long term beneficial impacts on floodplain and riparian habitat development. Planting riparian areas along Pearson Eddy channel and along the restored floodplain channel would result in restoring ecological functions such as soil stabilization, increased shade over surface water (water temperature moderation), increased input of small organic material (leaves, twigs, branches) into surface water for use a food base for macro-invertebrates and other wildlife, along with improved nesting and roosting habitat for migratory songbirds. The quantity of invasive species such as reed canarygrass and blackberry would be reduced during site preparation in the short term, with canopy cover of woody vegetation expected in the long term after the plantings mature.

Alternative #2: Floodplain Vegetation Modification

Impact Analysis: The primary difference in effect under Alternative #2 is due to the planned modifications to existing and planned native tree/shrub plantings. Reducing the quantity of native woody vegetation will have a short term moderate to major negative effects on riparian habitat for songbirds, amphibians, ungulates, and small mammals in the short term. Riparian habitat benefits for priority fish will be reduced in the short term with recovery of natural forested floodplain prolonged by dominance of invasive reed canarygrass (RCG) and blackberry. Removal of riparian vegetation is not supported by Basin salmon recovery plans and will reduce habitat for culturally important salmonid resources for local Tribal Nations. Long term improvements will come from active replacement of plant communities with smaller diameter species and natural re-colonization of native species.

5.3.5 Wetlands

Wetlands are present within the project area and are noted on the National Wetland Inventory Map, Figure 4-4. NRCS completed a wetland investigation and identified a total of 22.8 acres that would

be impacted by the project; refer to Figure 4-5 –Wetland Area Map for approximate locations of wetlands that would be disturbed by project. A total of 22.8 acres would be excavated or filled, with 267 acres improved.

No Action Alternative
The existing drainage features and hydrologic conditions that currently exist at the site, such as reduced duration of soil saturation and surface ponding, would continue to reduce wetland functions.

Alternative #1: Floodplain Vegetation Restoration
Impact Analysis: In the short term, this alternative would restore the duration of soil saturation and surface ponding. Over the long term, changes in wetland hydrology would assist with restoration of native plant communities in the wetland units identified in Table 4-1.

Alternative #2: Floodplain Vegetation Modification
Impact Analysis: No difference from Alternative #1.

5.3.6 Threatened & Endangered Species/Species of Concern

Through consultation with WDFW, NMFS, and USFWS, NRCS has determined that there are no federally listed species utilizing Pearson Eddy during the summer construction window. Consultation with WDFW, NMFS, and USFWS indicates that listed Puget Sound Chinook, Puget Sound steelhead, and bull trout utilize the adjacent Snoqualmie River, but are not present in Pearson Eddy channel. Coho salmon, a federal species of concern, and cutthroat trout do utilize the Pearson Eddy channel.

No Action Alternative
Impact Analysis: Under the No Action Alternative, valuable floodplain refugia and rearing habitat would not be restored. Long term adverse impacts at the local and regional scale would result from continued disconnection to off-channel refugia for salmonids with the quality of off-channel habitat remaining poor.

Alternative #1: Floodplain Vegetation Restoration
Impact Analysis: There are no short term impacts expected during construction due to lack of federally listed species in the project area.

Short term effects to coho, cutthroat trout and other native fish species would be mitigated by following the provisions of the Hydraulic Project Approval (HPA) issued by WDFW. Fish would be isolated from the work area by using either a total or partial bypass to reroute the channel through a temporary channel or pipe or the flap gates would be closed and work area de-fished to remove as many fish as possible from the work area during the low flow work period. During construction of the new channel (reconstruction of the northern drainage ditch) fish would need to be removed from the area. The amount of adverse effect to aquatic species would be minimized by having personnel, trained in the proper techniques of fish capture and removal, perform the work. The confluence of the northern drainage ditch with Pearson Eddy would be blocked with a net so that aquatic species can't enter the ditch. The upstream net would be placed upstream of where the new channel would cross the current ditch. Aquatic species would be 'herded' out of the blocked off area with a seine net. This would be done at least three times to reduce the number of species within the blocked off area that would be electro fished. The downstream net would be lifted as the seine net approaches

so that aquatic species would leave the ditch and enter Pearson Eddy. The blocked off area would then be electro fished, according to NMFS criteria ["Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act" (NMFS 2000)]. Any aquatic species would be moved (using nets and buckets) downstream into Pearson Eddy.

Long term moderate beneficial effects can be expected due to the project design including a MTR gate in the WCS design. Fish stocks utilizing the adjacent Snoqualmie River, including listed Puget Sound Chinook and Puget Sound Steelhead, coho, cutthroat trout, and other fish are expected to utilize restored off-channel floodplain habitats during flood events in the main stem river. Floodplain access during high river flows may also occur via local migration up the Pearson Eddy channel, through the new WCS when the flap gate fitted with a MTR is open, and onto the restored floodplain habitat. When flood flows recede from floodplain, there is potential for fish to become stranded on the floodplain in depressions. Salmon have evolved to utilize floodplains are refuge areas during high flow events and any resulting stranding in restored depressional wetlands (such as Treen Lake) would be considered a natural process. These improvements to floodplain access are expected to have short and long term beneficial effects at the regional river basin scale. NRCS would be effectively meeting the agency's responsibilities under ESA Section 7 (a) (1) to restore, protect, and recover listed species.

Alternative #2: Floodplain Vegetation Modification

Impact Analysis: Primary difference in effect under Alternative #2 is due to the planned modifications to existing and planned native tree/shrub plantings. Reducing the quantity of native woody vegetation will have a short term moderate to major negative effects on riparian habitat in the short term which will reduce cover, food, and shade resources for listed salmon that utilize the floodplain channels and wetlands as refugia habitat. Riparian habitat benefits for priority fish will also be reduced in the short and long term since natural recovery of a forested floodplain would be prolonged by dominance of invasive reed canarygrass (RCG) and blackberry. Removal of riparian vegetation is not supported by Basin salmon recovery plans and will reduce habitat for culturally important salmonid resources for local Tribal Nations. Long term improvements will come from active replacement of plant communities with smaller diameter species and natural re-colonization of native species.

The modifications to floodplain vegetation and riparian habitat are expected to have short and long term moderate to major effects at the regional river basin scale salmon recovery. NRCS would not be effectively meeting the agency's responsibilities under ESA Section 7 (a) (1) to restore, protect, and recover listed species.

5.3.7 Cultural Resources

NRCS completed consultation with the Snoqualmie Indian Tribe in 2016. It was determined that the project may affect cultural resources and NRCS received confirmation from the tribe that the project could proceed with on-site monitoring during construction. NRCS and the tribe would share on-site cultural resources monitoring duties. See Appendix B for consultation documentation.

No Action Alternative

Impact Analysis: Under the No Action Alternative, no additional work would be conducted on the WRP easements. There would be no increased risk of disturbance or destruction of cultural resources and would have no adverse impacts.

Alternative #1: Floodplain Vegetation Restoration

Impact Analysis: Section 106 consultation with the DAHP and the Snoqualmie Indian Tribe concluded that on-site cultural resources monitoring would be completed during construction activities involving earthmoving. During construction, any discovery of cultural materials would result in a suspension of work while the discovery is investigated by a professional archeologist and the Snoqualmie Indian Tribe. If the project were suspended as a result of a discovery of cultural materials, the project construction would not resume until written clearance is given by the NRCS Cultural Resource Specialist. Maintaining existing floodplain vegetation and additional restoration plantings improves habitat for culturally significant salmon and will have negligible short term effects and minor long term benefits.

Alternative #2: Floodplain Vegetation Modification

Impact Analysis: Primary difference in effect under Alternative #2 is due to the planned modifications to existing and planned native tree/shrub plantings that would will reduce habitat for culturally important salmonid resources for local Tribal Nations. Reducing the quantity of native woody vegetation will have a short term moderate to major negative effects on riparian habitat in the short term which will reduce cover, food, and shade resources for listed salmon that utilize the floodplain channels and wetlands as refugia habitat. Riparian habitat benefits for priority fish will also be reduced in the short and long term since natural recovery of a forested floodplain would be prolonged by dominance of invasive reed canarygrass (RCG) and blackberry.

Table 5-3 Summary of Alternative Impacts to the Affected Environment

	No Action Alternative	Alternative #1	Alternative #2
RESOURCE CONCERNS	**No Action**	**Floodplain Vegetation Restoration**	**Floodplain Vegetation Modification**
WATER, Water Quantity (Excessive Runoff, Flooding, or Ponding)	**Regional: No impacts** The No Action Alternative would not have an impact at the regional scale. **Floodplain: Major short and long term adverse effects** Failure of the existing WCS is imminent and would allow uncontrolled flood events to back up onto private land upstream of the WCS. **Local: Major short and long term adverse effects** Scour erosion around the WCS would cause continued head cut and bank erosion on WRP easement. Loss of ability to access the WRP easement would halt future restoration efforts.	**Regional: No impacts** The Alternative would not have an impact at the regional scale. **Floodplain: WCS-Major short and long term beneficial effects** Replacement with new WCS would provide improved flood risk reduction for private land upstream of the WCS by preventing floodwaters from backing up onto adjacent farmland. Vegetation Restoration: Moderate to Major negative effects due to short term increases in flood water elevation following overbank flood events. **Local: Major short and long term beneficial effects** Scour erosion and head cut onto easement would cease. Replacement WCS would remain as stable access route onto WRP easement for implementation of restoration activities, management activities, and monitoring into the future.	**Regional: No impacts** The Preferred Alternative would not have an impact at the regional scale. **Floodplain: WCS-Major short and long term beneficial effects** Replacement with new WCS would provide improved flood risk reduction for private land upstream of the WCS by preventing floodwaters from backing up onto adjacent farmland. Vegetation Modification: Collaborative vegetation plan will reduce negative short term effects to Negligible due to removal and/or replacement of existing trees/shrubs. No new tree/shrub planting in floodway. **Local: See Alt #1, Major short and long term beneficial effects**

PLANTS, Adaptability (Plants Not Adapted or Suited to Site) & (Noxious and Invasive Plants)	**Regional: No impacts** The No Action Alternative would not have an impact at the regional scale. **Floodplain: Moderate short and long term adverse effects** The floodplain would remain dominated by homogeneous plant communities that are less diverse than historic conditions. **Local: Moderate short and long term adverse effects** No active restoration of native plant communities ensures the floodplain is dominated by non-native and invasive vegetation.	**Regional: No impacts** The Alternative would not have an impact at the regional scale. **Floodplain: Negligible short term effects; Minor long term beneficial effects** Active tree/shrub planting and wetland restoration activities would increase the diversity of the floodplain plant communities **Local: Negligible short term effects; Moderate long term beneficial effects** Active tree/shrub planting and wetland restoration activities would increase the diversity of the floodplain plant communities on the WRP easement.	**Regional: No impacts** The Preferred Alternative would not have an impact at the regional scale. **Floodplain: Short term moderate to major negative effects; Long term Minor effects** Modification of existing floodplain native trees/shrubs will decrease the quantity of native plants. Natural recolonization will increase quantity of native plants occupying the site over time, however invasive RCG will slow natural processes. **Local:** Same as Floodplain.
ANIMALS, Fish and Wildlife (Inadequate Cover/Shelter)	**Regional: No impacts** The No Action Alternative would not have an impact at the regional scale. **Floodplain: Negligible short term and minor adverse long term impacts** Channels located on the WRP would continue to be unmanaged on the easement which could reduce floodplain drainage over time. Project would not	**Regional: No impacts** The Alternative would not have an impact at the regional scale. **Floodplain: Minor short term beneficial impacts; Major long term beneficial impacts** Floodplain drainage may be improved in the restored channel with the reed canarygrass-free conditions after construction. Project contributes to salmon recovery at basin scale	**Regional:** The Preferred Alternative would have negligible negative effects due to reduction in quantity of riparian habitat along the river. Action not supported by Basin Salmon Recovery Plan. **Floodplain:** Moderate to Major short term negative effects from modifications to existing restoration

	contribute to salmon recovery at the river basin scale. **Local: Negligible short term impacts; Moderate long term adverse impacts** Cover quality for fish and wildlife continues to degrade over time as invasive species continue to spread and off-channel habitats remain modified with limited physical habitat.	by reconnecting floodplain habitat and improving rearing habitat quality. **Local: Negligible short term impacts; Major beneficial long term impacts** Cover quality for fish and wildlife becomes more diverse with floodplain channel, wetland hydrology restoration, and active planting of native trees and shrubs.	plantings. Long term natural re-colonization will occur but will be slowed by dense invasive RCG. **Local:** Same as Floodplain Scale effect.
ANIMALS, Fish and Wildlife (Habitat Fragmentation)	**Regional: No impacts** The No Action Alternative would not have an impact at the regional scale. **Floodplain: Negligible short term impacts; minor long term beneficial impacts** Fish passage continues to block access to floodplain habitat upstream of the WCS in short term. After PE channel bypasses the WCS, fish passage upstream in PE and onto floodplain habitat would occur with adverse impacts on upstream property. Project would not contribute to salmon	**Regional: No impacts** The Alternative would have short and long term moderate beneficial effects at the regional Snohomish River Basin scale due to increased floodplain access for salmonids. **Floodplain: Major short and long term beneficial impacts** The replacement WCS includes a MTR that would increase the frequency and duration of water exchange between Person Eddy and floodplain habitats upstream. Project contributes to salmon recovery at basin scale by reconnecting floodplain habitat and improving rearing habitat quality.	**Regional:** No difference from Alternative #1. **Floodplain:** No difference from Alternative #1.

	recovery at the river basin scale. **Local:** Same as at Floodplain Scale	**Local:** Same as Floodplain Scale	**Local:** No difference from Alternative #1.
ANIMALS, Fish and Wildlife (Inadequate Food)	**Regional: No impacts** The No Action Alternative would not have an impact at the regional scale. **Floodplain: Negligible short term impact; moderate long term adverse impacts** Forage quality for fish and wildlife continues to degrade over time as invasive species continue to spread. **Local: Negligible short term impact; Minor adverse impact in long term** Forage quality for fish and wildlife continues to degrade over time as invasive species continue to spread and off-channel habitats remain modified with limited prey base.	**Regional: No impacts** No discernable change in forage for fish and wildlife at the regional scale. **Floodplain: Minor long term beneficial impacts** Active tree/shrub planting and native plant community restoration would occur on the WRP easement, a small portion the Snoqualmie River floodplain. **Local: Minor short term impact; Moderate long term beneficial impact** Forage quality for fish and wildlife becomes more diverse with floodplain channel, wetland hydrology restoration, and active planting of native trees and shrubs, and planting of improved grassland forage for waterfowl under a CUA.	**Regional: No impacts** No discernable change in forage for fish and wildlife at the regional scale. **Floodplain: Short term moderate to major negative effects; Negligible long term effect due to slow natural re-colonization of native early successional species and through active replacement** Loss of prior native tree/shrub plantings will reduce quantity of available food resources (leaves, twigs, seeds, insects) **Local:** Same as Floodplain effects.
ECONOMIC/SOCIAL, Risk and Concern	**Regional: No impacts** The No Action Alternative would not have an impact at the regional scale. **Floodplain: Major short and long term adverse effects**	**Regional: No impacts** The Alternative would not have an impact at the regional scale. **Floodplain: Major short and long term beneficial effects towards flood risk protection**	**Regional: No impacts** The Alternative would not have an impact at the regional scale. **Floodplain: WCS-Major short and long term beneficial effects**

	Failure of the existing WCS is in progress with flooding of offsite properties expected. **Local: Major short and long term adverse effects** Failure of the existing WCS is in progress with soil erosion and long term damage to adjacent mitigation bank property continuing	Replacement WCS would restore flood risk reduction to private farm land located upstream of the WCS. Vegetation Restoration: Moderate to Major negative effects due to short term increases in flood water elevation following overbank flood events. **Local: Major short and long term beneficial effects** Replacement WCS would restore controlled flood return flows through the WCS and off the easement, preventing further damage to the adjacent mitigation bank property.	Replacement with new WCS would provide improved flood risk reduction for private land upstream of the WCS by preventing floodwaters from backing up onto adjacent farmland. Vegetation Modification: Collaborative vegetation plan will reduce negative short term effects to Negligible due to removal and/or replacement of existing trees/shrubs. No new tree/shrub planting in floodway. **Local: See Floodplain.**
SPECIAL ENVIRONMENTAL CONCERNS			
Prime and Unique Farmland	**Regional: No impacts** The No Action Alternative would not have an impact at the regional scale. **Floodplain: Major short and long term adverse impact.** Loss of flood protection on prime farmland mapped with conditions requiring drainage and protection from flooding. **Local: No effect in short or long term** due to WRP easement deed agricultural prohibitions	**Regional: No impacts** The Alternative would not have an impact at the regional scale. **Floodplain: Major short and long term beneficial impact.** King County farmland retains protection from flooding to continue to meet prime farmland criteria. **Local: No effect in short or long term** due to WRP easement deed agricultural prohibitions	**Regional: Same as Alternative #1** **Floodplain: Same as Alternative #1** **Local: Same as Alternative #1**

Water Quality/Clean Water Act	**Regional: No impacts** The No Action Alternative would not have an impact at the regional scale. **Floodplain: Minor short and long term adverse impacts** Continued reduced native floodplain vegetation would continue to cause minor adverse effects to the Snoqualmie River temperature impairment. **Local: Negligible short term effects; minor long term beneficial impacts** No change in floodplain vegetation in the short term with natural recolonization of native floodplain vegetation having minor beneficial impacts as cover of waterways increases.	**Regional: No impacts** The Alternative would not have an impact at the regional scale. **Floodplain: Negligible short term impact; Minor long term impacts** Increased native floodplain cover would have beneficial effects to the temperature impairment in the main stem Snoqualmie River over time as cover increases over waterways. **Local: Short term negligible impacts; long term moderate beneficial impacts** as plant cover increases over waterways.	**Regional: Same as Alternative #1** **Floodplain: Moderate short and long term negative impacts** Decrease in quantity of shade/cover over waterways and channels will increase water temperature and decrease dissolved oxygen. **Local:** Same as Floodplain scale effects
Floodplain Management	**Regional: No impacts** The No Action Alternative would not have an impact at the regional scale. **Floodplain: Major adverse short and long term effects** Ultimate failure of the WCS would lead to no ability to control water to the south of the WCS and increased flood risk to off-site properties.	**Regional: No impacts** The Alternative would not have an impact at the regional scale. **Floodplain: Major beneficial short and long term effects** Replacing the WCS and NRCS authorization of structure management would have major beneficial impacts to the drainage capacity and flood risk reduction on	**Regional: Same as Alternative #1** **Floodplain: Same as Alternative #1**

		the floodplain upstream of the WRP easements.	
	Local: Major adverse short and long term effects Failure of the WCS would preclude equipment travel across Pearson Eddy and eliminate the ability for management activities on the WRP easements.	**Local: Major beneficial short and long term effects** Replacement of the WCS ensures ability access the WRP easements in the future to conduct management activities.	**Local: Same as Alternative #1**
Riparian Areas/Invasive Vegetation	**Regional: No impacts** The No Action Alternative would not have an impact at the regional scale.	**Regional: No impacts** The Alternative would not have an impact at the regional scale.	**Regional: No impacts** The Alternative would not have an impact at the regional scale.
	Floodplain: Negligible short term impact; moderate long term adverse impacts riparian habitat quantity and quality for fish and wildlife continues to degrade over time as invasive species continue to spread.	**Floodplain: Negligible short term impact; minor long term beneficial impacts** with plant community restoration on the WRP easement, a small portion the floodplain.	**Floodplain: Moderate to Major short term negative effects** Reduction in quantity of past riparian plantings on floodplain and along River reduces habitat for terrestrial wildlife and critical salmon resources valued by local Tribal Nations.
	Local: Negligible short term impact; Minor adverse impact in long term Riparian habitat quantity and quality for fish and wildlife continues to degrade over time as invasive species continue to spread and off-channel refugia remain modified with limited plant diversity.	**Local: Negligible short term impact; Moderate long term beneficial impact** Riparian habitat quantity and quality for fish and wildlife becomes more diverse with floodplain channel, wetland hydrology restoration, and active planting of native trees and shrubs.	**Local:** Same negative effects as Floodplain scale.

Wetlands/Hydrology	**Regional:** No impacts The No Action Alternative would not have an impact at the regional scale. **Floodplain:** Negligible short and long-term impacts. Modeling results have shown wetland restoration areas proposed for restoration and enhancement would not impact adjacent farmland located in King County. **Local:** Moderate long-term adverse effects. The current hydrology that serves to reduce soil saturation and surface water ponding would remain.	**Regional:** No impacts The Alternative would not have an impact at the regional scale. **Floodplain:** Negligible short and long-term impacts. Modeling results have shown wetland restoration areas proposed for restoration and enhancement through ditch filling, de-leveling, and SRT installation in the WCS would not impact adjacent farmland located in King County. See WATER, Water Quantity (Excessive Runoff, Flooding or Ponding) for description of negative effects from existing and planned vegetation restoration. **Local**: Short term moderate beneficial effects due to filling of ditches and inclusion of a MTR gate on the WCS that would increase the amount of flood flow onto the easement. Major long term beneficial effects as natural woody and herbaceous wetland plant communities are restored over time by active planting and passive restoration.	**Regional: Same as Alternative #1** **Floodplain: Same as Alternative #1** See WATER, Water Quantity (Excessive Runoff, Flooding or Ponding) for description of reduction of negative effects expected from planned vegetation removal/modifications and re-location of future tree planting out of the floodway **Local: Same as Alternative #1**

Threatened & Endangered Species/Species of Concern	**Regional: No impacts** The No Action Alternative would not have an impact at the regional scale. **Floodplain: Minor short and long term adverse effects** Salmonids would continue to be disconnected from off-channel refugia habitats with the current WCS and associated fill remaining. **Local:** Same as at Floodplain	**Regional:** The Alternative would have short and long term moderate beneficial effects at the regional Snohomish River Basin scale due to increased floodplain access for listed salmonids. **Floodplain: Negligible short term effects; Moderate long term beneficial effects** Beneficial effects to salmonid use on the WRP easement can be expected with the project design including a MTR gate in the WCS design. When open, the MTR gate would pass fish through the WCS and onto restored channel and wetland habitats for refuge and rearing. Increased plantings will improve refugia habitats that will be used by listed salmon. **Local:** These improvements to floodplain access are expected to have short and long term beneficial effects; NRCS would be effectively meeting the agency's responsibilities under ESA Section 7 (a) (1) to restore, protect, and recover listed species.	**Regional: Same as Alternative #1** **Floodplain:** Reducing the quantity of native woody vegetation will have a short term moderate to major negative effects on riparian habitat which will reduce cover, food, and shade resources for listed salmon that utilize the floodplain channels and wetlands as refugia habitat. NRCS would not be effectively meeting the agency's responsibilities under ESA Section 7 (a) (1) to restore, protect, and recover listed species.

			Local: Modifications to floodplain vegetation and riparian habitat are expected to have short and long term moderate to major negative effects. NRCS would not be effectively meeting the agency's responsibilities under ESA Section 7 (a) (1) to restore, protect, and recover listed species.
Cultural Resources	**Regional: No impacts** The No Action Alternative would not have an impact at the regional scale. **Floodplain: No impacts** The No Action Alternative would not have an impact at the floodplain scale. **Local: Negligible impacts** No action would be taken which would cause inadvertent discovery of cultural resources, however, taking no action would lead to continued soil erosion as the Pearson Eddy channel continues to erode around the WCS. Erosive processes could expose cultural resources and would	**Regional: No impacts** The Alternative would have negligible short them and moderate long term beneficial effects at the regional Snohomish River Basin scale due to increased floodplain access for listed salmonids. **Floodplain: No impacts** Maintaining existing floodplain vegetation and additional restoration plantings improves habitat for culturally significant salmon and will have negligible short term effects and minor long term benefits. **Local: Negligible short term effects; No long term effects** On-site cultural resources monitoring by a qualified archeologist would ensure work is stopped if there were	**Regional:** The Alternative would have negligible short them and moderate long term negative effects at the regional Snohomish River Basin scale due to decreased quality of floodplain habitat for listed salmonids. **Floodplain:** Reducing the quantity of native woody vegetation will have a short term moderate to major negative effects on riparian habitat in the short term which will reduce cover, food, and shade resources for listed salmon that utilize the floodplain channels and wetlands as refugia habitat. Riparian habitat benefits for priority fish will be reduced in the short and long term since natural

	not be monitored by a professional archeologist.	inadvertent discovery of cultural resources. Maintaining existing floodplain vegetation and additional restoration plantings improves habitat for culturally significant salmon and will have negligible short term effects and minor long term benefits.	recovery of a forested floodplain would be prolonged by dominance of invasive reed canarygrass (RCG) and blackberry. **Local: Same as Floodplain.**

Chapter 6: Cumulative Effects

The CEQ regulations to implement NEPA require an assessment of cumulative effects or impacts. Under CEQ regulations, a "cumulative impact is 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 impacts can result from individually minor but collective actions taking place over a period of time." For the purposes of this EA, cumulative impacts include other ongoing or reasonably foreseeable future projects and plans at the Pearson Eddy project site or the adjacent upstream reach of the Snoqualmie River floodplain, and the contribution of those actions on cumulative effects to the resource. The area of consideration for the cumulative effects analysis is the Pearson Eddy project site and adjacent areas within the left bank Snoqualmie River floodplain.

6.1 Past Actions

Past actions including the use and development of the project area are detailed throughout various sections of Chapter 1. These actions on the WRP easements included:

- Establishment of 55 acres of native trees and shrubs along the Snoqualmie River and the east bank of Pearson Eddy
- Complete removal of a stream crossing (culvert and associated fill)
- Removal of livestock fencing on the floodplain
- Location and re-attachment of one flap gate on a culvert in the WCS in Pearson Eddy

Section 1.3.1 provides details and a timeline for NRCS acquisition of the adjacent FPE. Approximately 150 acres of the ~170 ac easement were planted with native floodplain vegetation.

6.2 Present and Reasonably Foreseeable Future Actions

No Action: The no action alternative would not result in cumulative impacts at the regional, floodplain, or local scale beyond what has been described in Chapter 5 and included in Table 5-3.

Alternative #1: Floodplain Vegetation Restoration: This alternative, combined with past, present, and reasonably foreseeable future actions would not result in more intensified cumulative adverse effects than those already described at the Floodplain scale in Chapter 5. The key difference between the two action alternatives is that Alternative #1 would continue to have moderate impacts by adding a small quantity of flood water during some flood events that would exceed the King County zero rise regulation intended to regulate structures in floodways.

Alternative #2: Floodplain Vegetation Modification:

In addition to the actions in the preferred alternative (Alternative #2: Floodplain Vegetation Modification), actions that would occur on and in the vicinity of the Pearson Eddy project site at present or in the reasonably foreseeable future include management actions to improve native plant communities and wildlife forage such as weed control, mowing, disking, seeding of herbaceous vegetation and spot spray. The WCS would be carefully monitored during the first year of operation to ensure water levels allowed onto the WRP easement are controlled and would not have unanticipated off site impacts to farmland enrolled in King County Farmland

Protection Program. Surface drainage ditches could be maintained by removal of beaver dams, dredging (via CUA), and other actions that would maintain drainage features that were in place at the time of easement acquisition of the WRP and FPE.

NRCS studied the potential effect of adding an additional ~30 acres of tree/shrub plantings to the WRP easement during the most recent Hydraulic Impact Analysis which included adjacent areas on the floodplain outside of the WRP easement. See Figure 5-1 for study area, Appendix C for the complete March 2017 Report, and Table 5-2 for additional hydrologic model outputs that analyzed the effects of removal of existing trees/shrubs on the WRP and FEP). The study found that the proposed planting would not have any effect on flood levels during local flood events when the Snoqualmie River does not overtop its banks. During larger floods when the Snoqualmie River does exceed its banks, floodplain vegetation can cause a small rise in peak flood levels, as shown in the output tables in Table 5-1, adding generally less than two inches to floodplain water depths of many feet. While these effects are considered beneficial at the local scale by providing water on the floodplain for critical salmon refuge habitat and wetland restoration within the easement areas, adding any amount of additional surface water to existing flood levels off of the easement area is considered by some upstream landowners to have moderate to major negative effects to lands within the Snoqualmie River floodplain. The concern is that adding floodwater onto agricultural land will decrease viable farming, crop production, and that restoration projects receive greater latitude in meeting the King County zero rise standard than requests for structures located in the floodway on private land.

The Preferred Alternative (Alternative 2: Floodplain Vegetation Modification) includes development of a plan to reduce effects at the floodplain scale be lowering the flood water elevations as close as reasonable to meet the King County Zero Rise standard of 0.1 inches without having major adverse effects to critical salmon habitat and culturally important resources for local Tribal Nations.

6.3 Future Mitigation

NRCS would utilize the most recent two-dimensional hydraulic analysis HEC-RAS model designed to proceed with development of a collaborative Vegetation Management plan as described in Section 3.4. NRCS would consider management actions such as altering the planting footprint by removal of some previously planted trees/shrubs, replacing trees with smaller diameter species, reducing the density of existing plantings, or other actions to reduce the impact floodwater elevation increases on lands outside of the easements during out-of-bank Snoqualmie River floods.

In order to reduce minor adverse effects associated with large out-of-bank flood events, the planting layout for any additional tree/shrub planting on the WRP would avoid planting areas located in the floodway.

NRCS can issue CUAs to the WRP for wildlife forage management to attract migratory waterfowl to the WRP easement. In addition, CUAs would be issued if requested by easement landowners to maintain surface drainage ditches by removal of beaver dams, dredging, and other

actions that would maintain drainage features that were in place at the time of easement acquisition of the WRP and FPE. Lastly, NRCS would consider issuing a CUA to the landowner to re-establish a pumping facility in Pearson Eddy channel. All installation and maintenance costs would be burdened by a local entity/sponsor and not NRCS. It is recommended that an economic analysis be completed for pumping plant alternatives, as a high operating cost may negate the economic benefits of installing and operating a pump.

Additional projects may occur in the future in an effort to comprehensively restore the Snoqualmie River floodplain outside of areas that preclude restoration via farmland preservation easements. However, it is difficult to account for future project specifics as different agencies and organizations would be working on these projects. It is also difficult to analyze the cumulative effects of unplanned future projects to any great extent, but it is assumed that the Preferred Alternative, in conjunction with future restoration projects, would have a positive long term cumulative benefit to salmon recovery at the basin scale.

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