

Rivers Flood Hazard Management Plan—Vol. I

2018 Update

Adopted November 6, 2018 Ordinance 2018-83

Pierce County

2018 Pierce County Rivers Flood Hazard Management Plan Contributors

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Flood Plan Advisory Committee

The Flood Plan Advisory Committee consisted of 26 members representing cities, counties, tribes, state and federal agencies, business, environmental and agricultural interests, floodplain residents and citizens outside of the planning area.

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Pierce County Project Team

A Pierce County Project Team made up of representatives from SWM, Transportation Planning, Emergency Management, Planning and Land Services, Economic Development, Government Relations, and Parks and Recreation Services guided development of the Plan.

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Pierce County Steering Committee

An internal Steering Committee (composed of the SWM Management Team) reviewed all elements of the Flood Plan prior to broader external review.

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Flood Plan Advisory Committee

The Flood Plan Advisory Committee consisted of 26 members representing cities, counties, tribes, state and federal agencies, business, environmental and agricultural interests, floodplain residents and citizens outside of the planning area.

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Pierce County Steering Committee

An internal Steering Committee (composed of the SWM Management Team) reviewed all elements of the Flood Plan prior to broader external review.

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Marsha Huebner, Environmental Permitting and Planning Manager
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INTRODUCTION

In 2013, Pierce County adopted the Pierce County Rivers Flood Hazard Management Plan (Flood Plan) that outlined how Pierce County addressed and managed flooding and channel migration hazards on major rivers, large tributaries and associated floodplains within Pierce County. The Flood Plan was developed to meet the requirements of the Washington Administrative Code (WAC 173-145) related to the Comprehensive Flood Control Management Plans, Revised Code of Washington (RCW 86.12 flood control by counties), and the Community Rating System Guidance for floodplain management planning under the National Flood Insurance Program. The purpose of the Pierce County Rivers Flood Hazard Management Plan is to: recommend regional policies, programs, and projects to reduce risks to public health and safety; reduce infrastructure and property damage; reduce maintenance costs; and improve habitat conditions, while protecting and maintaining the regional economy.

The 2018 Flood Plan Update and Progress Report (Flood Plan Update) is a companion document to the 2013 Flood Plan. This update is a technical update and progress report that reflects new information on hazards, vulnerabilities, and accomplishments since the adoption of the 2013 Flood Plan. The National Flood Insurance Program's Community Rating System (CRS) requires an update to the agency's flood hazard management plan every five years. Currently, Pierce County is a Class 2 rated community. This rating provides a discount of up to forty percent on federally backed flood insurance premiums for unincorporated Pierce County property owners.

Chapters, subsections and appendices of the Flood Plan Update are presented in the same order as the 2013 Flood Plan. Only new and updated information is presented in this edition. This plan does not establish or propose new policy, but it reports on relevant regulatory changes that may have emerged from the 2013 plan. Organization of this plan update is broken out into two sections, a progress report section and errata. Definitions of each section are as follows:

Progress report: The progress report provides a status update, clarifying information or additional details on projects and plans that were listed in the 2013 Flood Plan. The report is listed in the order it appears in the 2013 Flood Plan. Minor updates to cost estimates, current or completed project names, corrected river miles or other minor updated information can be found in the Errata to the Flood Plan.

Errata to the Flood Plan: The errata documents additions, deletions or corrections to the text of the 2013 Flood Plan. These additions, deletions or corrections are to: to correct grammar, minor errors, updated cost estimates to 2017 dollars, correct names or references. Text that has been deleted or changed is shown in strikeout and text that has been added is underlined and listed in the order it appears in the 2013 Flood Plan. If no change was proposed, it is not included.

Purpose of the plan

The purpose of the Pierce County Rivers Flood Hazard Management Plan continues to be to: recommend regional policies, programs, and projects that reduce risks to public health and safety; reduce public and property damage; reduce maintenance costs; and, improve habitat conditions, while protecting and maintaining the regional economy.

Planning process and stakeholder involvement for 2018 Flood Plan Update and Progress Report

Development of the 2018 Flood Plan Update and Progress Report was led by Pierce County Planning and Public Works, Surface Water Management (SWM). Three planning committees were formed to help guide the development of the plan. The Steering Committee is comprised of members from the Surface Water Management leadership team along with the Executive Director of the Pierce County Flood Control Zone District. The Steering Committee had four meetings during the development of the plan and was utilized to make final decisions on various elements throughout the process.

An Internal Planning Committee was also formed that was comprised of key individuals from various departments in Planning and Public Works, the Department of Emergency Management as well as the Department of Parks and Recreation. This committee had four meetings and provided valuable input on modifications to the 2013 goals, objectives, and guiding principles. Lastly, an Advisory Committee was formed that was comprised of local citizens, tribes, private nonprofits, cities, state agencies, the Port of Tacoma, and King and Thurston counties. This committee had five meetings throughout the development of the plan update and provided feedback on how they would modify the 2013 goals, objectives, and guiding principles that were outlined in the plan. Once all elements of the Flood Plan were discussed with both committees, the Steering Committee reviewed the suggested revisions prior to a broader external review. To see a complete list of all the committee members and their affiliation refer to Appendix C.

Individual meetings also took place during the plan update process. Meetings were held with SWM project managers and local officials that were knowledgeable of projects or events that had taken place along the rivers. In addition, a meeting with staff from the Puyallup Tribe of Indians and the Muckleshoot Tribe was held on July 19th, 2017 to update the Roles of the Tribes section of the Flood Plan (6.1.3). This meeting was a crucial part of updating the plan as it provided additional information on how the tribes has assisted the County in improving our flood risk.

The Flood Control Zone District (FCZD) Advisory Committee also played a role in the plan update process. During regularly scheduled FCZD Advisory Committee meetings, presentations were on the Flood Plan Update. Advisory Committee members provided valuable feedback and even requested that notification about the Flood Plan Update go out to the residents in their respective jurisdictions. In January and March 2018, notification was

sent to city officials and residential postal customers throughout Pierce County, informing them of the plan update and inviting their input through the virtual open house. See appendix K for an example of this notification.

A virtual open house for the Flood Plan Update went live April 11, 2018. This open house gave residents an opportunity to provide feedback on the draft plan before it went through various committees for approval and later adoption. This was the first time that this method of public participation was used for the Flood Plan Update. Comments or questions that were submitted were given to the Steering Committee for discussion and consideration.

Notification of the Flood Plan Update was also sent out to all the watershed councils in Pierce County. An email went out to watershed council members in September 2017 to inform them of the plan update process and provide them with an opportunity to participate in the Advisory Committee. SWM staff also partnered with Pierce County Department of Emergency Management Regional Hazard Mitigation groups (total of 5 groups) to inform them of the plan update process and invite them to participate in the Advisory Committee. In addition, SWM collaborated with Pierce County Department of Emergency Management Public Education Department to create a brochure that was used to hand out to residents at fairs and other events that provided information on the plan update process and how they could be involved.

State Environmental Policy Act (SEPA) Environmental Impact Statement (EIS) process for the 2018 plan update

This update is a progress report of the existing projects and recommendations already included in the 2013 Flood Plan. This update does not include new projects or activities that change the original threshold determination or require new analysis, nor does it include significant changes to any project or recommendation. Pierce County has concluded that a Supplemental Environmental Impact Statement (SEIS) or addendum is not required for this update. However, Pierce County will distribute the plan update and progress report for public comment and review.

During the development of the 2013 Pierce County Rivers Flood Hazard Management Plan, a State Environmental Policy Act (SEPA) Environmental Impact Statement (EIS) was published in conjunction with the plan development. The EIS described the potential effects of the proposed activities on the environment that were listed in the flood plan. This process included:

- Preparing and distributing a Determination of Significance and scoping notice during a 21-day scoping period.
- Drafting an EIS to inform the public of the environmental analysis and describe how the public could be involved in the EIS preparation.

- Publishing a Notice of Availability and distributing the draft EIS to inform the public of the preliminary results of the environmental analysis during a 45-day comment period.
- Drafting a final EIS that provided responses to substantive comments received during the draft EIS 45-day comment period.
- Publishing a Notice of Availability in the SEPA Register and distributing the final EIS which explained the agencies decision, the alternatives the agency considered, and the agencies plans for mitigation and monitoring.

PROGRESS REPORT

CHAPTER 1 INTRODUCTION

Goals, Objectives, And Guiding Principles

The Flood Plan Update includes updated goals, objectives, and guiding principles that are more concise and comprehensive to fit the needs of county staff, committee members and residents. Throughout the plan update process, each goal, objective, and guiding principles was reviewed using the 2013 methodology. Below is a summary table of the revised goals, objectives, and guiding principles.

Goals			
2013 Goals	**Kept as is?**	**Revised?**	**New revised language**
Reduce risks to life and property from river flooding and channel migration;	X		N/A
Identify and implement flood hazard management activities in a cost-effective and environmentally-sensitive manner;	X		N/A
Support compatible human uses, economic activities, and improve habitat conditions in flood-prone and channel migration areas; and		X	(3) Support resilient communities, economic activities, and improve habitat conditions in flood-prone and channel migration areas;
Develop a long-term and flexible funding strategy for river flood hazard management;		X	(4) Continue to implement cost effective river flood hazard management activities supported by a long term flexible funding strategy;

Below is a summary table of the revised objectives:

Objectives			
2013 Objectives	**Kept as is?**	**Revised?**	**New Revised language**
(1) Evaluate the risks to public safety and existing development (e.g., critical facilities, infrastructure, and structures) in flood-prone and channel migration hazard areas;	X		N/A
(2) Examine alternatives to reduce risk to life and property, while reducing economic and environmental impacts of flood hazard management actions and programs;		X	(2) Examine and prioritize opportunities to reduce risk to life and property, while reducing economic and environmental impacts of flood hazard management actions and programs;

Objectives			
2013 Objectives	**Kept as is?**	**Revised?**	**New Revised language**
(3) Regulate new development in flood-prone and channel migration hazard areas to minimize risks to life, property, and habitat, and strive for consistency of regulations among affected local governments;		X	(3) Regulate new development in flood-prone and channel migration hazard areas to minimize risks to life, property, and habitat;
(4) Identify current and establish future "Levels of Service" for existing and new flood risk reduction facilities;		X	(4) Review current and establish future "Level of Service" for existing and new flood risk reduction facilities;
Additional added objective		X	(5) Promote coordination among Pierce County Agencies for consistency of regulation among affected local governments; NEW OBJECTIVE
(5) Maintain, repair and modify necessary existing flood risk reduction facilities in a cost-effective manner that makes the facilities less susceptible to future damage, reduces impacts on aquatic and riparian habitat, and ensures consistency with public law (PL) 84-99, or similar federal, tribal and state laws and programs;		X	(6) Manage flood risk reduction facilities in a cost -effective manner that makes the facilities less susceptible to future damage, reduces impacts on habitat, and ensures consistency with public law (PL) 84-99, or similar federal, tribal, and state laws and programs;
(6) Identify repetitive-loss properties and properties needed for future flood risk reduction facilities;	X		RENUMBERED TO OBJECTIVE #7
(7) Prioritize projects and programs based on the level of risk, benefit, cost effectiveness over the life of the plan or facility, and adverse effects on habitat;		X	(8) Identify and examine the connections between floodplain management, salmon recovery, aquatic and riparian habitat, water quality, open space, public access and agricultural resources to take advantage of efficiencies in addressing multiple objectives;
(8) Provide for the participation of stakeholders in the assessment of acceptable risks, evaluation and ranking of alternatives, natural resource management issues and development of recommendations;		X	(9) Prioritize projects and programs based on the level of risk, benefit, cost effectiveness and effects on habitat; over the life of the plan or facility;
(9) Coordinate among Pierce County departments, other agencies and governments (cities, tribes, adjacent counties) to seek consistency in flood hazard management and flood disaster response and recovery;		X	(10) Provide for the participation of stakeholders in the assessment of acceptable risks, evaluation and ranking of alternatives, natural resource management issues and in the development of plan recommendations;

Objectives			
2013 Objectives	**Kept as is?**	**Revised?**	**New Revised language**
(10) Implement a County-wide public education and outreach program to improve flood awareness that includes actions people can take to reduce their risks (e.g., flood insurance, flood proofing);		X	(11) Coordinate among Pierce County departments, other agencies and governments to seek consistency in flood hazard management, development regulations, and flood disaster response and recovery;
(11) Identify possible funding sources for implementing the recommended flood hazard management activities;		X	(12) Implement a County-wide public education and outreach program to improve flood awareness that includes actions people can take to reduce their risks (e.g., flood insurance, flood proofing);
(12) Examine the connections between flood hazard management, river corridors, salmon recovery, aquatic and riparian habitat, water quality, open space, public access and agricultural resources to take advantage of efficiencies in addressing multiple objectives;		X	(13) Identify supplemental funding sources for implementing recommended flood hazard management activities;
(13) Remove or modify existing flood risk reductions facilities, to protect, restore, or enhance critical riparian or instream habitat that benefits threatened or endangered species;			(14) Remove or modify existing flood risk reduction facilities, where feasible, to protect, restore or enhance critical riparian or instream habitat that benefits threatened or endangered species;
Removed objective #14		X	
(15) Protect and enhance natural systems that prevent flooding;		X	(15) Protect and enhance natural systems that reduce flood risk;
(16) Adaptively manage implementation to learn from successes, develop long-term cost-effective approaches and reduce the need for costly solutions;		X	(16) Monitor the effectiveness of projects and repairs to learn from successes, develop long-term cost-effective approaches and reduce the need for costly solutions;
Removed objective #17		X	
(18) Increase our understanding and incorporate information about climate change (including potential increases in rainfall, glacial retreat and changes in sediment transport) into flood hazard management decision-making; and		X	(17) Increased our understanding and incorporate information about climate change into flood hazard management decision-making;
(19) Cooperate with regional agencies in maintaining a network of accurate stream flow and weather gauges, and water quality data.		X	(18) Maintain a network of accurate stream flow, weather gauges, and water quality data to inform management decisions;

Guiding Principles			
2013 Guiding Principles	**Kept as is?**	**Revised?**	**New Revised language**
(1) River flooding and channel migration are natural processes that continually form and alter river valleys and the floodplain landscape. Rivers transport water, sediment, and woody material that may threaten public safety and infrastructure in flood prone areas. Biological productivity and diversity are sustained by natural riverine processes, such as flooding, that create and alter aquatic habitats that sustain fish and wildlife species.	X		N/A
(2) Actions in the upland and upstream portions of watersheds impact flooding, channel migration, and water quality within the river corridor. Sources of sediment and pollution from human activities like logging and urbanization also impact water quality and habitat.		X	**(2) Activities in the watersheds impact flooding, channel migration, habitat, ground water, and water quality** within the river corridor.
(3) Flood damage creates financial costs, both public and private. Effective flood hazard management can reduce long-term damage costs. Public infrastructure, such as roads, utilities, levees, revetments and dams, and private improvements such as homes, businesses and structures located in the floodplain, are vulnerable to flood damage. As the budgets of federal, state, and local governments tighten, the amount of funding available for flood hazard management is reduced.		X	**(3) Flood damage creates financial costs, both public and private. Effective flood hazard management can reduce long-term damage costs.** Public infrastructure and private improvements located in the floodplain are vulnerable to flood damage. Funding for structural flood risk reduction projects is limited and continues to be reduced.
(4) A river and its valley floor, including adjacent floodplains, floodways, and potential channel migration areas, constitute a corridor through which floodwaters flow and within which opportunities exist for various and compatible land uses, including agriculture, recreation and open space. Floodplains are subject to inundation during flooding events, varying in magnitude from the 2-year to 100-year event or larger, depending on the river system and floodplain conditions.		X	**(4) A river and its valley floor, including adjacent floodplains, floodways, and potential channel migration areas, constitute a corridor through which floodwaters flow and within which opportunities exist for agriculture, recreation, and open space.** Floodplains are subject to inundation during flooding events depending on the river system and floodplain conditions.

Guiding Principles			
2013 Guiding Principles	**Kept as is?**	**Revised?**	**New Revised language**
(5) Future development within Pierce County, including cities and unincorporated areas if guided away from flood-prone areas, can reduce future risks to life and property. Adverse impacts of development both inside and outside the floodplain can be minimized by development practices that reduce future risks through appropriate regulation and land use, open land preservation and acquisition, multi-objective planning, relocation or elimination of high hazard structures, prohibiting unacceptable encroachments, and establishing ongoing maintenance practices that preserve and enhance environmental functions.		X	**(5) Future development in flood prone areas should be designed to reduce risks to life and property.** Adverse impacts of development can be minimized by practices that preserve and enhance environmental functions.
(6) Beneficial functions of floodplains and rivers can be achieved by restoring, preserving, and enhancing natural processes – even if these flood-prone and environmentally sensitive areas are not subject to development in the future, past degradation of them needs to be remedied through restoration and enhancement actions.		X	**(6) Beneficial functions of floodplains and rivers can be achieved by restoring, preserving, and enhancing natural processes.**
(7) The levels of funding for floodplain management should meet demand within Pierce County (both incorporated and unincorporated areas) to ensure that necessary infrastructure maintenance and improvements meet citizen's expectations and willingness to pay.		X	(7) Adequate and stable funding is necessary for ongoing flood risk reduction activities and maintenance of existing facilities.
(8) Protecting and working with, rather than trying to control, natural riverine processes generally will reduce flood risks to people and property in a less costly manner than traditional structural approaches to flood hazard management, while also benefiting native fish and wildlife and preserving aesthetic landscapes.		X	**(8) Protecting and working with, rather than trying to control, natural riverine processes generally will reduce flood risks to people and property in a less costly manner than traditional structural approaches.**
(9) Communication with and involvement of a diverse groups of citizens and stakeholders and public and private landowners is vital in developing a responsible, effective flood hazard management plan.		X	**(9) Communication and involvement of diverse groups of citizens, stakeholders, and landowners is vital** in developing a responsible, effective flood hazard management plan.

Guiding Principles			
2013 Guiding Principles	**Kept as is?**	**Revised?**	**New Revised language**
(10) Assume personal and public responsibility – we need to revive our ethic of land and water stewardship. The County needs a framework that will foster localized responsibility for flood risk, water-related resources, and wise use of flood-prone lands. Private property rights should be respected when providing flood protection.		X	**(10) Promote community stewardship and personal responsibility.** Flood risk reduction should be a joint effort with private property owners. Assistance programs exist at the State, Federal, and local level for public agencies and individuals. The county will foster localized responsibility for flood risk, water-related resources, and wise use of flood-prone lands.
(11) Leadership and cooperation among affected governments and public agencies (counties, cities, tribes, and resource agencies) is essential for the success of long-term flood hazard management.		X	**(11) Leadership and cooperation among affected governments and public agencies is essential** for the success of long term flood hazard management.
(12) Advances in technical information and an evolving understanding of flood risks call for an adaptive management approach to implementing the flood hazard management plan. Our knowledge and levels of understanding of risk will change over time – e.g., changing flood maps, new data, etc. We need to learn from approaches and actions that are most effective in achieving the goals and objectives, and then adjust management actions to reflect the latest information.		X	**(12) Use an adaptive management approach when implementing the flood hazard management plan.** Knowledge and levels of understanding will change over time.
(13) Education regarding riverine processes, flooding and preparedness can raise public awareness and reduce future flood damages and costs.		X	**(13) Education regarding riverine processes, flooding, and preparedness can raise public awareness reducing future flood damages and costs.**

Additional Plans and Programs Implemented since the 2013 Flood Plan

United States Army Corps of Engineers General (USACE) Investigation for the Puyallup River

Pierce County and the FCZD have been collaborating on the Lower Puyallup River General Investigation (GI) Study to be eligible for federal funding for flood facility investments needed to protect the Lower Puyallup basin, including the economic assets of the Port of Tacoma. The study area includes 28 levee segments currently in the USACE National Levee Database (NLD). This includes 26 non-federal levees and two federally owned and operated levees.

The current cost estimate for proposed improvements exceeds $340 million. The potential

federal funding share of construction is 65%. Work on the GI began in 2010 and the Chief's report is expected in 2019. Congressional action is needed to authorize additional funding for design and construction once the Chief's report is completed.

The USACE is the lead Federal agency for this study. The non-Federal, cost-sharing sponsor (sponsor) is Pierce County. As the non-Federal sponsor, the County contributes 50 percent of the total feasibility study costs in the form of cash or in-kind contributions. The USACE and County executed a Feasibility Cost Sharing Agreement (FCSA) in September 2010 for a single-purpose, flood risk management feasibility study.

Several local stakeholders have executed an Inter-Local Agreement with Pierce County to financially support the County's non-federal sponsor cost share including: City of Tacoma, City of Sumner, City of Puyallup, City of Orting, City of Pacific, City of Fife, and the Puyallup Tribe of Indians. Additionally, other stakeholders include Federal, state and local agencies such as Washington State Department of Transportation (WSDOT), Port of Tacoma, City of Auburn, other Federally-recognized tribes and the general public.

In April 2018, USACE informed Pierce County that the Corps moved the GI study to inactive status. With this being said, over the next year, the County will begin to put together a plan with options to prioritize, fund, and move forward with projects listed in the study.

System Wide Improvement Framework (SWIF)

In 2014, Pierce County submitted a letter of intent to the United States Army Corps of Engineers (USACE) to develop a System Wide Improvement Framework (SWIF). In 2017, the SWIF was accepted by the USACE and the County is actively working to implement the actions and milestones listed in the plan.

The SWIF represents Pierce County's local approach to improving the system of levees enrolled in the U.S. Army Corps of Engineers (USACE) Public Law (PL) 84-99 Rehabilitation and Inspection Program by addressing identified levee deficiencies, including the correction of unacceptable inspection items, in a prioritized manner to optimize flood risk reduction. The plan is intended to be a "living" document for a 20-year period, and will be amended over time to address evolving river conditions that may affect levee integrity and the associated level of flood risk.

Actions are phased over the implementation of the SWIF into categories of work as near-term, mid-term, long-term, programmatic, and monitoring actions. Near-term actions are typically those that will be addressed within the current budget cycle, such as routine maintenance or response to deficiencies that pose a high level of risk. Mid-term actions are generally those of moderate-high risk, more extensive in scope and cost, including capital improvement projects scheduled to coincide with the county's capital improvement program (CIP) six-year budget cycle. Representative mid-term actions include a capital maintenance project to correct extensive or chronic deficiencies in a levee segment and a capital improvement project listed in the Pierce County Rivers Flood Hazard Management Plan (RFHMP) or Flood Control Zone District Comprehensive Plan of Development. Long term

actions include projects already listed in the RFHMP but not yet included in the current six-year CIP or whose funding source has not yet been identified or programmed into the overall budget. Programmatic actions are ongoing and implement the SWIF over the course of the 20-year planning period. Programmatic actions, such as the levee vegetation management strategy, the asset management program, and the capital maintenance program are important components of the SWIF that will be ongoing through the 20-year course of implementation to maintain and improve the system of levees over time. Monitoring actions are intended to ensure that the SWIF's objectives are met, that levee deficiencies do not worsen, and that programmatic actions are successful.

The SWIF Action Plan describes interim risk reduction measures to apply while the SWIF Plan is being implemented. This strategy relies upon the various programs already in place, coordinated between Pierce County SWM and the Pierce County Department of Emergency Management.

Structural and nonstructural risk reduction measures are employed, depending on the level of risk identified at the levee segment and area of inundation. The SWIF Action Plan also identifies implementation costs and revenue sources. SWIF implementation is dependent upon the appropriate level funding to address identified levee deficiencies, levee maintenance, and capital improvements necessary to improve the PL 84-99 system of levees over time. Current funding ensures that the continued eligible inspections (CEIs) deficiencies identified in the 2010 and 2013 CEI reports will be maintained to at least a minimally acceptable level, as defined by the USACE. Mid-to long-term maintenance objectives will require additional funding beyond current levels to ensure SWIF Plan objectives are met. Funding for full implementation of the vegetation management strategy will be addressed more fully in upcoming budgets. Capital maintenance projects that build additional resiliency into the levee structure will be limited to major repair sites until additional funding is available to expand the program. Capital improvement projects identified in the RFHMP will be implemented through the six-year capital improvement program, subject to limited funding from the SWM and Flood Control Zone District budgets, but mostly dependent upon as-yet unidentified outside sources of revenue.

CHAPTER ONE ERRATA CORRECTIONS

The errata sheet for Chapter One focused on providing clarifications, revised river miles, revised goals objectives and guiding principles, and minor errors in facts or spelling.

CHAPTER TWO
MAJOR RIVER FLOODING IN PIERCE COUNTY

Information provided in Chapter Two was reviewed. The information provided in the 2013 continues to represent the most current understanding of river flooding in Pierce County. No new information is provided in this update.

CHAPTER TWO ERRATTA

The errata sheet for Chapter Two focused on providing clarifications, revised river miles, updated numbers to reflect changes between 2013 and today, included information to reflect adoption of new FEMA maps, and other minor errors in facts or spelling.

CHAPTER THREE
FLOOD HAZARD MANAGEMENT POLICIES

Information provided in Chapter Three was reviewed. The information provided in the 2013 continues to represent the management policies for the creation of the Flood Plan. No new information is provided in this update.

CHAPTER THREE ERRATTA

The errata sheet for Chapter Three focused on providing clarifications and other minor errors in facts or spelling.

CHAPTER 4
PROGRAMMATIC RECOMMENDATIONS

Programmatic Recommendations

The 2013 Rivers Flood Hazard Management Plan recommended 27 programmatic actions to reduce the associated risks of flooding and channel migration problems along the major rivers and streams in Pierce County. Each of the programmatic recommendations provides a description of the issue being addressed as well as background and other supporting information. A status update has been provided in the following table for each programmatic recommendation contained in Chapter 4. Additional information regarding individual elements within this chapter are found in the Progress Update.

Programmatic Recommendations	
Information/Mapping/Technical Assistance	
FPW #1	**Floodplain Mapping** These recommendations address the adoption and use of preliminary FEMA flood maps (DFIRMs) and other flood studies; subsequent periodic update of such studies; related communication with agencies and the public; and other issues related to flood hazard mapping. (Pierce County, cities/towns, other agencies, public) **Status Update: Digital Flood Insurance Rate Maps (DFIRM) were adopted in February 2017**.
FPW #2	**Channel Migration Zone Mapping and Regulation** These recommendations address the completion and adoption of CMZ studies within Pierce County; regulation of severe channel migration zones as floodways; evaluating levees/revetments for resistance to channel migration, revisions to CMZ mapping to reflect changes in risks, and notification of hazards. (Pierce County, cities/towns, public) **Status Update: CMZ studies for Upper Nisqually and South Prairie Creek were adopted as part of DFRIM Adoption in late 2016 or 2017. In 2017 a channel migration zone study was completed for the Greenwater River.**
FPW #3	**Technical Assistance on Floodplain Information** These recommendations address internal Pierce County training; external technical assistance to public and private entities; and coordination on repair and replacement of infrastructure in flood hazard areas. Also includes coordination to ensure compatible uses of floodplains. (Pierce County, cities/towns, public) **Status Update: The County is currently working with the City of Orting on the Levee Analysis and Mapping Procedures (LAMP) process for Calistoga and the Soldiers Home levees. The Calistoga Levee was constructed by the City of Orting; and maintenance and operation is performed by Pierce County. In 2017, Pierce County responded to 1432 calls from homeowners, insurance agents and surveyors relative to flood issues and concerns**.
FPW #4	**Flood Insurance and the Community Rating System (CRS)** These recommendations address participation in the National Flood Insurance Program and the Community Rating System, encouraging communities to achieve a CRS rating of Class 5 or better; and promotion of flood insurance. (Pierce County, cities/towns) **Status update: The Re-Verification process was completed and the County remained a Class 2 community. SWM has held talks with local real estate, surveyors, and hosts a quarterly multi-state CRS User Groups.**

Programmatic Recommendations	
Land Use/Regulatory/Acquisition/Structure Elevation	
FPW #5	**Consistent Floodplain Development Regulations** These recommendations address consistency of floodplain and flood hazard area regulations between Pierce County and cities/towns; regulation based on best available data; zero rise and compensatory storage regulations; establishment of a regulatory working group to support consistency and assess residual flood risks and appropriate regulations behind certified levees. (Pierce County, cities/towns) **Status update: The Cities of Sumner and Puyallup are considering joining the CRS program.**
FPW #6	**Urban Growth Area Expansion** This recommendation extends the current prohibition on expansion of Urban Growth Areas into the 100-year regulatory floodplain of the Flood Plan planning area. (Pierce County, cities/towns) **Status Update: This work is on-going.**
FPW #7	**Agricultural Land Uses and Activities** These recommendations address review of and amendments to Pierce County code to enable agricultural practices in floodplains, including removal of sediment deposited by floods, construction of flow-through non-residential agricultural structures, promoting the leasing of publicly held floodplain lands suitable for agriculture, and allowing composting when accessory to on-site agriculture. (Pierce County, public) **Status update: As part of the Floodplains for the Future Program, PCC Farmland Trust (in collaboration with Environmental Science Associates (ESA), and SWM) completed several agriculture-related memoranda for the Clear Creek area such as: agricultural drainage, sediment, and tide gate assessments. The County has also updated floodplain regulations to allow new agriculture structures in the Clear Creek Deep and Fast Flowing (DFF) floodway**.
FPW #8	**Floodplain Acquisition and Home Buyouts** These recommendations address identification and evaluation of floodplain properties for home buyouts or property acquisition; outreach with floodplain property owners; pursuit of federal and state grant funding, coordination with other agencies, and local funding for proactive floodplain acquisition. (Pierce County, cities/towns, public) **Status update: Since 2013, 50 properties have been purchased in flood hazard areas, recent purchases have been focused in the Clear Creek and Alward Road areas.**
FPW #9	**Home/Structure Elevation and Floodproofing** These recommendations address technical assistance provided to floodplain property owners; identification of areas needing targeted outreach; and pursuit of grant funding to support an elevation program. (Pierce County, public) **Status update: This work is on-going**.
River Channel Management	
FPW #10	**River Channel Monitoring** These recommendations address monitoring of river channel conditions including river stage and flow, cross-sections, conveyance capacity, sedimentation trends, topography (LiDAR), aerial photos during floods, and project-specific monitoring to evaluate project effectiveness. (Pierce County, other agencies) **Status Update: River channel conditions are monitored every fall prior to flood season to identify hot spots. In 2017, river channel monitoring occurred after the three-high water/flood events. A project specific monitoring program is under development.**
FPW #11	**Management of Large Woody Material** These recommendations address the repositioning, relocation and removal of large woody material in Pierce County rivers posing imminent threat, LWM removal when threatening bridge piers and public infrastructure; working with resource agencies and tribes to identify rivers segments that function naturally; and obtaining approvals and coordinating with agencies in emergency and non-emergency situations. (Pierce County, other agencies)

Programmatic Recommendations	
	Status Update: No large woody debris was repositioned, relocated, or removed in 2017.
PR#1/ WR#1/ CR#1	**Sediment Management and Gravel Removal** These recommendations address the approach for sediment management and gravel removal, including use of technical data and studies; pursing levee setback projects as the preferred means to manage downstream sediment transport; conditions under which gravel removal may occur; evaluating alternative approaches to gravel removal; monitoring locations of gravel removal; and convening a sediment management work group to develop a plan to guide sediment management and gravel removal. (Pierce County, cities/towns, resource agencies, tribes) **Status update: The Habitat and Flood Capacity Creation Project formally known as Sediment Management as Risk Reduction Tool (SMRRT) pilot project is being funded by the Flood Control Zone District in 2018.**
Facility Repair/Maintenance	
FPW #12	**Facility Repair & Maintenance – PL 84-99 Program** These recommendations address Pierce County's participation in the Corps of Engineers' PL84-99 program for emergency response activities and rehabilitation of flood risk reduction facilities; engaging in review of levee maintenance standards; maintaining program eligibility while pursuing bio-engineering designs; notifying, coordinating with and seeking input from resource agencies and tribes in implementation. (Pierce County, Corps of Engineers, resource agencies, tribes) Status Update: SWM developed a System Wide Improvement Plan (SWIF) that was completed in January 2017.
FPW #13	**Annual Repair and Maintenance Program** These recommendations address Pierce County's repair and maintenance program for flood facilities, including routine repair and maintenance, evaluating options for long-term capital solutions, implementation of the Puyallup River vegetation management program, update of the County's operations, repair and maintenance manual, and working with resource agencies and tribes to obtain programmatic approval of annual, repair and maintenance activities. (Pierce County, resource agencies, tribes) **Status Update: Beginning in 2013, the Pierce County Flood Control Zone District directed 15 % of the total annual budget (approximately $1.2 million) and Pierce County directed approximately $3 million annually to M & O activities. In 2017 SWM received a 5- year programmatic shoreline, SEPA and HPA approvals for levee repairs.**
Flood Hazard Education and Flood Preparedness, Flood Warning and Emergency Response	
FPW #14	**Flood Education and Outreach Program** These recommendations address consistency of education and outreach activities with the CRS program; outreach to floodplain property owners through an annual mailing; promotion of all aspects of the County's flood hazard management program; promotion of flood preparedness and purchase of flood insurance; internal and external coordination and collaboration. (Pierce County, cities/towns, public) **Status Update: Annually SWM sends direct mailings to residents within unincorporated Pierce County. Each mailing is directed to residents within coastal, urban or riverine flood hazards areas. SWM mailed notifications to property owners and professionals in 2017 when the FEMA DFIRM's became effective. Multiple hearings, press releases and media interviews were done in conjunction with Pierce County Council adoption.**
FPW #15	**Flood Warning and Evacuation System** These recommendations address regional coordination and communication before and during flood events with the National Weather Service, Pierce County's River Watch program, Tacoma Public Utilities and Corps of Engineers (dam operators); and developing technical tools and mapping to improve river flooding forecasts to help guide evacuation decisions. (Pierce County, cities/towns, other agencies, public) **Status Update: The County continued to maintain existing levels of service in all reaches of the Carbon, Puyallup and White Rivers.**
FPW #16	**Emergency Response and Flood Fighting**

Programmatic Recommendations	
	These recommendations address regional coordination of response and recovery services during and after flood events through the Emergency Operations Center; coordination with cities, towns, tribes, state and federal agencies; documenting all costs associated with response activities; sand bagging support; flood emergency exercises; and periodic updating of guidance and protocols. (Pierce County, local jurisdictions, other agencies, public) **Status Update: SWM continues to coordinate with the Department of Emergency Management prior, during, and post flooding.**
Miscellaneous/Other	
FPW #17	**Incidental Take Authorization** These recommendations address Pierce County SWM seeking incidental take authorization for its activities that affect species listed as threatened or endangered under the federal Endangered Species Act (ESA). (Pierce County, other agencies) **Status Update: SWM is currently developing a Habitat Conservation Plan (HCP).**
FPW #18	**Adaptive Management** These recommendations address the use of adaptive management as a component of plan implementation, including evaluation and assessment of project and program performance, cost, and effectiveness, and incorporation of learned information into future project actions. (Pierce County, other agencies) **Status update: Annual lessons learned meetings are held for SWM staff and quarterly performance report publications are published for all Public Works.**
FPW #19	**Climate Change** These recommendations address development of an approach to incorporate information about climate change, including predicted changes in precipitation patterns, future peak flows, and sediment transport into future project designs and program implementation; and working with regional experts. (Pierce County, cities/towns, other agencies) **Status Update: Pierce County is currently developing a Climate Change Resilience Plan that will be completed in 2018.**
FPW #20	**Habitat and Riparian Areas Mitigation** These recommendations address the restoration of fish habitat and riparian areas as part of advance mitigation for flood management projects, for circumstances where mitigation cannot be accomplished onsite; working with resource agencies and tribes to identify sites for mitigation; and allocating funds to a mitigation account to acquire property and construct advance mitigation projects. (Pierce County, other agencies) **Status Update: Two In-Lieu-Fee (ILF) mitigation sites within the Clover/Chambers watershed have been constructed and are active. The Habitat Conservation Plan is being developed to mitigate future levee repair impacts.**
FPW #21	**Public Access to Rivers** These recommendations address public access to rivers, including passive use, shoreline access points, and multi-purpose trails; identifying opportunities for improved public access; recommending appropriate levels of future public access; and educating the public regarding restrictions on public access. (Pierce County, cities/towns, public) **Status Update: Beginning in 2016, Pierce County identified segments of the river system that were available for public access. A website and map identify the locations and access points are identified with signage. Additionally, the Foothills trail, which follows the Puyallup River has been expanded since 2013 and is now 21 miles long and runs from City of Puyallup to the City of Buckley.**
FPW #22	**Minimizing Water Quality Impacts of Flooding** These recommendations address the management of pollutant sources in floodplains subject to flooding, and potential water contamination, including storage of hazardous chemicals, wastes, pesticides, and fertilizers; leveraging of existing resources focused on stormwater and source control; and limitations, inspections,

Programmatic Recommendations	
	operations and maintenance for on-site sewage systems within 100-year floodplains. (Pierce County and cities/towns) **Status Update: Pierce County has a pollutant inspection, elimination, and outreach program.**
FPW #23	**Coordination with Other Jurisdictions, Tribes and Agencies** These recommendations address coordination with other jurisdictions in flood plan implementation, including cities/towns, counties, tribes, state and federal agencies; and coordinating with local governments adjacent to and across the river from proposed capital projects. (Pierce County, cities/towns, tribes, other counties) **Status Update: Participation in the White River Dialogue group (that includes Pierce County, the City of Sumner, the Muckleshoot and Puyallup Indian Tribes) for the development of the Lower White River floodplain restoration and flood protection project.**
PR#2/ WR#2	**Inter-County River Improvement Agreement** These recommendations address collaborating with King County to renew the Inter-County River Improvement Agreement to address necessary maintenance and capital project needs, responsibilities and funding for the Lower White and lower Puyallup Rivers (the original agreement is due to expire in 2013). (Pierce and King counties) **Status update: No update available at this time, the existing agreement will expire in 2020. Pierce and King county are determining next steps.**
Capital Projects	
FPW #24	**River Reach Management Strategies** This recommendation proposes four management strategies (levels of service) for levees, two management strategies for revetments, and two non-structural strategies to address flood and channel migration risk reduction goals for different river reaches in the planning area; and encourages promotion of agriculture, recreation and open space as the most compatible land uses in the floodplain. (Pierce County and cities/towns) **Status update: This work is on-going. The Levee Analysis and Mapping Procedures (LAMP) process will help identify the contemporary level of service following changes to channel geometry and hydrology from recent floods.**
FPW #25	**Levee and Revetment Setback Program** These recommendations address updating the levee and revetment inventory map; updating the Setback Levee Feasibility Study; performing a comprehensive hydraulic study to determine cumulative benefits of flood protection of setback build-out scenario; pursuing funding for design and construction of setback projects; and evaluating additional sites for possible levee/revetment setbacks as new needs are identified. (Pierce County, cities/towns, other agencies) **Status Update: The Setback Feasibility Study was updated in 2014. A small update to include the Clear Creek area is underway**.
FPW #26	**Additional Capital Project Analysis** This recommendation addresses the need to complete further analysis and develop solutions for Tier 2 problem areas for flooding and channel migration that could not be addressed in the Flood Plan due to resource and time constraints. (Pierce County) **Status Update: No update is available at this time**.
FPW #27	**Transportation – Roads and Bridges** These recommendations address the need to examine transportation infrastructure design issues, including road designs accounting for compensatory storage, zero-rise, and elevation above BFE requirements; bridge designs considering scour, freeboard above BFE, assessment of future peak discharge flows and backwater effects, and passage of large woody material; conducting a cost benefit analysis for roads and bridges with high associated flood and erosion protection costs; and designing future roads and bridges (and

Programmatic Recommendations	
	replacements) to accommodate planned levee and revetment setback projects. (Pierce County, cities/towns, WSDOT) **Status Report: Ongoing assistance with planning for the new Puyallup bridge replacements at 128th Street and Milwaukee Ave**.

Agricultural Land Use and Activities

Agriculture Conservation Easements

In February 2015, Pierce County completed one of the largest conservation easements in the county. Forterra, a non-profit land conservancy, and Pierce County were able to preserve the 153-acre Matlock farm in the Puyallup River Valley. Matlock farms had been in operation for over 100 years and was considered an institution in the Puyallup valley, providing food throughout Pierce County. With the owners wishing to retire, Pierce County and Forterra worked to secure funding to purchase a conservation easement and the development rights of 116 acres of the property. This easement protected the land from being developed over time and allowed it to continue in agricultural production. With a grant from the Washington State Department of Ecology's Floodplains by Design Program, the County was also able to purchase the remaining 37-acres of the property along the Puyallup River and Ball Creek to improve the creek conductivity and improve salmon habitat.

Floodplain Acquisition and Home Buyouts

Home Buyouts and Property Acquisitions

Since 2013, Pierce County has acquired an estimated 50 homes in flood prone areas along our major river systems using various funding sources. Funding sources such as Floodplains by Design, FEMA's Hazard Mitigation Grant Program, FEMA's Flood Mitigation Assistance program as well as Pierce County Surface Water Management funds are just some of the funding sources that assist with property acquisitions. Due to various flood events that have taken place in the county, Surface Water Management developed a property acquisition program that assists willing property owners with getting out of the floodplain. These buyouts provide a permanent solution to the risks and damages of repetitive flooding. Interested property owners in the acquisition process are ranked and prioritized to determine which properties will result in the highest benefits in preventing flood damage. However, recently flooded areas and active capital improvement program projects (involving property acquisition) take precedence over other properties. Property buyouts and acquisitions are strategic, as sometime these parcels can provide a more permanent solution to flooding in the area. The county tries to buyout properties in targeted areas so that a permanent solution to flooding can be achieved. This requires a more collaborative approach when working within communities where not all properties will not be purchased. Pierce

County works with the existing community for interim solutions until a more permanent solution such as a flood control structure can be built.

Repetitive Loss Updates

Surface Water Management has been very active in the last two years purchasing properties in the repetitive loss areas and removing the structures from the site. Thirty-nine (39) structures have been demolished in this period with six (6) of these structures located on four (4) repetitive loss properties.

In 2014 Unincorporated Pierce County had 58 Repetitive loss properties listed by FEMA. Of these 31 were unmitigated, 2 were in different communities and 25 had been mitigated.

In 2018 Unincorporated Pierce County has 63 Repetitive loss properties listed by FEMA. Five additional properties have been added. Two from the 2014 coastal winter storms and three from the 2015 riverine flooding in the Clear Creek area. This brings the totals to 29 are unmitigated, while the same 2 properties in other communities continue to be list but 32 of the listed properties have been mitigated.

The county has five primary repetitive loss areas where many properties have experienced flood losses in the last twenty years. These areas are: Clover Creek near Parkland, Coastal Dash Point, Mid Puyallup River south of Sumner, South Prairie Creek and Clear Creek behind the River Road levee. While FEMA has a list of over sixty homes where property owners had purchased flood insurance to mitigate the cleanup and repair cost there are many more homes were flood insurance was purchased after the “big” flood or not at all. This means that many homes will continue to be added to the repetitive loss list until the area can be mitigated.

River Channel Management

Sediment Management and Gravel Removal

In 2010 and 2012, the United States Geological Survey released two sediment studies for Mount Rainier, Lower Puyallup, White, Nisqually, and Carbon Rivers. The 2012 report (USGS 2012-1242) documents:

- Historic and current sediment loads in rivers draining from Mount Rainer;
- Additional sources of sediment within the watershed;
- Important sediment-production and sediment –delivery processes within the watershed;
- Long-term trends of increasing discharge or sediment loads; and,
- The anticipated magnitude of sedimentation 25 and 50 year into the future using public climate-change predictions.

As glaciers continue to recede on Mount Rainier, heavy rainfall, snow melt, and resulting floods can move more sediment materials down the system. An increased amount of sediment can cause some upper river reach channels to widen. The below figure from the USGS report shows how some upper reaches of Mount Rainier river channels have widen over time.

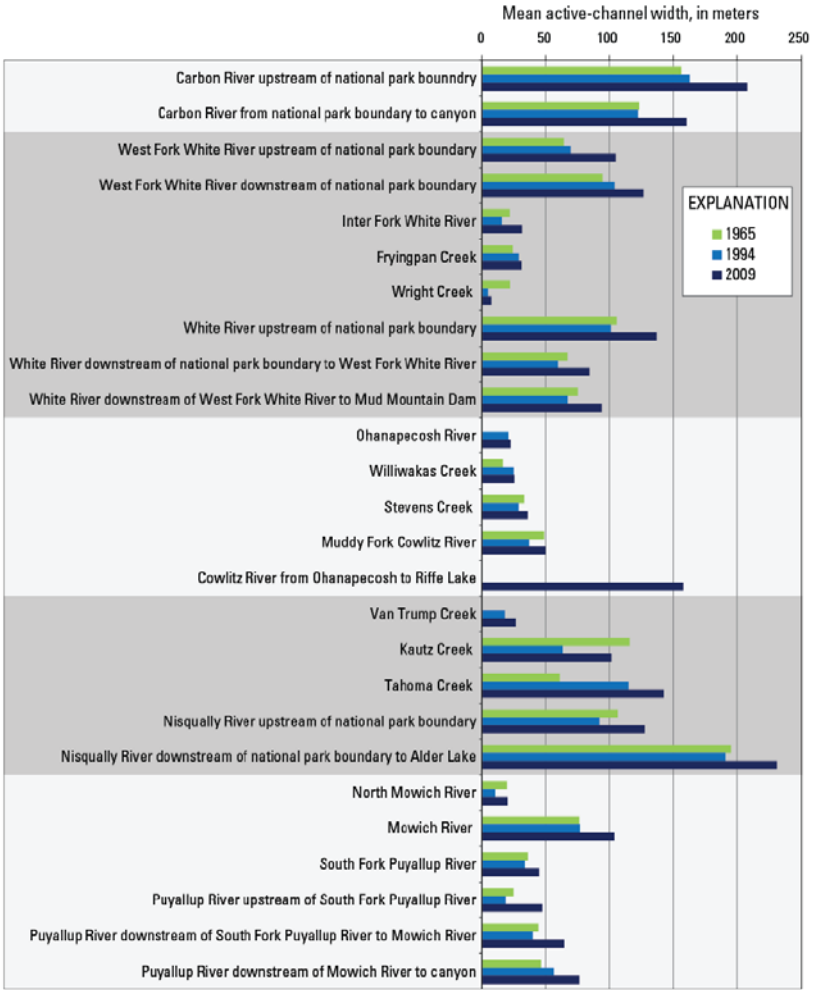


Figure 1: USGS Report 2012-1242

A recent study completed by the USGS in 2012 indicated that sediment is being transported from Mount Rainer to the Puget lowland through a sequence of glacial and fluvial processes that deliver material downstream. Studies found that the total sediment load for the upper Nisqually River from 1945 to 2011 was determined to be 1,200,000 (±180,000) tonnes per year (tonnes/yr). From 1956 to 1985, the total sediment load for the upper Nisqually River was determined to be 860,000 (±370,000) tonnes/yr, which is a significant decrease from 1945 to 2011 (USGS Report 2012-1242). The lower Puyallup River was found to be 860,000 (±300,000) tonnes/yr between 1978 and 1994. Calculations for the White River at R Street

carried a total load of 590,000 tonnes in 2011 with an annualized total load of 420,000 tonnes/yr from April 2010 to March 2012 (USGS Report 2012-1242). The below figure shows the estimated annual bedload which is the volume or mass of sediment being transported along the bed of a river for the White, Carbon, and Puyallup Rivers from 1984 to 2011.

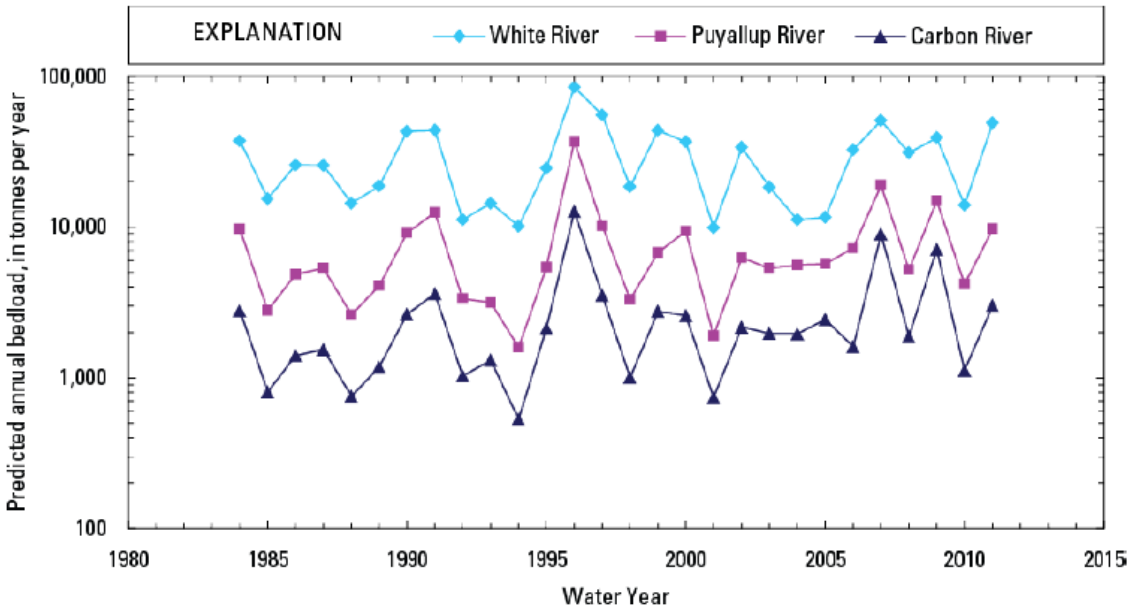


Figure 2. USGS Report 2012-1242

The Puyallup River delivers about four times less bedload than the White River and will experience less severe aggradation, while the Carbon River will experience the least aggradation (USGS Report 2012-1242). Once sediment arrives and deposits in the Puget Lowland, there is limited structural methods for managing sediment to reduce flood risk. Potential sediment-management actions including setback levees and gravel removal would be most effective in reaches that tend to accumulate sediment naturally; these reaches were identified based on geomorphic conditions (USGS 2012-1242).

In summary, rivers draining near Mount Rainier can assume to be in a general state of sediment surplus. As a result, future aggradation rates will be largely influenced by the underlying hydrology carrying sediment downstream. River management actions (such as setback levees, active sediment management, etc) may be more effective in reaches of the river where sediment residence times are large. Long term river management decisions can be improved with the monitoring of suspended-sediment load, bedload, and aggradation in river reaches.

Pierce County Pilot Gravel Removal Project

Since the initiation of the Pilot Gravel Removal Project, Pierce County has continued to study the feasibility of sediment removal to reduce flood risk. In 2014, the Sediment as a Risk Reduction Tool Project began, building on previous work but focused more on public safety and the reduction of flooding during moderate events. It was conceived to be one in a suite of flood management strategies as described in this plan. Other flood risk reduction strategies were presented in the 2013 Flood Plan however, there exists a significant need for shorter-term flood risk reduction tools, such as sediment removal to aid in reducing flood damages during moderate events that are protective of valuable habitat and natural resources. This is especially the case where alternative flood risk reduction strategies such as setback levees are not effective or feasible or could not be implemented for many years.

It was important to choose a suitable site where impacts to resources were minimized and benefits to existing infrastructure were maximized. The project team engaged in a nearly year-long process throughout 2016 to select a site that best met the criteria set early in the process. The team analyzed 41 miles of Pierce County managed river system to look at where rivers were depositing and storing sediment. The reach that scored the highest in the final analysis is an approximately half-mile stretch of the Puyallup River between the cities of Puyallup and Sumner, known as Old Cannery Reach. More information on the site selection process can be viewed in the Habitat and Flood Capacity Creation Project Background and Overview document available here: http://www.co.pierce.wa.us/4487/Habitat-and-Flood-Capacity-Creation-Proj

Following the site selection, Pierce County met with federal and state agencies to seek feedback on the feasibility of the concept of sediment removal specifically at the confluence of the Puyallup and White Rivers. Because of the feedback received during that outreach, Pierce County reevaluated the purpose of the project. Rather than simply mitigating for impacts to habitat caused by sediment removal, the team determined that the project would more likely receive permits if habitat creation was incorporated directly into the design of the project. The project was renamed the Habitat and Flood Capacity Creation Project to reflect the multiple benefits resulting from the project. Various efforts in Pierce County have sought to study if sediment management could be incorporated as a flood risk reduction tool. The Habitat and Flood Capacity Creation Project is set apart from these previous efforts because it incorporates habitat creation in a reach of the Puyallup River where none currently exists or is degraded with the added benefit of flood reduction.

In the coming months, Pierce County will continue project planning, permitting, and design activities at Old Cannery Reach. Once Pierce County receives all permits, construction could begin as early as summer of 2020.

Coordination, Adaptive Management, and Multiple Benefits

Incidental Take Permits (10.a.1(b))

Habitat Conservation Plan

Since the publication of the Flood Plan, Pierce County has continued its pursuit of an Incidental Take Permit (ITP) for Public Works' flood risk reduction maintenance and operations activities. The Habitat Conservation Plan (HCP) which is needed to obtain an ITP describes anticipated effects of proposed maintenance and operations activities along rivers and streams and how county staff and contractors will minimize or mitigate the impacts to habitat and species. Those activities include: managing vegetation along levees for inspection and maintenance, flood fighting or other emergency work on levees, culvert and discharge pipe maintenance, imminent threat projects, and routine levees and revetment maintenance. The ITP will allow Pierce County to conduct routine maintenance activities along segments of the Puyallup, White, Carbon and Nisqually rivers, that might result in incidental takes, without violating the Endangered Species Act (ESA).

Pierce County is working closely with the USFWS and NMFS in the development of the HCP. Several draft versions of the HCP have been reviewed by the USFWS, NMFS, and tribes. Issuance of an ITP is a federal action subject to National Environmental Policy Act (NEPA) compliance. The USFWS and NMFS are preparing a joint NEPA environmental assessment (EA) that will analyze the potential impacts of USFWS and NMFS each issuing an ITP to Pierce County. The EA does not address the impacts of the County's flood risk reduction activities, which necessarily would take place with or without the issuance of an ITP.

Pierce County has also continued coordination with federal, state, and local agencies, tribes, and other stakeholders throughout the development of the HCP. Publication of the final draft HCP and draft EA is anticipated to occur sometime in 2018. Following that publication Pierce County, USFWS and NMFS will solicit public comments during a 45-day comment period before issuing the ITP.

Updates on the project and materials can be found on the project webpage located here:

http://www.co.pierce.wa.us/4488/Habitat-Conservation-Plan-HCP

Public Access to Rivers

Rivers and associated riparian corridors are desirable locations for passive or active recreational uses. A survey conducted during development of the 2014 Pierce County Park, Recreation, and Open Space (PROS) Plan (Chapter 19D.160) confirms that riverfront water access has high priority and value for the public. Desired activities include trail use, fishing, boating, and passive recreation.

Public access has been limited along much of the river corridor within the planning area. Although some public lands near rivers may be suitable for public use, supported use of many publicly-managed properties is constrained. Conditions such as lack of legal access,

absence of supporting infrastructure, safety concerns, regulatory issues, maintenance issues, and potential conflicts with other uses restrict use of the areas. In spite of those problems, many fisherman and boaters access the river at unauthorized locations, and numerous people use the riparian areas with few appropriate supporting facilities (e.g., parking, restrooms).

Legal access is a significant concern. The county owns and maintains levees and revetments along the rivers, but sometimes does not own the underlying land or roadway. In these instances, property owners have granted the county easements exclusively for flood management purposes. The county can not authorize use of those properties by others.

Construction of public access areas is prohibitively expensive. At a minimum, there must be signage and parking. Properties must contain sufficient area to accommodate improvements, and measures must be undertaken to prevent environmental degradation. Impacts to surrounding uses must be mitigated. Ongoing maintenance of the access areas can be time consuming and expensive.

In recent years PPW-SWM has evaluated a number of properties along the rivers for public access potential. Properties that provide a level of informal access to the river are identified on the county website https://www.co.pierce.wa.us/4740/Our-Properties.

The website contains information about property locations and allowable activities. No improvements have been installed at these locations. Additional information about recreational opportunities along the water is available on the Parks and Recreation Services website https://www.co.pierce.wa.us/1474/Resource-Stewardship.

CHAPTER FOUR ERRATA

The errata sheet for Chapter Four focused on providing clarifications, updated citations to reflect changes between 2013 and today, clarification of Level of Service with a corrected map, additional information of agricultural ditches, additional information on SWIF Levee Vegetation Management Strategy, updates of Community Rating System Outreach material, deleted outdated information on public access to rivers, and other minor errors in facts or spelling.

CHAPTER 5
RIVER REACH CHARACTERIZATION, MANAGEMENT STRATEGIES AND RECOMMENDED CAPITAL PROJECTS

LOWER PUYALLUP UPDATES

Flood Damage to Facilities

Since 2013, there has been one repair project completed along this reach. The project entailed the restoration of the Benston/Boatman Revetment. Concrete panels which provide bank protection were severely undermined by erosion resulting in significant damage and increased risk to the remaining structure and adjacent homes.

A new summary table of damages to flood facilities in the lower Puyallup River between 1996 and 2017 has been created for this update. The original 2013 Flood Plan did not include this table.

Summary of Damages to Lower Puyallup River Facilities (1996-2017)					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1996					
1996	Tiffany's	Left	9.2	100	Toe and slope failure.
2005					
2005	River road	Left	7.2	540	Concrete panel repair.
2009					
2009	North levee road	Right	5.3	190	Silt bench repair – Dolos.
2010					
2010	Benston/boatman	Right	9.35	100	Moderate slumping.
2010	Benston/boatman	Right	9.35	200	Moderate slumping, Major erosion; concrete panels collapsed.
2011					
2011	Benston/boatman	Right	9.35	200	Four-foot deep slump. Exposed concrete at toe.
2011	Murphy	Right	8.47 - 8.54	390	Scour and minor cracking in silt bench. Scour five feet in areas.
2011	North levee road	Right	4.27	105	Four-foot slump.
2011	North levee road	Right	4.45	106	Sha Dadx Seepage Control Buttress and drainage.

Summary of Damages to Lower Puyallup River Facilities (1996-2017)					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2011	Old cannery	Right	10.3	60	Toe rock failure.
2011	River road	Left	6.4	30	Six-foot deep scour.
2012					
2012	Murphy	Right	8.5	200	Toe and rock failure, some slump and erosion.
2012	Murphy	Right	8.55	30	Scour pocket out of face, downed tree.
2012	North levee road	Right	4.3	30	Four-foot slump.
2012	North levee road	Right	4.45	180	Sha Dadx: soil buttress - sand boils
2012	North levee road	Right	5.8	100	Melroy Bridge partial scour/slumping.
2012	River road	Left	3.05	40	Cave dug into silt on LB, 5' scour depth.
2012	River road	Left	6.4	30	6ft deep scour in silt bench due to culvert outfall.
2014					
2014	River road	Left	7.45	45	Toe and face rock failure.
2015					
2015	Benston/boatman	Right	9.35	150	Slump in revetment. Concrete Panel missing.
2017					
2017	Benston/boatman	Right	9.35	200	Storm drainage outlet onto revetment face has caused severe scour to occur and end segments of the outlet pipe have failed.
2017	Benston/boatman	Right	9.3	140	Potential scour.
2017	Murphy	Right	8.4	120	Silt bench scour.
2017	Murphy	Right	8.41	25	Scour

Figure 3

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Lower Puyallup River

Tacoma
Port Of Tacoma Rd
509
54th Ave E
Milton
King County
Pierce County
Jovita Blvd E
Pacific
Stewart Rd Sw
Eells St
Pacific Hwy E
99
5
Fife
70th Ave E
Edgewood
167
River Road
Puyallup River
North Levee Road
Valley Ave E
Valley Ave Nw
Valley Ave Ne
Sumner
Tiffanys
Murphy
512
Puyallup
162
Old Cannery
Linden Flash Cube
410
Benston Boatman
Canyon Rd E
72nd St E
N Meridian
2nd St Ne
S Meridian
3rd St Se
W Pioneer
E Pioneer

- Levee
- Revetment
- Highway
- Major Road
- Water Body
- City
- County Boundary

Pierce County

N

3/6/2018

0 0.25 0.5 Miles

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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Land Purchases

Since 2013, eighteen properties have been purchased totaling 61 acres. This brings the number of acquired acres in the Clear Creek area to an estimated 117 acres.

Partnerships

Key partnerships with non-profits organizations has been essential for the county to accomplish work along the Puyallup watershed. Partnerships with organizations such as Forterra, the Pierce County Conservation District, and PCC Farmland Trust have assisted the county with identifying and providing funding to complete projects in the Clear Creek area. In addition, since 2016 SWM has received an estimated $4.9 million for projects in the Clear Creek watershed from the Floodplains by Design program.

Status Update on Recommended Capital Projects

LP1 Tacoma Wastewater Treatment Plant Flood Wall

Project Update: This project is complete. The City of Tacoma designed a floodwall with automatic gates at vehicle entrances and an emergency pump station inside the Central Wastewater Treatment Plant. This project also earned the American Public Works Association 2016 Public Works Project of the Year Award.

Estimated Cost: **$8,420,966**



Figure 4: Image of the East Side wall



Figure 5: Image of the south wall with grass art panel

LP2 Clear Creek Acquisition and Levee

Project Update: The primary objective of this project is to minimize the impacts of flooding on the lowlands behind the existing levee while preserving existing farmland. Preliminary design efforts also revealed that with proper design, the project will be able to provide refuge and habitat for juvenile salmon and other wildlife in the lower Puyallup River system. Given the size of the project and the complexity surrounding property acquisition, the project has been broken into phases. Phase one will identify and analyze alternatives, develop a property acquisition plan and prepare construction plans and specifications. The alternative analysis developed in cooperation with the Floodplains for the Future stakeholders group will take into consideration potential mitigation benefits, agricultural sustainability, and mitigation projects within the area currently being developed by other stakeholders. A prioritized property acquisition schedule will be developed to acquire properties that meet the needs of the project. Preliminary engineering will be completed to 60%, and construction will be completed at a future date.

Estimated Cost: $55,744,043



Figure 6: Clear Creek Floodplain during the 2009 flood event

LP3 Oxbow Lake Flooding/Sewer Lift Station Protection

Project Update: This project is being constructed by the City of Fife. A contractor has been selected and design and permitting will be completed in 2018.

Estimated Cost: **$460,624**



Figure 7: Location of Oxbow Lake Flooding Sewer Lift Station Protection

LP4 North Levee Road Setback Levee

Project Update: This project is a part of the United States Army Corps of Engineers, Seattle District Office General Investigation study for the Puyallup River Basin. As of January 2018, the USACE completed a draft report called the Integrated Feasibility Report and Environmental Impact Statement. This draft report went through a public review and comment period in April 2016. The draft report is being updated with additional information and findings from public comments and additional analysis. The update will also include development of 30% designs for the conceptual identified flood reduction measures and features.

Estimated Cost: ***$315,878,160***

LP5 Puyallup Wastewater Treatment Plant Flood Wall

Project Update: This project was designed to protect the City of Puyallup's Water Pollution Control Plant (WPCP). In lieu of constructing a wall around the plant, the City decided it was more efficient to provide protection through a combination of flood proofing and elevation of critical infrastructure within the plant. This project began construction in October 2017 and is anticipated to be completed in October 2018.

***Estimated Cost:* $6,300,000**



Figure 8: Puyallup Wastewater Treatment Plant, Digester East

LP6 Tiffany's Skate Inn/Riverwalk Flood Wall

Project Update: This project is in the General Investigative study with the United States Army Corps of Engineers (USACE).

***Estimated Cost:* $ 5,055,633**

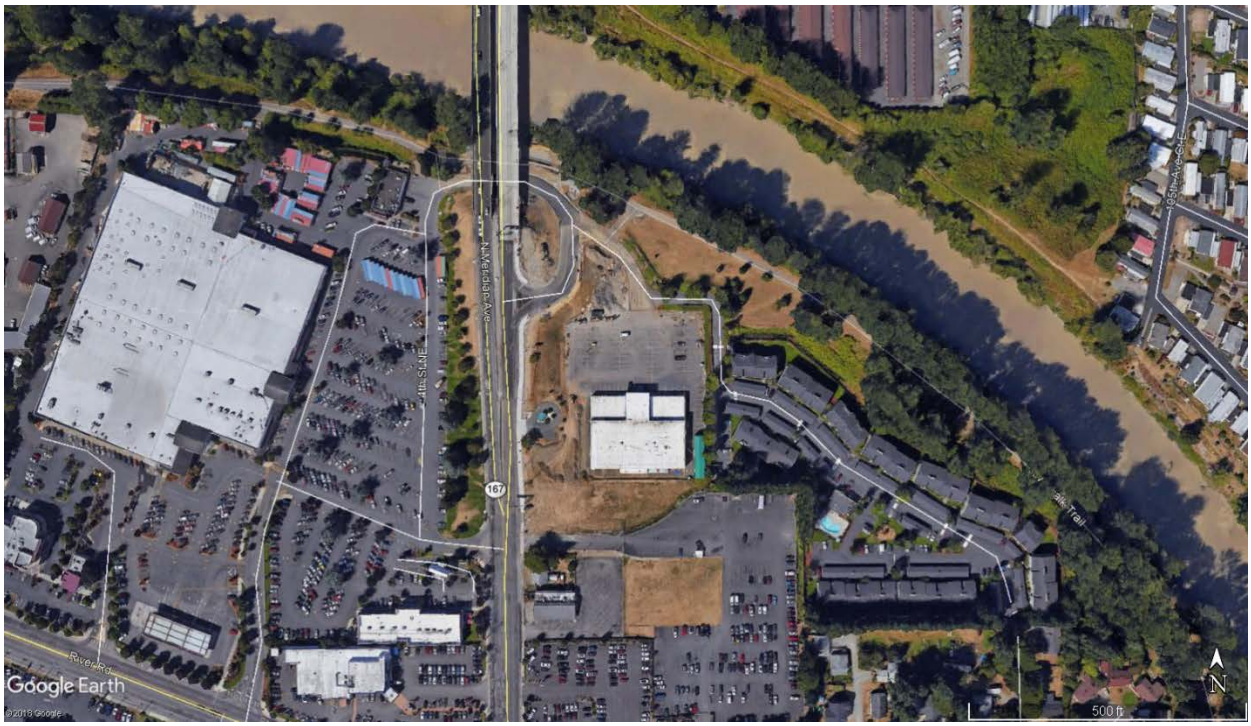


Figure 9: Location of Tiffany Skate Inn/ Riverwalk Flood

LP7 Puyallup Executive Park Flood Wall

Project Update: No project update is available at this time.

***Estimated Cost:* $179,755**

LP8 Linden Golf Course Oxbow Setback Levee

Project Update: No project update is available at this time.

Estimated Cost: **$48,309,389**

MIDDLE PUYALLUP UPDATES

Major Flooding

Since the plan was adopted in 2013, there has been no major flooding in this reach.

Flood Damage to Facilities

Flood damages to Middle Puyallup River flood risk reduction facilities range from mild to moderate in the past three decades. Damages sustained generally range from partial washout of the flood risk reduction structure over a few hundred lineal feet to localized moderate scour and erosion. Damages from major floods and high-water events between 1990 – 2017 have resulted in approximately 91 identified damage locations comprising 3.6 mile of levees and revetments. Damages have been estimated at nearly $7.37 million (based on 2017 dollars). The middle portion of the Middle Puyallup River reach between RM 12.2 and RM 14.2 has historically been most vulnerable to repetitive damages requiring repair actions to restore the structures. Since 2013, levees and revetments that have experienced repetitive damages include WAZZU, Bowman-Hilton, Van Ogles, and Sportsman.

Table 5.10 Summary of Damages to Middle Puyallup River Facilitates (1991 – 2009) has been reformatted, revised and updated to include current damages since prior to 1991 and after 2009.

Table 5.10 Summary of Damage to Facilities in the Middle Puyallup 1990-2017

Storm Season	Segment Name	Bank	River Mile	Damage Lineal Feet	Damage
1995					
1995	Bowen/Parker	Left	16.8	50	Toe/slope failure.
1995	Bowman-Hilton	Left	13.2	150	Partial Washout. Toe and face rock.
1995	Bowman-Hilton	Left	13.2	600	Toe/slope failure.
1995	Mosby - Historic	Right	16.0	400	Toe/slope failure with spots of total failure.
1995	Mosby - Historic	Right	16.2	250	Partial Washout. Toe and face rock.
1995	Riverside Revetment	Right	12.8	600	Some Toe/slope failure
1995	Van Ogle Revetment	Right	13.4	225	Partial washout. Toe and face rock.
1996					
1996	Bowen/Parker	Left	16.7	100	Total failure
1996	Bowen/Parker	Left	16.8	200	Toe/slope failure
1996	Bowen/Parker	Left	17.4	100	Toe/slope failure
1996	Bowman-Hilton	Left	13.2	500	Toe/slope failure
1996	Dollar Creek	Right	16.8	800	Toe/slope failure

Table 5.10 Summary of Damage to Facilities in the Middle Puyallup 1990-2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1996	Mcmillin	Left	16.0	600	Toe/slope failure with spots of total failure.
1996	Mcmillin	Left	16.2	250	Toe/slope failure with spots of total failure.
1996	Mosby - Historic	Right	16.0	400	Toe/slope failure
1996	Riverside Revetment	Right	12.8	600	Toe/slope failure
1996	Sportsman	Left	14.2	100	Slope failure
1996	Wazzu Revetment	Left	12.2	600	Toe/slope failure
2002					
2002	Van Ogle Revetment	Right	13.0	50	Toe and face repair
2004					
2004	Riverside	Right	12.7	100	Partial washout of the toe and levee facing.
2005					
2005	Evanger/White	Right	14.2	450	Repair/replace toe and face rock
2006					
2006	Bowen/Parker	Left	17.3	220	Face erosion
2006	Bowman-Hilton	Left	13.2	500	Fracture: scour
2006	Evanger/White	Right	15.0	300	Face erosion
2006	River Grove	Right	11.0 - 11.5	0	Overtopping with minor levee damage
2006	Sportsman	Left	13.6	40	Fracture
2006	Sportsman	Left	14.0	300	Washout
2006	Wazzu Revetment	Left	12.2	300	Face erosion
2007					
2007	Bowman-Hilton	Left	13.2	880	Repair scour from levee being overtopped
2007	Mcmillin	Left	16.3	50	
2008					
2008	128th & Mccutcheon	Right	16.7	12	Top of levee/access road scour
2008	Bowen/Parker	Left	16.8	75	Toe rock failure
2008	Bowen/Parker	Left	16.81	50	Toe rock failure and partial face rock failure
2008	Bowman-Hilton	Left	13.2	60	Minor top coat damage
2008	Mcmillin	Left	15.7	30	Damaged toe and face rock
2008	Mcmillin	Left	16.1 - 16.2	30	Toe and face rock failure
2008	Riverside	Right	12.0	30	Damaged toe and face rock
2008	Riverside	Right	12.4	236	Damaged toe and face rock

Table 5.10 Summary of Damage to Facilities in the Middle Puyallup 1990-2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2008	Riverside	Right	12.7	5	Minor top coat damage
2008	Sportsman	Left	13.75	0	Blocked culvert
2008	Van Ogle Revetment	Right	13.5	30	Damaged face rock
2008	Wazzu Revetment	Left	12.2	148	Wazzu partial washout
2009					
2009	128th & Mccutcheon	Right	16.75	20	Toe and face rock failure
2009	Bowen/Parker	Left	16.7	12	Top of levee/access road scour. Tide gate damaged.
2009	Bowen/Parker	Left	16.7	300	Access road scour, face rock failure.
2009	Bowen/Parker	Left	16.8	75	Toe rock failure.
2009	Bowman-Hilton	Left	13.2	200	Scour 200 LF facing rock failure.
2009	Bowman-Hilton	Left	13.3	50	Scour 1/2 feet deep for 50 LF.
2009	Evanger/White	Right	15.0	200	Total levee failure/ end of levee.
2009	Mcmillin	Left	16.1 - 16.2	60	Toe and face rock failure.
2009	River Grove	Right	11.0 - 11.5	0	Overtopping with minor levee damage.
2009	Riverside	Right	12.6	15	Scour over top of rev. 1-2Ft
2009	Sportsman	Left	13.75	200	Blocked culvert.
2009	Sportsman	Left	13.9	250	Damaged toe and face rock.
2009	Sportsman	Left	14.00	300	Major scour.
2009	Sportsman	Left	14.10	150	Head cutting on back side of levee.
2009	Wazzu Revetment	Left	12.2	65	Partial washout
2010					
2010	Riverside Revetment	Right	12.8	50	Minor face rock slippage and possible toe rock misplaced.
2010	Sportsman	Left	14.05 - 14.17	650	Slump and scour near Sportsman Club.
2010	Sportsman	Left	14.05 - 14.17	650	Slump and scour near Sportsman Club.
2010	Van Ogle Revetment	Right	13.65	100	Slump in front of Knobloch residence.
2010	Van Ogle Revetment	Right	14.14	120	Toe rock and face rock failure.
2011					
2011	128th & Mccutcheon	Right	16.8	440	Major scallop scour missing levee.
2011	Evanger/White	Right	14.2	75	Toe rock failure.
2011	Evanger/White	Right	14.9	200	Toe and face rock failure.

Table 5.10 Summary of Damage to Facilities in the Middle Puyallup 1990-2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2011	Fennel Creek	Right	15.4	45	6ft deep scour.
2011	River Grove	Right	11.42	50	3ft slump.
2011	River Walk Revetment	Right	11.9	60	Minor toe scour.
2011	Riverside	Right	12.3 - 12.4	425	Toe rock failure.
2011	Riverside Revetment	Right	12.8	70	Toe and face rock failure.
2011	Sportsman	Left	14.05 - 14.17	650	Slump and scour.
2011	Sportsman	Left	14.2	220	Toe rock failure.
2011	Van Ogle Revetment	Right	13.65- 13.66	100	Slump in front of Knobloch residence.
2011	Van Ogle Revetment	Right	14.14 - 14.16	120	Toe and face rock failure.
2012					
2012	Ball Creek	Left	15.3	100	Toe and face rock failure.
2012	Bowen/Parker	Left	16.7 - 16.8	300	Face rock failure.
2012	Mcmillin	Left	16.1	100	Toe and face rock failure.
2012	Riverside	Right	12.3 - 12.4	425	Toe rock failure.
2012	Riverside Revetment	Right	12.8	100	Missing face rock.
2012	Van Ogle Revetment	Right	14.1	120	Toe and face rock failure.
2012	Wazzu Revetment	Left	12.2	50	Over steepened, loss of face and toe rock.
2013					
2013	Mcmillin	Left	16.1	100	Toe & face rock failure
2013	Riverside Revetment	Right	12.8	100	Missing face rock.
2013	Wazzu Revetment	Left	12.2	50	Toe & face rock failure.
2015					
2015	River Grove	Right	11.2	75	Tree root pulled out section of levee.
2015	Sportsman	Left	13.7	250	Partial erosion of revetment face rock.
2015	Wazzu Revetment	Left	12.2	150	Missing rock and over steepened
2015	Wazzu Revetment	Left	12.2	150	Missing rock and over steepened.
2017					
2017	River Grove	Right	11.2	110	Overly steep. Sloughing. USACE repair.
2017	Wazzu Revetment	Left	12.1	60	Levee damage.

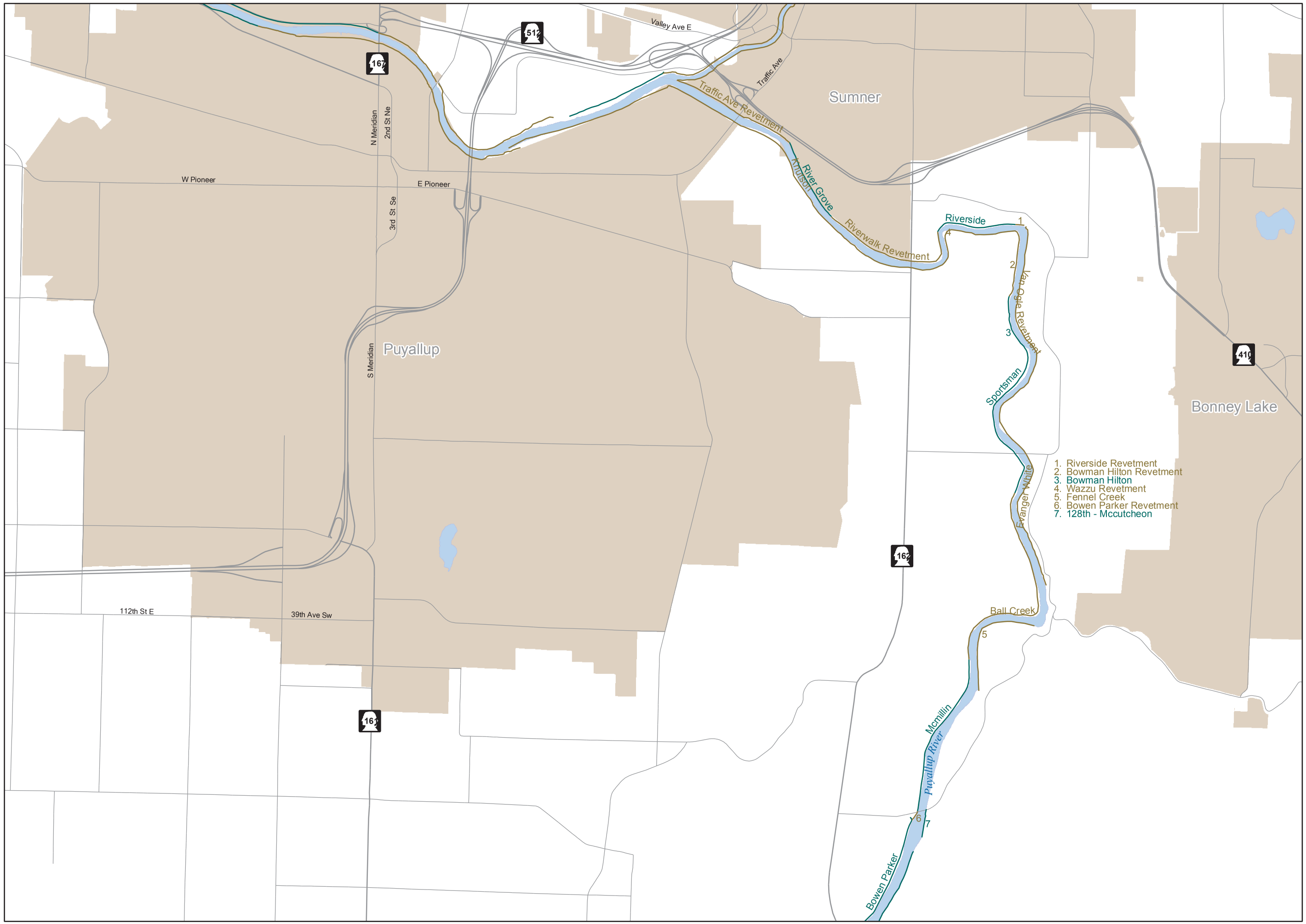


Figure 10

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Middle Puyallup River

- Levee
- Revetment
- Highway
- Major Road
- Water Body
- City

Pierce County

N

3/6/2018

0 0.25 0.5 Miles

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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Land Purchases

In 2015, one property near Riverside Drive was purchased for flood damage mitigation. This parcel was an estimated .75 acres.

Status Update on Recommended Capital Projects

MP1 Rainier Manor/Riverwalk/ Rivergrove and SR-410 Flood Wall and Levee

Project Update: Currently, the United States Army Corps of Engineers (USACE) is doing a repair on this structure.

***Estimated Cost:* $12,358,215**



Figure 11: Sand bag berm installed along top of levee as an interim flood risk reduction measure

MP2 McCutcheon Rd & 96th St E Road Barricade

Project Update: No project update is available at this time.

Estimated Cost: ***$56,173***

See Figure 12

MP3 116th St E. Point Bar Gravel Removal

Project Update: No project update is available at this time.

Estimated Cost: ***$247,164***

See Figure 13

*MP4 Middle Puyallup and 128th St East

(formally known McCutcheon Rd and 128th St East)

Project Update: This project is currently in the Pierce County Surface Water Management Capital Facilities plan to begin preliminary design and engineering in 2019.

Estimated Cost: **$14,700,949**

See Figure 14

* The project name has been changed to be consist with other Pierce County documents.



Figure 12

River Flood Hazard Management Plan

MP2 McCutcheon Rd and 96th St E

- River Milepost
- Levee
- Revetment
- City

Pierce County

N

0 200 400 Feet

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Figure 13

River Flood Hazard Management Plan

MP3
116th St E Point Bar Gravel Removal

- River Milepost
- Levee
- Revetment

Pierce County

N

0 125 250 Feet

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The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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Figure 14

River Flood Hazard Management Plan

MP4 McCutcheon Rd and 128th St E

- River Milepost
- Proposed Setback Levee
- Levee
- Revetment

Pierce County

N

0 160 320 Feet

3/6/2018

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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UPPER PUYALLUP UPDATES

Major Flooding

Since the plan was adopted in 2013, there have been multiple high-water events that have not resulted in any significant damage to private property or public infrastructure other than flood facilities.

Flood Damage to Facilities

Flood damages to upper Puyallup River flood risk reduction facilities have been extensive in the past three decades. Five significant flood events more than 16,000 cubic feet per second (cfs) have occurred along the study reach since 1990. Damages sustained ranged from full washout of the flood risk reduction structure over several hundred lineal feet to localized moderate scour and erosion. Damages from the major floods and high-water events have resulted in approximately 243 identified damage locations along 16.3 miles of levees and revetments. Damages have been estimated at nearly $41.62 million (based on 2017 dollars). The upper portion of this Puyallup River reach between RM 25.4 and RM 28.6 has historically been the most vulnerable to significant repetitive damages requiring repair and implementation of capital solutions to reduce flood risk.

Table 5.16 Flood Damage to Levees in Upper Puyallup River has been reformatted, revised and updated to include current damages from 1990 to 2017.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017

Storm Season	Segment Name	Bank	River Mile	Damage Lineal Feet	Damage
1990					
1990	McAbee	Left	P-68 23.6	100	Reshape and replace rip rap and toe rock.
1990	Ford - Historic	Right	P-70 24.0	100	Reshape and replace rip rap and toe rock.
1990	The Country - Remnant Iii	Left	P-74: 24.7	200	Partial washout.
1990	High Bridge Revet.	Right	P-76 25.1	600	Restore damaged rip rap.
1990	Fiske Creek Revetment	Right	P-78 25.5	800	Reconstruction
1990	Neadham Road-Historic I	Right	P-80 25.9	280	Reconstruction
1990	Neadham Road-Historic I	Right	P-81: 26.0	900	Reconstruction
1990	Orville-Kapowsin	Right	P-82: 26.2	800	Reconstruction
1990	Orville-Kapowsin	Left	P-82: 26.2	150	Reconstruction
1990	Orville-Kapowsin	Left	P-83 26.4	501	Reconstruction
1990	Orville-Kapowsin	Right	P-83: 26.4	700	Reconstruction

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1990	Orville-Kapowsin	Left	P-84 26.6	600	Washout
1990	Orville-Kapowsin	Left	P-84: 26.6	900	Reconstruction
1990	Orville-Kapowsin	Left	P-85 26.8	350	Partial washout.
1990	Neadham Road	Right	P-85: 26.8	250	Reconstruction
1990	Orville-Kapowsin	Left	P-86: 27.0	800	Reconstruction
1990	Stehn Large Lot	Left	P-87 27.2	500	Washout
1990	Stehn Large Lot	Left	P-88 27.4	632	Reconstruction
1990	Griessel	Left	P-89: 27.6	1000	Reconstruction
1990	Griessel	Left	P-90 27.7	200	Partial washout.
1990	Champion Bridge	Left	P-94 28.5	400	Washout restore channel alignment.
1991					
1991	Neadham Road	Right	P-85: 26.8	250	Reconstruction
1992					
1992	High Bridge Revet.	Right	P-78: 25.4	160	Reconstruction
1992	Neadham Road-Historic Ii	Right	P-82: 26.2	150	Reconstruction
1994					
1994	Jones	Right	21.8	20	Repair of levee damages.
1994	Ford - Historic	Right	23.6	20	Repair of levee damages.
1994	Ford - Historic	Right	23.8	20	Repair of levee damages.
1995					
1995	Calistoga	Right	19.8 - 20.2	500	Total levee failure
1995	Calistoga	Right	20.0	375	Partial washout.
1995	Leach Road	Left	20.0	195	Reshape and replace riprap and toe rock.
1995	Leach Road	Left	20.2	300	Mostly toe failure with some slope failure.
1995	Calistoga	Right	20.7	100	Partial Washout.
1995	Leach Road	Left	20.7	200	Partial Washout
1995	Calistoga	Right	20.9	200	Toe/slope failure
1995	Jones	Right	22.3	250	Toe/slope failure
1995	Jones	Right	22.4	200	Toe/slope failure
1995	Soldiers Home - Historic	Left	22.5	200	Partial washout.
1995	Soldiers Home - Historic	Left	22.5	50	Total failure.
1995	Soldiers Home	Left	22.9	200	Partial washout.
1995	Ford - Historic	Right	23.6	900	Total failure.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1995	Ford - Historic	Right	23.7	200	Partial washout.
1995	The Country - Historic Ii	Left	24.0	200	Partial washout.
1995	The Country - Historic Ii	Left	24.0	800	Total failure.
1995	Mint Creek	Left	25.1	300	Partial washout.
1995	Neadham Road - Remnant I	Right	25.6	200	Partial washout.
1995	Orville-Kapowsin	Left	26.2	1500	Full levee washout
1995	Orville-Kapowsin	Left	26.5	225	Partial washout.
1995	Orville-Kapowsin	Left	26.6	200	Partial washout.
1995	Neadham Road	Right	26.8	500	Partial washout.
1995	Orville-Kapowsin	Left	27.0	500	Full levee washout.
1995	Griessel	Left	27.6	400	Full levee washout.
1995	Griessel-Historic	Left	28.1	300	Cutoff levee, full washout.
1995	Griessel-Historic	Left	28.1	700	Full levee washout.
1996					
1996	High Cedars	Right	17.6	400	Toe failure.
1996	High Cedars	Right	18.0	500	Toe failure.
1996	High Cedars	Right	18.0	400	Total failure.
1996	South Fork	Left	18.2	200	Levee access road damage.
1996	High Cedars	Right	19.0	100	Toe/slope failure
1996	Calistoga	Right	19.8 - 20.2	500	Total levee failure
1996	Calistoga	Right	19.8 - 20.2	1200	Total levee failure
1996	Calistoga	Right	20.0	375	Toe/slope failure
1996	Calistoga	Right	20.2	200	Mostly toe with some slope failure.
1996	Leach Road	Left	20.5	300	Toe/slope failure.
1996	Calistoga	Right	20.7	300	Toe failure.
1996	Calistoga	Right	20.8	100	Toe failure.
1996	Calistoga	Right	20.9	300	Toe/slope failure.
1996	Calistoga	Right	21.2	200	Toe/slope failure.
1996	Soldiers Home - Historic	Left	21.9	400	Toe/slope failure.
1996	Jones	Right	22.3	250	Toe/slope failure.
1996	Jones	Right	22.4	200	Toe/slope failure.
1996	Jones	Right	22.5	200	Total failure.
1996	Ford	Right	22.9	300	Toe/slope failure.
1996	Ford	Right	23.1	200	Total failure.
1996	Ford - Historic	Right	23.6	900	Total failure.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1996	McAbee	Left	23.6	1200	Total failure.
1996	The Country - Historic Ii	Left	24.0	500	Total failure.
1996	The Country - Historic Ii	Left	24.1	300	Total failure.
1996	Ford - Historic	Right	24.6	1200	Total failure.
1996	High Bridge Revet.	Right	25.1	200	Total failure.
1996	Mint Creek	Left	25.15	250	Toe/slope failure.
1996	Neadham Road - Remnant I	Right	25.6	1300	Total failure.
1996	Neadham Road-Historic Ii	Right	26.2	2000	Total failure.
1996	Neadham Road	Right	26.4	600	Total failure.
1996	Neadham Road	Right	26.6	1000	Total failure.
1996	Orville-Kapowsin	Left	26.6	900	Toe/slope failure.
1996	Orville-Kapowsin	Left	26.7	1200	Toe/slope failure.
1996	Neadham Road	Right	26.8	1000	Total failure.
1996	Orville-Kapowsin	Left	26.8	2000	Total failure.
1996	Griessel	Left	27.6	2000	Toe/slope failure.
1996	Griessel-Historic	Left	28.0	2500	Toe/slope failure.
1996	Orville-Kapowsin	Left	26.7 - 27.6	3000	Total failure
2003					
2003	Calistoga	Right	21.0	300	Partial washout of the toe and levee facing.
2003	Soldiers Home	Left	22.8	220	Partial washout of the toe and levee facing.
2003	Orville-Kapowsin	Left	26.2	360	Partial washout of the toe and levee facing.
2003	Champion Bridge	Left	28.2	40	Partial washout of the toe and levee facing.
2004					
2004	High Cedars	Right	17.8	1,300	Partial washout of the toe and levee facing.
2004	High Cedars	Right	19.6	250	Partial washout of the toe and levee facing.
2004	Leach Road	Left	20.7	10	Re-establish heavy rip-rap around outfall pipe.
2004	Soldiers Home - Historic	Left	22.3	250	Partial washout of the toe and levee facing.
2005					
2005	Soldiers Home - Historic	Left	22.3	100	Repair/replace toe and face rock.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2006					
2006	South Fork	Left	17.7	40	Washout
2006	High Cedars	Right	18.0	50	Washout
2006	South Fork	Left	18.0	350	Washout
2006	High Cedars	Right	19.4	150	Washout
2006	Leach Road	Left	19.4	50	Washout
2006	Calistoga	Right	19.8	100	Washout
2006	Leach Road	Left	19.8	200	Washout
2006	Soldiers Home	Left	22.6	100	Face erosion
2006	Ford	Right	22.8	350	Washout
2006	McAbee	Left	23.6	600	Washout
2006	Orville-Kapowsin	Left	26.3	415	Washout
2006	Champion Bridge	Left	28.4	450	Washout
2006	Champion Bridge	Left	28.6	150	Washout
2006	Champion Bridge	Left	28.6	700	Washout
2006	Neadham Road-Historic Iii	Right	26.7 - 27.0	1500	Washout
2007					
2007	High Cedars	Right	18.0	70	Washout
2007	Jones	Right	22.0	200	Repair
2007	Orville-Kapowsin	Left	25.7	500	Washout
2007	Orville-Kapowsin	Left	26.2	200	Washout
2007	Neadham Road	Right	26.7	330	Cut-off construction.
2007	Neadham Road	Right	26.4 - 26.8	1,600	Washout - USACE Assistance.
2008					
2008	High Cedars	Right	18.2	75	Toe rock failure and partial face rock failure.
2008	High Cedars	Right	18.5	175	Toe rock & partial face failure.
2008	Leach Road	Left	19.3	250	Top of levee/access road scour.
2008	Leach Road	Left	19.75	350	Partial washout of the toe and levee facing.
2008	Jones	Right	21.7 - 22.4	600	Partial washout of the toe and levee facing.
2008	The Country - Historic I	Left	23.6 - 23.8	620	Washout
2008	Calistoga	Right	19.82	200	Top surface access road scour.
2008	Calistoga	Right	20.78	130	Potential toe rock failure and face rock failure.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2008	Calistoga	Right	21.15	120	Potential toe rock failure and face rock failure.
2008	Jones	Right	21.3	450	Toe rock failure.
2008	Soldiers Home	Left	21.30	120	Toe rock failure.
2008	Jones	Right	22.0	300	Toe rock failure.
2008	Jones	Right	22.05	100	Toe rock failure.
2008	Ford	Right	22.8	150	Toe rock failure.
2008	Soldiers Home	Left	23.0	600	Toe rock failure.
2008	McAbee	Left	23.6	150	Partial levee core failure.
2008	Ford	Right	24.6	100	Toe rock failure.
2008	Neadham Road-Historic Ii	Right	26.3	738	Complete washout
2008	Champion Bridge	Left	28.3	127	Toe and Face Rock Failure.
2008	Champion Bridge	Left	28.5	299	Partial washout.
2009					
2009	High Cedars	Right	18.2	75	Toe rock failure and partial face rock failure.
2009	High Cedars	Right	18.8	700	High cedars facing rock failure.
2009	Leach Road	Left	19.3	250	Top of levee/access road scour.
2009	High Cedars	Right	19.4	120	Face rock failure.
2009	Leach Road	Left	19.8	520	Revetment 30% of facing rock missing.
2009	Jones	Right	22.1	200	Primarily face scour loss of face rock.
2009	Jones	Right	22.35	60	Primarily face scour loss of face rock.
2009	Ford	Right	22.7	150	Primarily face scour loss of face rock.
2009	Soldiers Home	Left	22.7	141	Primarily scour along the lower portion of the face rock.
2009	McAbee	Left	23.3	200	Primarily face scour loss of face rock.
2009	McAbee	Left	23.6	150	Partial Levee Core failure.
2009	Neadham Road	Right	26.8	130	Cut-off extension.
2009	Champion Bridge	Left	28.15	150	Complete washout of levee.
2009	Champion Bridge	Left	28.2	168	Primarily face scour loss of face rock.
2009	Champion Bridge	Left	28.25	300	Primarily face scour loss of face rock.
2009	Champion Bridge	Left	28.3	135	Toe scour causing face rock to slough away.
2009	Champion Bridge	Left	28.5	435	Primarily face scour loss of face rock.
2010					
2010	High Cedars	Right	18.18	10	Small face scour pocket.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2010	Leach Road	Left	19.8	550	Toe and face scour - USACE assistance.
2010	Soldiers Home	Left	21.3	150	Slope and toe scour - USACE assistance.
2010	Jones	Right	21.4	500	Toe and partial embankment scour - USACE assistance.
2010	Soldiers Home	Left	22.5	140	Slope and toe scour - USACE assistance.
2010	Soldiers Home	Left	22.7	175	Slope and toe scour - USACE assistance.
2010	Neadham Road	Right	26.8 - 27.0	550	Levee extension.
2011					
2011	Leach Road	Left	19.9	60	Partial failure.
2011	Ford	Right	23.4	120	Face and toe rock failure.
2011	Ford	Right	24.7	300	Lower face scour.
2011	High Bridge Revet.	Right	25.3	90	Major face scour/scarp.
2011	Neadham Road	Right	26.45	120	Face and toe rock failure.
2011	Champion Bridge	Left	28.3	100	Face rock failure & sloughing.
2011	Champion Bridge	Left	28.15 - 28.3	700	Face & toe rock failure.
2012					
2012	High Cedars	Right	19.3	75	Toe scour.
2012	Leach Road	Left	19.9	60	Partial failure upstream end of Corp.
2012	Calistoga	Right	20.7	25	Knick point.
2012	Soldiers Home	Left	21.45	50	Lower face and possible toe scour.
2012	Soldiers Home	Left	22.6	50	Lower face erosion.
2012	Ford	Right	23.5	200	Toe scour.
2012	McAbee	Left	23.6	80	End of levee @ rock point washed out to river mile post sign.
2012	Soldiers Home	Left	23.6	80	End of levee @ rock point washed out to river mile post sign.
2012	Ford	Right	24.7	200	Toe scour & loss of lower face.
2012	High Bridge Revet.	Right	25.2	30	Knick point in revetment.
2012	High Bridge Revet.	Right	25.4	50	Over steepened w/ lots of rock missing.
2012	Neadham Road	Right	26.5	240	Face rock sloughing along entire length due to lost toe rock or toe being lost.
2012	Neadham Road	Right	26.65	210	Toe rock missing causing face to slough.
2012	Neadham Road	Right	26.7	75	Several upper level toe rocks rolled out.
2012	Champion Bridge	Left	28.15	200	Continued damage from last year.
2012	Champion Bridge	Left	28.45	100	Sloughing moving upstream.
2012	Champion Bridge	Left	28.1- 28.2	700	Sloughing.

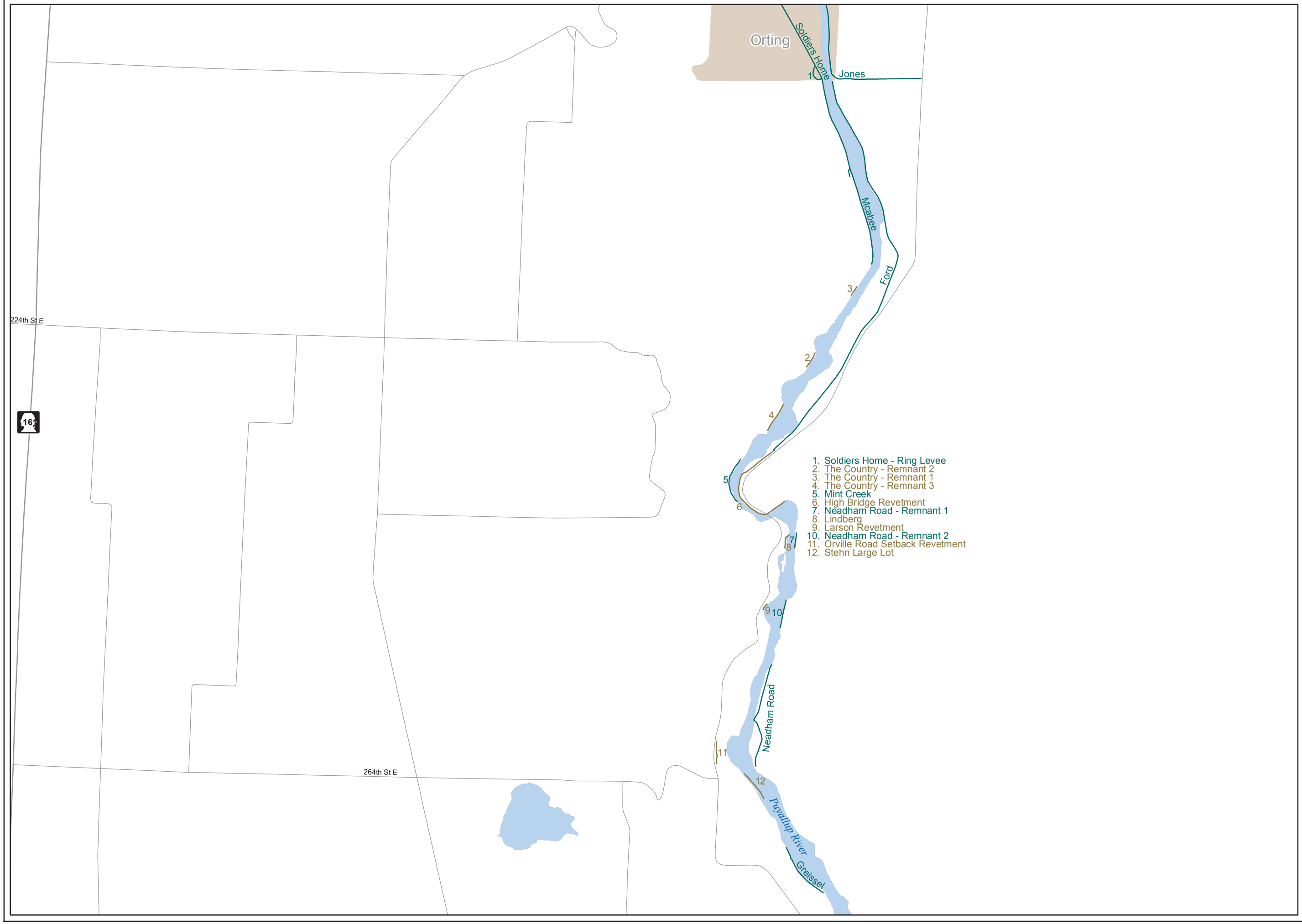
Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2013					
2013	High Cedars	Right	18.70	30	Toe rock and face rock missing with some core erosion.
2013	High Cedars	Right	19.4	75	Knick point. Toe rock loss and face sloughing.
2013	Ford	Right	23.50	200	Toe scour.
2013	Neadham Road	Right	26.65	210	Toe rock missing causing face to slough.
2013	Neadham Road	Right	26.70	60	Toe rock is being scoured and causing the face to slough.
2013	Champion Bridge	Left	28.3	100	Revetment repair.
2014					
2014	Soldiers Home	Left	21.45	100	Lower face scour.
2014	Neadham Road	Right	26.4	300	Thalweg against toe causing scour along the lower face and toe.
2014	Neadham Road	Right	26.6 & 26.7	285	Toe scour causing lower face to slough.
2014	Champion Bridge	Left	28.2 - 28.3	400	Toe rock rolling out and face sloughing.
2015					
2015	High Cedars	Right	18.15	100	Maintenance
2015	High Cedars	Right	18.25	160	Missing face rock.
2015	High Cedars	Right	18.3	130	Missing face rock.
2015	High Cedars	Right	19.4	200	Maintenance
2015	Leach Road	Left	19.4	200	Overtopping & scour over access road.
2015	Leach Road	Left	19.6	150	Overtopping and facing rock damaged.
2015	Leach Road	Left	20.3	10	Tree pulled in a chunk of levee.
2015	Leach Road	Left	21.0	75	Toe and face rock missing.
2015	Soldiers Home	Left	21.45	40	Levee rehabilitation.
2015	McAbee	Left	23.2	100	Core exposed.
2015	Ford	Right	23.60	100	Missing face and toe rock.
2015	McAbee	Left	23.6	100	Buttress end has started to erode.
2015	Ford	Right	24.70	300	Full washout over 200 LF. Orville road only 40 feet away.
2015	Ford	Right	24.70	400	Washout of levee. Emergency repair.
2015	High Bridge Revet.	Right	25.2	60	Face scour, sloughing, loss of toe rock.
2015	High Bridge Revet.	Right	25.35	350	Face scour & loss of toe rock.
2015	Neadham Road	Right	26.4	150	Missing face rock.
2015	Griessel	Left	27.7	30	Access road at culvert damaged.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2015	Champion Bridge	Left	28.15	40	Erosion at end of Champion Bridge Levee.
2015	Champion Bridge	Left	28.2	110	Missing toe and face rock.
2015	Champion Bridge	Left	28.2	220	Severe face scour.
2015	Champion Bridge	Left	28.2	450	Emergency - levee rehab
2015	Champion Bridge	Left	28.25	150	Missing face rock and over steepened.
2015	Champion Bridge	Left	28.25	100	Project has grown from 150 to 250 from November Flood.
2015	Neadham Road	Right	26.6 & 26.7	80	Levee rehabilitation.
2017					
2017	High Cedars	Right	17.6	1	Over steepened.
2017	High Cedars	Right	18.6	100	Toe and face rock failure.
2017	High Cedars	Right	18.77	40	Toe and face rock failure.
2017	Leach Road	Right	19.3	800	Access Rd damage.
2017	Soldiers Home	Left	22.8 - 22.9	900	Levee rehabilitation.
2017	Leach Road	Right	19.9	25	Scour at top of levee
2017	Leach Road	Left	20.2	60	Localized scour. Missing toe and face rock.
2017	Leach Road	Left	20.7	50	Localized scour. Missing toe and face rock.
2017	Leach Road	Left	21.0	310	Face and toe rock failure.
2017	Jones	Right	22.2	500	Toe rock failure.
2017	McAbee	Left	23.6	160	Further erosion of buttress.
2017	Ford	Right	24.6	400	Levee washout.
2017	High Bridge Revet.	Right	25.4	50	Upstream end of past repair project is damaged.
2017	Neadham Road	Right	26.65	125	Thalweg against toe causing scour along the lower face and toe.
2017	Champion Bridge	Left	28.2	150	Emergency - levee rehabilitation.
2017	Champion Bridge	Left	28.2	175	Further damage at end of levee.
2017	Champion Bridge	Left	28.25	50	Project has grown from 150 to 250 from November Flood.
2017	Champion Bridge	Left	28.25	50	More toe and face rock missing .

Figure 15

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Upper Puyallup River



1. Soldiers Home - Ring Levee
2. The Country - Remnant 2
3. The Country - Remnant 1
4. The Country - Remnant 3
5. Mint Creek
6. High Bridge Revetment
7. Neadham Road - Remnant 1
8. Lindberg
9. Larson Revetment
10. Neadham Road - Remnant 2
11. Orville Road Setback Revetment
12. Stehn Large Lot

Levee
Revetment
Highway
Major Road
Water Body
City

Pierce County

N

3/6/2018

0 0.25 0.5 Miles

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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Key Accomplishments since the 2013 Flood Plan

Table 5.17 has been updated to include major projects completed between 2013 and 2017. This table replaces the 2013 version.

Table 5.17 Major Projects Completed on Upper Puyallup River Since 1991 Flood Plan

Storm Season	Segment Name	Bank	River Mile	Damage Lineal Feet	Damage
2014					
2014	Champion Bridge	Left	28.2 - 28.3	400	Toe rock rolling out face sloughing. Face scour, face rock missing and sloughing.
2015					
2015	Ford	Right	24.70	400	Washout of levee. Emergency repair.
2015	Champion Bridge	Left	28.2	450	Emergency - levee rehab.
2017					
2017	Soldiers Home	Left	22.8 - 22.9	900	Levee Rehabilitation..
2017	Jones	Right	22.2	500	Toe Rock Failure 300 -500LF.
2017	Ford	Right	24.6	400	Levee Washout.

Land Purchases

The following land and home acquisitions have occurred since 2013, using a combination of federal, state, and local funds.

- In 2014, three properties were acquired in the Neadham Road area (17 acres);
- In 2015, six properties were acquired along Neadham Road and one property was acquired near Orville Road Kapowsin Creek (40 acres);
- In 2016, one property was acquired along Orville Road and one property was acquired near Neadham road (7 acres); and
- In 2017, three properties were acquired along Orville Road (73 acres).

Partnerships

Since the adoption of the 2013 Flood Plan, Pierce County has partnered with the Salmon Recovery Funding Board to acquire five parcels which totaled an estimated $1 million of grant funds. The department of Ecology's Floodplains by Design program also contributed $700,000 in grant funds to acquire a property located along Neadham Road.

Status Update on Recommended Capital Projects

UP1 Calistoga Setback Levee

Project Update: This project was completed in 2015 by the City of Orting. Currently this levee is undergoing the FEMA Levee Analysis and Mapping Procedures (LAMP) process that will certify the levee.

Estimated Cost: **$18,000,000**

See Figure 16

UP2 Ford Levee Setback-Gravel Removal

Project Update: No project update is available at this time.

Estimated Cost: **$1,011,126 plus study, design, and permitting costs**

See Figure 17

UP3 Neadham Road Floodplain Reconnection

Project Update: This project is currently in the property acquisition phase. When this project is complete, it will improve channel migration protection in the Neadham Road area along the upper Puyallup River. Pierce County continues to acquire properties located at RM 5.5 south of Orting. When the property acquisition phase is complete, the existing levee will be removed along Neadham Road. This will allow the river to access its full historical right bank floodplain for the first time in a century. This project is one step of many which ultimately will result in the reconnection of 1.3 miles of uninterrupted floodplain and riparian area along the right bank of the Puyallup River.

Estimated Cost: **$14,000,000**

See Figure 18

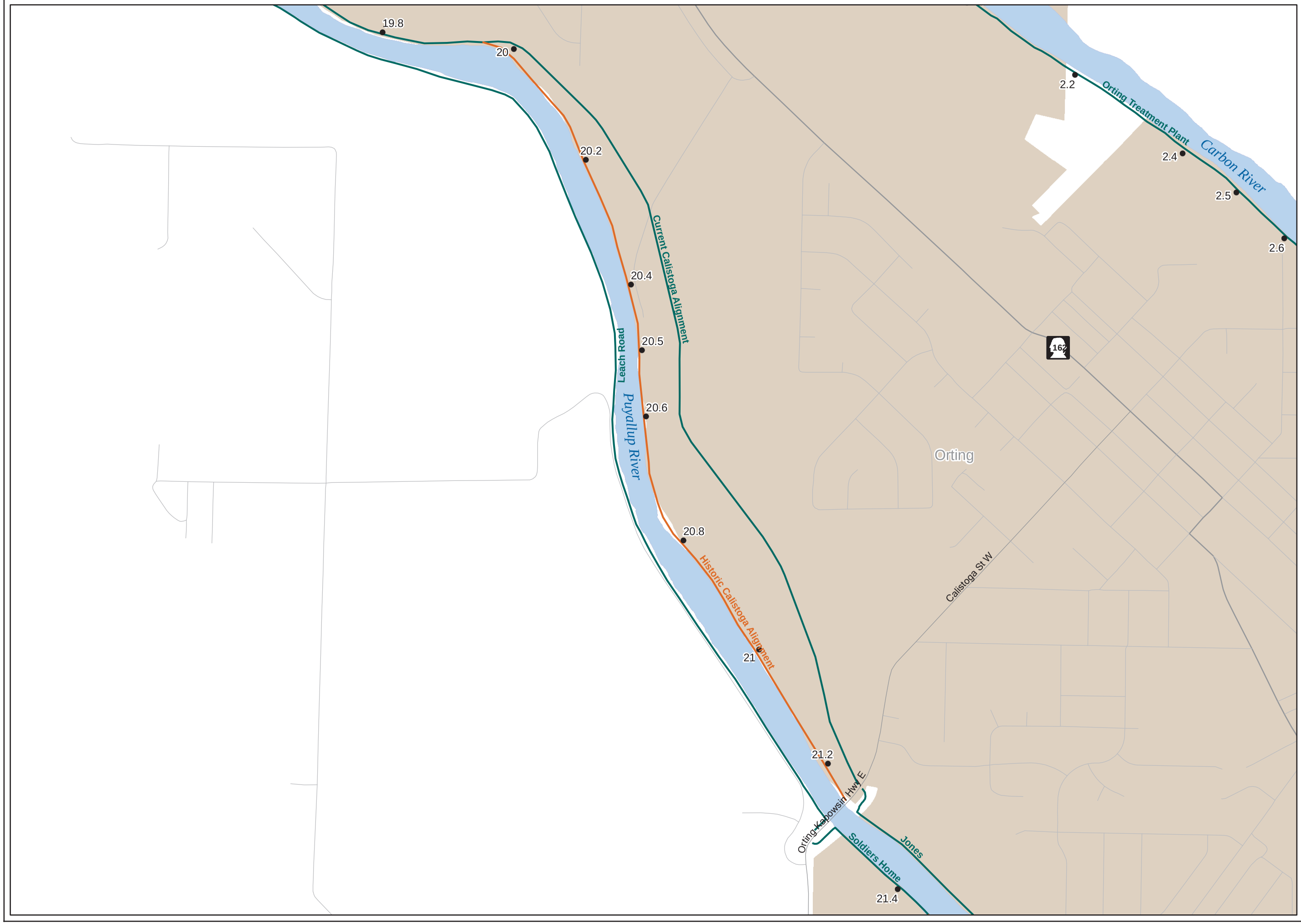


Figure 16

River Flood Hazard Management Plan

UP1 Calistoga Setback Levee

- River Milepost
- Historic Levee
- Levee
- Highway
- Major Road
- Residential Road
- Water Body
- City

Pierce County

N

3/6/2018

0 390 780 Feet

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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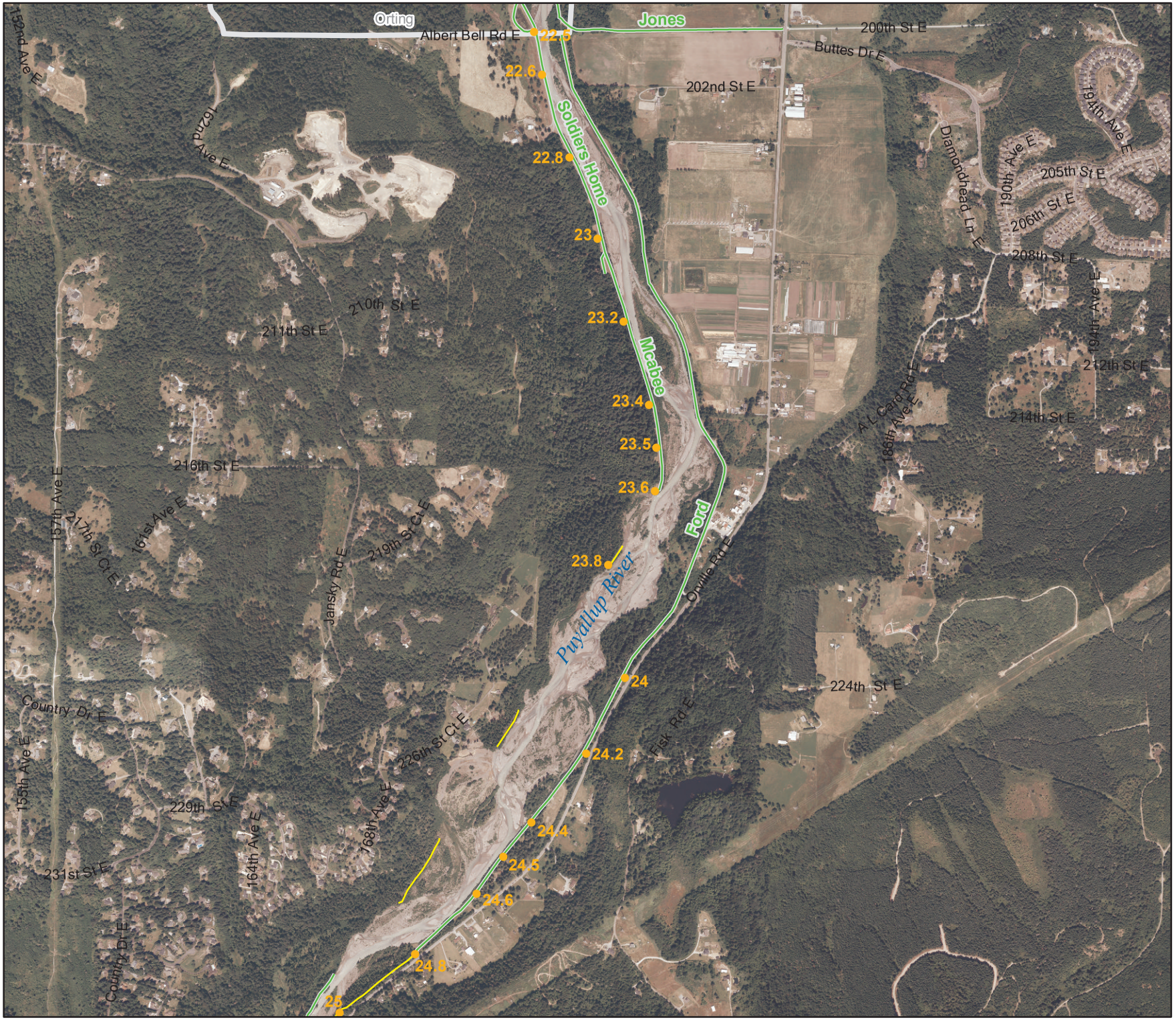


Figure 17

River Flood Hazard Management Plan

UP2
Ford Levee Setback
Gravel Removal

- River Milepost
- Levee
- Revetment
- City

Pierce County

N

0 437.5 875
Feet

3/6/2018

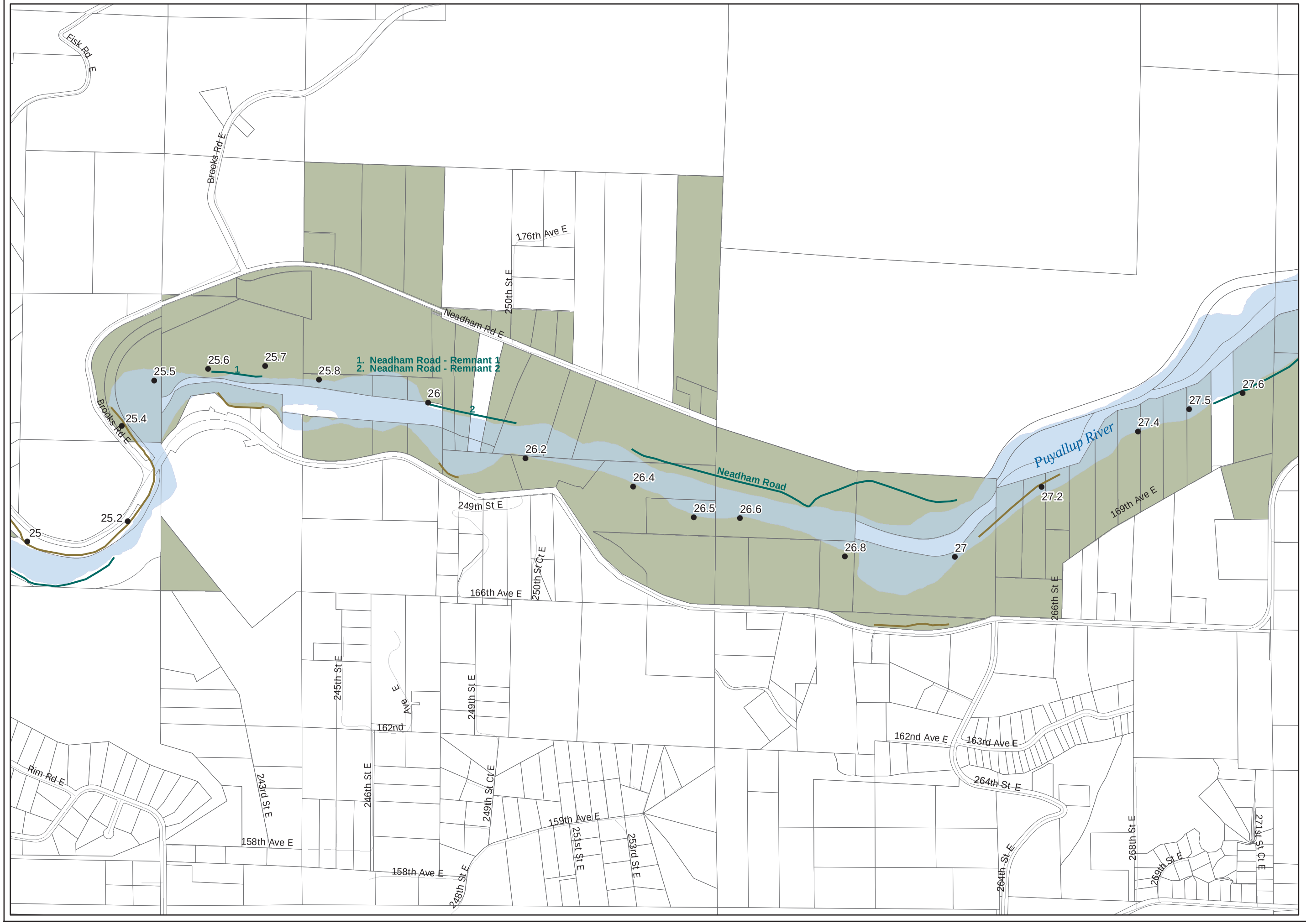
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Figure 18

River Flood Hazard Management Plan

UP3 Neadham Road



- River Milepost
- Levee
- Revetment
- Major Road
- Residential Road
- Surface Water Management Properties
- Tax Parcels
- Water Body

Pierce County

N

3/6/2018

0 465 930 Feet

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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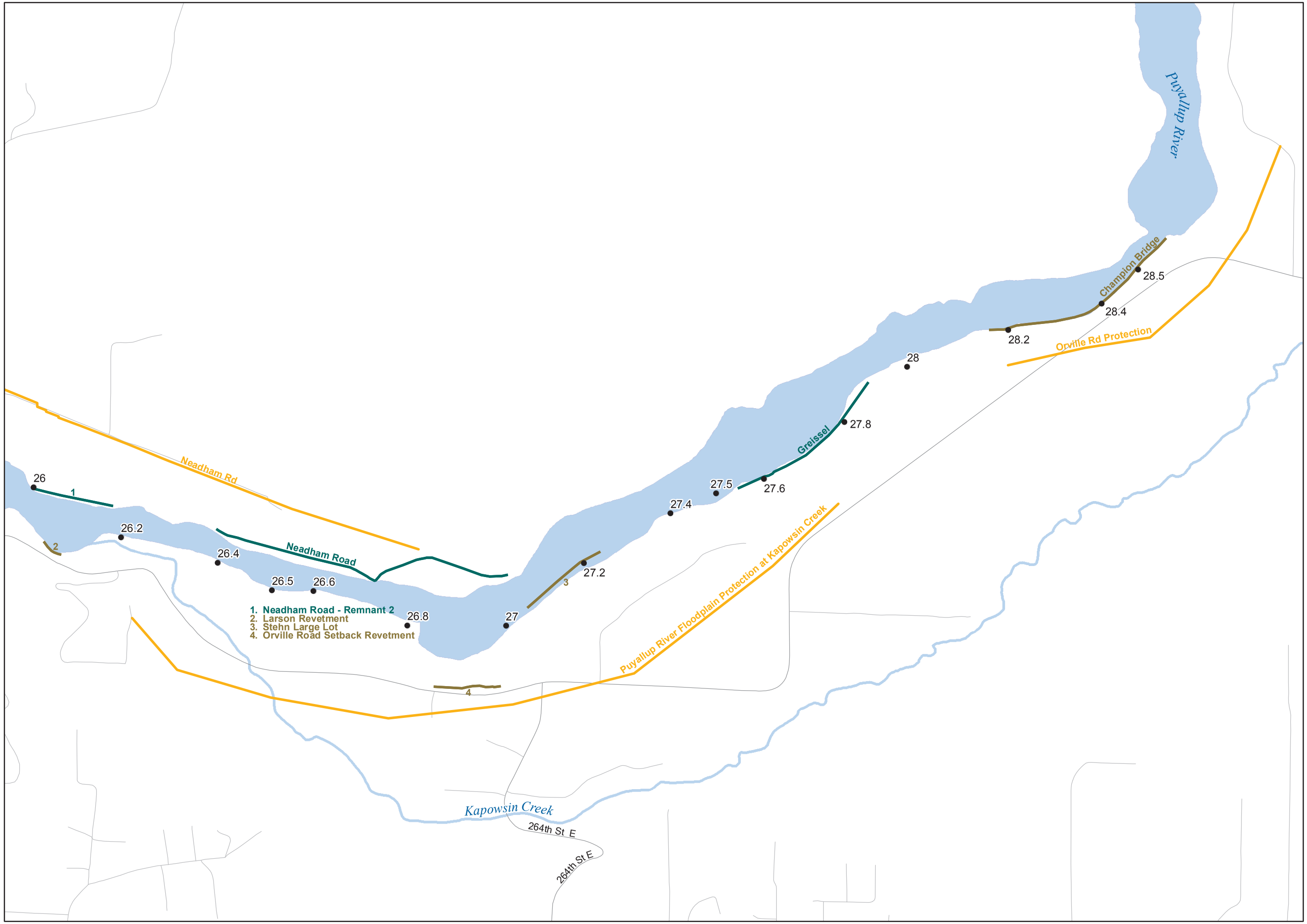


Figure 19

River Flood Hazard Management Plan

UP4 Orville Road Revetment at Kapowsin Creek, UP5 Orville Road Channel Migration Protection, and UP6 Puyallup River/ Orville Road Revetment and Riparian Habitat Restoration

- River Milepost
- Levee
- Revetment
- Major Road
- Residential Road
- Watercourse
- Water Body

Pierce County

N

3/5/2018

0 500 1,000 Feet

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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The following three Orville Road projects are a part of a much larger project that have been broken up into phases. A reach analysis of the Puyallup River from RM 25.3 to RM 28.6 was completed in July 2011 that developed cost effective solutions that inhibit further expansion of the channel migration zone. Since this study was completed and the Flood Plan was adopted, these three projects have further developed. Figure 19 shows the proposed Orville Road project in its entirety.

UP4 Orville Road Revetment at Kapowsin Creek

Project Update: This project is currently in the monitoring phase. The remaining 600 feet of levee was destabilized in 2013 and the river continues to re-occupy a portion of the channel. The adjacent properties have been purchased and the residences have been removed. A proposal to construct a 750-lineal foot combination of engineered log jam (ELJ) and dolo timber structures would provide scour and erosion protection for Orville Road. Recent shifts in the mainstem channel and the proposed right bank projects have decreased the urgency for this project. Channel changes following the completion of the right bank project will be analyzed to assess the left bank needs.

Estimated Cost: **Approximately $6,773,885**



Figure 20: Upper Puyallup river re-occupying remnant levee section 26.2

UP5 Orville Road Channel Migration Protection

Project Update: This project is currently under construction and will be completed in Spring 2018. The Orville Road setback revetment project will construct two miles of setback revetment to protect Orville Road from the upper Puyallup River left bank channel migration. At the closest point, the river channel is about 200 feet away from Orville Road. This project will be constructed in five phases. Phase one construction was completed in 2013, and a portion is currently under construction and anticipated to be completed in Spring 2018. The remaining portion will be completed upon funding availability. This project provides flood protection benefit and will improve salmonid habitat. Upon completion of all phases, a portion of existing levees will be removed and the river will occupy its historic channel and flood plain.

Estimated Cost: **$8,917,149**



Figure 21: Crews installing an engineered log jam along the Puyallup River in December 2017

UP6 Orville Road Revetment and Riparian Habitat Restoration

Project Update: This project was completed in 2014.

Estimated Cost: **$1,891,531**



Figure 22: Photo of the finished Orville Road Revetment and Riparian Habitat Restoration

LOWER WHITE RIVER UPDATES

Flood Damage to Facilities

Flood damages to lower White River flood risk reduction facilities in the past three decades have not been significant. Damages from major floods and high-water events between 1990 – 2017 have resulted in approximately 17 identified damage locations comprising 0.7 mile of levees and revetments. Damages have been estimated at nearly $1.54 million dollars (based on 2017 dollars).

Since 1990, the levees and revetments along the lower White River have been stable requiring minimal repairs. However in 2009, sediment accumulation became more apparent as there was a rapid diminishment of channel capacity resulting in increased flood risk. In 2017, King County constructed a new setback levee to improve channel capacity and habitat. The new County Line Setback levee was constructed on the left bank between RM 5.0 and 6.2. It was designed to provide capacity for the 1% chance storm event with sufficient free-board. King County is scheduled to monitor and maintain the project into the future.

Damage to the Sumner Commercial Revetment segment was identified in 2011 during an annual condition assessment. Over the course of the following storm season the damage rapidly increased in length and severity and is scheduled for repair. Due to the complexities associated with the site, developing a solution amicable to the stakeholders involved has delayed the repair of this revetment.

Table 5.22 Damage to Facilities in the Past 20 Years along the Lower White River has been reformatted, revised and updated to include current damages from 1990 and 2017.

Table 5.22 Damage to Facilities the along the Lower White River (1990-2017)

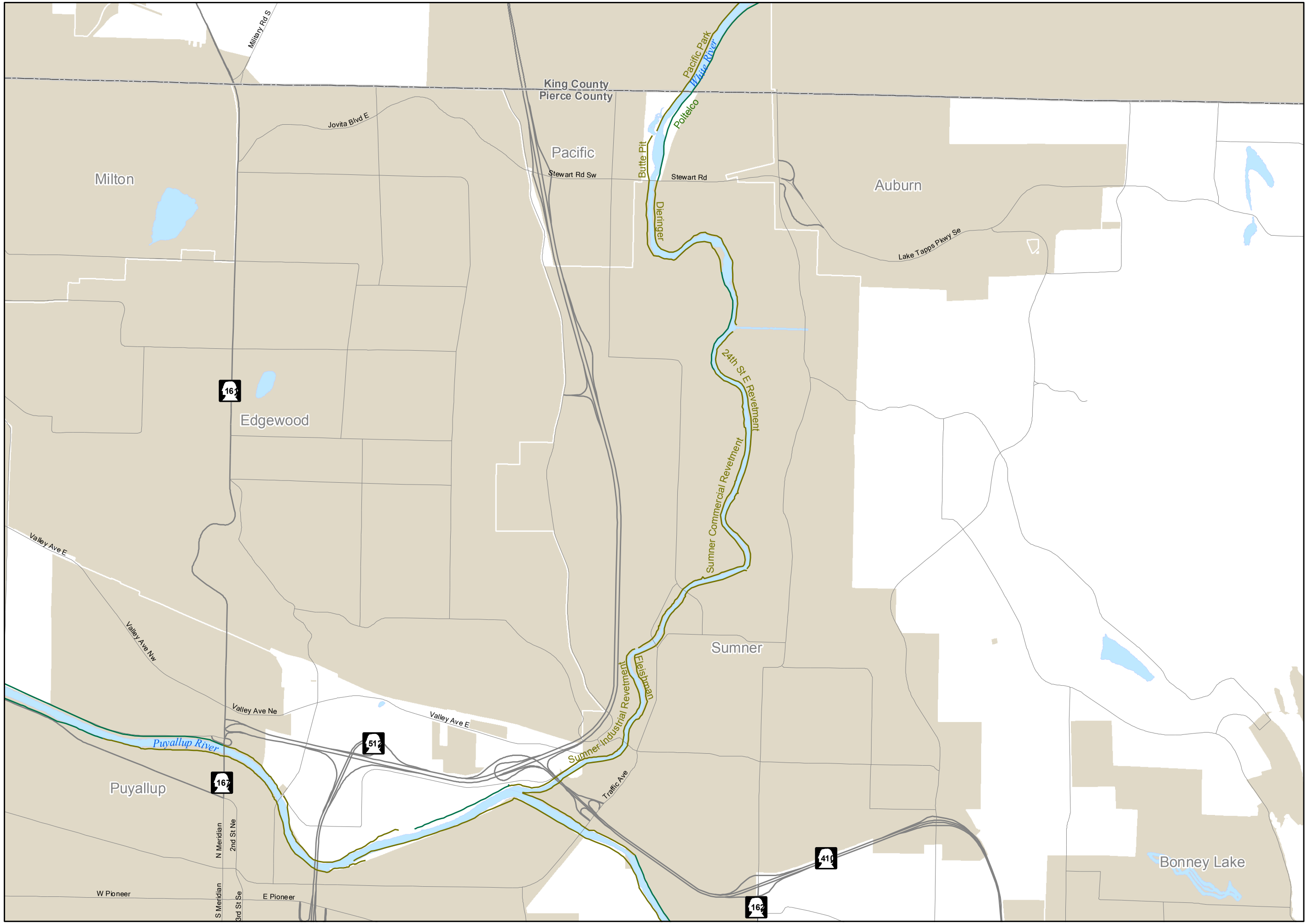
Storm Season	Segment Name	Bank	River Mile	Damage Lineal Feet	Damage
1990					
1990	Sumner Commercial Revetment	Right	W-49 2.0 & W-58 3.8	400	Partial washout.
1993					
1993	Sumner Commercial Revetment	Right	3.4	100	Toe and face scour.
2008					
2008	Potelco	Left	5.4	20	Damaged face rock.

Table 5.22 Damage to Facilities the along the Lower White River (1990-2017)					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2009					
2009	Potelco	Left	5.25	20	Damaged face rock.
2011					
2011	Potelco	Left	5.05 - 5.15	650	Levee overtopping from wetland.
2011	Potelco	Left	5.35 - 5.5	570	Levee overtopping flowing to wetland.
2011	Sumner Commercial Revetment	Right	3.85	100	Levee core erosion, toe and face rock failure.
2011	Sumner Industrial Revetment	Right	0.03	30	Culvert replacement.
2012					
2012	Sumner Commercial Revetment	Right	3.85	400	Levee core erosion, toe and face rock failure.
2012	Sumner Industrial Revetment	Right	0.03	30	Culvert replacement.
2013					
2013	Dierenger	Left	4.0	135	Erosion and scour protection installed by the City of Sumner's.
2014					
2014	Dierenger	Left	4.0	50	Erosion and scour of the City of Sumner's soft armoring.
2014	Potelco	Left	5.35 - 5.5	570	Levee overtopping flowing to wetland.
2015					
2015	Potelco	Left	5.3	50	Repairs spots where trees overtopped and damaged levee.
2017					
2017	Dierenger	Left	4.0	75	Old Sumner Levee repair site.
2017	Sumner Commercial Revetment	Right	3.8	530	Levee damage.

Figure 23

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Lower White River



- Levee
- Revetment
- Highway
- Major Road
- Water Body
- City
- County Boundary

Pierce County

N

6/26/2018

0 0.25 0.5 Miles

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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Key Accomplishments since the 2013 Flood Plan

The Lower White River Countyline Levee Setback Project (LB 5.0 - RB 6.33)

In 2009, significant flooding occurred in the City of Pacific affecting more than 100 residences. This flooding was caused by ongoing sedimentation in the White River. King County constructed a 6,000-foot setback levee to help address the loss of channel capacity and reduce flood elevations in the City of Pacific. This project was completed in the fall of 2017 and now provides significant flood risk reduction benefits. Project funding was provided by the King County Flood Control Zone District with partial funding from Pierce County, the Salmon Recovery Funding Board, and the Natural Resource Damage Assessment. Total project cost was $24 million. For more information about this project, please see the King County Natural Resources and Parks webpage.

https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/lower-white-river-countyline-a-street.aspx

The Pacific Right Bank Flood Protection Project (RM 6.3 – RM 5.5)

The Pacific Right Bank Flood Protection Project is the second of two projects along the Countyline reach of the White River. This project will be designed to reduce flood risk to homes and properties along the river's right (northwestern) bank in the City of Pacific. It will also provide habitat for threatened Chinook Salmon. Currently, this project is still in the initial scoping and design phase with an estimated project completion date of 2022. For more information about this project, please see the King County Natural Resources and Parks webpage.

https://kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/lower-white-river-right-bank.aspx

Land Purchases

There have been no land purchases or buyouts along the lower White River by Pierce County since 2013. However, 14-acres of property have been acquired by the City of Sumner between RM 3.8 and RM 4.9 for future use as a part of the Stewart to 16th street setback levee, Pacific Point Bar Setback Levee, and the White River Restoration. Additional floodplain property is anticipated to be purchased in the future.

Status Update on Recommended Capital Projects

LW1 State Street Flood Wall or Emergency Access

Project Update: The City of Sumner purchased the remaining private residents surrounding the Sumner Wastewater Treatment Plant and reached an agreement with Washington State Department of Transportation to allow for temporary emergency access from the Traffic Avenue exit ramp. This is not considered a permanent solution. The City has indicated a desire to continue to pursue the State Street Floodwall in the future.

Estimated Cost: **$1,150,000**

LW2 Lower White River Floodplain Restoration and Flood Protection

Project Update: Understanding of river conditions in the Lower White continue to evolve. A series of high water events between 2015 and 2016 revealed that the White River had a diminished carrying capacity and local areas were experiencing an increased risk of flooding at lower flow levels. The proposal identified in the 2013 Flood Plan anticipated a combination of setback levees, revetments and other methods to increase the capacity of the river during flood events. Beginning in late 2016, the City of Sumner initiated an effort to develop a comprehensive strategy for addressing increased flood risk on the river through the City. Early partners included: City of Sumner, Pierce County, Muckleshoot Indian Tribe, and the Puyallup Tribe of Indians. These efforts led to a common understanding of the issues presented by this section of the river and the development of an approach to concurrently reduce flood risk and increase floodplain habitat. The overall intent is to create a sustainable river system to the extent feasible in this reach of the river. The project area includes both left and right banks between RM 1.8 and RM 4.9 and will include setback levees, side channels, channel roughening, engineered log jams, revetments, property acquisitions and other methods to create a more sustainable system. This project has been divided up into segments:

- ***White River Restoration***, left bank RM 2.5 - RM 4.2
  Estimated Cost: $29,783,896; $20,000,000 for construction and remaining in engineering
- ***Pacific Point Bar***, right bank RM 3.9 – RM 4.9
  Estimated Cost: $4,596,280 for construction and engineering plus $8,000,000 for property acquisition
- ***Left Bank Setback***, left bank between RM 4.4 - RM 4.8
  Estimated Cost: $3,677,024 for construction and engineering plus $7,000,000 for property acquisition
- ***Stewart Road Bridge*** replacement (left and right bank RM 4.9)
  Estimated Cost: $35,438,708

Estimated Total Cost: Approximately: $88,495,909

Phase I of the project is led by the City of Sumner and will be located on the left bank between RM 2.5 and 4.2 and includes approximately 162 acres. More natural riverine processes will be created in part by excavating floodplain areas to create wetland and slough habitats. This will allow the river to interact with its floodplain at lower flows than it currently does. This strategy will also allow for some natural channel migration which is essential for the creation and maintenance of fish habitat. The side channels will be designed to provide off-channel habitat that juvenile fish need. Large woody debris in the main channel and side channels will also be designed to provide essential cover, pools and refugia

for juvenile and adult fish. The project is also expected to include riparian forest areas that will provide for long term accumulation of the large woody debris while also providing shade.

LW3 Butte Avenue Levee and Berm

Project Update: This project is currently within the Pierce County Surface Water Management Capital Facilities plan to begin preliminary design and engineering in 2019. Changes in the conditions in the river channel caused flooding in 2015 and 2016. As a result of this flooding, the City of Pacific installed a temporary pump station in Government Canal at the county boundary line to address back water flooding of surrounding properties. Additionally, Pierce County installed HESCO barriers to provide protection to Butte Avenue. A more permanent solution will be influenced by projects in King County (the Pacific Right Bank project), the Lower White River Floodplain Restoration and Flood Protection project and the City of Pacific's permanent pump station. All of these projects will become part of a longer-term strategy for the lower White River.

Estimated Cost: $6,334,770

UPPER WHITE RIVER UPDATES

Flood Damage to Facilities

The Greenwater Village Levee continued to experience partial toe rock displacement. Since the last update, the residents of Crystal Village Ranch funded, permitted and installed a buried rock groin along the left bank of the White River. The groin was installed to address the residents concern about the possibility of channel migration continuing to impact their development.

Table 5.27 Damage to Facilities in the Past 20 Years along the Upper White River has been reformatted, revised and updated to include current damages from 1990 to 2017.

Table 5.27 Damage to Facilities along the Upper White River 2013-2017

Storm Season	Segment Name	Bank	River Mile	Damage Lineal Feet	Damage
1996					
1996	Greenwater	Right	46.2	150	Toe/slope failure
1996	Greenwater	Right	46.2	100	Toe failure.
2006					
2006	Greenwater	Right	46.2	300	Face erosion.
2007					
2007	Greenwater	Right	45.0- 45.2	750	Face erosion.
2015					
2015	Greenwater	Right	45.2	30	Partial toe rock displacement and missing face rock.
2015	Greenwater	Right	45.2	20	Missing toe rock

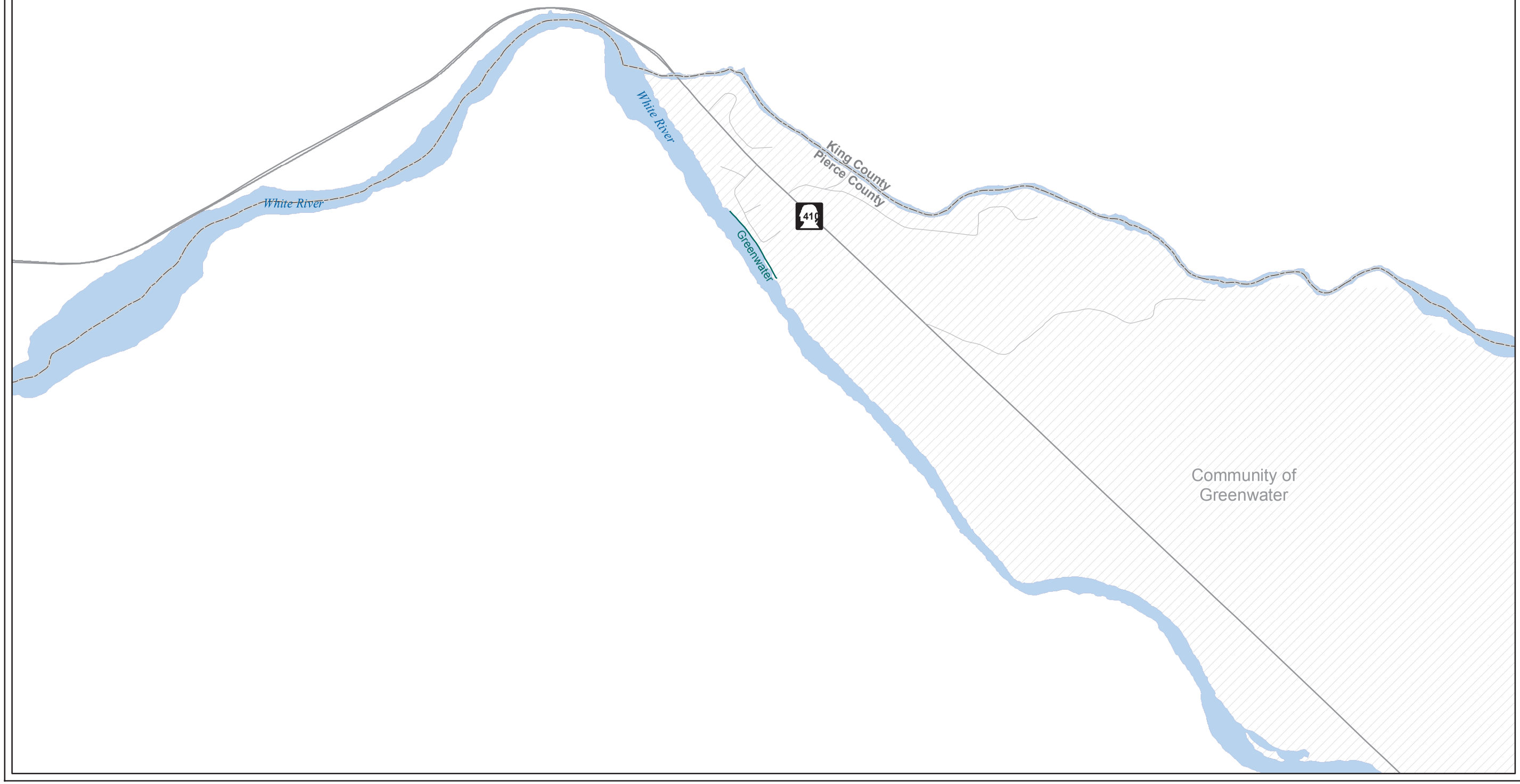
Land Purchases

There have been no land purchases or buyouts along the upper White River from 2013-2017.

Figure 24

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Upper White River



Levee
Highway
Residential Road
Water Body
Community
County Boundary

Pierce County

N

3/6/2018

0 0.1 0.2 Miles

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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GREENWATER RIVER UPDATES

Major Flooding

There has been no major flooding on the Greenwater River since 2013.

Key Accomplishments since the 2013 Flood Plan

Pierce County completed a Channel Migration Zone study in October 2017. The study focused on the lower 1.25 miles of the river where roads and homes are located. Above RM 1.25 is forest lands. A public meeting was held at the Greenwater Fire Station on November 29, 2017 to discuss this study with the residents of Greenwater as well as the process the County will use to adopt this stud.

Channel Migration Hazard Mapping

A channel migration zone study for the Greenwater was completed in October 2017. Pierce County contracted with Geo Engineers to study the lower 1.25 mile of the Greenwater River. This study is still in the early stages of the adoption process.

CARBON RIVER UPDATES

Flood Damage to Facilities

Table 5.36 Damage to Facilities in the Past 20 Years along the Carbon River has been reformatted, revised and updated to include current damages since between 1990 and 2017.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017

Storm Season	Segment Name	Bank	River Mile	Damage Lineal Feet	Damage
1990					
1990	Alward 1	Left	C-36 6.8	750	Reconstruction
1990	Alward 1	Left	C-37 & 38 7.2	1300	Reconstruction
1990	Bridge Street	Left	C-17 3.2	175	Washout
1990	Guy West	Left	C-31 5.9	400	Reconstruction
1990	Lindsay	Right	C-2 0.4	250	Levee slope protection damage.
1990	Lindsay	Right	0.8	400	Reslope and replace levee washed out by flood.
1990	Riddell	Left	C-2 0.4	400	Reslope and replace levee washed out by flood.
1990	Riddell	Both	0.9	400	Reslope and replace levee washed out by flood.
1990	Riddell	Left	C-5 0.9	150	Levee slope protection damage.
1990	Ski Park	Right	6.0	770	Flood damage repair.
1990	Ski Park	Right	C-34 6.4	300	Washout
1990	Ski Park	Right	C-34 6.4	500	Reconstruction
1990	Ski Park	Right	6.5	300	Reshape and replace rip rap and toe rock.
1990	Ski Park	Right	6.8 and 7.6	1550	Flood damage repair.
1990	Ski Park	Right	C-32 6.1	900	Reconstruction
1990	South Prairie Confluence	Right	C-31 5.9	100	Reconstruction
1995					
1995	Alward 1	Left	6.7	350	Partial washout
1995	Alward 1	Left	6.9	150	Full levee washout.
1995	Alward 1	Left	7.1	700	Full levee washout.
1995	Alward 1	Left	7.3	100	Partial washout.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1995	Alward 2	Left	6.2	255	Repair partially failed embankment.
1995	Alward 2	Left	6.3	250	Partial washout.
1995	Guy West	Left	4.6	100	Full levee washout
1995	Guy West	Left	4.9	100	Partial washout.
1995	Lindsay	Right	0.8	379	Toe/slope failure.
1995	Ski Park	Right	6.9	200	Partial washout.
1995	Ski Park/Alward 1	Both	6.9, 7.3, & 7.4	730	Rebuild fully washed out levee.
1996					
1996	Alward 1	Left	6.6	400	Toe failure.
1996	Alward 1	Left	6.9	200	Toe failure.
1996	Alward 1	Left	7.2	400	Total levee failure.
1996	Alward 1	Left	7.2	850	Total levee failure.
1996	Alward 2	Left	6.05	250	Toe/slope failure.
1996	Alward 2	Left	6.25	250	Toe/slope failure.
1996	Alward 2	Left	6.3	100	Toe/slope failure.
1996	Bridge street	Left	3.2	50	Toe/slope failure.
1996	Bridge street	Left	3.6	350	Total levee failure.
1996	Fish Ladder	Left	6.4	50	Toe/slope failure.
1996	Guy West	Left	4.6	100	Total levee failure.
1996	Guy West	Left	4.9	100	Toe/slope failure.
1996	Lindsay	Right	0.2	450	Toe/slope failure.
1996	Lindsay	Right	0.5	50	Toe/slope failure.
1996	Lindsay	Right	0.6	80	Toe/slope failure.
1996	Lindsay	Right	0.95	50	Toe/slope failure.
1996	Lindsay	Right	1.0	30	Toe failure.
1996	Lindsay	Right	1.1	40	Toe failure.
1996	Lindsay	Right	1.2	125	Toe/slope failure.
1996	Orting Treatment Plant	Left	2.7	20	Toe/slope failure.
1996	Riddell	Left	0.4	100	Toe/slope failure.
1996	Riddell	Left	0.8	30	Toe/slope failure.
1996	Riddell	Left	1.05	20	Toe/slope failure.
1996	Ski Park	Right	7.1	800	Total levee failure.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1996	Ski park	Right	6.18	40	Toe/slope failure.
1996	Ski park	Right	6.9	320	Total levee failure.
1998					
1998	Alward 1	Left	6.9	150	Repair levee.
1998	Alward 1	Left	7.6	150	Repair levee.
1998	Alward 1	Left	8.0	200	Repair levee.
2003					
2003	Guy West	Left	5.4	260	Partial washout of the toe and levee facing.
2003	Ski Park	Right	6.6	450	Partial washout of the toe and levee facing.
2005					
2005	Alward 1	Left	6.6	450	Replace/ reconstruct/repair.
2005	Alward 1	Left	7.6	750	Replace/ reconstruct/repair.
2006					
2006	Alward	Left	8.3	100	Face erosion.
2006	Alward	Left	8.3	300	Face erosion.
2006	Alward 1	Left	7.2 - 7.4	750	Washout
2006	Alward 1	Left	7.5	1200	Washout
2006	Alward 1	Left	7.6	700	Washout
2006	Alward 1	Left	8.2	150	Face erosion.
2006	Alward 2	Left	6.0 - 6.1	600	Face erosion.
2006	Alward 2	Left	6.3	600	Washout
2006	Bridge street	Left	3.2	50	Washout
2006	Bridge street	Left	3.6	120	Washout
2006	Bridge street	Left	3.6	200	Face erosion.
2006	Guy west	Left	4.6 - 4.9	1700	Toe erosion/undercut bank
2006	Guy west	Left	4.8	150	Washout
2006	Guy west	Left	4.8	100	Washout
2006	Guy west	Left	4.8	140	Washout
2006	Guy west	Left	5.0	270	Face erosion.
2006	Guy west	Left	5.2	150	Face erosion.
2006	Guy west	Left	5.4	30	Washout
2006	Lindsay	Right	0.8	60	Fracture
2006	Lindsay	Right	1.2	150	Washout
2006	Lindsay	Right	17.4	50	Face erosion.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2006	Riddell	Left	0.2	50	Slump
2006	Riddell	Left	0.4	0	Overtopping
2006	Riddell	Left	1.2	0	Overtopping
2006	Ski park	Right	6.0	500	Washout
2006	Ski park	Right	6.0	300	Washout
2006	Ski park	Right	6.3	100	Face erosion.
2006	Ski park	Right	6.4	500	Washout
2006	Ski park	Right	6.8	550	Washout
2006	Voights d.s.	Left	3.8	180	Face erosion.
2006	Voights u.s.	Left	4.2	20	Fracture
2006	Voights u.s.	Left	4.4	110	Restore levee face and toe.
2007					
2007	Alward 1	Left	6.6 - 6.7	810	Reconstruct new levee prism and set new face rock.
2007	Alward 1	Left	6.8 - 7.0	1250	Reconstruct levee prism, set new toe, and face.
2007	Alward 1	Left	7.2 - 7.4	850	Reconstruct new levee prism and set new face rock.
2007	Alward 1	Left	8.1	390	Replaced toe and re-slope and replaced face rock.
2007	Alward 1	Left	8.0	450	Re-establish toe and repair face.
2007	Bridge Street	Left	3.6 - 3.7	0	Overtopping
2007	Guy West	Left	5.0	500	Set new toe and re-slope face.
2007	Lindsay	Right	0.8	600	Replace/ reconstruct/repair
2007	Lindsay	Right	1.2	450	Re-establish toe and repair face.
2007	Ski Park	Right	6.0	540	Replace/ reconstruct/repair
2007	Ski Park	Right	6.8	800	Re-establish toe and repair face.
2008					
2008	Alward 1	Left	7.0	100	Face scour and loss face rock.
2008	Alward 1	Left	7.2 - 7.3	796	Toe scour and loss of face rock. Lower face slumping.
2008	Alward 1	Left	8.0	100	Toe scour and loss of face rock. Lower face slumping.
2008	Alward 1	Left	8.1	100	Toe scour and loss of face rock. Lower face slumping.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2008	Alward 1	Left	8.25	150	Toe scour and loss of face rock. Lower face slumping.
2008	Alward 2	Left	6.0	824	Face rock thin due to scour.
2008	Alward 2	Left	6.25	302	Toe scour and loss face rock.
2008	Alward 2	Left	6.35	136	Toe scour and loss face rock.
2008	Bridge Street	Left	3.5	300	Toe scour and loss face rock
2008	Bridge Street	Left	3.55 - 3.7	325	Routine maintenance to the existing levee structure.
2008	Bridge Street	Left	3.6 - 3.7	380	Toe and face scour.
2008	Fish Ladder	Left	6.4	171	Toe scour and loss face rock.
2008	Guy West	Left	4.7	296	Scalloped washout.
2008	Guy West	Left	4.8	1,200	Re-establish levee core to inhibit lateral piping during high water.
2008	Guy West	Left	5.0	290	Replace undersized face rock.
2008	Guy West	Left	5.2	196	Replace undersized face rock.
2008	Guy West	Left	5.3	253	Toe scour and loss face rock.
2008	Lindsay	Right	1.0	50	Toe rock failure and partial face rock failure.
2008	Orting Treatment Plant	Left	2.0	25	Toe scour and loss face rock.
2008	Riddell	Left	0.4 - 0.5	634	Toe scour and loss face rock.
2008	Riddell	Left	0.9 - 1.10	500	Washout of the toe and levee face.
2008	Ski Park	Right	6.0	336	Toe scour and loss of face rock.
2008	Ski Park	Right	6.25	140	Toe scour and loss of face rock.
2008	Ski Park	Right	6.45 - 6.6	900	Face scour and loss face rock.
2008	Ski Park	Right	7.0	139	Washout
2008	Voights u.s.	Left	4.2	324	Washout
2008	Voights u.s.	Left	4.4	123	Toe and face scour.
2009					
2009	Alward 1	Left	7.5	118	Face scour with core exposure. Possibly some toe loss. Bank is undercutting.
2009	Alward 2	Left	6.35	140	Toe scour and loss face rock.
2009	Fish Ladder	Left	6.4	110	Lower face scour.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2009	Lindsay	Right	0.6	30	Facing rock failure.
2009	Lindsay	Right	0.9	75	Facing rock failure.
2009	Lindsay	Right	0.9	180	Re-establish toe and repair face.
2009	Lindsay	Right	16.9 - 16.95	100	Toe and facing rock failure.
2009	Riddell	Left	0.4	0	Overtopping
2009	Ski Park	Right	5.95	50	armored spillway/notch
2009	Ski Park	Right	6.2	255	Face scour with loss of most face rock.
2009	Ski Park	Right	6.25	144	Primary lower face scour causing upper face to slough.
2009	Ski Park	Right	6.4	310	Face scour with loss of most face rock.
2009	Ski Park	Right	6.75	200	Lower face scour.
2009	Ski Park	Right	6.45 - 6.6	400	Toe scour and loss of embankment.
2011					
2011	Alward 1	Left	7.1	75	Face and potential toe rock failure.
2011	Alward 1	Left	7.55	90	Toe and face rock failure.
2011	Alward 1	Left	8.05	130	Toe and face rock failure.
2011	Alward 1	Left	8.15	50	Face rock failure.
2011	Bridge Street	Left	3.35	30	Toe and face rock failure.
2011	Bridge Street	Left	3.45	120	Face rock failure.
2011	Guy West	Left	4.8	270	Undermining levee.
2011	Guy West	Left	5.3	70	Toe/face scour.
2011	Orting Treatment Plant	Left	2.0	129	Toe and rock failure.
2011	Riddell	Left	1.0	140	Toe is scoured out along with some face rock.
2011	Riddell	Left	1.1	400	Toe is scoured out along with some face rock.
2011	Riddell	Left	1.6	210	Undermined section with prism showing in sections.
2011	Voights d.s.	Left	3.75	90	Partial damage to facing rock.
2011	Voights d.s.	Left	3.8	130	Damage to toe and face rock.
2011	Voights u.s.	Left	4.2	700	Some toe rock failure.
2012					
2012	Alward 1	Left	7.1	250	Face and potential toe rock failure

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2012	Alward 1	Left	8.05 - 8.15	350	Toe and face rock failure.
2012	Bridge Street	Left	3.35	60	Face and toe scour.
2012	Bridge Street	Left	3.4	45	Facing and toe scour.
2012	Bridge Street	Left	3.45	120	Face rock is gone.
2012	Guy West	Left	4.8	270	Levee undermined along toe.
2012	Guy West	Left	5.3	170	Toe & face rock failing.
2012	Orting Treatment Plant	Left	2.0	129	Toe and face rock failure.
2012	Riddell	Left	0.4	634	Toe scour and loss of face rock.
2012	Riddell	Left	1.0	140	Toe is scoured out along with some face rock.
2012	Riddell	Left	1.6	210	Undermined trees are pulling apart face rock.
2012	Voights d.s.	Left	3.8	130	Some minor damage to face rock.
2012	Voights u.s.	Left	4.2	700	Some toe rock failure.
2013					
2013	Alward 1	Left	7.0 - 7.1	400	Toe & face rock failing.
2013	Alward 1	Left	7.2	150	Minor toe rock repair.
2013	Fish Ladder	Left	6.4	100	Toe & face rock failure.
2013	Guy West	Left	5.5	250	Toe & face rock failing.
2013	Orting Treatment Plant	Left	2.0	150	40 LF of prism core exposed.
2013	Riddell	Left	1.6	250	Missing face and toe rock.
2014					
2014	Guy West	Left	5.75	250	Face rock failure.
2014	Riddell	Left	0.5	500	Toe scour and loss face rock.
2014	Riddell	Left	1.6	260	Toe & face rock failure.
2014	Ski Park	Right	6.0	100	Toe and face erosion.
2015					
2015	Alward 1	Left	6.55	200	Levee Rehabilitation
2015	Alward 1	Left	7.1	40	Missing toe rock.
2015	Alward 1	Left	7.2	390	Levee rehabilitation.
2015	Alward 1	Left	7.9	100	Large log jam diverting flows/jet scour into levee.
2015	Alward 1	Left	7.9	20	Log jam is gone that forced flows into levee.
2015	Alward 1	Left	7.9	120	Toe and face rock damaged from large log Jam.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2015	Alward 1	Left	8.1	60	Toe rock missing.
2015	Alward 1	Left	8.2	40	Missing Toe Rock in 3 locations.
2015	Alward 1	Left	8.2	30	Missing Toe Rock in 3 locations.
2015	Alward 1	Left	8.2	150	Large scour has formed at the toe of the levee. Toe and face rock has fallen into scour hole.
2015	Alward 2	Left	6.35	100	Levee rehabilitation.
2015	Alward 2	Left	6.2 -6.3	490	Levee rehabilitation.
2015	Bridge Street	Left	3.35	200	Levee rehabilitation.
2015	Bridge Street	Left	3.4	130	Face rock missing.
2015	Fish Ladder	Left	6.35 - 6.4	200	Rock displaced
2015	Fish Ladder	Left	6.35	100	Levee rehabilitation
2015	Fish Ladder	Left	6.4	34	Missing Toe rock.
2015	Fish Ladder	Left	6.4	16	An additional 16 feet of revetment damaged from flood event.
2015	Fish Ladder	Left	6.4	100	Emergency repair
2015	Fish Ladder	Left	6.45	150	Face and Toe Rock missing.
2015	Guy West	Left	4.65	150	Levee rehabilitation.
2015	Guy West	Left	4.8	360	Levee rehabilitation.
2015	Guy West	Left	5.3 - 5.35	375	Levee rehabilitation.
2015	Guy West	Left	5.2	40	Missing toe and face rock.
2015	Guy West	Left	5.75	150	Missing toe rock
2015	Lindsay	Right	1.2	150	Toe rock missing.
2015	Lindsay	Right	0.8	30	Missing toe rock and face rock slumping.
2015	Lindsay	Right	0.8	200	Trees were undermined and then pulled out a section of face rock in several locations.
2015	Lindsay	Right	0.8	125	Missing toe rock and face rock.
2015	Riddell	Left	0.55	60	Missing face rock
2015	Ski Park	Right	6.2 - 6.3	735	Levee rehabilitation.
2015	Ski Park	Right	6.20	40	Section of toe rock missing.
2015	Ski Park	Right	6.25	180	Missing toe and face rock.
2015	Ski Park	Right	6.80	200	Vertical face along inside radius of river bend.
2015	Ski Park	Right	6.80	200	Vertical face.
2015	Voights d.s.	Left	3.8	120	Missing toe and face rock.
2015	Voights d.s.	Left	3.8	140	Levee rehabilitation

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2015	Voights u.s.	Left	4.2	40	Partial undermining thru two repair sites in trees section.
2015	Voights u.s.	Left	4.2	80	Missing toe and face rock.
2015	Voights u.s.	Left	4.2	90	Missing toe and face rock.
2015	Voights u.s.	Left	4.3	20	Tree pulled out a chuck of face and toe rock.
2015	Voights u.s.	Left	4.3	50	Tree pulled out a chuck of face and toe rock
2015	Voights u.s.	Left	4.3	100	Large Cedar tree and Alder tree pulled a section of levee down.
2017					
2017	Alward 1	Left	7.9	120	Toe and face rock damaged from large log Jam.
2017	Alward 1	Left	8.1	100	Toe rock missing. Scalloped along toe.
2017	Alward 2	Left	6.20	478	Reconstruction/preservation.
2017	Alward 2	Left	6.000	150	Unacceptable PL 84-99 tie in, proposing slightly setback levee alignment to tie into former Railroad embankment.
2017	Bridge Street	Left	3.4	130	Face rock failure. Face rock missing.
2017	Bridge Street	Left	3.7	120	Toe and face rock.
2017	Bridge Street	Left	3.4	340	Loss of toe and face rock.
2017	Bridge Street	Left	3.1	200	Loss of toe rock.
2017	Fish Ladder	Left	6.4	200	Loss of bank between 177th and the end of Alward 1 Levee.
2017	Guy West	Left	5.75	150	Toe & face rock failure.
2017	Orting Treatment Plant	Left	2.3	20	Portion of face rock missing.
2017	Orting Treatment Plant	Left	2.7	40	Toe rock failure.
2017	Orting Treatment Plant	Left	2.7	140	Partial of face rock missing.
2017	Orting Treatment Plant	Left	2.1	75	Levee face damage.
2017	Riddell	Left	1.2 - 1.3	500	Toe rock failure.

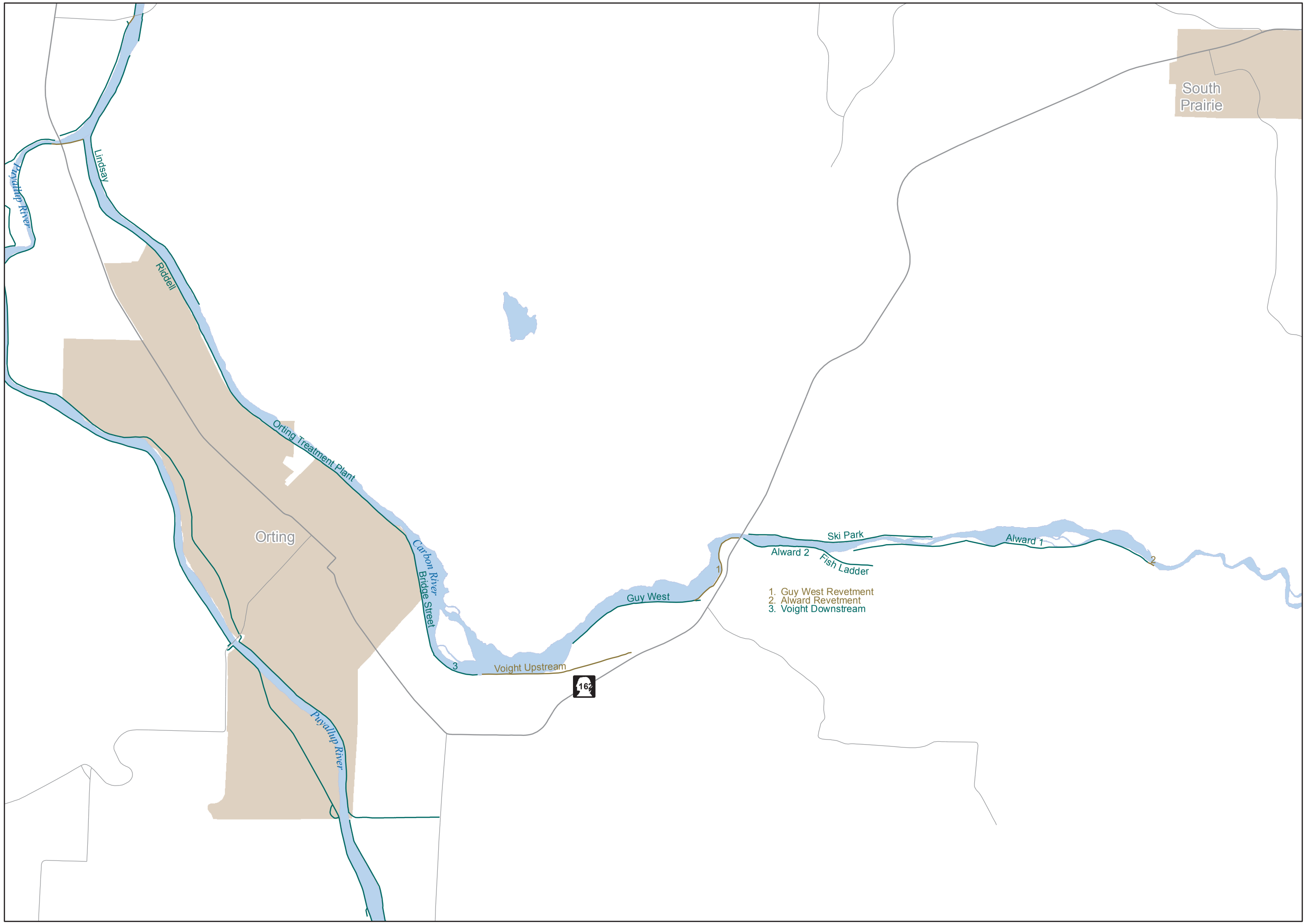


Figure 25

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Carbon River

Levee
Revetment
Highway
Major Road
Water Body
City

Pierce County

N

3/6/2018

0 0.25 0.5 Miles

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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Key Accomplishments since the 1991 Flood Plan

During the January 2009 storms, the Voights Creek Fish Hatchery facilities was just one of many facilities that was damaged due to record flooding. This event triggered a presidential disaster declaration, making funds available to public entities for disaster-related damage. FEMA provided financial assistance to the Washington State Department of Fish and Wildlife (WDFW) to replace and relocate the fish hatchery with a new facility outside of the 100-year floodplain. WDFW requested funding assistance from the State Legislature for the repair and replacement of the flood-damaged fish hatchery. The project was approved for funding using state appropriations and federal funds. Since the 2013 Flood Plan was adopted, this project has been completed with coordination and support from the Puyallup Tribe of Indians.

Land Purchases

The following land and home acquisitions have occurred since 2013, using a combination of federal and state grant funds and local match.

- In 2014, one property was acquired along Alward Road area (1.05 acres);
- In 2015, one property was acquired along Alward Road area (5.69 acres);
- In 2016, five properties were acquired along Alward Road area (4.36 acres);
- In 2017, four properties were acquired along Alward Road (4.54 acres).

Status Update on Recommended Capital Projects

C1 Carbon Confluence Setback Levee

Project Update: No project update is available at this time.

Estimated Cost: **$5,954,413**

C2 Carbon Levee Bank Stabilization / Flow Deflection and Cheese Creek Backwater improvements

Project Update: There has been an interest by local stakeholders to modify this project to include the construction of the Bridge Street Setback Levee identified in the 2008 Setback Feasibility Study. The goal and objective for this project is to construct a setback levee that has multiple benefits such as flood reduction, floodplain reconnection, and fish habitat. The concept is preliminary planning and conceptual design and will be looked at in future updates for inclusion within the Flood Plan.

Estimated Cost: **$3,033,380**

C3 Alward Road Floodplain Acquisition

Project Update: No project update is available at this time.

Estimated Cost: **$1,348,169**

C4 Alward Road Floodplain Acquisition and Setback Levee

Project Update: This project is currently in the project acquisition phase. Once this project has been completed, it will allow the river to revert back to its natural condition in perpetuity. -To date, SWM has purchased 53 of 81 properties between the river and 177th Street East. This project was originally scoped to include a setback levee however, a value engineering study will be conducted in 2019 to evaluate other alternatives.

Estimated Cost: **$27,517,187**

See Figure 26

C5 Upper Carbon/Fairfax Road Bank Stabilization

Project Update: No project update is available at this time.

Estimated Cost: **$ 1,685,211**

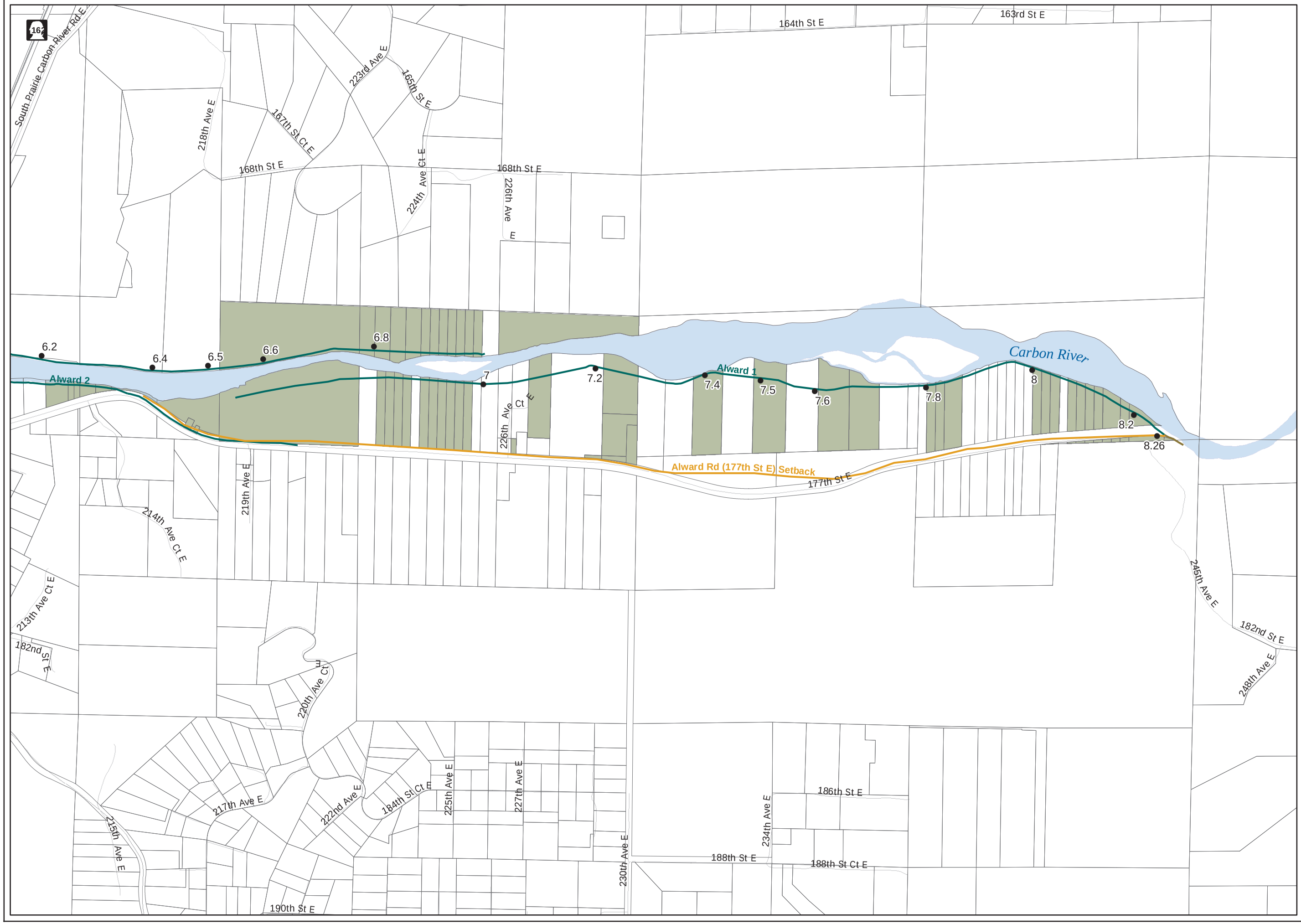


Figure 26

River Flood Hazard Management Plan

C4 Alward Road Floodplain Acquisition and Setback Levee

- River Milepost
- Proposed Setback Levee
- Levee
- Revetment
- Highway
- Major Road
- Residential Road
- Surface Water Management Properties
- Tax Parcels
- Water Body

Pierce County

N

3/6/2018

0 462.5 925 Feet

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SOUTH PRAIRIE CREEK UPDATES

Flood Damage to Facilities

Since the plan was adopted in 2013, there has been no damage to facilities located on South Prairie Creek.

Status Update on Recommended Capital Projects

SP1 South Prairie Floodplain Acquisition

Project Update: No project update is available at this time.

Estimated Cost: $ 640,380

SP2 South Prairie Fire Station Flood Protection

Project Update: Flood valves on the storm drains in the Fire Station were installed in 2010. This project is complete.

Estimated Cost: **$ 446,400**

See Figure 27



Figure 27

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MIDDLE NISQUALLY RIVER UPDATES

Flood Damage to Facilities

There are no flood control facilities in this reach.

Status Update on Recommended Capital Projects

MN1 McKenna Area Flood Plain Acquisition and Structure Elevation

Project Update: No project update is available at this time.

Estimated Cost: **$12,245,868**

UPPER NISQUALLY RIVER UPDATES

Flood Damage to Facilities

Table 5.48 Damage to Facilities in the Past 20 Years along the Upper Nisqually River has been reformatted, revised and updated to include current damages since between 1990 and 2017.

Table 5.48 Damage to Facilities in the Upper Nisqually River 1990-2017

Storm Season	Bank	River Mile	Damage Lineal Feet	Damage
1991				
1991	Right		0	Gravel removal & dike construction.
2003				
2003	Right	64.7	219	Partial washout of the toe and levee facing.
2003	Right	64.8	137	Partial washout of the toe and levee facing.
2003	Right	65.0	547	Partial washout of the toe and levee facing.
2004				
2004	Right	64.8	1200	Partial washout of the toe and levee facing.
2005	Right	65.1	850	Partial washout of the toe and levee facing.
2005	Right	65.13	70	Partial washout of the toe and levee facing.
2006				
2006	Right	64.6	200	Face erosion.
2006	Right	64.9	100	Washout
2006	Right	65.1 - 65.4	1600	Washout
2008				
2008	Right	64.8	400	Toe scour and loss of face rock.
2008	Right	65.1 - 65.3	1150	Toe Scour and Loss of face rock.
2008	Right	65.3 - 65.4	600	Toe scour and loss of face rock.
2010				
2010	Right	65.25 - 65.4	700	Severe toe scour.
2011				
2011	Right	64.6	150	Toe & face scour.
2011	Right	65.05 - 65.25	1100	Severe toe scour.

Table 5.48 Damage to Facilities in the Upper Nisqually River 1990-2017				
Storm Season	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2012				
2012	Right	64.65	100	Active toe scour w/ face sloughing.
2012	Right	64.75	100	Active toe scour w/ face sloughing.
2012	Right	64.85 - 65.05	1000	Severe toe scour and loss of lower face.
2015				
2015	Right	64.8	320	Missing face rock near toe.
2015	Right	65.4	300	Major toe scour along the road.
2017				
2017	Right	65.4	300	Toe scour and loss of face rock.
2017	Right	64.77	90	Under cut toe, dislodged riprap, voids.
2017	Right	64.97	200	Toe rock failure.
2017	Right	65.02	30	Toe rock may be missing.
2017	Right	64.6	150	Toe rock has been scoured out.

Status Update on Recommended Capital Projects

See Figure 29



Figure 28: Image of the Upper Nisqually site. December 2017.

UN1 Nisqually Park Subdivision Levee Protection/ UN 2 Upper Nisqually/Mt. Rainier National Park Revetment Retrofits/ELJs

Project Update: The UN1/UN2 projects have been combined into one project and are delineated by the Mount Rainier National Park (MNRP) boundary. The project continues upstream from the park boundary 2100 L and downstream 2600LF. This project consists of constructing 28 flow deflectors along the existing levee to redirect damaging high flows away from the face of the levee, reducing reoccurring damages, and increasing the flood protection of the MRNP access road. Primary benefits for this project are habitat improvement and flood risk reduction.

Estimated Cost: **$1,683,172**

564th St Ct E
380th Ave Ct E
565th St Ct E
382nd Ave Ct E
566th St E
383rd Ave Ct E
567th St Ct E
382nd Ave Ct E
568th St Ct E
384th Ave Ct E
386th Ave E
387th Ave Ct E
570th St Ct E
Mount Rainier
National Park
706
64.3
64.4
64.5
64.6
64.7
64.8
64.9
65
65.1
65.2
65.3
65.4
65.5
Nisqually River
Pierce County
Lewis County
Nisqually Park

Figure 29

River Flood Hazard Management Plan

UN1 Nisqually Park Levee Protection and UN2 Upper Nisqually/ Mt. Rainier National Park Revetment Retrofit/ELJs

- River Milepost
- Levee
- Highway
- Residential Road
- Water Body
- National Park
- County Boundary

Pierce County

N

3/6/2018

0 250 500 Feet

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Figure 30

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Upper Nisqually River

Mount Rainier National Park

706

Nisqually Park

Nisqually River

Pierce County
Lewis County

Wold Rd

Wold Rd

Skate Creek Rd N

Elderberry Ln

Levee
Highway
Residential Road
Water Body
National Park
County Boundary

Pierce County

N

3/6/2018

0 0.1 0.2 Miles

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MASHEL RIVER UPDATES

Status Update on Recommended Capital Projects

M1 – SR-161 Mashel River Bridge – Bridge Scour and Slope Repair Project

Project Update: WSDOT completed this project.

Estimated cost: $2,246,948- $2,808,685

CHAPTER FIVE ERRATTA

The errata sheet for Chapter Five focused on providing clarifications, revised river miles, updated numbers to reflect changes between 2013 and today, updated information on current flood damages, updates on channel migration hazards, and other minor errors in facts or spelling.

CHAPTER SIX
FLOOD PLAN IMPLEMENTATION AND FUNDING

PLAN IMPLEMENTATION

Role of Tribes in Implementation

Representatives from two tribes were invited and participated in the Flood Plan Advisory Committee to provide input on Plan development and ensure their views and concerns were addressed. The importance of maintaining good relationships with the local tribes cannot be understated. Pierce County is committed to continuing to coordinate and communicate with the tribes as the projects, policies, and strategies described in this plan and future updates are implemented.

Role of Tribes in Flood Hazard Management Planning

The Disaster Mitigation Act of 2000 requires a FEMA mitigation plan for State, local, and tribal governments as a condition of mitigation grant assistance. The Puyallup Tribe of Indians Mitigation plan was completed in 2012 and was a compilation of over five years of work. In accordance with Federal requirements, the Puyallup Tribe of Indians developed an All Hazards Mitigation plan that was adopted and approved in 2017 and will expire in 2022.

One of many elements to having a FEMA approved mitigation plan is to develop mitigation measures to help achieve goals and objectives to reduce the effects of flood hazards on the reservation. Strategies identified within the Puyallup Tribe of Indians Hazard Mitigation Plan include:

- Join the NFIP- The Tribe will continue to evaluate joining the National Flood Insurance Program over the next five years and the county is committed to providing assistance throughout this process.
- Development of a floodplain ordinance and resolution. Currently, the tribe does not have an ordinance that outlines floodplain regulations but they continue to make progress to develop one.

For additional information on the Puyallup Tribe of Indians All Hazards mitigation strategies, please refer to the link below:

http://www.puyallup-tribe.com/publicsafety/hazard_mitigation_plan/2017Section_5_PTI%20Mitigation.pdf

As a result of extensive research that has been developed on the impacts of climate change, the Puyallup Tribe of Indians also developed a Climate Change Impact Assessment and Adaptation Plan in 2016. This plan is being used as one of many models to develop the Pierce County Climate Change Resilience Strategy.

For additional information on this climate plan, please refer to the link below:

http://www.puyallup-tribe.com/tempFiles/PuyallupClimateChangeImpactAssessment_2016_FINAL_pages.pdf

Role of Tribes in Planning, Implementation, and Permitting

The county and the tribes have continued to work collaboratively before and after flood events. Repairs of levee damage continue to be expedited when scour cuts occur along the face of levees that are near the reservations. A levee vegetation management program was started in 1985 which outlined a basic policy of cooperation between the Puyallup Tribe of Indians and Pierce County. The goal of this program was to set standards for riparian vegetation management, removal, and maintenance.

The tribes have also assisted the county with long term habitat improvements through improved flood risk reduction and mitigation efforts. The Puyallup Tribe of Indians was highly instrumental in assisting the County with the Soldiers Home Setback project (RM 21.3 and 22.3). The project restored an estimated 70-acres of Puyallup River floodplain to historic pre-levee conditions for fish and wildlife. Restoration was accomplished by constructing a new setback levee and setting it back approximately 950 feet from the Puyallup River. The new setback levee provides increased flood protection (100-year level of protection) as well as it allows the river to naturally meander in the opened floodplain area. The Puyallup tribe contributed $2.3 million in Natural Resource Damage Assessment (NRDA) funding for this project. This grant program provides for the protection of public resources through



Figure 31: Image of the Soldiers Home Setback Levee



Figure 32: Image of the Soldiers Home Setback Levee

mitigation planning and approval.

The Puyallup Tribe of Indians also assisted the county with the 96th Street Oxbow which was an identified project in the Puyallup Tribe Fisheries Site Restoration Catalog. This project replaced an existing culvert under the Puyallup River levee located north of the 96th Street East bridge along the Puyallup River (about RM 14.1) and reconnected an oxbow and an associated wetland to the main stem of the Puyallup River. A $60,000 flood study was

required as a part of this project. This cost was split between the Puyallup Tribe of Indians and the United States Army Corps of Engineers (USACE).

The Muckleshoot and the Puyallup Tribe of Indians have also partnered with the County to reduce flood risks and channel migration zone issues along the major rivers. In 2003, the Muckleshoot Tribe provided input on the Geomorphic Evaluation and Channel Migration Zone Analysis for the Puyallup, Carbon, and White Rivers. In 2008, the Puyallup Tribe provided valuable input on the Levee Setback Feasibility Analysis for the Puyallup River. More recently in 2017, the County conducted a channel migration zone (CMZ) study along the Greenwater River where the Muckleshoot tribe provided valuable data and aerial photos to assist Geo Engineers with completing this study.

FUNDING

The 2013 Flood Plan recommended a new county-wide funding source which has since been implemented. SWM expends up to $8 million per year on floodplain maintenance, programs and capital improvement projects. SWM funds the feasibility, engineering, and construction of capital projects through local and external funding sources. Local funding sources are the SWM Utility Service Charge (SWM Fees) Real Estate Excise Tax (REET), and Flood Control Zone District (FCZD). External funds consist of grants and partnerships from state, local and federal agencies and jurisdictions.

Local Sources of Funding

Grants and Cost-Share Funding

In 2018, external funds such as Flood Control Zone District, and state and federal grants accounted for 54 percent of SWM's River projects, while local funds only made up 46 percent. The primary sources of external funding to implement flood damage and mitigation projects include: The Federal Emergency Management Agency (FEMA), State of Washington Department of Ecology (WDOE) and Salmon Recovery Board Funding (SRFB). Some of SWM's larger capital projects highlighted in the Flood Plan, such as The Orville Road Acquisition and Revetment Phase 2 project (1413) received hundreds of thousands of dollars from multiple agencies simultaneously by leveraging local funds to external grant revenue. This project is one of the County's largest undertakings in achieving multiple benefits with the least amount of local funds. The County was successful by leveraging local funds to maximize external grant revenue. By expanding the scope of the project by including habitat restoration components, the County reduced flood risk to the rural Orting community in a way that benefits threatened species of salmon. This inclusion of habitat restoration for endangered salmonid species increased the ability to obtain state and federal grant funds, which allowed the County to complete a large scale, multiple benefit project with only $300,000 of local SWM funds. The total project cost is almost $8.5 million, approximately $1 million of which is budgeted as local funds. Flood Control Zone District, state and federal grants will account for 88 percent of the total project cost.

This example of the leveraging of funds is the reason SWM can sustain over 30 capital projects at one time. Operating on local funding alone would require more than an 80 percent reduction in capital projects in the Flood Plan.

Surface Water Management Service Charge

In 2018, $3.4 million of the SWM service charges will be directed toward capital projects. This includes $1.7 million of SWM's cash reserve. Capital projects will see a $1 million increase in SWM fee revenue from 2017.

Flood Control Zone District

Since 2014, SWM has received an estimated $11 million for capital projects from the Flood Control Zone District to reduce flood risk and address channel migration problems. For additional information on the projects that the Pierce County Flood Control Zone District funds, please see the link below:

https://www.piercefloodcontrol.org

Future Plan Revisions

Progress of the River Flood Hazard Management plan has been monitored on an annual basis to support the CRS recertification process. This annual reporting will continue. In addition, Pierce County has committed to looking at a full update of the 2013 Pierce County Rivers Flood Hazard Management Plan on a 10-year schedule. The next scheduled full update is targeted for adoption in 2023. Our understanding of flood hazards continues to be more refined. Based on new and emerging information, and a need to update the nine basin plans which address urban flooding, the Pierce County Rivers Flood Hazard Management Plan will be revised to become a comprehensive Pierce County Flood Hazard Management Plan. The plan will be expanded to include sections on:

- Urban flooding;
- Groundwater flooding; and
- Coastal Flooding.

Work on this effort is scheduled to begin in 2019. The new plan will follow the basic concept and layout used in the 2013 Flood Plan and will meet the requirements of Washington Administrative Code (WAC 173-145) related to Comprehensive Flood Control Management Plans, Chapter 86-12 RCW (flood control by counties), the National Flood Insurance Program, and the Community Rating System Program. The plan will use a targeted approach to identify top concerns, problems and priorities and develop programs and project to address these issues.

CHAPTER SIX ERRATTA

The errata sheet for Chapter Six focused on providing clarifications, updated numbers to reflect changes between 2013 and today, and other minor errors in facts or spelling.

REFERENCES

King County. 2013 Flood Hazard Management Plan Update: King County, Washington. King County Department of Natural Resources and Parks, Water and Land Resources Division. Seattle, Washington.

Mauger, G.S., J.H. Casola, H.A. Morgan, R.L. Strauch, B. Jones, B. Curry, T.M. Busch Isaksen, L. Whitely Binder, M.B. Krosby, and A.K. Snover, 2015. State of Knowledge: Climate Change in Puget Sound. Report prepared for the Puget Sound Partnership and National Oceanic and Atmospheric Administration.

Thurston County. 2017 Thurston County Flood Hazard Mitigation Plan. Thurston Regional Planning Council. Thurston County, Washington.

VOLUME II-APPENDICES

Updates to Volume II of the Pierce County Rivers Flood Hazard Management Plan were minor in nature. Minor updates were done in Appendices A, B, C, D, F, and G. Those updates can be found on the website using the link provided below. In addition, a new appendix was added to the document, Appendix K. This appendix provides a brief overview of some of the notifications Pierce County sends out throughout the year regarding flood risk and flood insurance in the county. This appendix can also be found here. No updates were done for Appendices E, H, I, and J.