ECONOMIC OUTCOMES OF URBAN FLOODPLAIN RESTORATION IN PUGET SOUND

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Prepared for American Rivers

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That assistance notwithstanding, ECONorthwest is responsible for the content of this report. The staff at ECONorthwest prepared this report based on their general knowledge of economic benefits of floodplain restoration, and on information derived from the reports or data of others and sources believed to be reliable. ECONorthwest has not independently verified the accuracy of all such information, and makes no representation regarding its accuracy or completeness. Any statements nonfactual in nature constitute the authors' current opinions, which may change as more information becomes available.

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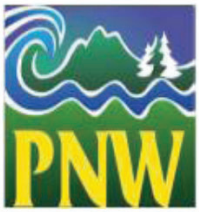

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- Floodplain restoration in Puget Sound can provide multiple amenities and reduce costs for communities. When planned for multiple benefits and implemented through corridor-wide planning, floodplain restoration can improve quality of life and safety.
- Even without quantifying the environmental benefits of floodplain restoration, a single floodplain restoration project can deliver millions of dollars in value for local communities and a positive return on investment. The largest benefits for communities are avoided flood costs. Floodplain restoration projects reduce flood risks and costs by providing rivers with more room to spread into wetland environments during flood events.
- Floodplain restoration offers benefits that traditional flood projection infrastructure cannot, such as creating green and open space, allowing for new recreation opportunities, and enhancing habitat and environmental quality.
- Floodplain restoration projects support jobs, income, and economic activity in local communities. On average, every $1 million spent on a floodplain restoration project supports an additional 12.1 jobs and $930,000 in economic activity in Washington. Spending on these projects also generates fiscal revenue for the state and local taxing jurisdictions through sales and use taxes and business and occupation taxes.
- Historically marginalized populations are often the people in a community who are most at risk of flooding and experience the highest levels of environmental degradation. Floodplain restoration can provide value to these populations by reducing their flood risks and enhancing community amenities that contribute to a higher quality of life.
- The return on investment from floodplain restoration projects can be positive from the value of reduced flood risks alone. The added value from secondary economic activity, fiscal revenues, enhanced ecological functions, enhanced recreation, and any other benefits yielded from the project provide additional value to communities.

Case Study Findings

The purpose of this report is to document the findings for three case studies that demonstrate the outcomes that communities in Puget Sound have achieved from floodplain restoration. These case studies serve as examples of the outcomes that future floodplain restoration projects can offer when they are designed for multiple benefits and part of an integrated floodplain restoration planning process. The three case studies are briefly described below and the key economic outcomes and facts are presented in the summary table.

- **Reddington Levee Setback Project:** This project was constructed to reduce flood risk by replacing the existing levee that did not meet modern design standard and posed a frequent flood risk to the adjacent mobile home park. This project required acquisition of 16 mobile homes and included installing a new, paved trail atop the levee.
- **Lower White River Countyline Levee Setback Project:** This project was motivated by the ongoing sedimentation of the White River that increases flood risk over time as the river's height increases. Flooding in January 2009 was partially due to the accumulated sediment and that flood event affected more than 100 residences and numerous businesses in the City of Pacific and temporarily closed Stewart Road SW. There were partial acquisitions of residential, agricultural, and industrial land for this project.
- **Cedar River Project at Rainbow Bend:** This project was motivated by reoccurring flooding for the homes in the project area, particularly in 1990 and 2009. To move residents out of harm's way of flooding, King County acquired the 18-acre mobile home park and nine single family homes.

Economic Outcomes and Metrics for the Case Studies of Floodplain Restoration in Puget Sound

	Reddington Levee Setback Project	Countyline Levee Setback Project	Cedar River Project at Rainbow Bend
Location	City of Auburn, King County	City of Pacific, King County and City of Sumner, Pierce County	Unincorporated King County (between Renton and Maple Valley)
River	Green/Duwamish River	White River	Cedar River
Acres of Floodplain Restored	0.44 acres restored and 19 acres revegetated	121 acres	40 acres
Project Construction Period	2010 to 2014	2012 to 2017	2010 to 2014
Avoided Costs of Flooding	$22.9 million from reduced risk to structures and contents	$2.36 million from reduced risk to structures and contents and $10,300 per day of avoided closures of Steward Road Bridge	$2.4 million from reduced risk to structures and contents
Number of Jobs Supported (direct and secondary)	39 average annual jobs	46 average annual jobs	37 average annual jobs
Labor Income Supported (direct and secondary)	$9.7 million	$15.6 million	$6.9 million
Total Economic Activity Supported in Washington (direct and secondary)	$12.3 million	$12.3 million	$17.9 million
Sales and Use Tax Generated	$844,000	$1.2 million	$673,000
Business and Occupation Tax Generated	$195,000	$297,000	$138,000
Recreational Opportunities	$9.6 million in recreational use value from trail expansion	Reduced flood risks at Pacific City Park	39-acre increase in open space
Project Spending	$16.5 million	$24.1 million	$12.2 million

1 INTRODUCTION

1.1 Overview

Floodplain restoration in Puget Sound provides an opportunity to enhance the environmental qualities of rivers and streams to support sensitive species like salmon. Floodplain restoration has also been a critical tool for floodplain managers to reduce the risks and associated damages of flooding by increasing water storage capacity. Along with these primary drivers of floodplain restoration, projects that are planned for multiple benefits allow communities to leverage investments in their floodplains to support additional community revenue drivers. The goal of this report is to evaluate floodplain restoration projects within Puget Sound to understand the multitude of outcomes that communities can achieve in the form of improved environmental quality and flood risk reduction, as well as supporting jobs, economic activity, tax revenue, community livability, business and development attraction and retention, and quality of life.

1.2 Purpose of This Report

The purpose of this report is to document the findings for three case studies that demonstrate the outcomes that communities in Puget Sound have achieved from floodplain restoration. These case studies serve as examples of the outcomes that future floodplain restoration projects can offer to communities when they are designed for multiple benefits and part of an integrated floodplain restoration planning process. Additional projects planned and underway in the region provide opportunities for future research to further document the economic outcomes of floodplain restoration and the cumulative effects of multiple projects.

This report is part of a multi-phased effort to better understand and articulate the economic outcomes of urban floodplain restoration on communities — some of which are often overlooked or have historically been poorly understood. Phase 1 of this work was an effort to document the prior research on the economic outcomes of urban floodplain restoration both within and outside of Puget Sound. The results of this initial effort are available in the report: Economic Outcomes of Urban Floodplain Restoration: Implications for Puget Sound.[1] The findings from that effort are that urban floodplain restoration projects support local economic activity, even if only some benefits are quantified. The economic outcomes from the literature review suggest that as rivers are restored, people want to live, work, and play near healthy rivers — supporting local economic activity. Public amenities are the clearest way to yield co-benefits from floodplain restoration projects. Projects that decrease flood risk while improving investments in water quality, habitat, open space, and recreation can increase development and adjacent property values, as well as tax revenues.

[1] The Economic Outcomes of Urban Floodplain Restoration: Implications for Puget Sound report is available at: https://www.americanrivers.org/2020/06/restoration-supports-revenue/

2 PROJECT PURPOSE AND INTENT

The purpose for this project is to develop a more detailed understanding of the economic outcomes of floodplain restoration for urban and suburban communities in Puget Sound. Urban and suburban floodplain restoration projects are the focus of this work, rather than rural floodplain restoration, because of the opportunities for supporting local revenue and other economic outcomes in a setting where development has historically occurred in floodplains. The intent of this work is to inform the extent and types of economic outcomes that can be realized through floodplain restoration in developed areas. Although the case studies evaluated in this work are for specific locations, the general findings on the type and magnitude of economic outcomes are meant to be broadly applicable to areas where there is development in river corridors.

A secondary goal of this work is to document how local jurisdictions in the Puget Sound have incorporated river restoration into comprehensive community planning and the ways in which that process can be improved upon to maximize the potential economic outcomes from floodplain restoration. The largest beneficial economic outcomes occur when the river restoration is designed for multiple benefits that address not only ecological needs and flood risks but seeks to create a community asset through things like recreation and housing considerations. River restoration can be integrated into land use planning and local decision-making to advance multiple community goals that improve the quality of life and economic opportunities for businesses and residents.

3 BACKGROUND INFORMATION

3.1 Context Setting

The policies that influence floodplain restoration in Puget Sound are shaped by the history of the built environment and manipulation of natural river systems. Beyond the floodplains, land use decisions, community investments, and social policies also influence the economic outcomes from floodplain restoration. For example, historically many residential developments in floodplains were for lower income housing, such as mobile home parks. As a result, many property acquisitions have been for lower-income housing and impacted lower-income residents. There are equity implications surrounding the fact that buyout programs are often for lower income housing. There are many tradeoffs for residents who participate in these programs. It is beyond the scope of this study to perform a program analysis of those acquisition programs beyond any information that we have on the specific programs themselves and the experiences of residents. More broadly, gentrification and homelessness have become significant issues in the Puget Sound region and beyond.

Acquisitions and the creation of open space intersect with these issues. Acquisitions in Puget Sound are generally not large enough to meaningfully impact housing prices, but they can take low-income housing out of the marketplace. The housing shortage and steep price increases in recent years both contribute to gentrification and homelessness. Increases in homeless encampments can alter perceptions of safety and cleanliness for residents. Encampments are often on public properties, such as road shoulders and medians, as well as parks and open space natural areas. There are a suite of equity considerations associated with these larger social issues around housing insecurity and homelessness – but the purpose of this report is not to address those factors. Although there are homeless encampments in some of the project areas, there is no evidence that the floodplain restoration project caused encampments to exist, rather they are reflections of the larger social issues and dynamics in the Puget Sound.

Another social issue that intersects with river restoration is tribal treaty rights and historic injustices for Native American populations. Although floodplain restoration can advance goals that are compatible with tribal treaty rights to fishing and cultural and spiritual values for Native American people, the case study projects were not managed by local tribes. For this reason, we do not attempt to draw any conclusions on the value of their projects to Native American people in the Puget Sound.

This report and analysis acknowledge the complexities of these factors and how they could potentially influence the economic outcomes from the floodplain restoration case studies. For these reasons it is potentially difficult to disentangle effects that are due to floodplain restoration compared to the larger underlying social and policy issues. It is beyond the scope of this analysis to provide a full review and understanding of these issues beyond the directly evident effects for the individual floodplain restoration projects that are evaluated in the case studies. We acknowledge the limitations of the findings without a full review of these context considerations.

3.2 History of Floodplain Development in Puget Sound

Human development within Puget Sound has changed the landscape dramatically. Rivers that used to meander and spread out across floodplains during high flows were channelized and straightened to protect farmlands and residents near the rivers' edges. The intent of the dikes and levees that were built throughout the region was to protect land from flooding. However, these engineered approaches concentrated floodwaters into faster moving channels and shifted the risk to downstream or to more vulnerable areas. These engineered systems have risks of failure — particularly if they are not maintained — that can be, and at times have been, catastrophic for the people and properties that rely on them for protection.

Today, approximately 64.4 percent of Puget Sound floodplains have been either disconnected from the river or developed.[2] As agricultural and urban development replaced floodplain habitat, 9 of the 31 historic Puget Sound Chinook salmon runs went extinct,[3] and wild Chinook salmon populations declined by 93 percent.[4] Today, all 59 salmon populations in the Puget Sound are listed under the Endangered Species Act.[5] These changes also represent a large-scale loss for Native American rights, including treaty rights. Tribes have legal rights, economies, and cultural and spiritual traditions centered around the area's rivers and the resources they support. The flood risk, expense, and impact on the environment are prompting floodplain managers to seek out natural infrastructure solutions that reduce flood risk while also enhancing the environment and local community amenities, without the expenses and risks associated with built infrastructure. Floodplain restoration and reconnection projects are a critical natural infrastructure solution to provide benefits while reducing costs.

3.3 Floodplain Restoration Efforts in Puget Sound

Floodplain restoration is not a new occurrence in Puget Sound — projects throughout the region have been ongoing for decades through both public and private organizations. Major efforts in the region have been supported by Floodplains by Design. This collaborative was started in 2013 as a public-private partnership between The Nature Conservancy,

[2] ESA, Washington Department of Ecology, and Puget Sound Partnership. (2019). Floodplains Condition Assessment and Vital Signs Refinement. Available at: **https://pspwa.app.box.com/v/MonitoringFloodplainProject/file/427774422228**

[3] Northwest Fisheries Science Center. (2015). Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. Available at: **https://www.webapps.nwfsc.noaa.gov/assets/11/8623_03072016_124156_Ford-NWSalmonBioStatusReviewUpdate-Dec%2021-2015%20v2.pdf**

[4] Ford, M.J. (ed.), et al. (2010). Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Northwest. U.S. Department of Commerce, NOAA Technical Memorandum NOAA-TM-NWFSC-XXX. pg. 131.

[5] State of Salmon, Puget Sound. Available at: **https://stateofsalmon.wa.gov/regions/puget-sound/**

Washington Department of Ecology, and Puget Sound Partnership. Floodplains by Design implements a broad approach to river restoration that includes a multi-benefit planning process at the watershed or reach scale. Since 2013, 45 projects protecting over 7,217 acres throughout the State of Washington have been funded by the Floodplains by Design program.[6]

3.4 Understanding Priorities through Stakeholder Outreach

To validate the need for this project, the first step involved in this work was to conduct stakeholder outreach. The purpose of the stakeholder outreach was to understand what information is currently available to describe the economic outcomes of floodplain restoration in Puget Sound and to identify where there are gaps that can potentially be filled by the case study analyses. This outreach was conducted in two ways: a meeting with thought leaders and project funders, as well as a survey that was distributed widely to interested stakeholders throughout the Puget Sound area.

3.4.1. Floodplain Thought Leaders and Funders Meeting

The "Thought Leaders and Funders Outreach Meeting" occurred in November 2020 and convened floodplain managers from organizations such as the Washington Department of Ecology, Puget Sound Regional Council, Puget Sound Partnership, U.S. Environmental Protection Agency, U.S. National Oceanic and Atmospheric Agency, and county floodplain managers. The goal of this meeting was to understand the metrics currently being used to measure outcomes of floodplain restoration (i.e., jobs, tax revenue, flood risk, etc.), which metrics are most effective at communicating the benefits of floodplain restoration, and which metrics they would like to be able to better measure and communicate.

The key findings from this meeting include the following:

- There are two different ways that metrics are used, they are "projected" before a project has begun, such as for grant funding applications, and they are "tracked" after project completion.
- Biophysical metrics are currently the most commonly used metrics. Barriers for reporting other metrics — such as improvements in community livability, public health, business attraction and retention, and greenhouse gas sequestration — include a lack of expertise on project teams and funding for monitoring.
- Metrics related to impacts to historically disadvantaged populations, as well as populations that are less resilient to flooding, are of particular interest to participants.
- Jobs are important and have been messaged in a specific way in the past (i.e., 16.7 jobs per $1 million spent on restoration projects from the Washington State Office of Financial Management, but there is still a need to better document and track jobs — including types of jobs created and the types of people who benefit from the jobs created.
- There is some consistency and guidance in what metrics are being reported and how from Floodplains by Design, Puget Sound Vital Signs used by Puget Sound Acquisition and Restoration (PSAR), and NOAA's Pacific Coastal Salmon Recovery Fund Database that is used by the Washington Recreation and Conservation Office (RCO).
- City of Seattle and Puget Sound Partnership are working on projects that may change some metrics that are currently used, such as the Human Wellbeing Survey and updates to the Vital Signs program.
- Some participants expressed concerns about using overly standardized metrics that can miss the nuances across watersheds.
- Metrics that participants expressed interest in obtaining additional information about that they do not currently have available for their projects include:
  - public support for projects;
  - non-traditional partners and relationship building ("How do you bring in chamber of commerce, master builders, etc. so that they see value in the project?");

[6] Floodplains by Design website, Impact, available at: **https://www.floodplainsbydesign.org/impact/**

- tribal benefits including economic activity in the form of jobs and income, as well as economic value, such as subsistence and spiritual values;
- social impacts of the projects and the connection of the ecological benefits with social impacts (e.g., number of green jobs, access to open space, impacts to marginalized populations);
- distributional impacts (e.g., who is benefiting from job losses or gains?; how are benefits and risks distributed across the community?);
- climate change resiliency (how projects can adapt and recover from change, ability to sequester carbon, detain flood water, etc.);
- how the project contributes to larger end goals (e.g., increased salmon population, climate resiliency; flood damage reduction).

3.4.2. Survey

The purpose of the survey was to gather information on how river corridor planning is viewed in the Puget Sound Region to inform the need to communicate economic outcomes of floodplain restoration to varying audiences. The survey was administered broadly, targeted at three types of audiences with generalized and unique questions for each: 1) the floodplain restoration and management community, and 2) community planners, developers, and other community leaders, and 3) economic development staff and businesses. The survey was open to both urban and rural perspectives. A copy of the survey questions is available as Appendix A.

There were 36 completed survey responses and 43 partial survey responses. Over half of respondents self-identified as members of the floodplain restoration and management community (Table 1).

Table 1. Survey Respondent Types

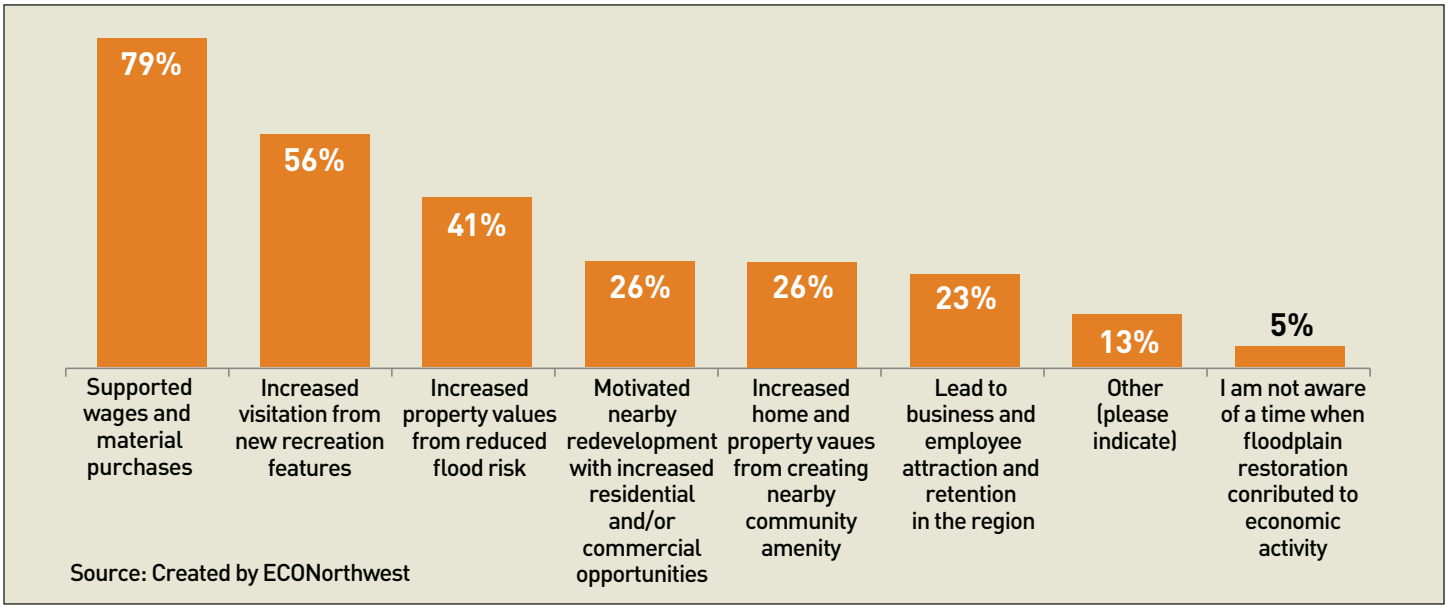
Answer Choices	Number of Responses	Percent of Responses
You are a member of the floodplain restoration and management community	22	57.9%
You are a community planner, developer, or other community leader	9	23.7%
You work in economic development or are a business representative	3	7.9%
Other (please indicate)	4	10.5%
Total Complete Responses	**38**	**100%**

Source: Created by ECONorthwest

Floodplain restoration and reconnection projects are a critical natural infrastructure solution to provide benefits while reducing costs.

The results of the survey demonstrated that respondents are most familiar with the direct economic activity that floodplain restoration contributes from spending associated with the project, but less familiar with floodplain restoration contributing to economic activity from secondary sources like creating community amenities and improving quality of life to make the area more attractive to live, work, and locate a business (Figure 1).

Figure 1. Survey responses to the question: "Are you aware of a time when floodplain restoration contributed to jobs and economic activity from any of the following sources?" [Select all that apply]



Source: Created by ECONorthwest

Members of the floodplain restoration and management community were asked about what metrics they currently use to measure the outcomes associated with floodplain restoration projects. The top response to this question was "reduced flood risk for people and property" followed by "change in salmon population supported" and "change in water quality" — these responses are consistent with the primary motivators for floodplain restoration discussed in the Thought Leaders and Funders meeting. Table 2 contains all responses to this question.

Table 2. Survey responses to the question: "What metrics do you currently use to measure the success of a floodplain restoration project?" [Select all that apply]

Response	Percent	Count
Reduced flood risk for people and property	90%	19
Change in salmon population supported	81%	17
Change in water quality (e.g., temperature, pollutants, etc.)	81%	17
Amount of new water storage or infiltration	62%	13
Climate change resiliency	62%	13
Enhances tribal treaty rights	62%	13
Cost savings from reduced flood risk to people and property (e.g., avoided flood damages, avoided grey infrastructure investment differential, avoided maintenance costs, etc.)	57%	12
Number of jobs supported by project implementation	38%	8
Number and type of new recreation resources (i.e., trails, boat ramps, fishing bank, etc.)	33%	7
Change in quality of life	29%	6
Amount or potential for displacement	14%	3
Other (please indicate)	14%	3
Economic activity (e.g., Gross Regional Product) supported by project implementation	10%	2
Number of visitors to a restoration site	10%	2
Return on investment	10%	2
Change in educational opportunities	10%	2
Change in business and employee attraction and retention	5%	1
Impact to nearby property values	0%	0
Change in nearby value-add development	0%	0
Amount of carbon sequestration	0%	0

Source: Created by ECONorthwest

Members of the floodplain restoration and management community were also asked what metrics they would like to be able to measure and communicate but do not have sufficient resources to do so. The top response to this question was "amount of carbon sequestration" followed by "return on investment" and "economic activity (e.g., Gross Regional Product) supported by project implementation" (Table 3). The second and third highest responses to this question are directly addressed by the case study analyses that focus on the economic outcomes associated with floodplain restoration. Amount of carbon sequestration is not a focus metric for this research on economic outcomes, but represents an area for future research and creating processes to provide floodplain management organizations with the tools needed to measure and communicate this metric.

Table 3. Survey responses to the question: "What other metrics would you or your organization like to be able to use but do not have sufficient information, resources, or expertise to do so?" [Select all that apply]

Response	Percent	Count
Amount of carbon sequestration	86%	18
Return on investment	81%	17
Economic activity (e.g., Gross Regional Product) supported by project implementation	71%	15
Change in quality of life	57%	12
Cost savings from reduced flood risk to people and property (e.g., avoided flood damages, avoided grey infrastructure investment differential, avoided maintenance costs, etc.)	48%	10
Number of jobs supported by project implementation	48%	10
Change in nearby value-add development	48%	10
Change in business and employee attraction and retention	48%	10
Change to nearby property values	43%	9
Amount of new water storage or infiltration	38%	8
Climate change resiliency	38%	8
Number of visitors to a restoration site	29%	6
Change in educational opportunities	29%	6
Amount or potential for displacement	29%	6
Change in salmon population supported	24%	5
Number and type of new recreation resources (i.e., trails, boat ramps, fishing bank, etc.)	24%	5
Enhances tribal treaty rights	19%	4
Change in water quality (e.g., temperature, pollutants, etc.)	14%	3
Reduced flood risk for people and property	10%	2
Other (please indicate)	5%	1

Source: Created by ECONorthwest

4 OUTCOMES EVALUATED IN THE ANALYSIS

This case study analysis is evaluating the **economic outcomes** of floodplain restoration, which includes three types of economic analysis: economic value, economic impacts, and economic equity. The economic outcomes are measured through **metrics**, which include items such as the number of jobs, amount of tax revenue, amount of reduced flood risk, number of recreation visitors, number of trees surviving after one year, etc. The metrics fall into one of each of the three categories of economic outcomes:

- **Economic Value:** These types of metrics measure a change in total social welfare and include things like benefits and costs.
- **Economic Impacts:** These types of metrics measure the change in jobs, labor income, output (i.e., Gross Region Product), and tax payments within the study area. Economic impacts are not the same as economic benefits or economic value because they do not consider any change in social welfare.
- **Economic Equity:** These types of metrics evaluate the distribution of changes in economic value for different people. For example, if the people who are receiving the benefits are the same people incurring the costs or not.

The metrics evaluated in this analysis are the result of the findings from the outreach and technical expertise developed in the earlier phases of this project, including the survey results. The focus metrics are economic outcomes that relate to economic activity, particularly those that drive community revenue. Where information is readily available, the evaluation also considers supplemental metrics that are potentially of interest based on the results of outreach associated with this project. The specific focus metrics for this project are listed in Table 4. Each case study does not demonstrate every economic outcome. For example, a case study may not include changes in recreational uses or quality of the recreational experience, so there would be no associated change in recreational value.

Table 4. Focus Metrics Used for the Case Study Evaluations

Focus Metrics	Metric Type
Total Jobs Supported	Economic Impact
Total Labor Income Supported	Economic Impact
Total Economic Activity Supported	Economic Impact
Change in Sales and Use Tax Payments	Economic Impact
Change in Business and Occupation Tax Payments	Economic Impact
Change in Property Tax Payments	Economic Impact
Change in Recreation Spending	Economic Impact
Change in Recreation Use Value	Economic Value
Change in Property Values and Land Development	Economic Value
Avoided Costs of Flooding	Economic Value
Change in Environmental Quality and Quantity	Economic Value
Change in Distributions of Values and Impacts	Economic Equity
Return on Investment	N/A

Source: Created by ECONorthwest

5 CASE STUDY SELECTION

5.1 Case Study Selection Criteria

The list of potential case studies and criteria used to select the case studies to evaluate was developed through stakeholder outreach and with input from the project's Steering Committee. The criteria are designed to identify the case studies that best exemplify best practices for floodplain restoration and highlight the focus metrics of interest for this project. The criteria used to select the case studies are as follows:

- **Geographic Diversity:** The three case studies need to be from different watersheds in order to achieve geographical diversity. Floodplains and built environments vary throughout Puget Sound. Although economic outcomes of floodplain restoration are often similar across geographies, the geologic, hydrologic, land use, and policy differences throughout the region result in different management strategy needs. Having geographically diverse case studies from different watersheds increases the applicability of the results to different settings.
- **Land Use Diversity:** The three case studies need to represent the different land use types associated with the urban and built environments of Puget Sound. There needs to be at least one case study adjacent to each of the three urban/built environment land use types of interest for this study: residential high density (i.e., urban residential), residential low-density (i.e., suburban residential), and industrial/commercial (i.e., urban non-residential). Rural and agricultural lands are not the focus of this study and therefore not an eligible land use type criteria.
- **At least one of the case studies needs to be from the Green-Duwamish River watershed.** This criterion is in place because of the motivations and funding sources for this study.
- **Relevant Impacts:** The case studies need to have at least one of the three primary impacts of interest, and together the case studies must cover all three primary impacts of interest: avoided costs of flooding, recreational use, and land use/value changes (e.g., could motivate nearby investments; changes surrounding area due to property acquisitions).

5.2 Selected Case Studies

Using the selection criteria, we reviewed 29 potential case studies and selected three to evaluate. The details of the three case studies are summarized in Table 5 and the locations of the projects are displayed in Figure 2.

Together, these case studies satisfy all criteria. Although the case studies are all from different watersheds, they are all located in central Puget Sound. This lack of physical geographic diversity, despite the different watersheds, is a limitation to this study that can be addressed through future research that can take advantage of evaluating projects in northern Puget Sound, Southern Puget Sound, and the Olympic peninsula that are currently in progress.

Table 5. Overview of Case Studies

Case Study Name	Case Study Watershed	Case Study WRIA	Case Study Land Use Type(s)	Case Study Impacts of Interest Present
Reddington Levee Setback Project	Duwamish - Green	WRIA 9	High-Density Residential	Avoided costs of flooding Recreational use value Land use/value changes
Lower White River Countyline Setback Project	Puyallup-White	WRIA 10	High-Density Residential and Industrial/ Commercial	Avoided costs of flooding Recreational use value Land use/value changes
Cedar River Project at Rainbow Bend	Cedar - Sammamish	WRIA 8	Low-Density Residential	Avoided costs of flooding Land use/value changes

Source: Created by ECONorthwest

Figure 2. Case Study Locations

Source: Created by ECONorthwest

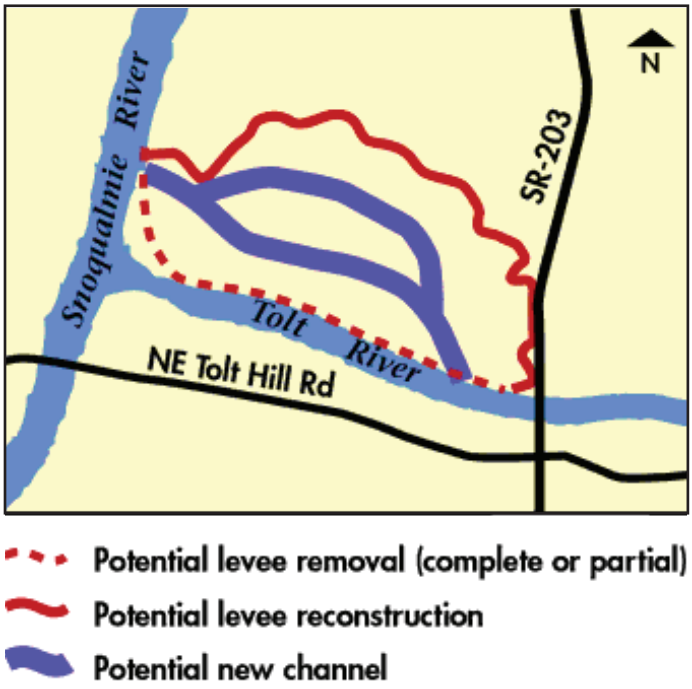
5.3 Additional Case Study Examples

In addition to the selected case studies, through the stakeholder outreach process we were made aware of many other ongoing floodplain restoration projects. Many of these case studies would have met the criteria and served as ideal case studies, but they had not yet been fully built, so the economic outcomes could not be analyzed empirically. An example of projects that are in progress and could have served as case studies if they were completed are the White River Restoration in Sumner and the Lower Russell Road Levee Setback in Kent. Many of the suggested projects were also located in more rural areas, which is not the focus of this study. These projects represent opportunities for future research. **A full list of all case studies considered for this analysis is available as Appendix B.**

The review of case studies also provided information about the complexity of quantifying the outcomes of individual floodplain restoration projects. The complexity is due to the dynamic nature of natural systems and multiple human interventions and nearby human activity. For example, the Lower Tolt River Floodplain Reconnection project in Carnation is located at the confluence with the Snoqualmie River (Figure 3). During high flows the Snoqualmie can back up water into the Tolt River, meaning that the floodplain is influenced by both river systems. Because this segment of the Tolt River is influenced by both river systems the flood reduction impacts of the Lower Tolt River Floodplain Reconnection project alone could not be quantified independently.

Another example of a floodplain restoration project that was considered but not ultimately selected is the Zis a ba Restoration project by the Stillaguamish Tribe. The Zis a ba project reconnected 88 acres of coastal wetlands to help with tidal flooding, including protecting farmland from flooding. Restoration efforts are complicated in this region by sea level rise and saltwater intrusion of groundwater which also threaten the agricultural lands. These coinciding factors complicate the flood risk reduction analysis because flood risk is influenced by both freshwater and saltwater. These complex factors motivated the restoration project to protect farmland, but because of the unique conditions the findings are not as relevant for the inland, urban floodplain restoration projects that are the focus of this analysis.

Figure 3. Lower Tolt River Floodplain Reconnection Project Location



Source: King County website, Lower Tolt River Floodplain Restoration Project. Available at: https://kingcounty.gov/services/environment/animals-and-plants/restoration-projects/projects/tolt-restoration.aspx

6 REDDINGTON LEVEE SETBACK PROJECT

6.1 Project Summary

The Reddington Levee Setback Project is located on the Lower Green River in Auburn, Washington in WRIA 9.[7] The project area is 1.3 miles in length and extends from 26th Street Northeast/Brannan Park (River Mile 29.5) north to the southern boundary of the Port of Seattle's wetland mitigation project at 43rd Street Northeast (River Mile 28.2).[8] A map of the project area is available in Figure 4.

Figure 4. Reddington Project Location

Source: Created by ECONorthwest

The primary motivation for the Reddington Project was flood risk reduction to protect nearby homes, habitat enhancement through replacing and setting back levees, as well as reconnecting the river to a side channel. The project was designed and constructed from 2010 to 2015, and monitoring has been ongoing ever since (Table 6). Funding for the project was from King County Water and Land Resources Division.

Table 6. Reddington Project Timeline

Property Acquisitions	2010 – 2012
Planning, Design, Construction	2010 – 2014
Monitoring, Maintenance, and Site Stewardship	2014 – Present

Source: King County, Reddington Levee Setback Project, available at: https://kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/reddington-levee-setback-and-extension.aspx

The Reddington Project is part of the larger corridor strategy for the Green/Duwamish River. The goals for the Green/Duwamish River are memorialized in the Water Resource Inventory Area (WRIA) 9 2021 Salmon Habitat Plan Update.[9] The Reddington Project supports a strategy in this planning document to protect, restore, and enhance floodplain connectivity. The 2021 Salmon Habitat Plan Update also emphasizes the importance of implementing multi-benefit projects to balance fish habitat needs with flood risk reduction and other community priorities. The Plan defines the policy for floodplain restoration to achieve multi-benefit projects as:

> "Support multi-benefit flood risk reduction projects that also enhance salmon habitat by allowing rivers and floodplains to function more naturally. Multi-benefit projects can (1) reduce community flood risk; (2) provide critical salmon habitat; (3) increase floodplain storage; (4) improve water quality; (5) replenish groundwater; (6) expand public recreation opportunities; and (7) strengthen community and ecological resilience to extreme weather events due to climate change."

[7] A map of the Reddington Levee Setback project is available at: **https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/capital-projects/ReddingtonSetbackConcept_Mar2013.pdf**

[8] King County, Reddington Levee Setback Project, available at: **https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/reddington-levee-setback-and-extension.aspx**

[9] Water Resource Inventory Area 9. (2001). Salmon Habitat Plan 2021 Update. Available at: **https://www.govlink.org/watersheds/9/reports/salmon-habitat-plan-update/default.aspx**

6.2 Project Outcomes

6.2.1 Avoided Costs of Flooding

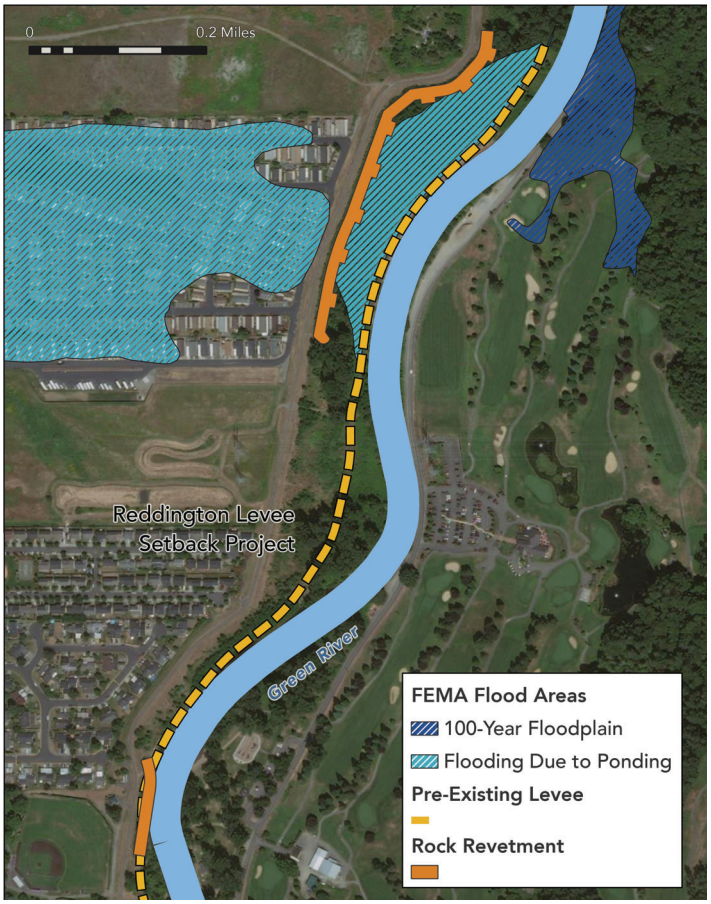
Prior Flood Risks

The Reddington Project was primarily constructed for the purpose of reducing flood risk by protecting 592 residential and commercial properties.[10] Before the setback project the pre-existing Reddington Levee was built in the 1960s and did not meet modern design and construction standards.[11] The pre-existing levee had a wetland on the opposite side of the river and the levee had porous soils that would allow water to seep from the levee. The prior levee design created conditions that would sometimes flood the adjacent mobile home park, River Mobile Estates.[12] Figure 5 displays the location of the prior levee in relation to the 100-year floodplain, River Mobile Estates, and the Rock Revetment constructed as part of the levee setback. By upgrading the levee to modern design standards and moving homes out of harm's way, the Reddington Project alleviated the reoccurring flooding at River Mobile Estates.

Property Acquisitions

The Reddington Project required private property acquisitions to obtain the area needed for the setback levee. The property acquisitions included 16 mobile home units and an RV storage yard within River Mobile Estates, as well as undeveloped property from private developers.[13] The property acquisition was voluntary for the mobile home developer but involuntary for the residents living in the mobile homes. Figure 6 shows the properties that were acquired at River Mobile Estates using a 2010 aerial photo. The cost of the land acquisitions in 2010 through 2012 was $3.5 million (nominal dollars at the time of purchase). The 2020 aerial photo demonstrates the landscapechanges with the rock revetment as well as a new development on the south end of the mobile home park. This strip of land on the southern edge of River Mobile Estates was purchased for $595,000 in 2014 from the City of Auburn. With the funds from the acquisitions and coordination with the City, River Mobile Estates was able to replace the supply of housing affected by the acquisition.

Figure 5. Pre-existing Reddington Levee, New Rock Revetment, and 100-year Floodplain



Source: Created by ECONorthwest

[10] Data on protected properties provided at the parcel level by King County River and Floodplain Management Section.

[11] Peters, E. (2019). Reddington Levee Setback Project Closeout Report. Department of Natural Resources and Parks, Water and Land Resources Division. April 30.

[12] Whale, R. (2013). "County launches Reddington Levee setback project". The Auburn Reporter. July 10. Available at: https://www.auburn-reporter.com/news/county-launches-reddington-levee-setback-project/

[13] Peters, E. (2019). Reddington Levee Setback Project Closeout Report. Department of Natural Resources and Parks Water and Land Resources Division. April 30.

Figure 6. 2010 and 2020 Aerial Photos of River Mobile Estates

Source: Google Earth

Reduced Flood Risk and Avoided Cost of Flooding

There were approximately 0.44 acres of new floodplain storage capacity created by the Reddington Project. However, the primary flood risk reduction from the project is due to improvements in the flood standard of the levee. By upgrading the levee to modern design standards, increasing the height of the levee, and moving residents out of harm's way, the Reddington Project alleviated the recurring flooding at River Mobile Estates and reduced the risk of flooding for the larger 500-year floodplain area.

River Mobile Estates does not have estimates of monetary damages from flooding prior to the setback project. If the location of a mobile home is disturbed due to flooding, estimates from FEMA suggest that it can cost a few hundred dollars to tighten ground anchor straps and a few thousand dollars to replace anchors or reset a home.[14] Personal property will also likely be damaged by a flood event.

Although the pre-existing levee was designed for a 100-year flood, devastating flooding impacts could have occurred if a flood exceeds the channel capacity through that section of the river. The Reddington Project increased the flood conveyance capacity to meet 500-year flood flows.[15] There are 596 properties protected by the upgraded Reddington Levee, including 964 structures.[16,17] The value of these structures is approximately $1.15 billion.[18]

The economic value associated with increasing the flood standard of the levee from a 100-year to a 500-year flood can be calculated by comparing the expected value of damages under each risk scenario. Estimates from the U.S. Army Corps of Engineers are that the per structure damages from flooding are approximately $50,500.[19,20] Estimates contents damage by property types is in Table 7.

Table 7. Contents Damage Estimates by Structure Type for 1-foot Flood Depth

Property Type	Contents Damage ($2021)
Mobile Home	$31,498
One-story Residential	$28,235
Two-story Residential	$35,771
Multi-family	$560,471
Professional Business	$39,859
Retail	$582,621
Warehouse	$254,669
Eating and Recreation	$114,385
Groceries and Gas Station	$398,413

Source: U.S. Army Corps of Engineers New Orleans District. (2006). Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSVR) in Support of the Donaldsonville to the Gulf, Louisiana, Feasibility Study. March. Available at: **https://www.mvn.usace.army.mil/Portals/56/docs/PD/Donaldsv-Gulf.pdf**

[14] FEMA. (2009). Protecting Manufactured Homes from Floods and Other Hazards: A Multi-Hazard Foundation and Installation Guide. November.

[15] Peters, E. (2019). Reddington Levee Setback Project Closeout Report. Department of Natural Resources and Parks Water and Land Resources Division. April 30.

[16] Peters, E. (2019). Reddington Levee Setback Project Closeout Report. Department of Natural Resources and Parks Water and Land Resources Division. April 30.

[17] The counts of property values are based upon 2009 assessor data records. Accordingly, there may be additional properties that have been built at this time within the area protected by the Reddington Levee.

[18] Data on protected properties provided at the parcel level by King County River and Floodplain Management Section.

[19] U.S. Army Corps of Engineers New Orleans District. (2006). Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSVR) in Support of the Donaldsonville to the Gulf, Louisiana, Feasibility Study. March. Available at: **https://www.mvn.usace.army.mil/Portals/56/docs/PD/Donaldsv-Gulf.pdf**

[20] The per structure value is inflated to 2021 dollar from "Table 11. Expert Opinion Depth-Damage Estimates for One-Story On Slab Structure, Short Duration (Freshwater and Saltwater)". The value is for a 1-foot depth flood.

With a 100-year flood standard the expected damages for structures and contents protected by the Reddington Project in the 100-year floodplain are approximately $24.5 million over a 50-year time period. By enhancing the levee to the 500-year flood level for those same structures the expected damages from flooding are $4.7 million over the 50-year time period.[21] **The economic value of the reduced risk of flooding is therefore $19.8 million over the 50-year time period (2021 dollars).**

The $19.8 million in avoided flood costs from reduced flood risk is only an estimate of the value of damage to structures and contents. This value may be an underestimate because it does not consider additional properties that could be impacted from a 500-year flood compared to a 100-year flood (there are more structures in the 500-year floodplain but the extent of that data is not available). In addition, the cost to structures and contents does not consider landscaping, road, utility, or vehicle damage, which would increase the expected value of flood damages. Business disruptions could also occur in a flood event, which would further increase the expected damages from flooding in both the 100-year and 500-year scenario.

Previous flooding near the Reddington Project has affected properties on both sides of the Green River. Upstream, the Howard Hanson Dam plays a major role in controlling riverine flooding. A 2009 storm resulted in releases from the dam that resulted in multiple road closures as well as flooding at Auburn Golf Course and Isaac Evans Park, which are located immediately east of the Reddington Project. The Reddington Project eased pressure on Green River Road, the flood barrier for the Auburn Golf Course, but did not reduce the 100-year floodplain risk for that area. As recently as February 2020 there was significant flooding at Isaac Evans Park and Auburn Golf Course from a heavy rain event. According to Jeremy Sagele with the Auburn Golf Course, the 2020 flooding "could be so much worse if we haven't had any of this levee work done… North Auburn would all be looking like this [the flooded Auburn Golf Course] instead of this little area."[22]

6.2.2. Economic Contributions

Project Spending

Total spending on the Reddington Project was approximately $16.5 million over the project period of 2010 to 2014 (including property acquisitions, planning, design, and construction). Construction began in 2013 to rebuild approximately 4,800 feet of levee. In 2014, additional construction extended the levee north to 4th Street Northeast. A summary of spending by category is in Table 8. Approximately half of the spending on the project was on construction related activities.

Table 8. Reddington Project Spending by Category

IMPLAN Industry	Total Cost	% of Project Cost
463 — Environmental and other technical consulting services	$1,397,608	8.4%
457 — Architectural, engineering, and related services	$859,212	5.2%
56 — Construction of other new non-residential structures	$7,980,111	48.2%
478 — Other support services	$311,132	1.9%
6 — Greenhouse, nursery, and floriculture production	$58,609	0.4%
534 — Government	$2,393,305	14.4%
Land Acquisitions	$3,571,249	21.6%
Total	**$16,571,227**	**100.0%**

Source: Peters, E. (2019). Reddington Levee Setback Project Closeout Report. Department of Natural Resources and Parks Water and Land Resources Division. April 30.

Jobs

Approximately 22 direct average annual jobs were supported in Washington through pre-construction and construction of the Reddington Project. These jobs include positions at King County as well as the third-party contractors. Some jobs were filled by short-term, temporary workers who perform a very

[21] In a 500-year flood event there would be more properties at risk of flooding because it is a larger flood than the 100-year flood extent. This analysis only considers the 100-year flood scenario event and the properties that could be impacted by that event. The 500-year flood scenario would have higher expected damages because more properties and structures would be at risk.

[22] Phan, S. (2020). "Green River flooding drowns King County farms, parks and golf courses". Komo News. Available at: https://komonews.com/news/local/green-river-flooding-drowns-king-county-farms-parks-and-golf-courses

specific job on one of the construction sites. Other jobs were held by workers who are on the project for the majority of the planning, design, and construction period.

In addition to the direct jobs supported by contractors and at King County, the spending on the Reddington Project also supported approximately 18 average annual jobs in Washington through secondary impacts (Table 9). Secondary impacts are comprised of indirect and induced effects. **Induced effects** represent the additional jobs and economic activity resulting from increases in household spending from wages. **Indirect effects** are the supply chain effects from purchases of goods and services from suppliers. Including direct, indirect, and induced effects, the total job-years supported in Washington from the Reddington Project are 12.1 job-years per $1 million in spending.[23, 24]

Table 9. Jobs Supported by the Reddington Project During Planning, Design, and Construction

	Average Annual Jobs (FYE)	Total Job-Years Throughout the Project
Direct	22	86
Indirect	8	31
Induced	10	41
Total	**39**	**158**

Note: The term "job-years" is used instead of "jobs" for calculations over periods of more than one year to represent the fact that the same job may be held over multiple years. Job-years represents the total jobs (FYE) per year throughout the entire 4 years planning, design, and construction period. Job-years is not the number of positions supported by the project. One job performed over all four years would be represented as 4 job-years. Average annual jobs are calculated by diving the total job-years by the years of the project.

Source: Calculated by ECONorthwest using IMPLAN (2014 Data Year)

Not included in these job estimates is the employment supported before and after the project period. Before the project, grant programs and King County need staff to envision, prioritize, and fund the work. After the project, monitoring, maintenance, and site stewardship for the Reddington Project also supports jobs in King County. These jobs are largely with King County Department of Natural Resources and Parks. Monitoring for the project will be ongoing for 10 years.

Labor Income

Labor income is comprised of both employee wages, benefits, and other compensation as well as proprietor income (i.e., owner profits). In total, the project supported approximately $9.7 million in total labor income in Washington during the project period (2014 dollars). Of the $9.7 million in labor income, the majority, $7.5 million, consists of employee compensation and the remainder, $2.2 million, is proprietor income (Table 10).

Table 10. Labor Income Supported by the Reddington Project During Planning, Design, and Construction

	Average Annual Labor Income	Total Labor Income
Direct	$1,444,241	$5,776,962
Indirect	$488,340	$1,953,360
Induced	$498,342	$1,993,366
Total	**$2,430,922**	**$9,723,689**

Source: Calculated by ECONorthwest using IMPLAN

Economic Activity

Economic activity, also known as output, represents the broad amount of goods and services produced – it can be thought of as the economic footprint of the project. Output is equal

[23] The term "job-years" is used instead of "jobs" for calculations over periods of more than one year to represent the fact that the same job may be held over multiple years. Job-years represents the total jobs (FYE) per year throughout the entire 4 years planning, design, and construction period. Job-years is not the number of positions supported by the project. One job performed over all four years would be represented as 4 job-years. Average annual jobs are calculated by diving the total job-years by the years of the project.

[24] Note that this value is calculated based on $13.0 million in project spending, which does not include land acquisitions since that spending does not create value add in the economy. With the $3.5 million in land acquisitions, for a total of $16.5 million in project spending, there would be 9.5 average annual jobs per $1 million in project spending.

to the sum of labor income, business income, and business costs (such as intermediary inputs). The Reddington Project had direct output of $13.0 million. This value is less than the full $16.5 million project budget because it excludes land acquisition — which can be considered a transfer rather than new economic activity supported.

The total amount of output supported by the Reddington Project in Washington was $25.3 million including direct, indirect, and secondary effects (Table 11). The output multiplier refers to the amount of secondary effects (indirect and induced) created by the direct effects. The output multiplier for the project is 1.94.

Table 11. Output Supported by the Reddington Project During Planning, Design, and Construction

	Average Annual Output	Total Output
Direct	$3,249,994	$12,999,978
Indirect	$1,489,718	$5,958,872
Induced	$1,573,254	$6,293,017
Total	**$6,312,967**	**$25,251,866**

Source: Calculated by ECONorthwest using IMPLAN

6.2.3 Fiscal Revenues

Sales and Use Taxes

The sales and use tax rate for the area of the project is 10.1 percent – this value is comprised of 6.5 percent of state tax and 3.6 percent of local tax. Retail spending on the project itself is largely subject to sales and use tax, including construction services.[25] King County pays sales tax on all construction contracts (applied to the full contract). It does not pay a tax for construction management services by consultants.

Accordingly, the $8.0 million construction contract for the Reddington Project is subject to sales tax. As a result, the total expected sales and use taxes directly generated from the project were approximately $812,000 (2014 dollars). Secondary sales and use taxes are also supported by project spending as contractors purchase needed supplies that are subject to the tax. Employees and proprietors also generate sales and use tax from their household spending. Based on estimates from IMPLAN, the total sales and use taxes supported by secondary spending on the project were $32,160 (2014 dollars).

Business and Occupation Taxes

Washington's business and occupation tax rate for services is 0.015 of gross receipts (i.e., the value of products, gross proceeds of sale, or gross income of the business).[26] The businesses that supplied professional services to the Reddington Project experienced an increase in their gross receipts that is subject to this tax. The estimated business and occupation tax associated with the Reddington Project is $195,000 (2014 dollars). Note that this value does not include any tax credits that would reduce the amount of Business and Occupation tax the entity pays.

Property Taxes

Because of how Washington calculates property taxes, increases in property values or reductions in the tax base, such as from property acquisitions, are not likely to change the property taxes collected by the local taxing jurisdictions. Washington's property tax is not directly based on increases in property values, it is budget- based. Rather than property tax revenue calculated as a percentage of a fixed share of property value (e.g., $10 per $100,000 of assessed value), it is based on a share of revenue necessary to meet a particular taxing jurisdiction's budget needs. The distribution is based on assessed value, so an increase in assessed value would shift a larger proportion of the tax burden onto the properties with improved value, but not necessarily increase tax revenue.[27]

[25] More information about retail sales tax is available from Washington Department of Revenue: https://dor.wa.gov/taxes-rates/retail-sales-tax/services-subject-sales-tax

[26] More information about Washington's Business and Occupation tax is available from Washington Department of Revenue: https://dor.wa.gov/taxes-rates/business-occupation-tax

[27] Increases in a given taxing district's levy are limited to 1 percent per year or the rate of inflation, whichever is lower. Thus, if a county's budget this year is $100,000, next year it cannot be more than $100,100.

6.2.4 Community Value

Property Values and Development

The Reddington Project could have influenced property values in multiple ways. The first is from the reduced flood risk associated with the project. Properties could have an increase in their property value commensurate to the value they gained from the flood risk reduction. The second is the associated value with the amenities created by the project. Higher water quality and improved environmental conditions can increase property values for homes near waterways. The Reddington Project included constructing a new, paved trail on the levee. This recreation feature is also an amenity for nearby residential properties. Lastly, the extent to which the project supports property development outside the floodplain – either through reduced flood risk, creating community amenities, or demonstrating the area's commitment to its natural capital – could also lead to additional changes in property values.

In King County in 2021, properties within 0.5 miles of a major river sold for approximately 8 percent more than properties that were further away.[28] Although a correlation, this finding, as well as the literature discussed in the Phase 1 report for this project,[29] provides evidence that being located near a river is often considered an amenity that is desirable by property owners. People like to reside near rivers due to aesthetics, connection to nature, recreational opportunities, and other personal preferences – a healthier river generally supports increased value for residents.

The Reddington Project could be considered a project that transforms the river from creating costs to homeowners through flooding to an amenity that provides recreation, aesthetic, and experiential value for neighboring residents. A hedonic property value analysis of single-family residential properties within 0.5 mile of the Reddington Project found that property values increased relative to property values for homes that are greater than 0.5 miles away at first during the project's construction period (2010 to 2014) but experienced a relative decrease from 2015 to 2021 after the project was complete.

Recreational Use Values

As part of the Reddington Project a new, paved trail was installed on top of the levee. The 4,800-foot (0.9 mile) long Reddington Levee Trail is used primarily for walking and biking by neighborhood residents. It connects to the Brannan Park trail to create a 2.42-mile segment.[30] The City of Auburn is considering expanding this trail to north to S. 277th Street, and south from Reddington Levee trail to Auburn Narrows.[31] The trail can also be used for fishing and swimming access (Figure 7). The more complex habitat and addition of rock structures (i.e., barbs) within the river has improved conditions for fishing.[32]

Local trails are a source of economic value for the residents and any visitors who use them. A study of the economic value of these types of trails calculates the economic value to visitors as $9.76 per trip (2021 dollars).[33] King County does not maintain visitor counts for the Reddington Levee Trail. However, counts of other river trails can be applied proportionally to estimate visitation to the site. Based on visitation estimates for the Green River Trail, the approximate annual visitation to the Reddington Levee trail is 37,000

[28] ECONorthwest analysis of King County and Pierce County single-family residential property sales transactions. More information about the hedonic analysis methodology is available in Appendix D.

[29] The Phase 1 report, Economic Outcomes of Urban Floodplain Restoration: Implications for Puget Sound, is available at: **https://www.americanrivers.org/2020/06/restoration-supports-revenue/**

[30] City of Auburn. (2015). Parks, Recreation, and Open Space Plan. Available at: **https://p1cdn4static.civiclive.com/UserFiles/Servers/Server_11470554/File/City%20Hall/Parks,%20Arts,%20&%20Recreation/City%20Parks%20and%20Trails/Park%20&%20Recreation%20Open%20Space%20Plan.pdf**

[31] City of Auburn. (2015). Parks, Recreation, and Open Space Plan.

[32] Personal communication with Erik Peters, River and Floodplain Management Section, King County.

[33] Siderelis, C., & Moore, R. (1995). Outdoor recreation net benefits of rail-trails. Journal of Leisure Research, 27(4), 344-359.

visits per year (approximately 100 per day).[34, 35] Based on this visitation estimate, **the economic value for trail users is approximately $365,000 per year which equates to $9.6 million over a 50-year period.**[36]

Figure 7. Water Recreation Occurring Alongside Construction Activity for the Reddington Project

Source: Peters, E. (2019). Reddington Levee Setback Project Closeout Report. Department of Natural Resources and Parks Water and Land Resources Division. April 30.

6.2.5 Environmental Outcomes

The environmental and ecological goals and objectives for the Reddington Project were to develop a more ecologically complex riparian habitat and to provide floodplain refuge for fish through a larger, forested floodplain. To create a more complex habitat, the project installed 122 pieces of large wood and eight engineered log jams, reconnected the river to create 0.44 acres of riverine wetland habitat and new floodplain storage, and revegetated 19 acres of riparian and wetland habitats. The project also included the construction of nine buried rock barbs to deflect erosive flows away from the newly installed setback levee, reducing long term maintenance costs.

The project has met the majority of its environmental objectives and has resulted in improved habitat conditions and channel complexity. After construction, the amount of low velocity edge habitat increased between 190 to 1911 percent, depending on flow conditions.[37] The setback levee provides more habitat for rearing and refuge for juvenile salmonids during high flow events. The rock barbs, intended to prevent scouring flows from damaging the setback levee, have created pockets of slow-moving water which has provided rearing habitat for juvenile salmon.[38] Abundant populations of juvenile Chinook, Coho, and chum have been observed in these areas since project completion.[39]

The Reddington Project also included planting vegetation within the project area. Riparian plantings have experienced varying levels of success with survival rates ranging from 58 to 89 percent, depending on location.[40] In response to poor vegetation survival in the early years, King County has altered its approach to revegetation in these sites and instead of planting species intended to provide canopy cover, the County has planted native wildflowers and grasses.[41] Project managers hope that these species will help rebuild soil conditions in order to more successfully recruit trees and other canopy cover species in the future.

[34] There are approximately 2,164 visits per day to the 19-mile long Green River Trail, which has a southern terminus approximately 3.5 miles downstream from the Reddington Levee Trail.

[35] King County Flood Control District. (2016). Green River, King County, Washington: System-Wide Improvement Framework (SWIF) Interim Report. February 2016.

[36] Dollars are 2021 values. Future values are discounted using a 3 percent discount rate.

[37] King County. (2014). Reddington Levee Setback Project Year 1 Monitoring Report. Available at: **https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/2014-Reddington-Year-1-Monitoring-Report.pdf**

[38] Personal communication with Kerry Bauman, King County.

[39] King County. (2014). Reddington Levee Setback Project Year 1 Monitoring Report. Available at: **https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/2014-Reddington-Year-1-Monitoring-Report.pdf**

[40] King County. (2014). Reddington Levee Setback Project Year 1 Monitoring Report. Available at: **https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/2014-Reddington-Year-1-Monitoring-Report.pdf**

[41] Personal communication with Kerry Bauman, King County.

6.2.6 Distributional Effects of the Project

The Reddington Project was specifically designed to protect a marginalized population from flooding — residents of the mobile home park. Mobile home residents may be less economically resilient than the general population in terms of ability to respond to and recover from a flood event.[42] Underinsurance or lack of insurance reduces the ability of residents to respond to a flood event. Flood insurance is also only required if the resident has a federally backed mortgage and if they are located within the 100-year floodplain. If owners of mobile homes do not have a mortgage they are not required to have flood insurance. Lower-income households are generally less likely to have flood insurance.[43] Combined, these two factors result in mobile homeowners generally being less likely to have insurance to recover from flooding.

There were 16 mobile home units purchased as part of the Reddington Project. King County acquired these properties in accordance with U.S. Department of Housing and Urban Development acquisitions standards under the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (URA). These standards mean that displaced residents were compensated based on the cost of relocating to decent, safe, and sanitary (DSS) comparable dwellings and were compensated for their moving expenses and any other costs associated with relocation. Since the mobile homes were in the floodplain which generally is associated with lower property values (all else equal),[44, 45] it is likely that homeowners moved to higher-valued properties as a result of the acquisition.

Tenants who rented a property that was acquired receive relocation assistance of up to $5,250 for 42 months (unless more is needed to locate to a DSS dwelling).[46] Although these funds can assist renters with finding replacement housing that may be more suitable for their household – there are also significant barriers to finding and paying for replacement housing in Puget Sound and particularly in King County. Feedback from information interviews with King County relocation specialists suggests that mobile homes are scarce in Puget Sound and it can be difficult for displaced residents to relocate to another home in their budget or with the same community as the existing mobile home. The rental assistance payments are also temporary — meaning that when they expire the tenant may not have the income needed to continue living in the replacement housing.

The Reddington Project is in a neighborhood that has lower income and has higher percent people of color compared to the larger area of King County and Washington state (Table 12). Maps depicting the spatial extent of the census tracts and block groups and the values for the socioeconomic and demographic characteristics are available in Appendix C. The project represents an investment in the local community to provide flood protection, as well as amenities through improvements in environmental conditions, expanded recreational features, and enhanced vegetation and visual aesthetics. However, with any infrastructure project there are construction activities and other short-term noise and traffic implications that do not benefit local residents.

[42] Prasad, S., & Stoler, J. (2016). Mobile home residents and hurricane vulnerability in South Florida: Research gaps and challenges. International Journal of Disaster Risk Science, 7(4), 436-439.

[43] Walls, M., and Cortes, D.H. (2018). Recovering from Disasters: Evaluating FEMA's Housing Assistance Program in the 2017 Hurricane Season. University of Pennsylvania Warton School of Business. September 24.

[44] Netusil et. al (2019) found that homes with a structure located within the 100-year floodplain of the Johnson Creek area of Portland, Oregon sold for an average of 21.5 percent less that comparable properties.

[45] Netusil, N. R., Moeltner, K., & Jarrad, M. (2019). Floodplain designation and property sale prices in an urban watershed. Land Use Policy, 88, 104112.

[46] U.S. Department of Housing and Urban Development. (No Date). Planning and Budgeting Relocation Costs for HUD-Funded Projects. Available at: https://www.hud.gov/sites/documents/DOC_16291.PDF

Table 12. Socioeconomic and Demographic Characteristics of Neighborhoods Near the Reddington Project

	Median Household Income[1]	Percent People of Color[2]	Percent of Renter Occupied Units[3]
Census Tract 305.03 (Reddington Project Neighborhood)	$57,726	51.4%	33.4%
Block Group 1 (Southwest Side of Project)	$47,794	N/A	12.9%
Block Group 2 (Northwest Side of Project)	$60,578	N/A	48.9%
King County	$94,974	38.6%	36.0%
Washington State	$73,775	34.5%	24.6%

[1] Data Source: U.S. Census Bureau (2019). Median Household Income in the Past 12 Months, 2015-2019 American Community Survey 5-year estimates.

[2] Data Source: U.S. Census Bureau (2019). Total Population in Occupied Housing Units by Tenure by Year Householder Moved into Unit, 2015-2019 American Community Survey 5-year estimates.

[3] Data Source: U.S. Census Bureau (2019). Race, 2015-2019 American Community Survey 5-year estimates.

Note: Block Group 1 and Block Group 2 are smaller geographies located within Census Tract 305.03

6.2.7. Return on Investment

Return on investment (ROI) is a financial metric that is used to characterize the level of profitability from an investment. ROI is calculated as follows:

> ROI = Net Return/Total Costs, where Net Return = Gross Return – Total Costs

ROI is a commonly used metric for financial investments like stocks where ROI can be easily calculated by dividing net profit by the initial investment amount.[47] ROI is more complicated to calculate for environmental investments because some benefits are non-monetary, like cultural value or values that are not easily monetized due to uncertainty. The net benefits/profit (i.e., the "return" on the investment) is also complicated because the people who receive benefits are often not the same people who make the initial investment. For example, the floodplain restoration projects considered in the three case studies are funded by King County Flood Control District through taxes as well as grants. However, the beneficiaries of the "return" of the project are not the Flood Control District — they vary by benefit. Avoided flood costs accrue to nearby residents. Recreational use benefits accrue to the people who use the recreational resource (or have the option to do so). Benefits to habitats and species accrue broadly to people from beyond King County who value those changes in the ecosystem. **For purposes of this report, ROI is characterized broadly to include all societal benefits.**

Another methodological consideration for ROI is if both economic value as well as economic impacts should be included in the ROI calculation. This analysis calculates ROI with secondary economic output included as part of the "return".[48] By including secondary economic activity as a net benefit, the analysis assumes that the secondary economic activity is a net impact and would not have occurred but for the floodplain restoration project. Direct output (i.e., spending on the project) is not included as a net benefit/profit in the ROI calculation because those values reflect the cost (i.e., the investment).

This analysis also does not consider sales and use taxes or business taxes as a return from the project because those are either part of project costs or represent a transfer of funds between entities rather than a new economic benefit. Similarly, changes in property value are not represented as a return from the project because they generally do not result in increased property taxes and represent an increased cost for buyers.

[47] As a simple example, if an investor bought a stock for $100 then sold it for $120 the ROI would be: (120-100)/100=0.2 or 20%.

[48] ECONorthwest acknowledges that economic contributions, including output, are not benefits because they do not represent a change in social value since they do not account for substitution effects.

The ROI from the Reddington Project is 150 percent over a 50-year period (discounted at 3 percent). The $16.6 million invested in the project yielded a net return of $24.9 million with monetized values alone (Table 13). The net return would be even higher if all benefits were monetized.

Table 13. Return on Investment for Reddington Project (50-years, discounted at 3%)

ROI Category	Value (50-years, discounted at 3%)
Value of Avoided Costs of Flooding	$19.8 million
Recreational Use Value	$9.6 million
Property Value	Unknown, Likely Positive
Other Ecosystem Service Values	Positive
Secondary Output	$12.3 million
Total Gross Return	>$41.5 million
Total Investment	$16.6 million
Monetized Net Return	>$24.9 million
Monetized ROI	150%

Source: Calculated by ECONorthwest

7 LOWER WHITE RIVER COUNTYLINE LEVEE SETBACK PROJECT

7.1 Project Summary

The Countyline Levee Setback project is located on the east bank of the White River near the City of Pacific and City of Sumner in WRIA 10.[49] The project area extends from the Steward Road Bridge on the southern end to the BNSF railroad at Skinner Road on the northeast end. The project spans both King County and Pierce County. A map of the project area is available in Figure 8.

Implementing the Countyline Levee Setback project was motivated by past flooding that affected residences and businesses. The White River had been losing channel capacity due to sedimentation, making the river higher and increasing flood risk. The project was designed to make more room for the river by removing 4,500 feet of existing levee and reconnecting the river with 121 acres of floodplain. The project is adjacent to a major city park, Pacific City Park, and incorporates walking trails on the restored levee. A timeline of the project is detailed in Table 14. The project began construction in June 2016 after property acquisitions were completed. The project was completed in December 2017. Funding for the project was from King County Flood Control District, State Salmon Recovery Funding Board, Pierce County, and Thea Foss Mediation Group.

Table 14. Lower White River Countyline Levee Setback Project Timeline

Property Acquisitions	2009 – 2015
Planning, Design, Construction	2012 – 2017
Monitoring and Maintenance	2018 – Present

Source: King County, Lower White River Countyline Levee Setback Project, available at: **https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/lower-white-river-countyline-a-street.aspx**

Figure 8. Countyline Levee Setback Project Location

Source: King County Flood Control District, Lower White River Countyline Levee Setback Project. Available at: **https://kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/lower-white-river-countyline-a-street.aspx**

On the opposite riverbank as the Countyline Levee Setback project is the ongoing White River Pacific Right Bank Flood Protection project.[50] This project is in the design phase, with construction anticipated for 2025. The western bank of the

[49] A map of the project is available at: **https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/lower-white-river-countyline-a-street.aspx**

[50] More information about the White River Pacific Right Bank Flood Protection project is available at: **https://kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/lower-white-river-right-bank.aspx**

White River has many residential properties, so property acquisitions from willing sellers are an ongoing part of the initial project phase. The Right Bank Flood Protection project is being designed to reduce flood risk beyond what has been achieved so far through the Countyline Levee Setback project. There are also floodplain restoration projects planned downstream in Sumner on the White River.[51]

7.2 Project Outcomes

7.2.1. Avoided Costs of Flooding

Prior Flood Risks

Prior to construction of the Countyline Levee Setback project, this portion of the Lower White River was bounded by confining levees that trapped significant amounts of sediment. This trapped sediment accumulated in this portion of the reach and lowered the channel flood capacity from an estimated 25,000 cubic feet per second (CFS) in the 1980s to just 8,000 CFS prior to construction of the levee setback.[52] As a result, this segment of the Lower White River was highly susceptible to flooding and estimates concluded that if no action was taken, the project area was expected to completely fill with sediment by 2027.[53]

The justification for the Countyline Levee Setback project was motivated in part by flooding in January 2009 that was partially due to the accumulated sediment. That flood event affected more than 100 residences and numerous businesses in the City of Pacific and temporarily closed Stewart Road SW. Many of the residences that were impacted by the 2009 flood did not have flood insurance because the flood maps did not indicate that they were located within a flood zone.[54] The January 2009 flood event caused approximately $15 million in property damages (2009 dollars) as well as temporary business and road closures in this area.[55] This event made reducing flood risk a major priority for King County and prompted the Countyline Levee Setback project.[56]

Property Acquisitions

The Countyline Levee Setback required approximately $3.6 million in land acquisitions to have space for the project area. These acquisitions were primarily of partial areas of agricultural and industrial parcels, as well as one single family residential property. In one case, King County was able to work with a property owner to acquire a portion of their parking lot in order to protect and maintain the commercial business that they operated onsite.

Reduced Flood Risks and Avoided Cost of Flooding

The Countyline Levee Setback project connected 150 acres of forested floodplain habitat to the White River. The levee setback also provides more area for sediment deposition that will slow the rate of sediment aggradation – reducing future flood risk from rising river levels. The reduced flood risks from the project are from two primary sources. The first is the reduced risk to people and properties from flood hazards. The second is the reduced risk of road closures and road damages from flood events. The avoided costs of flooding are the sum of both of these flood risk reduction outcomes.

The additional room for the White River created by the Countyline Levee Setback project reduces flood risk by providing the river more room to expand into the project area as well as trapping sediment that would otherwise raise the

[51] More information about the Sumner White River Restoration Project is available at: **https://connects.sumnerwa.gov/white-river-restoration-project**

[52] King County Department of Natural Resources and Parks. (2020). Countyline Levee Setback Project Year 1 and 2 Monitoring Report. Available at: **https://your.kingcounty.gov/dnrp/library/2020/kcr3154.pdf**

[53] King County. (2012). King County Environmental Checklist – Countyline Levee Setback. Available at: **https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/capital-projects/countyline-levee-setback/countyline-SEPA-environmental-checklist.pdf**

[54] Cornwall, W. (2009). "Flood maps missed mark; Pacific homeowners got soaked". The Seattle Times. January 26. Available at: **https://www.seattletimes.com/seattle-news/flood-maps-missed-mark-pacific-homeowners-got-soaked/**

[55] Brummer, C., Stypula, J., McCarthy, S., and Shelton, S. (2017). Public Safety Management Plan Countyline Levee Setback Project. King County Department of Natural Resources and Parks Water and Land Resources Division.

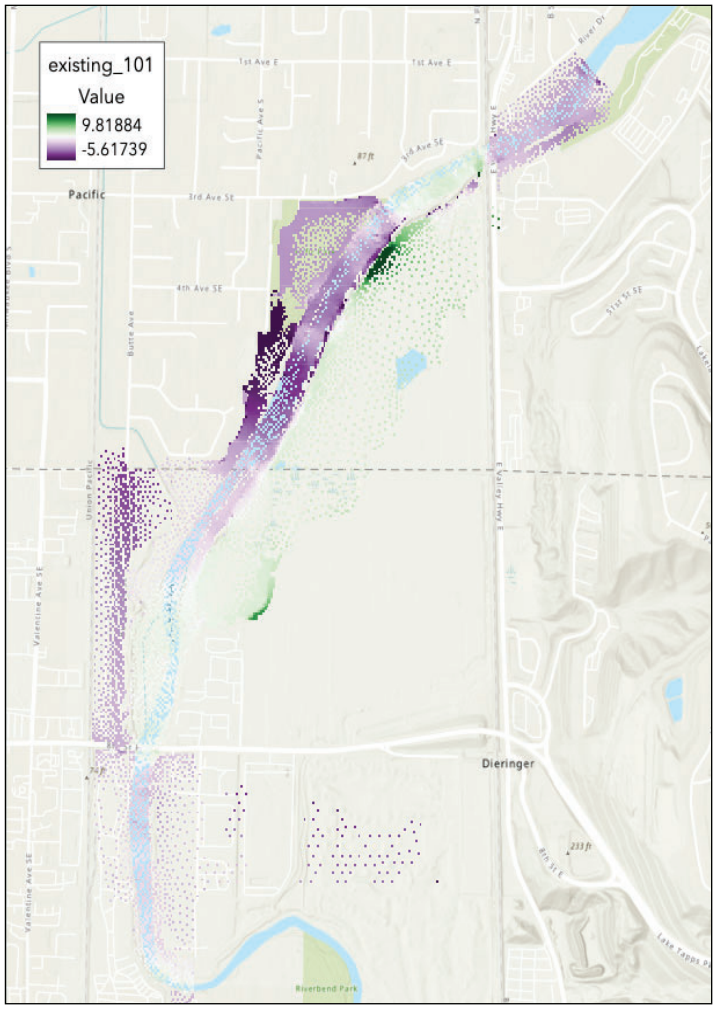
[56] Personal communication with Chris Brummer, King County.

river elevation. The Countyline Levee Setback Project reduced 100-year flood elevations for the White River by an average of one-foot for 93 properties in King County and Pierce County.[57] On these properties there are 83 buildings that have reduced flood risk due to the Countyline Project, including 51 mobile home units. Figure 9 displays the areas of reduced flooding with the Countyline Project in purple. Increased flooding is depicted in green and occurs in the project area.

The expected value of the avoided costs of flooding calculated using the estimate of $50,460 in damage per structure from US Army Corps of Engineers ($24,313 for a mobile home) and contents damage from one-foot of flooding of $28,235 for a one-story single family residential building, $31,498 for a mobile home, $147,264 for a commercial building, and $254,669 for a warehouse.[58] The annual damage for the nine structures is therefore $8.89 million per year – which is then multiplied by the expected probability for a 100-year flood (1 percent likelihood). **The avoided costs of flooding for structures and contents attributable to the Countyline project is $2.36 million over 50-years** (future values discounted at 3 percent).

On the western bank, properties upstream of RM 5.6 **benefited by as much as a three feet long reduction in water surface elevations resulting from the Countyline Levee Setback project.**[59] Additional flood risk reductions will occur through the ongoing Right Bank Flood Protection project. King County estimates that **once both projects are completed the avoided costs of flood damages to structures and contents from the 100-year flood event will reduce flood risks for 200 properties that are valued at more than $150 million.**[60]

Figure 9. Modelled Changes in 100-Year Flood Elevations with the Countyline Levee Setback Project



Source: Created by ECONorthwest using geospatial data provided by King County

[57] These 93 properties were identified by comparing pre-project projected 100-year flood elevations with post-project 100-year flood elevations. The geospatial data for this analysis was provided by King County.

[58] U.S. Army Corps of Engineers New Orleans District. (2006). Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSVR) in Support of the Donaldsonville to the Gulf, Louisiana, Feasibility Study. March. Available at: https://www.mvn.usace.army.mil/Portals/56/docs/PD/Donaldsv-Gulf.pdf

[59] Brummer, C., Stypula, J., McCarthy, S., and Shelton, S. (2017). Public Safety Management Plan Countyline Levee Setback Project. King County Department of Natural Resources and Parks Water and Land Resources Division.

[60] Brummer, C., Stypula, J., McCarthy, S., and Shelton, S. (2017). Public Safety Management Plan Countyline Levee Setback Project. King County Department of Natural Resources and Parks Water and Land Resources Division.

Prior to completion of the Countyline Levee Setback project there were risks of flooding and damage to Stewart Road SW and Stewart Road Bridge, located immediately south and downstream of the project. Figure 10 shows roadway flooding from the White River in the City of Pacific during a flood event in 2009. The City of Sumner is planning to upgrade Steward Road and the bridge over the White River by 2026 at an estimated cost of $30 million to address flood risk and traffic issues.[61] The avoided costs of flooding of the Stewart Road corridor include clean up and damage, risks to health and safety, and impacts of road closures. Clean up and damage costs could vary depending on the damage — the $30 million cost of needed upgrades provides a sense of the value of the bridge and roadway at this location. Risks to health and safety are also highly variable depending on if the road could be closed prior to a flood hazard event.

The impact of road closure would be the cost to drivers of detours, which would vary from 7 to 9 minutes depending on if drivers take a northern or southern detour route. Approximately 5,000 vehicles per day travel through the Stewart Road corridor.[62] The cost of detours for these vehicles is calculated $17.73 per hour.[63, 64] **The costs of additional travel time due to Stewart Road bridge closures would be approximately $10,300 per day.** Over a 50-year period (discounted at 3 percent) the expected value of the flooding decreases from $11,000 to $2,700 — resulting in an **expected value of avoided costs of flooding for Stewart Road Bridge of $8,200 over 50-years.**

An additional benefit of flood risk reduction provided by the Countyline Levee Setback project is through reducing the amount of sediment traveling downstream. The levee setbackallows more room and slower waters for sediment to deposit, reducing the loads that travel downstream to the City of Sumner and beyond. The slower accumulation of downstream settlement keeps riverbed levels lower downstream of the project, reducing the risk of flooding.

Figure 10. Roadway Flooding in Pacific, Washington in January 2009 Flood

Source: King County Department of Natural Resources and Parks, "County Line Finish". Available at: **https://www.youtube.com/watch?v=klKayG9R968**

7.2.2. Economic Contributions

Project Spending

Total spending on the Countyline Levee Setback project was approximately $24.1 million over the project period that included property acquisitions, planning, design, and construction (2009 to 2017). A summary of spending by category is in Table 15. Approximately 57.2 percent of the spending on the project was on construction related activities. Land acquisitions comprised $3.6 million of the $24.1 million project costs.

[61] More information about the planned Stewart Road updates is available at: **https://connects.sumnerwa.gov/stewart-road-bridge**

[62] Washington Department of Transportation, Traffic GeoPortal. Available at: **https://www.wsdot.wa.gov/data/tools/geoportal/?config=traffic**

[63] This value is calculated as 50 percent of hourly median household income, in accordance with U.S. Department of Transportation guidance on the value of travel time for personal trips. Personal trips have a lower associated value of time than business or freight trips, so this value is likely an underestimate.

[64] U.S. Department of Transportation. (2016). The Value of Travel Time Savings: Departmental Guidance for Conducting Economic Evaluations Revision 2 (2016 Update). Available at: **https://www.transportation.gov/sites/dot.gov/files/docs/2016%20Revised%20Value%20of%20Travel%20Time%20Guidance.pdf**

Table 15. Countyline Levee Setback Project Spending by Category

IMPLAN Industry	Total Cost	% of Project Cost
457 — Architectural, engineering, and related services	$3,772,490	15.7%
56 — Construction of other new non-residential structures	$13,785,603	57.2%
16 — Logging	$1,603,642	6.7%
6 — Greenhouse, nursery, and floriculture production	$635,772	2.6%
534 — Government	$445,563	1.8%
Permitting	$181,697	0.8%
Land Acquisitions	$3,675,495	15.3%
Total		**100.0%**

Source: Provided by King County Department of Natural Resources and Parks, Water and Land Resources Division

Jobs

Approximately 24 direct average annual jobs were supported in Washington to build the Countyline Levee setback project over a period of approximately 5 years. In addition to the direct jobs supported by contractors and at King County, the spending on the Countyline Levee Setback project also supported approximately 22 average annual jobs in Washington through secondary impacts (Table 16). Secondary impacts include the additional jobs and economic activity resulting from increases in household spending from wages and the supply chain effects from purchases of goods and services from suppliers. Including direct, indirect, and induced effects, the total job-years supported in Washington from the Countyline Levee Setback project are 11.2 jobs-years per $1 million in spending.[65]

Table 16. Jobs Supported by the Countyline Levee Setback Project During Planning, Design, and Construction

	Average Annual Jobs (FYE)	Total Job-Years
Direct	24	122
Indirect	10	48
Induced	12	58
Total	**46**	**228**

Note: The term "job-years" is used instead of "jobs" for calculations over periods of more than one year to represent the fact that the same job may be held over multiple years. Job-years represents the total jobs (FYE) per year throughout the entire 4 years planning, design, and construction period. Job-years is not the number of positions supported by the project. One job performed over all four years would be represented as 4 job-years. Average annual jobs are calculated by diving the total job-years by the years of the project.

Source: Calculated by ECONorthwest using IMPLAN (2017 Data Year)

Labor Income

Labor income is comprised of both employee wages, benefits, and other compensation as well as proprietor income (i.e., owner profits). In total, the Countyline Levee Setback project supported approximately $15.6 million in total labor income in Washington during the project period (2017 dollars) (Table 17). Of the $15.6 million in labor income, the majority, $12.0 million, consists of employee compensation and the remainder, $3.6 million, is proprietor income.

Table 17. Labor Income Supported by the Countyline Levee Setback Project During Planning, Design, and Construction

	Average Annual Labor Income	Total Labor Income
Direct	$1,873,795	$9,368,975
Indirect	$616,666	$3,083,332
Induced	$633,796	$3,168,978
Total	**$3,124,257**	**$15,621,285**

Source: Created by ECONorthwest

[65] Note that this value is calculated based on $13.0 million in project spending, which does not include land acquisitions since that spending does not create value add in the economy. With the $3.5 million in land acquisitions, for a total of $16.5 million in project spending, there would be 9.5 average annual jobs per $1 million in project spending.

Economic Activity

Economic activity, also known as output, represents the broad amount of goods and services produced – it can be thought of as the economic footprint of the project. Output is equal to labor income, business income, and business costs (such as intermediary inputs). The Countyline Levee Setback project had direct output of $20.2 million. This value is less than the full $24.1 million project budget because it excludes land acquisitions and permitting — which can be considered a transfer rather than new economic activity supported.
The total amount of output supported by the Countyline Levee Setback project in Washington was $38.7 million including direct, indirect, and secondary effects (Table 18). The output multiplier refers to the amount of secondary effects (indirect and induced) created by the direct effects. The output multiplier for the project is 1.91.

Table 18. Output Supported by the Countyline Levee Setback Project During Planning, Design, and Construction

	Average Annual Output	
Direct	$4,048,614	$20,243,070
Indirect	$1,752,114	$8,760,570
Induced	$1,950,589	$9,752,947
Total	**$7,751,317**	**$38,756,587**

Source: Calculated by ECONorthwest using IMPLAN

7.2.3 Fiscal Revenues

Sales and Use Taxes

The sales and use tax rate for purchases by King County for the Countyline Levee Setback project is 10.1 percent (6.5 percent of state tax and 3.6 percent of local tax). The $12.2 million construction contract for the Countyline Levee Setback project is subject to sales tax. As a result, the total expected sales and use taxes directly generated from the project were approximately $1.2 million (2017 dollars).

Secondary sales and use taxes are also supported by project spending as contractors purchase needed supplies that are subject to the tax. Employees and proprietors also generate sales and use tax from their household spending. Based on estimates from IMPLAN, the total sales and use taxes supported by secondary spending on the project were $53,000 (2017 dollars).

Business and Occupation Taxes

Washington's business and occupation tax rate for services is 0.015 of gross receipts (i.e., the value of products, gross proceeds of sale, or gross income of the business).[66] The businesses that supplied professional services to the Countyline Levee Setback project experienced an increase in their gross receipts that is subject to this tax. The estimated business and occupation tax associated with the Countyline Levee Setback project were $297,000 (2017 dollars). Note that this value does not include any tax credits that would reduce the amount of Business and Occupation tax the entity pays.

Property Taxes

Washington's property tax is based on a share of revenue necessary to meet a particular taxing jurisdiction's budget needs. The distribution is based on assessed value, so an increase in assessed value would shift a larger proportion of the tax burden onto the properties with improved value, but not necessarily increase tax revenue.[67] Because of how Washington calculates property taxes, increases in property values or reductions in the tax base, such as from property acquisitions, are not likely to change the property taxes collected by the local taxing jurisdictions.

7.2.4 Community Value

Property Values and Development

The properties that benefited from reduced flood risk from the Countyline Levee Setback project are residential, warehouse, manufacturing, and vacant. They are located in both King County and Pierce County. The properties immediately north of Stewart Road SW were undergoing development to light

[66] More information about Washington's Business and Occupation tax is available from Washington Department of Revenue: **https://dor.wa.gov/taxes-rates/business-occupation-tax**

[67] Increases in a given taxing district's levy are limited to 1 percent per year or the rate of inflation, whichever is lower. Thus, if a county's budget this year is $100,000, next year it cannot be more than $100,100.

industrial use during the design phase of the Countyline Levee Setback project in 2014.[68] Since project completion some of those properties have been developed, as demonstrated by the change in aerial photos in Figure 11. There were nine structures on these lands as of 2009, five agricultural residential structures/outbuildings and four warehouses. Since 2009 some of the agricultural lands have transitioned to industrial land with built or planned warehouses. Today, these properties are valued at approximately $71 million in taxable value.[69]

Figure 11. Aerial Photos Before and After the Countyline Levee Setback Project

Source: Google Earth

[68] Herrera Environmental Consultants, Inc. (2014). Basis of Design Report: White River at Countyline Levee Setback Project. Prepared for King County Department of Natural Resources and Parks, Water and Land Resources Division.

[69] Pierce County Open GeoSpatial Data Portal website, Pierce County Tax Parcels. Available at: https://gisdata-piercecowa.opendata.arcgis.com/datasets/pierce-county-tax-parcels/explore

Further construction on the vacant lands is planned through 2025 and will support approximately 4,000 jobs.[70] To support this growing industrial economy, Stewart Road Bridge, facilitates transportation of 10 million tons of freight each year.[71] Although the new develop supports additional jobs, the conversion from agricultural lands to warehouses results in a loss of agricultural production and jobs, as well as porous soils and green space, which have their own economic values to the community.

A combination of factors contributes to a business's decision about where to locate. The Countyline Levee Setback project by itself may have made it more feasible to locate businesses north of Stewart Road SW because of the lower risk of flooding in this area and to Stewart Road Bridge provided by the project.

There is some evidence that the Countyline Levee Setback project contributed to higher long term property values in the immediate project vicinity for single-family residential properties. Prior to the project being in place, homes within 0.5 miles of the project area sold for about the same or slightly less than homes outside that region in King County and Pierce County. However, properties near rivers generally sell for higher on average. In 2021, properties within 0.5 miles of a major river sold for approximately 8 percent more than properties that were further away in King County and 5 percent more in Pierce County.[72]

After the project was completed properties within 0.5 mile of the project area sold for approximately 2 percent more than properties further away. These findings suggest that the residential homes near the Countyline Levee Setback may have benefited from increased property values as the flooding from the White River was further reduced in this area. However, properties near the project area are still associated with lower property values compared to residential properties near a river in other areas of the counties.

Recreational Use Values

The Countyline Levee Setback project was not specifically designed to provide recreation amenities in the project area. There is some informal walking and river use along the gravel surface road that was established on the eastern edge of the project. Recreational use occurs less often in this area than it does on the sidewalks of the roads surrounding the project.[73] In-river water recreation is less popular in the White River compared to other local rivers like the Green and Puyallup Rivers – the water temperature in the White River is colder and there is much more sediment and more variable water levels.[74] From July 4, 2013, through September 2, 2013, there were only 30 people on 26 vessels on the White River near Pacific City Park.[75]

The Countyline Levee Setback project reduced flooding levels within Pacific City Park by 1 to 2 feet.[76] The 0.27-acre Pacific City Park is described as "the jewel of the parks system" by the City of Pacific.[77] The park offers a playground, basketball court, baseball field, stage, picnic area, and restrooms and visitors also have access to the White River. The reduced flooding of Pacific City Park by the Countyline Levee Setback results in reduced maintenance costs for the City and continued recreational value by participants by avoiding cancelling activities at the Park due to flooding.

[70] City of Sumner, Stewart Road Factsheet. Available at: **https://connects.sumnerwa.gov/3560/widgets/11342/documents/17272**

[71] City of Sumner, Stewart Road Factsheet. Available at: **https://connects.sumnerwa.gov/3560/widgets/11342/documents/17272**

[72] ECONorthwest analysis of King County and Pierce County single-family residential property sales transactions. More information about the hedonic analysis methodology is available in Appendix D.

[73] Strava, Heatmap. Available at: **https://www.strava.com/heatmap#15.40/-122.24174/47.25818/hot/all**

[74] Brummer, C., Stypula, J., McCarthy, S., and Shelton, S. (2017). Public Safety Management Plan Countyline Levee Setback Project. King County Department of Natural Resources and Parks Water and Land Resources Division.

[75] King County Department of Natural Resources and Parks. (2013). King County River Recreation Study: Synthesis of 2013 River Recreation Studies. Available at: https://your.kingcounty.gov/dnrp/library/2014/kcr2629.pdf

[76] King County Department of Natural Resources and Parks. (2017). County Line Finish. Available at: **https://www.youtube.com/watch?v=klKayG9R968**

[77] City of Pacific, Parks/Trails. Available at: **https://www.pacificwa.gov/services/parks___recreation/parks__trails**

Figure 12. October 2017 Inundation in Countyline Levee Setback Project Area

Source: King County Department of Natural Resources and Parks. (2017). Countyline Levee Breach. Available at: **https://www.youtube.com/watch?v=jkayUDKGVWQ**

7.2.5 Environmental Outcomes

In October 2017, the beginning of the rainy season after the Countyline Levee Setback project was completed, the project performed exactly as expected and filled the eastern setback area. This change reconnected 121 acres of floodplain that had not been inundated for 80 to 100 years.[78] Figure 12 shows the inundation of the project area, as planned, in October 2017.

The pre-existing levee created poor habitat conditions for salmonids. The new setback levee was constructed to improve habitat by introducing 5,780 feet of woody debris and engineered log jams, creating off-channel rearing habitats and flood refuge for salmon, and planting riparian vegetation.[79]

Since completion, the Countyline Levee Setback project has met the majority of its objectives and created salmon habitat, reconnected floodplain, and improved channel complexity. Juvenile Chinook, Coho, and chum were observed at the site immediately after construction. Two years after completion, the number of side channel nodes increased from 20 (baseline conditions) to 46, low velocity edge habitat increased by 10.2 acres, and large amounts of sediment were deposited at the site creating sand and gravel bars in the channel.[80] The active channel area increased by 143 percent and the ratio of side channel to main channel length increased by 243 percent.

[78] King County Department of Natural Resources and Parks. (2017). Countyline Levee Breach. Available at: **https://www.youtube.com/watch?v=jkayUDKGVWQ**

[79] King County Department of Natural Resources and Parks. (2012). King County Environmental Checklist – Countyline Levee Setback. Available at: **https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/capital-projects/countyline-levee-setback/countyline-SEPA-environmental-checklist.pdf**

[80] King County Department of Natural Resources and Parks. (2020). Countyline Levee Setback Project Year 1 and 2 Monitoring Report. Available at: **https://your.kingcounty.gov/dnrp/library/2020/kcr3154.pdf**

Table 19. Socioeconomic and Demographic Characteristics of Countyline Levee Setback Neighborhoods

	Median Household Income[1]	Percent People of Color[2]	Percent of Renter Occupied Units[3]
Census Tract 309.02 (North side of Project)	$57,335	46.8%	43.6%
Block Group 2	$63,988	N/A	31.7%
Census Tract 733.01 (South side of Project)	$51,772	56.0%	16.4%
Block Group 3	N/A	N/A	11.5%
King County	$94,974	38.6%	36.0%
Pierce County	$72,113	35.3%	27.1%
Washington State	$73,775	34.5%	24.6%

[1] Data Source: U.S. Census Bureau (2019). Median Household Income in the Past 12 Months, 2015-2019 American Community Survey 5-year estimates.

[2] Data Source: U.S. Census Bureau (2019). Total Population in Occupied Housing Units by Tenure by Year Householder Moved into Unit, 2015-2019 American Community Survey 5-year estimates.

[3] Data Source: U.S. Census Bureau (2019). Race, 2015-2019 American Community Survey 5-year estimates.

Riparian plantings were also highly successful with an average survival rate of 94.5% two years after project completion, exceeding identified performance standards.[81] As riparian plantings become established, they filter water and trap sediments; eventually, as plants age and become more mature, they shade portions of the river and act as a source of woody debris which creates instream structure for rearing and pools for migrating adult salmonids.

The Countyline Project site is located downstream of Mud Mountain Dam, a flood control dam operated by the U.S. Army Corps of Engineers (USACE). Recently, Mud Mountain Dam has been managed at low flow rates. As a result, the site has not seen the high flow events necessary to move and recruit substantial amounts of large woody debris. In February 2021, the USACE has completed a fish passage project at Mud Mountain Dam and with construction complete, project managers hope that flow rates through the dam will increase, bringing more wood and additional channel movement to the site.[82]

7.2.6. Distributional Effects of the Project

The primary motivation for the Countyline Levee Setback project was to address adverse distributional effects resulting from the 2009 flooding. Some of the homeowners who were affected by the flood did not have flood insurance because the flood maps did not accurately reflect their risk. Reporting by the Seattle Times details the extent of some of the damage: "Half a foot of water covered their first floor, warping floorboards, soaking insulation and furnace ducts, turning drywall into mush, wrecking appliances and soaking his treasured comic collection."[83]

The area around the Countyline Levee Setback project is a neighborhood that is lower income and has a higher percentage of people of color compared to the larger area of King County, Pierce County, and Washington State (Table 19). These socioeconomic and demographic characteristics suggest that the investment in this neighborhood is working towards correcting historic inequities associated with higher flood risks among a more diverse population.

[81] King County Department of Natural Resources and Parks. (2020). Countyline Levee Setback Project Year 1 and 2 Monitoring Report. Available at: https://your.kingcounty.gov/dnrp/library/2020/kcr3154.pdf

[82] Personal communication with Lincoln, A. and Shelton, S., King County Department of Natural Resources and Parks

[83] Cornwall, W. (2009). "Flood maps missed mark; Pacific homeowners got soaked". The Seattle Times. January 26.

7.2.7. Return on Investment

With only avoided costs of flooding and secondary output values alone, the ROI from the Countyline Levee Setback Project is 13 percent less than the full project investment. The $24.1 million invested in the project yielded a total gross return of $20.9 million for local communities (Table 20). If the benefits of ecosystem services were monetized, such as the increased habitat provisioning and sediment trapping, the ROI would likely be positive over the 50-year period. Non-monetized economic outcomes that provide benefits to the community include reduced risk of closure of Stewart Road SE and reduced downstream sediment management costs.

Table 20. Return on Investment for Countyline Levee Setback Project (50-years, discounted at 3%)

ROI Category	Value (50-years, discounted at 3%)
Value of Avoided Costs of Flooding	$2.4 million
Recreational Use Value	N/A
Property Value	Unknown, Likely Positive
Other Ecosystem Service Values	Positive
Secondary Output	$18.5 million
Total Gross Return	>$20.9 million
Total Investment	$24.1 million
Monetized Net Return	-$3.2 million
Monetized ROI	-13%

Source: Calculated by ECONorthwest

8 CEDAR RIVER PROJECT AT RAINBOW BEND AND CEDAR RIVER CORRIDOR PROJECTS

This case study focuses on the Cedar River Project at Rainbow Bend that was completed in 2014. The Rainbow Bend Project is a stand-alone case study — similar to the prior two case study analyses. Because many other floodplain restoration projects are completed, underway, or planned for the lower Cedar River Corridor, this case study evaluation also characterizes the expected economic outcomes associated with the corridor-level restoration efforts.

8.1 Project Summary

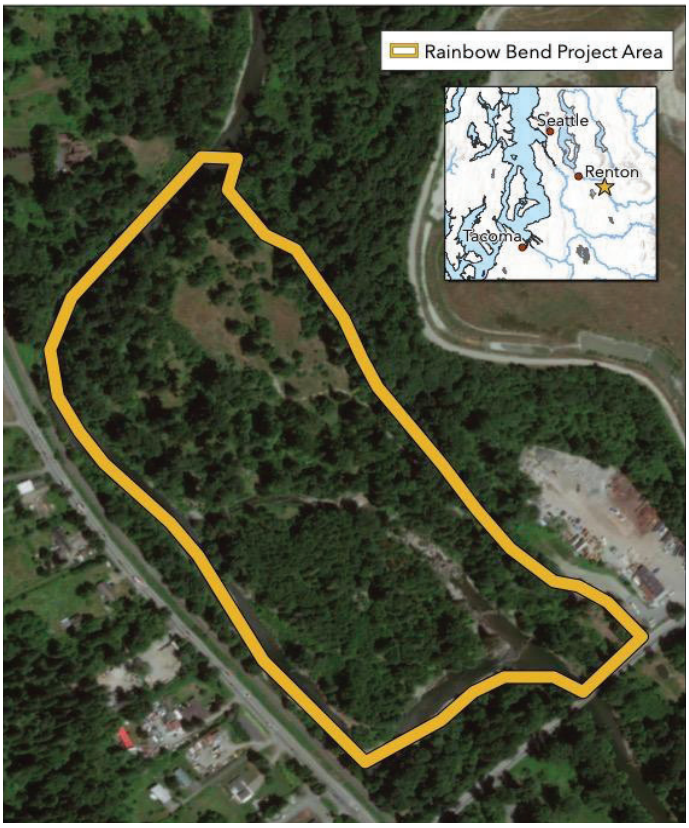
The Rainbow Bend Project on the Cedar River was accomplished through voluntary property acquisitions to move residents out of harm's way from flooding and setting back the levee to reconnect the Cedar River with 40 acres of historic floodplain.[84] The project site was originally a small neighborhood with nine single family homes and a mobile home park that experienced severe and repeated flooding. After the property acquisitions were completed, the restoration on the site included removing 12,000 feet of levee that allowed the Cedar River to connect with 40 acres of the floodplain on the right bank. The increased floodwater storage helps protect SR 169 and the Cedar River Trail on the left bank, and the reconnected floodplain provides critical rearing and refuge habitat for Chinook salmon. A timeline of this project is summarized in Table 21. A map of the project is available as Figure 13. Funding for the project was from by City of Seattle Cedar River Watershed Habitat Conservation Plan, Federal Emergency Management Agency, King Conservation District, King County, King County Conservation Futures, King County Flood Control District, Puget Sound Acquisition and Restoration, and Salmon Recovery Funding Board.

Table 21. Cedar River Project at Rainbow Bend Timeline

Phase 1 – Property Acquisitions	2003 – 2012
Phase 2 – Site Preparation	2011 – 2012
Phase 3 – Planning, Design, Construction	2010 – 2014
Monitoring, Maintenance, and Site Stewardship	2015 – Present

Source: King County, Rainbow Bend Levee Setback and Floodplain Restoration Project, available at: https://kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/rainbow-bend.aspx#:~:text=Overview,a%20major%20regional%20transportation%20corridor.

Figure 13. Rainbow Bend Project Location



Source: Created by ECONorthwest

[84] More information about the Rainbow Bend Levee Setback and Floodplain Restoration project is available at:https://kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/rainbow-bend.aspx#:~:text=Overview,a%20major%20regional%20transportation%20corridor.

8.2 Project Outcomes

8.2.1 Avoided Costs of Flooding

Prior Flood Risks and Property Acquisitions

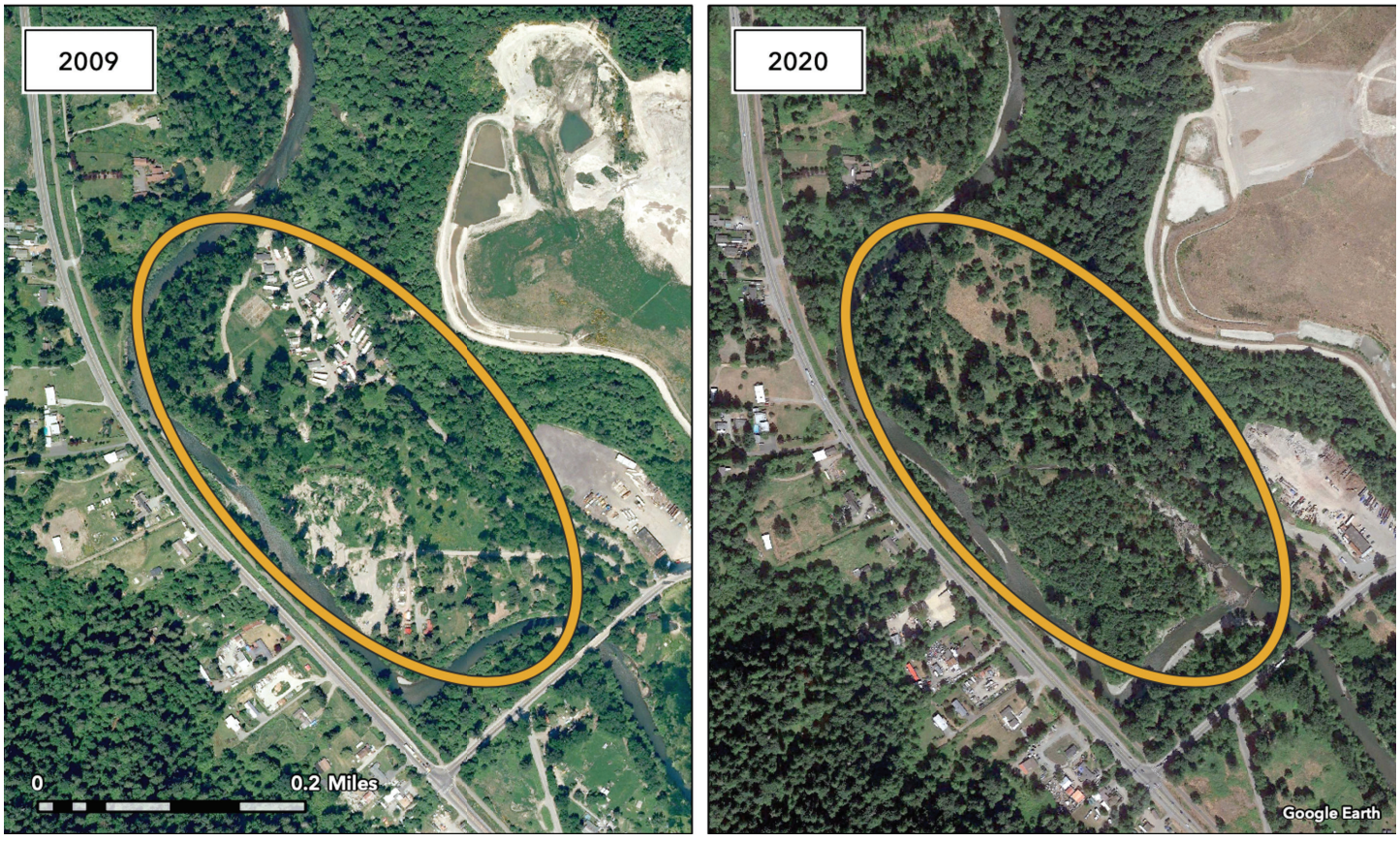
Prior to the Rainbow Bend Project being constructed there was reoccurring flooding for the homes in the project area northeast of the intersection of Cedar Grove Road SE and SR 169. The mobile home park and single-family residents in this area experienced devastating flooding in 1990 (when some properties had up to 1 foot of water in their home), and in 2009 (Figure 14). State Route 169 has also experienced recurring flooding in this section of the Cedar River.

King County acquired the 18-acre mobile home park on the Cedar River and nine single family homes for the Rainbow Bend Project. Figure 15 shows the location of the properties within the project area in 2009 and in 2020 to demonstrate the extent of the acquisitions.

Figure 14. January 2009 flooding of at the future Rainbow Bend Project Site

Source: King County Department of Natural Resources and Parks, Rainbow Bend Levee Removal Reach Floodplain Restoration. Available at: https://vimeo.com/111058132

Figure 15. Aerial Photo Showing Property Acquisitions for the Rainbow Bend Project



Source: Created by ECONorthwest using Google Earth

Reduced Flood Risks and Avoided Costs of Flooding

The Rainbow Bend Project achieved two outcomes to reduce flood risk. The first was moving people out of harm's way within the project area itself through the buyouts and relocation of residents of the mobile home park. The second was reducing flood risk and frequency on downstream and adjacent properties.

The avoided costs of flooding for the people in the mobile home park and single-family residential homes that were acquired through the Rainbow Bend Project is equivalent to the expected damage of these properties over the project lifetime.[85] The 2009 flood, a roughly 20-year flood event[86] with some reports of 1 foot of flood water inundation, provides an example of what the avoided flood costs are for these properties. Average damage from 1 foot of flooding for a mobile home is $16,983 and $50,500 for single-family homes (2021 dollars).[87] Content damage is $31,498 for a mobile home and $28,235 for a single-story residential home.[88] **The expected value of the avoided costs of flooding over a 50-year period for the acquired properties is $2.4 million.**

In addition to directly protecting homeowners and their property in the acquired area, the Rainbow Bend Project also reduced flood risk for other properties and infrastructure. This includes the Cedar River Trail, State Route 169, and a regional fiber optic cable line.[89] Flood risk for these areas was reduced but not eliminated. As recently as February 2020, the adjacent portion of SR 169 closed for five days due to flooding.[90, 91]

8.2.2 Economic Contributions

Project Spending

Total spending on the Rainbow Bend Project was approximately $12.2 million over the design, planning, and construction period (2011 to 2014). A summary of spending by category is in Table 22. Approximately half of the spending on the project was on construction related activities.

Table 22. Rainbow Bend Project Spending by Category

IMPLAN Industry	Total Cost	% of Project Cost
463 — Environmental and other technical consulting services	$514,470	4.2%
457 — Architectural, engineering, and related services	$1,271,135	10.4%
56 — Construction of other new non-residential structures	$6,426,807	52.7%
534 — Government	$993,771	8.1%
Permitting	$748,910	6.1%
Land Acquisitions	$2,244,907	18.4%
Total		**100.0%**

Source: Adopted from Reddington Levee Setback and Countyline Levee Setback project averages.

[85] This analysis assumes that all project lifetimes are 50 years for modelling purposes.

[86] Office of the Washington State Climatologist. (2009). January 2009 Flooding. January 12. Available at: https://climate.washington.edu/events/2009floods/

[87] U.S. Army Corps of Engineers New Orleans District. (2006). Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSVR) in Support of the Donaldsonville to the Gulf, Louisiana, Feasibility Study. March. Available at: https://www.mvn.usace.army.mil/Portals/56/docs/PD/Donaldsv-Gulf.pdf

[88] U.S. Army Corps of Engineers New Orleans District. (2006). Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSVR) in Support of the Donaldsonville to the Gulf, Louisiana, Feasibility Study. March. Available at: https://www.mvn.usace.army.mil/Portals/56/docs/PD/Donaldsv-Gulf.pdf

[89] King County Department of Natural Resources and Parks. (No Date). Rainbow Bend Levee Removal Reach Floodplain Reconnection Project. Available at: https://www.govlink.org/watersheds/8/pdf/1411_4479_WRIA8_RAINBOW_BEND.pdf

[90] King County Water and Land Resources Division. (2021). State Environmental Policy Act Determination of Non-Significance: SR 169 Flood Risk Reduction Project. Available at: https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/sepa/sr-169-dns.pdf

[91] Whitaker, D. (2020). "Cedar River runs dangerously close to King County homes". Komo News. Available at: https://komonews.com/news/local/cedar-river-runs-dangerously-close-to-king-county-homes

Jobs

Approximately 20 direct average annual jobs were supported in Washington through pre-construction and construction of the Rainbow Bend Project. These jobs include positions at King County as well as the third-party contractors. Some jobs will be filled by short-term, temporary workers who perform a very specific job on one of the construction sites. Other jobs were held by workers who are on the project for the majority of the planning, design, and construction period.

In addition to the direct jobs supported by contractors and at King County, the spending on the Rainbow Bend Project also supported approximately 17 average annual jobs in Washington through secondary impacts (Table 23). Including direct, indirect, and induced effects, the total job-years supported in Washington from the Rainbow Bend Project are 12.0 average annual jobs per $1 million in spending.[92]

Table 23. Jobs Supported by the Rainbow Bend Project During Planning, Design, and Construction

	Average Annual Jobs (FYE)	Total Job-Years
Direct	20	60
Indirect	7	22
Induced	10	29
Total	**37**	**110**

Note: Job-Years is calculated by multiplying the average annual jobs times the years of the project. Job-Years represents the total jobs (FYE) per year throughout the entire 4 years planning, design, and construction period. Job-Years is not the number of positions supported by the project. One job performed over all four years would be represented as 4 job-years.

Source: Calculated by ECONorthwest using IMPLAN (2014 Data Year)

Labor Income

Labor income is comprised of both employee wages, benefits, and other compensation as well as proprietor income (i.e., owner profits). In total, the Rainbow Bend Project supported approximately $6.9 million in total labor income in Washington during the project period (2014 dollars) (Table 24). Of the $6.9 million in labor income, the majority, $5.3 million, consists of employee compensation and the remainder, $1.6 million, is proprietor income.

Table 24. Labor Income Supported by the Rainbow Bend Project During Planning, Design, and Construction

	Average Annual Labor Income	Total Labor Income
Direct	$1,370,688	$4,112,063
Indirect	$456,902	$1,370,706
Induced	$471,129	$1,413,388
Total	$2,298,719	$6,896,157

Source: Calculated by ECONorthwest using IMPLAN (2014 Model Year)

Economic Activity

The Rainbow Bend Project had direct output of $9.2 million. This value is less than the full $12.2 million project budget because it excludes land acquisitions and permitting costs – which can be considered a transfer rather than new economic activity supported.

The total amount of output supported by the Rainbow Bend Project in Washington was $17.8 million including direct, indirect, and secondary effects (Table 25). The output multiplier refers to the amount of secondary effects (indirect and induced) created by the direct effects. The output multiplier for the project is 1.93.

Table 25. Output Supported by the Rainbow Bend Project During Planning, Design, and Construction

	Average Annual Output	Total Output
Direct	$3,068,728	$9,206,183
Indirect	$1,396,842	$4,190,526
Induced	$1,487,377	$4,462,131
Total	$5,952,947	$17,858,840

Source: Calculated by ECONorthwest using IMPLAN

[92] Note that this value is calculated based on $13.0 million in project spending, which does not include land acquisitions since that spending does not create value add in the economy. With the $3.5 million in land acquisitions, for a total of $16.5 million in project spending, there would be 9.5 average annual jobs per $1 million in project spending.

8.2.3 Fiscal Revenues

Sales and Use Taxes

The sales and use tax rate for the area of the project is 10.1 percent – this value is comprised of 6.5 percent of state tax and 3.6 percent of local tax. The $6.4 million construction contract for the Rainbow Bend Project subject to sales tax. As a result, the total expected sales and use taxes directly generated from the project were approximately $649,000 (2014 dollars). Secondary sales and use taxes are also supported by project spending as contractors purchase needed supplies that are subject to the tax. Employees and proprietors also generate sales and use tax from their household spending. Based on estimates from IMPLAN, the total sales and use taxes supported by secondary spending on the project are $23,900 (2014 dollars).

Business and Occupation Taxes

The estimated business and occupation tax associated with the Rainbow Bend Project is $138,000 (2014 dollars). Note that this value does not include any tax credits for the Business and Occupation tax.

Property Taxes

Because of how Washington calculates property taxes, increases in property values or reductions in the tax base, such as from property acquisitions, are not likely to change the property taxes collected by the local taxing jurisdictions.

8.2.4 Community Value

Property Values and Development

A hedonic analysis of property values suggests that the Rainbow Bend Project increased property values within 0.5 miles of the project area. **Prior to the project, homes in this area sold on average for about 2 percent less than homes located further away from the project area. After the project was completed in 2017 homes then sold for approximately 4 percent more than comparable properties.**[93] Although we cannot say with certainty that the increase in property values was a result of the investments in reducing flood risk through projects like Rainbow Bend, the reduction in flood risk is likely to increase property values over time. In particular, the cumulative effect of the investments to reduce flood risks in the Cedar River Corridor are likely to meaningfully decrease risks, and as a result increase property value and the ability of the area to attract and retain businesses and talent. The Renton River Days Festival, which takes place annually at Liberty Park and Cedar River Park in Renton, demonstrates how the river is a vital part of the economy of this local area and represents an amenity that increases quality of life for local residents.

Recreational Use Values

Prior to the Rainbow Bend Project, the Rainbow Bend Natural Area was a less than 1-acre public space located on the right bank of the Cedar River, near the single-family residential homes that were later acquired.[94] After completion of the Rainbow Bend Project the entire 40-acre site was designated as the Larry Phillips Natural Area in honor of a long-serving local councilmember.[95] This expansion of the natural area represents a 39-acre increase in open space. There is not visitation data to understand how many more people come to the larger Larry Phillips Natural Area instead of the Rainbow Bend Natural Area. There are other natural areas on this section of the Cedar River, but they are generally smaller at less than 10 acres.[96]

The Cedar River Trail is located immediately west of the Rainbow Bend Project between the Cedar River and SR 169.

[93] ECONorthwest analysis of King County and Pierce County single-family residential property sales transactions. More information about the hedonic analysis methodology is available in Appendix D.

[94] King County website, Rainbow Bend Natural Area. Available at: **https://kingcounty.gov/services/environment/water-and-land/natural-lands/ecological/rainbow-bend.aspx**

[95] WRIA 8 Salmon Recovery Council Meeting Notes from November 19, 2015. Available at: https://www.govlink.org/watersheds/8/committees/1603/2_SRC11-19-15MtgNotes.pdf

[96] King County website, Ricardi Reach, Cedar Grove, and Jones Reach Natural Areas. Available at: **https://kingcounty.gov/services/environment/water-and-land/natural-lands/ecological/ricardi-reach.aspx**

The 17.3-mile trail is one of the most popular trails for paved trail recreation in the area.[97] Approximately 30,000 pedestrians and bikers use the trail each year based upon the counter at the trail near SR 169 and 154th place Southeast.[98] The trail existed before the Rainbow Bend Project and the project did not alter or change the trail. The Cedar River in the project area is used by river users. For these users the recreational use value may have decreased since the introduction of more wood poses potential hazards for river users to avoid. However, wood also enhances salmon habitat and to the extent that it benefits salmon and results in easier catch for anglers it represents an increase in recreation value.

8.2.5 Environmental Outcomes

The Rainbow Bend Project reconnected the Cedar River with 40 acres of floodplain. In addition to reducing flood risk, the Rainbow Bend Project was also designed to restore salmon habitat in the Cedar River and support salmon recovery strategies and goals, including the Chinook Salmon Conservation Plan by WRIA 8.[99] The Cedar River has been extensively modified over recent history and the project site had been altered by channelization and rural development. This area was exposed to chronic flooding and is also an area used for adult spawning and juvenile rearing by Chinook, Coho, sockeye, steelhead, and cutthroat trout.[100] Flooding can adversely affect juvenile fish who are swept downstream in high flow and velocity events, especially in areas where floodplain has been disconnected from the river by levees or other bank armoring. The Rainbow Bend Project was designed to support ecological processes and allow the river to naturally become more dynamic with minimal intervention.[101] The design of the project included construction of pilot channels to divide river flows, removal of the levee, installation of four log jams, and riparian plantings.

The Rainbow Bend Project has met its identified objectives and performance standards.[102] As soon as the levee was removed, the flow rate slowed dramatically and the channel widened. From fall 2013 to spring 2015, the average rate of channel widening was 25 linear feet and two years after construction was completed, the site transitioned from a single channel to a braided channel flowing around several islands.[103] As the channel widened, significant amounts of wood were recruited to the site and there are now many woody debris jams in the project area that slow the water and provide refuge for aquatic species.[104]

In addition to the flow benefits observed, the site has also created large amounts of high-quality juvenile salmon habitat. The new areas of edge habitat and off-channel and backwater areas provide young Chinook and other salmonids places to feed and escape predators. The increased amount of side channel and backwater habitat, providing capacity for juvenile Chinook at the site increased from 600 to nearly 1,600 fish

[97] Strava, Heatmap. Available at: **https://www.strava.com/heatmap#15.40/-122.24174/47.25818/hot/all**

[98] WSDOT, Bicycle and Pedestrian County Portal. Available at: **https://wsdot.wa.gov/data/tools/bikepedcounts/**

[99] Water Resource Inventory Area 8. (2005). Lake Washington/Cedar/Sammamish Watershed (WRIA 8) Chinook Salmon Conservation Plan. July. Available at: **https://www.govlink.org/watersheds/8/planning/chinook-conservation-plan.aspx**

[100] King County. (2021). Cedar River Project at Rainbow Bend. **https://kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/rainbow-bend.aspx**

[101] Personal communication with J. Bethel, King County.

[102] King County (2016). Monitoring and Maintenance Report: Rainbow Bend Levee Removal and Floodplain Reconnection Project. King County Water and Land Resources Division. **https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/capital-projects/rainbow-bend/rainbow-bend-monitoring-rpt-may-2016.pdf**

[103] King County (2016). Monitoring and Maintenance Report: Rainbow Bend Levee Removal and Floodplain Reconnection Project. King County Water and Land Resources Division. **https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/capital-projects/rainbow-bend/rainbow-bend-monitoring-rpt-may-2016.pdf**

[104] Personal communication with J. Bethel, King County.

and over one year, the capacity for all salmonids increased by at least 3,000 to 5,000 fish, depending on flow levels.[105] Additionally, areas of edge habitat increased by 82 percent over baseline conditions in one year. The project also led to gravel exposure and the project site supported increased spawning in this area of the Cedar River. One year after construction, 19 Chinook redds were observed in the side channel which accounted for 10 percent of all Chinook redds in the Cedar River.[106]

8.2.6 Distributional Effects of the Project

The primary distributional effects of the Rainbow Bend Project arise from the acquisition of residential property within the project area as well as who benefits from the reduced flood risk benefits in the surrounding area. The property acquisitions required relocation assistance for 55 families, all with different and unique needs.[107] King County hired a relocation specialist to assist with the relocations, in accordance with the standards for non-voluntary acquisitions regulated by the U.S. Housing and Urban Development Authority. King County provided increased assistance to low income, disabled, and elderly residents. It also provided interpreter services for the Spanish speaking families.

Approximately one year after the acquisitions for the Riverbend project, King County contracted with a consultant to conduct an informal survey to find out how participants felt about the experience. The answers to the question "Do you feel like you are better off as a result of your relocation? " included the following answers (out of 23 total responses):

- "Yes, this house is newer and in better condition and we have the room we need."
- "Absolutely. I'm out of an RV and into a home, a much bigger home, in a very nice community."
- "This is ok, we have a bigger house now, but we loved living on the river, the nature walks, the wildlife, birds, a more secluded location."
- "It's OK. Our cost of living went up quite a bit. We liked living for less at Riverbend."
- "Yes and no. Yes as the money was a blessing to get into something nice. No, as moving … is hard."[108]

Overall, respondents overwhelmingly indicate that their living situation in terms of quality and size of home has improved after relocating. Respondents also stated that they were treated fairly and that the compensation that they received was "more than fair", "generous", and "the money was good". The adverse experiences that the survey revealed are due to having to move, including both the actual moving process as well as relocating away from a community and area amenities (such as being near the river) that people liked and have not found to be as valuable in their new location. Some respondents also indicated that their living costs have increased relative to the costs they had previously at the mobile home park.
Today, the area of the Rainbow Bend Project is generally higher income and home to fewer people of color and renters compared with the larger area of King County and Washington State (Table 26). In 2009 this area also had similar demographic and socioeconomic characteristics as compared to the larger county and state geographies.

[105] King County (2016). Monitoring and Maintenance Report: Rainbow Bend Levee Removal and Floodplain Reconnection Project. King County Water and Land Resources Division. **https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/capital-projects/rainbow-bend/rainbow-bend-monitoring-rpt-may-2016.pdf**

[106] King County (2016). Monitoring and Maintenance Report: Rainbow Bend Levee Removal and Floodplain Reconnection Project. King County Water and Land Resources Division. https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/capital-projects/rainbow-bend/rainbow-bend-monitoring-rpt-may-2016.pdf

[107] King County Department of Natural Resources and Parks, Restoring Rainbow Bend, Good for People and Fish. Available at: https://vimeo.com/111058132

[108] Personal details were removed from the responses to preserve anonymity.

Table 26. Socioeconomic and Demographic Characteristics of Neighborhoods Near the Rainbow Bend Project

	Median Household Income[1]	Percent People of Color[2]	Percent of Renter Occupied Units[3]
Census Tract 319.04 (Rainbow Bend northeast)	$106,438	13.6%	7.7%
Block Group 1 (Rainbow Bend northeast)	$127,375	N/A	7.7%
King County	$94,974	38.6%	36.0%
Washington State	$73,775	34.5%	24.6%

[1] Data Source: U.S. Census Bureau (2019). Median Household Income in the Past 12 Months, 2015-2019 American Community Survey 5-year estimates.

[2] Data Source: U.S. Census Bureau (2019). Total Population in Occupied Housing Units by Tenure by Year Householder Moved into Unit, 2015-2019 American Community Survey 5-year estimates.

[3] Data Source: U.S. Census Bureau (2019). Race, 2015-2019 American Community Survey 5-year estimates.

8.2.7 Return on Investment

With only avoided costs of flooding and secondary output values alone, the ROI from the Rainbow Bend Project is 11 percent less than the full project investment. The $12.2 million invested in the project yielded a total gross return of $10.8 million that could be monetized (Table 27). Additional benefits that are not monetized include the recreation benefits from 39 acres of new natural area open space, high-quality juvenile salmon habitat, and reduced risk of flooding to infrastructure like SR-169, the Cedar River Trail, and the fiber optic cable.

Table 27. Return on Investment for Rainbow Bend Project (50-years, discounted at 3%)

ROI Category	Value (50-years, discounted at 3%)
Value of Avoided Costs of Flooding	$2.4 million
Recreational Use Value	Positive
Property Value	Unknown, Likely Positive
Other Ecosystem Service Values	Positive
Secondary Output	$8.6 million
Total Gross Return	>$10.8 million
Total Investment	$12.2 million
Monetized Net Return	-$1.4 million
Monetized ROI	-11%

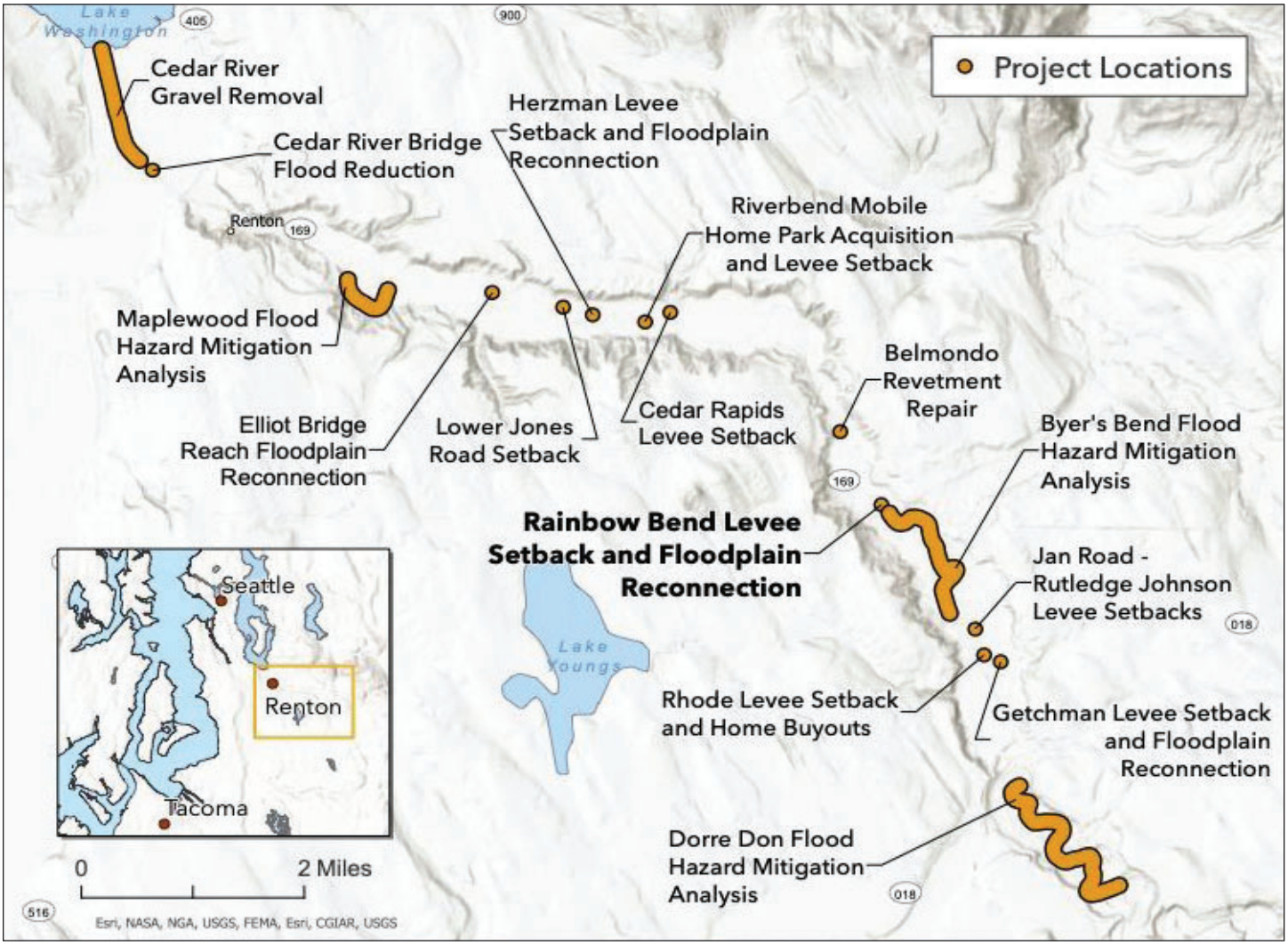
Source: Calculated by ECONorthwest

8.3 Corridor Wide Impacts in the Cedar River

Although a single project by itself might have only a localized impact on reducing flood risk, the approach being taken in the Cedar River is to perform restoration on the entire river corridor with a series of connected projects. There are multiple planning efforts and project sponsors for river restoration within the Cedar River corridor, which extends 22 miles from Landsburg to Lake Washington, the terminus of the Cedar River.

King County is implementing projects in the Cedar River as ways to execute the strategies and goals of the King County Flood Hazard Management Plan, the Cedar River Capital Investment Strategy, the Lower Cedar River Basin and Nonpoint Pollution Action Plan, the Clean Water and Healthy Habitat Strategic Plan, and the King County Land Conservation Initiative. WRIA 8, which covers the Lake Washington/Cedar/Sammamish Watershed, implements projects in the Cedar River corridor to pursue the goals and policies outlined in their Chinook Salmon Conservation Plan, including to reconnect 130 acres of floodplain by 2025. There are over 20 projects underway or planned in the Cedar River corridor. Together, these projects build upon each other to advance the goals of these plans and initiatives.

Figure 16. Location of Rainbow Bend and other Cedar River Restoration Projects



Source: Floodplains By Design. (2015). Cedar River Corridor Plan. Available at: http://www.floodplainsbydesign.org/wp-content/uploads/2015/02/Cedar-River-FY15-17-Request-two-Pager-022715.pdf

Figure 16 depicts the location of planned and completed Cedar River restoration projects. The goal of the downstream projects is to reduce flooding for the lower 1.25 miles of the Cedar river, which includes urban areas of Renton like the Boeing plant and Renton airport.[109]

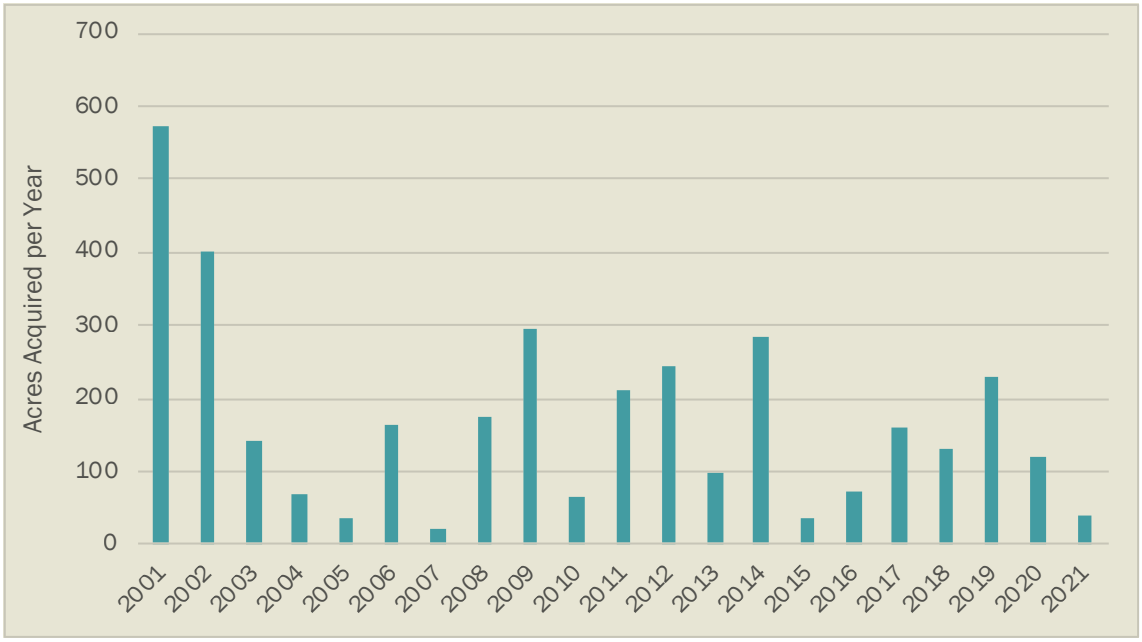
The motivation for the projects in the Cedar River corridor are explicitly to address the goals of the planning documents, particularly those around reducing the risk of flooding that are articulated in the Flood Plan and CIS, as well as the habitat needs for threatened species identified in the Salmon Recovery Plan.

The expected future economic outcomes and benefits expected from all the planned projects in the Cedar River include the following:

- Reduced flood risk from moving people out of flood-risk areas and reconnecting more of the river with historic floodplain. Historic flooding has demonstrated the costs of

[109] King County Department of Natural Resources and Parks. (2012). King County Flood Hazard Management Plan Update. Available at: **https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/flood-hazard-mgmt-plan-update-2012/basin-strategy-fact-sheets/1211_2797cedar.pdf**

Figure 17. Acquisitions in Cedar River Corridor by Year



Source: Provided by King County

flooding in the Cedar River watershed. The November 1990 flood caused damage in excess of $11 million (1990 dollars) and the November 1995 flood damaged approximately 90 homes and 39 public facilities.[110]

- Improved habitat conditions, including water quality and habitat area, that will support rearing, feeding, and refugia for salmon populations. Although specific estimates for how many more salmon will be in the Cedar River have not been projected, there is broad consensus that the efforts in the Cedar River corridor will benefit salmon populations.
- Investments in the environment provide value to people who are drawn to living somewhere with healthy environmental amenities that they can enjoy. Trails and recreation access, such as the Cedar River trail and many natural areas in the Cedar River corridor, make the area a more enjoyable place to live. Events on the Cedar River, the "Salmon Seeson" and "Cedar River Salmon Journey",[111, 112] allow people to learn about and see the salmon migration and spawning process — connecting people with the environment and providing educational opportunities in nature. These investments in the environment can attract and maintain residents and businesses who value living near healthy rivers.

To realize the goals for restoration and reducing flood risk in the Cedar River requires continued investments over time and buy in from the local community. Since 2001 there have been over 3,5000 acres acquired for over 100 projects in WRIA 8. Figure 17 shows the acres acquired by year by King County for projects in WRIA 8, which includes the Lake Washington, Cedar, and Sammamish watersheds.

Other planned projects in the Cedar River corridor provide examples of the need and outcomes from additional floodplain restoration work. The Riverbend Levee Setback project is located approximately 3 miles downstream of the Cedar River

[110] King County. (1993). Lower Cedar River Basin Plan Summary. Available at: **https://kingcounty.gov/services/environment/watersheds/cedar-river-lake-wa/documents/cedar-river-basin-plan/summary.aspx**

[111] Salmon SEEson is a multijurisdictional effort to map locations where viewers can see salmon spawning in Puget Sound rivers and streams through self-guided tours. More information is available at: **https://experience.arcgis.com/experience/779f2239705a42fba71f198d958da479/page/page_0/?data_id=dataSource_2-Salmon_viewing_sites_8034%3A7**

[112] The Cedar River Salmon Journey is hosted by the Seattle Aquarium every October. Trained naturalists are stationed at locations along the river to show visitors how to view spawning salmon and provide information about the salmon spawning and migration process. More information is available at: **https://www.seattleaquarium.org/salmon-journey**

project at Rainbow Bend.[113] The motivation for the project is to move residents out of harm's way of flooding through property acquisitions and use new flood water capacity to reduce risk for other nearby homes and infrastructure. The Riverbend Mobile Home park was acquired in 2013. The project is designed to reconnect approximately 52 acres of floodplain. This project is prioritized in the WRIA 8 "Chinook Salmon Conservation Plan"[114] and will bring the watershed closer to its goal of reconnecting 130 acres of floodplain by 2025. A complication to this project occurred on February 9, 2020, when a flood breached an existing levee at the project site, resulting in changes to project design that will be implemented in Phase 2 of the project. Despite the changes to the project plan, the flood breach should allow for greater habitat restoration and possibly increased flood risk reduction to be realized from the Riverbend Project.

Another project in this area of the Cedar River, the Herzman to Camp Freeman Project, will be located adjacent to the Riverbend Levee Setback project and is planned for completion in 2023. This project involves a levee setback, improvements to a revetment, and habitat enhancement. A specific goal of the project is to: "Maximize multi-benefits of flood risk reduction and habitat by coordinating the design with the Riverbend Levee Setback and Floodplain Restoration project located immediately upstream."[115] Upstream immediately west of Cedar River Park and the Riverbend Levee Setback project, the Elliott Bridge Reach Mitigation project will restore four acres of floodplain.[116]

The Riverbend Levee Setback project demonstrates other flood risk reduction benefits in the Cedar River. The river channel has been migrating over time, posing changing and higher risks to property owners. The picture below (Figure 18) shows the impacts to a home following a 1990 flood where the land underneath a mobile home was removed by floodwaters. The Riverbend project included purchasing an 18-acre mobile home park to reduce risks for these residents. It cost King County $6.5 million to purchase these properties, and $7.5 million in total for the acquisitions (including all costs associated with relocation).[117] Once complete, the Riverbend project will reconnect approximately 52 acres of floodplain.[118] The project will provide flood protection to an additional 19 properties worth approximately $4.6 million in assessed value (2015 values).[119]

Figure 18. Picture of Impacts to a Home from Cedar River Flooding in 1990

Source: King County Department of Natural Resources and Parks, Riverbend Reach Floodplain Restoration. Available at: **https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/capital-projects/riverbend/1510_5099_WRIA8_ILAFactSht_%20RIVERBEND.pdf**

[113] More information about the Riverbend Levee Setback and Floodplain Restoration project is available at: **https://kingcounty.gov/services/environment/animals-and-plants/restoration-projects/projects/riverbend-levee-setback.aspx**

[114] The Chinook Salmon Conservation Plan is available at: **https://www.govlink.org/watersheds/8/planning/chinook-conservation-plan.aspx**

[115] More information about the Herzman to Camp Freeman Project is available at: **https://kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/herzman-camp-freeman.aspx**

[116] King County Department of Natural Resources and Parks, Elliott Bridge Reach Mitigation Project. Available at: **https://kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/elliott-bridge.aspx**

[117] King County. (No Date). Riverbend Reach Floodplain Restoration. Available at: **https://your.kingcounty.gov/dnrp/library/water-and-land/flooding/capital-projects/riverbend/1510_5099_WRIA8_ILAFactSht_%20RIVERBEND.pdf**

[118] King County, Riverbend Levee Setback and Floodplain Restoration. Available at: **https://kingcounty.gov/services/environment/animals-and-plants/restoration-projects/projects/riverbend-levee-setback.aspx**

[119] Floodplains by Design. (2015). Cedar River Corridor Plan. Available at: **http://www.floodplainsbydesign.org/wp-content/uploads/2015/02/Cedar-River-FY15-17-Request-two-Pager-022715.pdf**

9 FINDINGS, CONCLUSIONS, AND NEXT STEPS

9.1 Findings and Conclusions

This evaluation reviewed three case studies of floodplain restoration and flood control projects in Puget Sound to understand the common economic outcomes for the local communities from the projects. The focus of this analysis is on the drivers of community revenue in local economies, including avoided flood costs, economic contributions in the form of jobs and economic activity, fiscal revenues for local taxing jurisdictions, and other sources of community value.

9.1.1 Avoided Cost of Flooding

The three case studies that were evaluated in this report shared a common feature — all were motivated, at least in part, by the January 2009 flooding. This flood, although smaller than a 100-year extent, exposed the vulnerabilities of the engineered structures like levees. The 2009 flooding also prompted policy responses to avoid flood damages in the future. Property acquisitions combined with levee setbacks were features in all three of the floodplain restoration project case studies. The findings of the case study analysis demonstrate that this strategy is effective by both moving people out of harm's way, as well as reducing flood risks for the people who remain by increasing the available flood storage capacity and redirecting high waters.

Flood risk reduction benefits are often some of the largest sources of economic value resulting from floodplain restoration. There are generally two sources of avoided cost of flooding value associated with the floodplain restoration case studies evaluated in this report. The first is the value to residents who are moved out of harm's way of flooding through property acquisitions.

The second source of avoided cost of flooding value is the project's ability to hold and slow floodwaters to lessen the flood risk in nearby areas. The Reddington Levee Setback Project demonstrated that $22.9 million in avoided costs can be achieved over the lifetime of the project by creating more storage area and improving levees by building to higher standards. The largest flood risk reduction benefits occur when there are multiple projects on both sides of the river. The Cedar River Corridor projects demonstrate how floodplain restoration fits into the long-term solution to reduce flooding throughout an entire reach of the river.

A conclusion from this case study evaluation is that there are opportunities to better communicate the benefits of avoided flood risks for local residents. The strategy for flood reduction often occurs through multiple projects, each designed to protect a specific area. Looking at only a single floodplain restoration project does not communicate the full reductions in flood risks anticipated over time in a river reach. **Flood risk reduction requires an integrated corridor-wide approach to both measure and estimate benefits, as well as communicate those outcomes to the people who rely on their local floodplain managers to keep them safe.**

9.1.2 Economic Contributions

Floodplain restoration projects require significant capital investments that support jobs and economic activity to oversee, design, plan, and execute the project. Those jobs provide compensation to workers and firm owners that they then spend in the local economy to support more economic activity. The average output multiplier for the three case studies was 1.93 — meaning that for every $1,000,000 spent on the project an additional $930,000 in economic activity is supported in Washington's economy. This multiplier value of 1.93 is similar to the multiplier for single-family residential construction (a multiplier of 1.89), hospitals (a multiplier of 1.95), and breweries (a multiplier of 1.79) in Washington.[120]

The three projects had similar annual jobs estimates, on average approximately 11.7 average annual jobs per $1 million spent on the project.[121] This value is similar to the total jobs

[120] IMPLAN Model for Washington State, 2014 model year.

[121] This per million-dollar estimate is lower than what is currently being used by Washington Department of Ecology to calculate the "jobs touched" from restoration projects of 16.7 per $1 million. The reason for this is primarily changes that have occurred over time. The 16.7 jobs per million dollars is based on work from 2010 using the IMPLAN 2008 data year model (Nielsen-Pincus, M., & Moseley, C. (2010). **Economic and employment impacts of forest and watershed restoration in Oregon.** Ecosystem Workforce Program. Working Paper Number 24**.)** Since 2008 there has been inflation and changes in spending patterns — resulting in the different values obtained in this analysis. Washington Department of Ecology and others using this number for jobs estimates could update it to more accurately reflect the current estimates of employment supported by project spending.

supported by $1 million in spending in other industries in Washington, including construction of new highways and streets (11.5 jobs), hospitals (11.8 jobs), and sawmills (9.8 jobs).[122]

In addition to the economic contributions from project spending there are also outcomes associated with reducing flood costs. With lower risks of flooding there is less loss of economic activity if businesses are disrupted, road closures impact transport, or people's lives are disturbed after a flood event. By reducing the risk of flooding, the case studies also achieve these economic outcomes.

Economic contributions from floodplain restoration are also supported by business and worker attraction and retention. To the extent that floodplains make people want to reside in the area compared to somewhere else represents new economic activity. Attributing a person or business's decision on where to locate based on a single floodplain restoration project is generally not possible. However, we know from the literature evaluated in Phase 1 that reducing flood risk, increasing water quality, and creating co-amenities like aesthetic or recreation features leads people to choose to locate near a river but outside of a floodplain. **The corridor-wide planning efforts, particularly in the Green-Duwamish River and Cedar River, can maximize the economic contributions by designing the projects to create co-amenities and support local business development.**

9.1.3 Fiscal Revenues

Fiscal revenues are tied to the economic contributions and spending on a floodplain restoration project. **The largest fiscal revenues to state and local taxing jurisdictions are from sales and use tax and business and occupation tax.** These fiscal revenue sources are supported both by the direct project spending, but also through secondary effects as workers spend household income from their compensation and businesses spend on operations and supply chains. To the extent that floodplain restoration and river management policies incentivize people to live and work in a local area supports additional fiscal revenues.

Because of the property tax structure in Washington there is no evidence that floodplain restoration projects by themselves create new property tax revenue. Similarly, evidence does not exist to demonstrate that property buy outs associated with these projects reduce property tax revenues. Property taxes may shift to other properties due to the reduction in number of properties. However, these buyout programs are generally small enough in scale that there would not be measurable effect on property tax payments.

A property tax policy relevant to river restoration projects is the public benefit rating system (PBRS) in King County. PBRS is a voluntary program where landowners can reduce their property tax burden by committing to provide certain public benefits on their property.[123] For example, a landowner could commit to protecting a buffer of riparian vegetation on their property near a floodplain and receive a property tax reduction for that arrangement. Although the public benefit rating tax incentive was not used in any of the case study projects, it is a potential tool using fiscal incentives to encourage participation in open space protection. There are PBRS lands located in other areas of the Cedar River and Green River.

9.1.4 Property Values

The evaluation of property sales in both King County and Pierce County provides evidence that suggests being near a river is generally supportive of higher property values compared to being farther than 0.5 miles away. The three case studies demonstrated mixed effects on property values before and after the floodplain restoration project, some of which may not have been directly caused by the project itself but on things that occurred later on (e.g., adjacent land uses, encampments, local development over the years, etc.). Homes within 0.5 miles of the Countyline and Rainbow Bend Project areas experienced an increase and shift in property values after the projects were completed, going from negative property value effects to positive. However, properties within 0.5 miles of the Reddington project were different — they began with higher property values than the larger area but after the project the values were lower. This relative decline could be due to the project, the increase in recent encampments, and/or due to

[122] IMPLAN Model for Washington State, 2014 model year.

[123] More information about the PBRS is available at: https://kingcounty.gov/services/environment/stewardship/sustainable-building/resource-protection-incentives.aspx

development and new construction occurring farther away that makes the relative value of the Reddington properties lower.

Overall, the correlations for King County and Pierce County suggest that living near or having views of a healthier river with open space have positive impacts on property values. Although increasing property values is not and should not be a goal of property managers — as there are equity considerations associated with high property values — additional housing and business opportunities could be better incorporated into large-scale project design. There may be opportunities for floodplain restoration managers to partner with community and economic development departments to design and fund projects that capitalize on attracting businesses and residents to the area, as well as supporting larger goals like homelessness and affordable housing opportunities.

9.1.5 Recreational Amenities

The Reddington Project created a new recreational amenity as part of the project's design – the updated and expanded levee trail. The Rainbow Bend Project created the 39-acre Larry Phillips Natural Area. Enhanced recreational facilities contribute to community value, not just for the person participating but also by impacting property values and contributing to business and resident attraction and retention.

Throughout this project we have heard feedback from floodplain restoration managers that recreation is not always consistent with project design. Terrestrial recreation takes up space, often in riparian zones, and requires resources that could otherwise be dedicated to restoration purposes. Restoration best practices like introducing large woody materials can pose hazards for recreational activities like tubing and rafting. Although restoration can improve fishing success by increasing fish populations, more complex habitat can also pose more challenging fishing conditions.

There may be opportunities for floodplain restoration managers to partner with parks and recreation departments to seek out funding and design projects together so that recreational amenities can be incorporated into projects to maximize the co-amenities that the project can produce. Incorporating recreational features is particularly important in areas where there is relative scarcity of these opportunities. The public lands needed for floodplain restoration mean that there are possibilities for easements and other management structures that support recreation design.

9.1.6 Environmental Outcomes

Environmental benefits and economic outcomes arising from the goods and services provided by a healthy ecosystem were not the focus of this report. The three case study projects were designed to enhance environmental conditions in the river to benefit sensitive species like salmon. These environmental outcomes provide value to people. Improving and enhancing aquatic and riparian habitats is an example of achieving multiple sources of economic value, in addition to reducing flood risk, through floodplain restoration. Like flood risk reduction, one project by itself will not recover populations of threatened aquatic species but the corridor-wide approach being taken in these rivers is likely to have measurable long-term benefits for these species.

The benefits to people from floodplain restoration are commonly synthesized and referred to as "ecosystem services". Ecosystem services are the benefits that the environment provides that humans do not have to pay for. Many previous evaluations of the benefits of floodplain restoration in the Puget Sound have focused on ecosystem services. Ecosystem services are generally categorized as provisioning, regulating, cultural, and supporting services. See Table 28 for descriptions of the ecosystem services that can be provided by floodplains.

Table 28. Ecosystem Services from Floodplains

Provisioning Services	Regulating Services	Cultural Services
The "products" obtained from ecosystems	Benefits obtained from the regulation of ecosystem processes	Nonmaterial benefits obtained from ecosystems
Food	Flood Regulation	Recreational
Habitat	Climate Regulation	Aesthetic & Artistic
Fresh Water	Water Purification	Spiritual
Raw Materials		Educational & Heritage
Supporting Services		
Services necessary for the production of all other ecosystem services		
Nutrient Cycling		
Biodiversity		
Soil Formation		
Primary Production		

Source: Created by ECONorthwest based on Millennium Ecosystem Assessment (2005)

This analysis did not calculate the full ecosystem service value for each case study. However, flood regulation and recreation are components of ecosystem services — and they are independently calculated in the case study analysis. Examples from the literature inform the magnitude of full ecosystem services provided by river restoration. The ecosystem/environmental services used for the FEMA BCA calculator include riparian and green open space values for acquisition projects. The associated ecosystem services values are in Table 29 (2013 dollars). These are national values derived from literature reviews. The largest ecosystem service benefits are for recreation/tourism, erosion control (for riparian only), water filtration, and flood hazard reduction (for riparian only).

Table 29. Ecosystem/Environmental Service Values Used in the FEMA BCA Toolkit (2013 Dollars)

Environmental Benefit	Green Open Space	Riparian
Aesthetic Value	$1,623	$582
Air Quality	$204	$215
Biological Control	—	$164
Climate Regulation	$13	$204
Erosion Control	$65	$11,447
Flood Hazard Reduction	—	$4,007
Food Provisioning	—	$609
Habitat	—	$835
Pollination	$290	—
Recreation/Tourism	$5,365	$15,178
Storm Water Retention	$293	—
Water Filtration	—	$4,252
Total Estimated Benefits	**$7,853**	**$37,493**

Source: Federal Emergency Management Agency. (2013). Consideration of Environmental Benefits in the Evaluation of Acquisition Projects under the Hazard Mitigation Assistance (HMA) Programs. FP-108-024-01. June 18.

The ecosystem services value for the water regulation function of rivers (i.e., floodplain water storage) has a value of $1,200 to $1,400 per year in Washington.[124] A full ecosystem service evaluation for an estuary restoration project in Puget Sound found that the per acre value of ecosystem services is between $350,000 and $600,000 per acre over a 50-year period (2014 dollars).[125] Earlier work on the value of ecosystem services in the Puget Sound estimates the per acre value of fresh wetlands as between $6,676 to $59,914 per acre per year (2012 dollars).[126]

9.1.7 Distributional Considerations

There are three primary distributional considerations associated with the floodplain restoration projects in the case studies. The first is who is receiving the benefits of the project. In all three case studies there were mobile homes and lower-valued housing that was impacted by flooding, some of whom even did not have flood insurance. By prioritizing funding and projects in these locations, floodplain managers are addressing historic inequities by protecting people who were previously at risk. Property acquisitions have complicated distributional considerations because people are being displaced from their home while they are also being provided the resources needed to move out of a high flood risk area.

The second distributional consideration is the effect of the property acquisitions. King County uses relocation specialists, even for voluntary acquisitions that do not use federal funds (which is not required under federal law). By using relocation specialists and compensation methods that are tied to the price of decent, safe, and sanitary replacement housing, King County is increasing the likelihood that sellers have the resources needed to maximize their economic value from the transaction while also stewarding taxpayer funds for these projects. The survey responses from participants in the Rainbow Bend acquisitions provides evidence that participants largely report that they are better off financially as a result of participating, but that they incur non-monetary costs from the moving process and relocating away from their community.

The third distributional consideration is what happens to the project area after the project is complete. Encampments are something that have occurred in the floodplain restoration projects like they do in other open spaces and public spaces. These activities create perceptions of risks to safety among residents and users of the area. The debris and environmental footprint of encampments can also impede environmental objectives of the restoration project through the effect on riparian vegetation and potentially water quality. Homelessness and houselessness are pervasive issues in Puget Sound that have been growing over time and affect not only floodplain restoration areas but also traditional grey infrastructure like underpasses, levees, parks, cemeteries, roadways, and other open spaces.

9.1.8 Return on Investment

The ROI analysis demonstrated the difficulty in monetizing the economic outcomes associated with floodplain restoration. Many aspects of "return" were not possible to monetize using available information for the case studies. In particular, avoided flood costs are one of the largest sources of value for the community from the case study projects, but the monetization of that value was often incomplete because of a lack of information about the difference in risk before and after the project and the benefiting properties. Recreation and value of natural spaces is also a large source of value from floodplain restoration projects — but these values are also challenging to monetize without information on recreational use and visitation to the sites.

9.1.9 Additional Conclusions

A primary conclusion from the case study analyses is that the floodplain restoration and flood risk reduction projects are designed to have cumulative effects at the river corridor level. King County does not build all the projects at once, instead implementing them individually as land is acquired and funding is available. This analysis attempted to evaluate the benefits of individual projects — but that approach leaves out the larger,

[124] Gustanski, J. A., Hayes, M.M., Scofield, A., Scarsella, D. (2020). Economic Value of Chehalis Basin Ecosystem Services. Resource Dimensions, Gig Harbor, WA. Table 48.

[125] Christin, Z. (2014). Return on Investment of North Wind's Weir. Earth Economics, Tacoma, WA.

[126] Batker, D., Swedeen, P., Costanza, R., de la Torre, I., Boumans, R., Bagstad, K. (2008). A New View of the Puget Sound Economy: The Economic Value of Nature's Services in the Puget Sound Basin. Earth Economics, Tacoma, WA.

long-term benefits that will be realized once restoration has occurred throughout the entire river. As discussed for the Cedar River Corridor, because the projects are not complete there is a lack of information and understanding about the cumulative, long-term effect of the projects.

The case studies also provide information that informs the impact of the projects on the communities' ability to attract and retain business and talent. The floodplain restoration projects improve quality of life by providing community amenities (e.g., environmental and recreational value) and reducing disamenities (e.g., reduced risk of flooding) – the primary findings of this report. These investments in the community not only improve quality of life for the people who are living here but also serve to attract and retain businesses and the workforce they rely upon. The investments in natural capital can therefore support a variety of economic activity as businesses and people are attracted to the region. Like the other findings from this report — a single river restoration project is not going to be the deciding factor for a business to locate in a region. However, investments in river corridors – including reduced flood risk as well as creating amenities like trails and open spaces — do provide incentives for people to want to live and work in a region.

9.2 Opportunities for Future Research

9.2.1. Future Project Evaluations

The goal of this project was to understand if urban floodplain restoration was able to create measurable changes in community value. At this point the changes from floodplain restoration projects in the Puget Sound are largely incremental. As discussed in each case study, these projects are occurring within the context of larger efforts throughout the watershed and river corridor — particularly to reduce flood risks and enhance environmental quality. Once complete, future research could evaluate the collective benefits from multiple projects and the long-term and co-benefits of sustained investments in a river corridor. Specific areas for additional research that were identified in this analysis include the effect of cumulative river restoration projects on:
Changes in floodplain extents and flood risk areas;

- Greenhouse gas sequestration and net greenhouse gas emissions;
- Attracting homeless encampments;
- Increasing coordination among public agencies and non-profits;
- Changes in Puget Sound salmon population levels;
- Business and employee attraction and retention;
- Changes in public perceptions of river restoration projects.

In addition, there were data gaps identified through this evaluation. Flood damage estimates for structures and contents at various flood levels were not available specifically for Puget Sound or Washington. Flood risk extents before and after floodplain restoration projects are conducted were also not systematically documented to allow for comparison before and after projects or across multiple projects. There is also an opportunity to update the values for jobs per one million dollars of project investment to reflect current economic conditions.

9.2.2. Economic Tool

Throughout both Phase 1 and Phase 2 of this project, floodplain managers and stakeholders have expressed a desire for a more standardized approach to evaluate the outcomes from floodplain restoration. There are currently, some existing guidelines for calculating some economic outcomes of floodplain restoration projects, including:
Floodplains by Design: Grants Funding Guidelines 2021-23[127]

- Puget Sound Acquisition and Restoration (PSAR): Project benefit metrics[128]
- Washington Recreation and Conservation Office: Salmon Recovery Funding Board (SRFB) project metrics tracked using PRISM[129]
- Environmental Protection Agency: Rapid Benefits Indicator for ecosystem services[130]

[127] Floodplains by Design Grants Funding Guidelines are available at: **https://apps.ecology.wa.gov/publications/documents/1906011.pdf**

[128] Puget Sound Acquisition and Restoration Fund metrics are described at: **https://www.psp.wa.gov/PSAR.php**

[129] More information about PRISM is available at: **https://rco.wa.gov/recreation-and-conservation-office-grants/apply-for-a-grant/prism/**

[130] The Rapid Benefits Indicator is available at: **https://www.epa.gov/water-research/rapid-benefit-indicators-rbi-approach**

These tools track some, but not all, economic outcomes associated with floodplain restoration. The tool envisioned as a potential Phase 3 for this project would be a web-based model that would allow users to input geographic and project information to evaluate the metrics described in this report. The needed tool would be focused on small-scale application, targeted to parcel-level decision-making, but also be relevant for watershed-scale planning. It would be designed to align with existing geospatial tools and best practices for valuation, including U.S. Army Corps of Engineers and EPA methodologies. This tool would not be meant to replace site specific Benefit-Cost analysis for individual projects, but for scoping and for smaller projects it could offer value by communicating general expected benefits for the project type and location characteristics.

Appendix A. Survey Language and Results
Attached

Appendix B. Potential Case Study List
Attached

Appendix C. Socioeconomic and Demographic Maps
Attached

Appendix D. Property Value Methodology
Attached

PHOTO: DRONE VIDEO, COURTESY OF KARL BELZAK

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