Chambers Creek Dam Study
Final Report

August 19, 2013

Pierce County
Public Works and Utilities
Sewer & Water Utility

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Executive Summary

Project Description

Over the last several years there have been a number of restoration-related proposals involving the Chambers Creek estuary that have addressed removal of the Chambers Creek dam. This report provides the findings of an initial investigation of several key issues that need to be clarified in order to determine the next steps for the Chambers Creek dam (i.e. removal, restoration, divestment, etc.), given its current source of water to the Chambers Creek Properties (CCP).

Project Scope, Schedule and Budget

The 2013 County budget for the Public Works & Utilities - Sewer & Water Utility (SWU) division contained $50,000 to complete a preliminary investigation study for the Chambers Creek dam. The Chambers Creek dam study began in early 2013 and was completed at the end of July 2013. The scope of the project, as represented in this report, focused on the following issues:

- Determine Chambers Creek dam ownership;
- Establish the status of Chambers Creek surface water and impoundment reservoir water rights;
- Identify potentially affected parties, regulatory, and environmental issues;
- Propose a range of options and associated costs regarding future dam scenarios; and
- Identify possible next steps.

Major Report Findings

- **Water Rights** – the validity of the Chambers Creek surface water rights is problematic; the impoundment rights are likely valid; and the Washington State Department of Fish & Wildlife (WDFW) has valid water rights and is currently beneficially using Chambers Creek water for their Fish Acclimation Facility operations.
- **Dam Ownership & Maintenance** – appears to be a co-ownership situation and co-maintenance obligation between the County and the current owner, Falls Development Group[1], of the former Abitibi Mill property. As an asset to the SWU division, the dam holds little value and operationally would cost more to keep and repair/maintain or remove than to surplus this asset. Expenses related to the dam are currently not programmed into the six-year Sewer Improvement Program or addressed in the division's rate model.
- **Potentially Affected Stakeholders** – there are a number of potentially affected stakeholders regarding any actions related to the dam including the dams' co-owners, local jurisdictions, WDFW, tribes, and marina. The railroad could be potentially affected by a larger estuary restoration effort.
- **Regulatory Issues** – the dam is currently subject to compliance with Washington State Dam Safety Regulation requirements and any modifications or removal would trigger a cadre of federal, state and local regulations.

[1] Note: On June 7, 2013 the Tacoma News Tribune reported that the former Abitibi Mill property had been purchased by Falls Development Group. The Pierce County Assessor's Office information still lists the current property owner as Chambers Bay LLC.

- **Environmental Issues** – Chambers Creek and its tributaries support runs of various salmon species. A Washington Department of Fish & Wildlife Fish Acclimation Facility is located adjacent to and interrelated with the dam and impoundment and is part of a larger fish hatchery operation. Removal of the dam could impair WDFW operations but would not affect groundwater wells that support irrigation of the CCP. Sediment buildup behind the dam is an issue that will need further evaluation.
- **Infrastructure Issues** – Actions related to the dam could affect the Chambers Creek Bridge, Steilacoom Sewer Force Main, WDFW Fish Acclimation Facility, Chambers Creek water pumping facilities, and Chambers Creek Marina.
- The American Rivers Dam Removal Process Guide is a potential resource for this issue.

Potential Options for the Chambers Creek Dam

The report contains seven possible scenarios for consideration including:

1. Maintain status quo with increased inspection for monitoring. Estimated cost is $917,500 over 50 years; timeline ongoing inspections 1per/year.
2. Transfer ownership of the dam and underlying land to another party. Estimated cost is $175,000 over 50 years; timeline 1 year process.
3. Repair and maintain the dam and fully comply with state law dam safety requirements. Estimated cost is $6,186,500 over 50 years; timeline 1-2 years for repair and compliance then ongoing inspections 1per/year and plan updates 1per/5 years.
4. Bypass the dam and fully comply with state law dam safety requirements. Estimated cost is $4,911,500 over 50 years; timeline 7-10 years for bypass then ongoing inspections 1per/year and plan updates 1per/5 years.
5. Fully remove the dam and restore shoreline. Assumes new bridge, roadway and utilities. Estimated cost is $14,539,000 over 50 years; timeline 7-10 years.
6. Replace the dam with a new dam structure and fully comply with state law dam safety requirements. Estimated cost is $13,411,500 over 50 years; timeline 7-10 years then ongoing inspections 1per/year and plan updates 1per/5 years.
7. Breach the dam and restore shoreline. Assumes new bridge, roadway and utilities. Estimated cost is $12,294,000 over 50 years; timeline 5-7 years.

Possible Next Steps

This study provided answers on a few key issues but there is more information that may be necessary to fully make long-term decisions about the dam's future. Some possible next steps include:

- Engage the potentially affected stakeholders to help validate assumptions and gain their perspective/interests on this issue (estimated cost $10,000 and 2-3 months time period).
- Truth the cost estimates for potential options and identify any missing feasible options (estimated cost $10,000 and 2-3 months time period).
- Consider and identify the best responsible party to proceed with each option and possible funding sources (estimated $10,000 cost and 2-3 months time period).
- Consider the full list of unanswered questions/issues identified in this report (estimated $10-500,000 cost and 6-18 months time period depending on scope).

Section 1: Introduction

Over the past few years, there have been numerous restoration-related proposals for the Chambers Creek estuary that have addressed removal of the Chambers Creek Dam (dam)[2]. This study is an initial investigation of several key issues relevant to decision making regarding the dam's future including:

- Potential stakeholders and their issues
- Status of water rights
- Dam ownership
- Dam safety regulatory compliance; and
- Future studies and permit requirements related to a range of alternative actions

Gaining clarification on these topics will aid Pierce County policy makers in better understanding the full range of available options related to the dam and determining the best course of action for the dam's future. This report contains an overview of findings related to these issues as well as potential options and next steps for consideration.

Section 2: Chambers Creek Dam Overview

The dam is located just south of the Chambers Creek Regional Wastewater Treatment Plant in University Place, Washington. Chambers Creek discharges to Chambers Bay, which is a coastal embayment in South Puget Sound.

Chambers Creek Estuary circa 2011

[2] The Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) include both a full and partial restoration plans for the Chambers Creek Estuary (See Appendix 1 for an overview).

The dam was originally constructed in the lower reach of Chambers Creek in 1933 via a joint venture contract between adjacent property owners Glacier Gravel Company and Everett Pulp & Paper Company. The original purpose of the dam structure was to create a water impoundment that would allow the withdrawal and beneficial use of Chambers Creek surface waters for their respective gravel mining and pulp/paper manufacturing operations.

Chambers Creek pre 1933 dam construction

The dam is currently owned, in part, by the Pierce County Sewer and Water Utility (SWU) and in part by Falls Development Group, the owner of the former Abitibi Mill property.

In 2009, Pierce County conducted an inspection of the dam and findings were documented in a Dam Condition Assessment Report[3]. The 2009 inspection report indicates the following:

- There are cracks in the concrete cap structure but it is generally sound
- Scouring of the bottom has occurred but does not appear to pose immediate threat to the dam; this situation should be monitored in the future
- There are holes/missing sections in the lower sheet pile that should be repaired; if not repaired then continued loss of material from behind the wall and continued corrosion can be expected and at some point a portion of the current sheet pile wall may fail resulting in a noticeable failure of the dam cap structure

Section 3: Potential Affected Stakeholders & Interested Parties

Multiple public and private property interests are stakeholders that could be potentially affected by decisions related to the dam including the following:

- Pierce County PWU (Sewer & Water and Transportation)
- Pierce County Parks & Recreation Services Department
- Falls Development Group (co-owner of the Chambers Creek Dam)
- Washington Department of Fish & Wildlife (WDFW)
- Chambers Creek Marina (Chambers Creek Boat Owners Association)
- Town of Steilacoom
- City of University Place
- City of Lakewood
- Burlington Northern Santa Fe (BNSF) Railroad Line
- Nisqually Tribe
- Puyallup Tribe
- Other Tribal Interests[4]

[3] Chambers Creek Dam Condition Assessment Report, BergerABAM, August 13, 2009.

[4] There may be other tribal interests (Squaxin, Steilacoom, Muckleshoot) in a project relating to the Chambers Creek Dam. Further research and stakeholder involvement will be necessary to determine all potential stakeholders.

Stakeholders are considered those that have a direct financial, infrastructure, fisheries or regulatory interest in the dam structure or lands that are either directly upstream or downstream of the dam. Appendix 2 contains more information on potential stakeholder issues. It is worth noting that the scope of this study did not include direct communication with each stakeholder, but rather identification of potential stakeholders. Engaging in comprehensive communication process with each potential stakeholder would provide additional insights/clarification on their specific interests and needs regarding the dam.

There are also numerous other parties that have a potential broader interest in actions related to the dam including but not limited to:

- Pierce County PWU-Surface Water Management Division
- Pierce County Conservation District
- Puget Sound Nearshore Ecosystem Restoration Project (PSNERP)
- Alliance for a Healthy South Sound
- Forterra
- Recreational and sport fisherman users of Chambers Creek

Section 4: Chambers Creek Water Rights

Available records for both Pierce County's property and that of the dam's co-owner, Falls Development Group, indicate that multiple surface and reservoir water rights were obtained between the late 1920's and the present. In general, it can be concluded that the surface rights at the impoundment of both parties could be subject to relinquishment for non-use if any type of change application process were initiated, however, Pierce County could continue to derive benefit until such action was taken. It also appears that the water reservoir rights, created via the impoundment, remain valid.

The Washington Department of Fish and Wildlife (WDFW) also hold currently active and valid water rights in the impoundment associated with its Fish Acclimation Facility operations.

If the dam was removed, the impoundment/reservoir created by the dam would disappear. Pierce County, as well as Falls Development Group and WDFW who also have water rights in the impoundment, would lose their active and valid water rights associated with the dam.
Further details on water rights can be found in Appendix 3.

Section 5: Chambers Creek Dam Ownership & Maintenance

Ownership

Based on available documentation, it appears that the dam structure is jointly owned by the successors in interest to Glacier Gravel Company and Everett Pulp & Paper. Creation of the dam was a cooperative venture between Glacier Gravel Company & Everett Pulp & Paper Company, with the duties and responsibility of each party carefully delineated within an unrecorded 1931 contract executed by these parties.

Both properties have had a series of owners and successors in interest since the 1931 contract. Currently, Glacier Gravel Company's properties are owned by Pierce County, and Everett Pulp & Paper Company's land is now owned by Falls Development Group. The land under the impoundment created by the dam is owned by Pierce County. Further details on the history of property ownership are provided in Appendix 4.

Maintenance

The 1931 contract between Glacier Gravel Company and Everett Pulp and Paper Company created the mutual obligation for each party to bear one half of dam maintenance costs. Therefore, as successors in interest, Pierce County and Falls Development Group are each fifty percent (50%) responsible for repair and maintenance of the dam. There were no records found that indicated maintenance of the dam has occurred since it's construction, however the dam condition assessment inspection noted that a second sheet pile had been driven in front of the original sheet pile at some point, which would indicate some repairs occurred in the dam's history.

Section 6: Regulatory Requirements

Due to the potential hazards associated with dam failure, dams and dam removal are highly regulated. Following is a description of ongoing dam safety requirements, and the array of regulations and permitting associated with dam removal. These are presented in order to help the County ensure compliance with regulations for existing dams, and also to anticipate costs and timeline considerations if dam removal is selected as the preferred alternative.

Regulations Related to Dam Maintenance

Dams in Washington State that impound a volume of 10 acre feet or more of water measured at the dam crest elevation are subject to regulation and oversight. Based on that regulatory threshold, the Chambers Creek Dam qualifies as a dam subject to state regulation. The Washington Administrative Code (WAC 173-175) contains dam safety regulations that pertain to the Chambers Creek Dam including the requirement for annual inspections and developing plans and manuals for operation, maintenance, and emergency management actions. The dam is considered a very low hazard dam by the Washington State Department of Ecology - Office of Dam Safety per downstream risk/impact (if failure) to public safety and property. Consequently, the dam is not currently, nor expected in the foreseeable future, to be subject to enforcement of regulatory standards/requirements (e.g., inspection, O&M Plan, etc) [5].

Regulations Related to Dam Removal

The processes, costs, and complexities of removing a dam in Washington State can be lengthy and complex, even for one as small as the Chamber Creek Dam. A large measure of the challenge associated with dam removal can be attributed to the complex array of state, local, and federal laws and regulations that potentially apply to such an action. Potentially applicable regulations and permit processes are summarized below and further explained in Appendix 5.

Federal Regulations

The primary agency responsible for regulating dam removals is the US Army Corps of Engineers (Corps). Most dam removals require a CWA Section 404 permit, issued by the Corps for dredging of a navigable waterway (33 U.S.C. §1344). Several studies and consultations are typically required to obtain the Section 404 permit.

[5] Per communication with DOE-ODS staff on 3/12/2013.

Washington State Regulations

The Department of Ecology (DOE) has the legal authority to regulate dams and dam removal in Washington State. The Dam Safety Regulations provide for the design, construction, operation, maintenance, inspection, and supervision of dams in a manner consistent with accepted engineering practice.

Local Regulations

The Chambers Creek Dam and impoundment and Chambers Creek Bridge are partially located within the unincorporated boundaries of Pierce County and the incorporated boundaries of the City of University Place. The City of Lakewood and the Town of Steilacoom also surround the project area. The potential removal of the Chambers Creek Dam, especially if coupled with a greater estuary restoration project, could trigger the regulatory interests of these jurisdictions. Applicable code provisions would likely be triggered include stormwater management, critical areas/wetlands, habitat, shoreline management, riparian buffers, and SEPA among other considerations.

Section 7: Environmental Issues

The scope of environmental issues associated with dam removal can include interactions among physical, biological, and chemical aspects of the environment, including baseline conditions and functions of a river and surrounding land with the dam intact, and with the dam being removed. Because a dam can fundamentally alter the functions and values of a river system and underlying hydrology, a clear understanding of those changes, and how such functions and values will be restored and/or manifested if a dam is removed, is central to informed decision-making.

Fisheries/Aquatic Habitat Conditions and Potential Impacts

According to various environmental studies conducted on the Chambers Creek watershed over the past several decades, baseline aquatic habitat conditions in the Chambers Creek system are satisfactory though some impacts of urbanization, such as increased siltation and some water quality impacts have been noted. The Chambers Bay estuary historically extended approximately 2,000 feet north of where it currently ends. The loss of that estuary habitat is attributable to the construction of the dam.

Chambers Creek and its tributaries contain approximately 9.4 miles of accessible salmon habitat. In the various studies conducted over the past few decades, it appears that the habitat below the dam has remained relatively healthy and stable since at least the 1970s. However, discussions with WDFW staff raise questions as to the quality of the habitat above the dam and impoundment, which may be of a lower quality primarily due to water quality issues.

The primary salmon species supported by the creek system are Coho and summer/winter chum. Winter chum are currently rated as healthy, though summer chum have been categorized as extinct. Coho stock was rated as depressed in 2002. Other fish typically present in the system include cutthroat trout and a few winter steelhead and sockeye. Coho salmon and steelhead have been deemed the highest priority species for habitat restoration and recovery. Chinook salmon are also present in the system, though their presence appears to be solely the result of the hatchery facilities at Chambers and Garrison creeks.

Removal of the dam would significantly impact operations at the WDFW Fish Acclimation Facility. A secondary concern exists that if the dam was removed intermingling between hatchery Chinook salmon and any returning wild Chinook salmon could occur. However, dam removal would likely benefit the chum salmon population, which tends to have more trouble than other salmon species with navigating

fish ladders. Discussion with WDFW on this topic would need to occur to determine their interests regarding the dam structure.

Hydrogeologic Status and Potential Impacts

The County has groundwater withdrawals in two aquifer systems on the Chambers Bay Properties: two shallower wells (CCP 1 and CCP 3) and two very deep wells (CCP 2 and CCP 4). Only CCP 3 is near the creek, being some 1,500 feet due west of the dam. Wells CCP 1, 2, and 4 are a significant distance to the north.

With the possible exception of the nearby shallow well CCP 3, removal of the dam would not impact the groundwater sources at Chambers Creek Properties. The other wells on the site are either distant from the likely area where groundwater changes might occur, or are deep enough to remain unaffected. These wells provide the primary source of water for irrigation of the Chambers Creek Properties.

However, surface water conditions would be dynamically modified by removal of the dam, both up and downstream of the dam position. Without the dam, tidal effects in the creek would be expected to migrate about 700 feet further upstream past the dam location. Surface water would become tidally-influenced "i.e. brackish" water and thus would not be acceptable for irrigation of the CCP due to the increase in salinity. Removal of the dam and water reservoir would mean an end to direct surface water withdrawals from the current Chambers Creek water pumping facility and obtaining new water rights farther up the stream channel are not foreseeable given that Chambers Creek watershed is a closed basin.

Chambers Creek Sediments and Potential Impacts

Comprehensive analysis has not been conducted of the sediment behind the dam in the impoundment but, in absence of detailed evaluation, some general issues are worth noting. In limited studies, the sediment and water have been found to have very low levels of pollutants. However, speculation exists that the sediment could be contaminated by copper that was used in the treatment of algae upstream in Lake Steilacoom. The level of sediment has been steadily building over the decades since the dam was installed and it appears that there are only a few feet of freeboard between the level of the top of the sediment and the top of the dam structure. This sediment buildup is beginning to impact the ability to withdraw water from the surface water creek pump (e.g. can't draw water with too much suction or the pump will intake sediment that can damage the pumping equipment and may be undesirable for intended purpose of water).

If the dam was removed, there would be a release to downstream waters of accumulated sediments from behind the dam and materials from which the dam itself was constructed. Such a sediment and debris plume is projected to settle out rather quickly in the intertidal environment and may not have far-reaching impacts beyond the bay. However, it would take a more detailed modeling process to fully gage the extent of actual sediment transport. Impacts to the Chambers Creek Marina from sediment transport are unknown at this time but the Boat Owners Association president has raised concerns about sediment impacts to the marina operation should the dam be removed.

Section 8: Infrastructure Issues

It is anticipated that the dam's removal would likely result in geomorphologic impacts to Chambers Creek that will affect the structural integrity of the infrastructure located above it. The Chambers Creek dam currently functions as a type of retaining wall by stabilizing the stream grade to some degree. If the dam were absent, the stream channel would naturally incise, becoming deeper and steeper. This could have serious implications for the following infrastructure and facilities:

- Chambers Creek Bridge/Pierce County Sewer Pipe
- Chambers Creek Road
- Steilacoom Sewer Force Main Pipe
- WDFW Fish Acclimation Facility
- Chambers Creek Water Pump Facilities
- Chambers Creek Marina

Chambers Creek Dam and WDFW Facility 7-18-13

Details on the specific impacts to each are presented in Appendix 6.

Section 9: American Rivers Dam Removal Feasibility Criteria

Though outside the scope of the current dam removal study, the American Rivers Dam Removal Process Guide (ARDRPG) could potentially be used to aid the county's decision making process regarding the dam's future. The ARDRPG contains a comprehensive set of decision-making criteria to aid in the dam removal consideration process. It contains four main elements (societal, ecological, economic, and technical/engineering). Each focus area represents an area of consideration necessary to ensure that a full range of costs and benefits are identified in the dam removal analysis process. See Appendix 7 for a high level overview of the American Rivers process elements.

Section 10: Potential Options for Chambers Creek Dam

There are a number of options available to Pierce County regarding future actions related to the Chambers Creek Dam, each with its own issues and associated costs. Listed below for consideration are seven potential options. The options range from an estimated low of $175,000 to divest the asset to a high of $14,539,000 for a dam removal process. It is worth noting that these are very high level estimates. Obtaining more precise estimates for the various options would entail hiring an engineering consulting firm, which would take approximately 2-3 months and an estimated cost of $10,000.

See Appendix 8 for a more detailed cost breakdown of each option listed below[6].

[6] Note: these cost estimates are in 2013 dollar values and have not been adjusted for inflation.

Option 1: Maintain Status Quo with Increased Inspection Frequency

- **Description:** Conduct annual inspections as outlined in Department of Ecology dam safety regulations and indefinitely defer repair/maintenance. Includes staff time for scoping inspection project and cost of annual inspections and doesn't include any expenditure associated with failure of the dam structure, repair of the dam structure or preparation of maintenance and operations plans/manuals.
- **Responsible Parties:** Pierce County Sewer & Water Utility, Falls Development Group.
- **Uncertainties/Factors to Consider**
  - Annual inspections would monitor dam's condition and identify maintenance needs.
  - Continued degradation of dam structure and potential failure if no repairs are made.
  - Willingness of Falls Development Group to engage in this effort and share costs as outlined in 1931 Dam Ownership and Maintenance Contract.
  - Not in full compliance with state law.
  - Contrary to stated wishes of local environmental groups for the dam's removal.
- **Estimated Cost:**
  - Total initial project cost = $42,500
  - 50 year O/M & CFP costs = $875,000
  - Total 50 year cost = $917,500
- **Estimated Timeline:** ongoing inspections 1x/year.

Options 2: Transfer Ownership Of The Dam and Underlying Land To Another Party

- **Description:** Enter into discussions with various interested parties on divestment, including Falls Development Group, WDFW and other state agencies, environmental groups, tribes; transfer ownership of the dam to interested party. Includes staff time for scoping the project, locating an interested party, conducting negotiations, legal review, real estate transaction, miscellaneous recording fees, etc.
- **Responsible Parties:** Pierce County Sewer & Water Utility, Falls Development Group.
- **Uncertainties/Factors to Consider:**
  - Willingness and ability of another entity to fully assume dam ownership.
  - Inability to know or predict subsequent owners' plans for the dam and potential implications on the Chambers Creek Properties.
- **Estimated 50 Year Cost:**
  - Total initial project cost = $175,000
  - 50 year O/M & CFP costs = $0
  - Total 50 year cost = $175,000
- **Estimated Timeline:** 1 year process.

Option 3: Repair And Maintain Dam Structure

- **Description:** Repair concrete apron and replace rusted sheet metal as recommended in the 2009 Chambers Creek Dam Condition Assessment Report, implement ongoing inspection and maintenance program as outlined in Department of Ecology Dam Safety regulations (i.e. achieves full compliance with state law requirements). Includes staff time for scoping the project, developing an O&M Plan and Manual, environmental regulations/permitting, construction and annual inspections. Doesn't include any expenditure associated with failure of the dam structure.
- **Responsible Party:** Pierce County Sewer & Water Utility and Falls Development Group
- **Uncertainties/Factors to Consider:**
  - Willingness of Falls Development Group to engage in this effort and share costs as outlined in 1931 Dam Ownership and Maintenance Contract.
  - Contrary to stated wishes of local environmental groups for the dam's removal.

- Future post repair decision to remove dam would leave “stranded costs”.

- **Estimated 50 Year Cost:**
  - Total initial project cost = $5,311,500
  - 50 year O/M & CFP costs = $875,000
  - Total 50 year cost = $6,186,500
- **Estimated Timeline:** 1-2 years for repair and compliance then ongoing inspections 1x/year and plan updates 1x/5 years.

Option 4: Bypass the Dam

- **Description:** Reroute Chambers Creek around the dam on County property, and conduct associated excavation and armoring for the new route. This option assumes full compliance with dam safety regulations as the dam would remain in place. Includes staff time to scope the project, conduct environmental studies, obtain permits, design, and construct bypass. This cost includes new utilities, dam safety regulation compliance and demolition of the Chambers Creek surface water facilities. This does not include a new bridge, or dredging or otherwise dealing with sediments located in the impoundment and behind the dam structure.
- **Responsible Party:** To be determined.
- **Uncertainties/Factors to Consider:**
  - Position of Falls Development Group on potential water rights impacts associated with bypass project.
  - Potentially altered flood risks after bypass.
  - Impacts on adjacent infrastructure from changing geomorphology.
  - Impacts on WDFW Fish Acclimation Facility.
  - Risks in obtaining regulatory approval.
  - Risks to fishery.
  - Obtaining funding to complete project.
- **Estimated 50 Year Cost:**
  - Total initial project cost = $4,036,500
  - 50 year O/M & CFP cost = $875,000
  - Total 50 year cost = $4,911,500
- **Estimated Timeline:** 7-10 years for bypass then ongoing inspections 1x/year and plan updates 1x/5 years.

Option 5: Dam Removal and Related Restoration

- **Description:** Remove the dam, address sediments, reroute Chambers Creek Road, replace Chambers Creek Bridge and nearby utilities, demolish Chambers Creek surface water pump facilities and WDFW Fish Facility, restore adjacent shoreline and vegetation as necessary. Includes staff time to scope the project, conduct environmental studies, obtain permits, design, and conduct demolition and restoration actions. Does not include cost of impacts to downstream properties or altered flood hazard.
- **Responsible Party:** To be determined.
- **Uncertainties/Factors to Consider**
  - Position of Falls Development Group on dam removal, removal of impoundment and associated surface water rights.
  - Potentially altered flood risks after removal.
  - Sediment content and downstream transport.
  - Impacts on adjacent infrastructure and downstream environment (fishery, marina, etc.).
  - Elimination of WDFW Fish Acclimation Facility.
  - Risks obtaining regulatory approval

- Obtaining funding to complete project.

- **Estimated 50 Year Cost:**
  - Total initial project cost = $14,539,000
  - 50 year O/M & CFP cost = $0
  - Total 50 year cost = $14,539,000

- **Estimated Timeline:** 7-10 years

Option 6: Construct New Dam

- **Description:** Remove the existing dam and replace with a new dam, address sediments, replace nearby utilities, restore adjacent shoreline and vegetation as necessary. Includes maintaining impoundment for water right purposes, compliance with Dam Safety Regulation requirements, staff time to scope the project, conduct environmental studies, obtain permits, design, conduct demolition of existing dam and construct new structure, and restoration actions. Does not include a new bridge or roadway alterations.

- **Responsible Party:** To be determined.

- **Uncertainties/Factors to Consider:**
  - Position of Falls Development Group on dam replacement and associated surface water rights.
  - Risks obtaining regulatory approval.
  - Obtaining funding to complete project.

- **Estimated Cost:**
  - Total initial project cost = $12,536,500
  - 50 year O/M & CFP cost = $875,000
  - Total 50 year cost = $13,411,500

- **Estimated Timeline:** 7-10 years then ongoing inspections 1x/year and plan updates 1x/5 years.

Option 7: Breach Existing Dam and Related Restoration

- **Description:** Groove or hammer the existing dam and leave in place, address sediments, replace Chambers Creek Bridge and nearby utilities, demolish Chambers Creek surface water pump facility and WDFW Fish Facility, restore adjacent shoreline and vegetation as necessary. Includes staff time to scope the project, conduct environmental studies, obtain permits, design, conduct demolition of existing dam and facilities, and restoration actions. Does not include cost of impacts to downstream properties or altered flood hazard.

- **Responsible Party:** To be determined.

- **Uncertainties/Factors to Consider:**
  - Position of Falls Development Group on dam removal, removal of impoundment and associated surface water rights.
  - Potentially altered flood risks after removal.
  - Sediment content and downstream transport.
  - Impacts on adjacent infrastructure and downstream environment (fishery, marina, etc.).
  - Elimination of WDFW Fish Acclimation Facility.
  - Risks obtaining regulatory approval.
  - Obtaining funding to complete project.

- **Estimated Cost:**
  - Total initial project cost = $12,044,000
  - 50 year O/M & CFP cost = $250,000
  - Total 50 year cost = $12,294,000

- **Estimated Timeline:** 7-10 years.

Section 11: Summary of Findings and Next Steps

Summary of Findings

Given the limited budget for this project, the scope of this study was narrowly focused on several key issues necessary for decision making regarding the dam's future. A summary of each topic area that was addressed in this study is provided below.

Water Right Status

- The validity of Chambers Creek surface water rights held by Pierce County and Falls Development Group are problematic due to prolonged periods of non-use.
- Chambers Creek water storage rights (i.e. the impoundment created by the dam) held by Pierce County and Falls Development Group are likely valid.
- Surface water rights held by WDFW are valid, beneficially used, or under extension.
- Pierce County groundwater rights would not be adversely affected by dam removal.

Dam Ownership

- Dam construction/ownership is result of a 1931 joint venture agreement (agreement) between Glacier Sand & Gravel Company and Everett Pulp and Paper Company.
- The agreement created perpetual legal interest, subject to right of assignment, for original (and successor parties in interest) in (shared) dam ownership, shared maintenance/repair obligations, respective surface water/storage rights, and easements to access/maintain water lines, pump station, and dam.
- Pierce County and Falls Development Group are current co-owners of Chambers Creek Dam. Pierce County retains ownership to the land upon which impoundment (storage) and dam structure is situated.
- There is no record of prior or current ownership/parties observing or enforcing agreement-based maintenance/repair obligation for the past 20 years (or more).
- As an asset to the Pierce County Sewer & Water Utility, the dam has little to no value. Groundwater wells provide the primary source of water for irrigation of the Chambers Creek Properties and removal of the Chambers Creek water pump facility, and associated water rights, would not impact the hydrology of the underlying aquifers that feed the wells nor the irrigation of the CCP. Operationally it would cost more to keep the dam and either repair and maintain it or remove it than to surplus this asset (i.e. transfer full ownership to the co-owner or another entity). In addition, any expenditure related to the dam are currently not programmed into the six-year Sewer Improvement Plan (SIP) nor incorporated into the Sewer Utility Rate Model. Any significant additions to the SIP have the potential to impact the current rate model and future projected rate increases.

Regulatory Status/Related Issues

- The dam is considered a very low hazard dam by DOE for downstream risk/impact (if failure) to public safety and property. Consequently, the dam is not currently, nor expected in the foreseeable future, to be subject to enforcement of regulatory standards/requirements (e.g., inspection, O&M Plan, etc).
- Dam provides no economic or operational value to the Pierce County Sewer & Water Utility. The opportunity to redevelop the Dam/water rights for other economic/revenue purposes (e.g., hydropower) is remote due to regulatory barriers.
- The only party currently securing value from Dam is WDFW for their Fish Acclimation Facility. Removal of Dam would trigger duty to comply with/bear costs of broad array of state, federal, and

local government laws, regulations, ordinances, and permitting processes, and pose impacts to public and private property/infrastructure.

- The process to remove dam/restore shoreline/vegetation, , including stakeholder process, and replace existing bridge and utility infrastructure would require identification, study, funding, and implementation of engineering, economic, legal, environmental, biologic, geomorphologic, physical demolition, habitat restoration, mitigation, public facility/private property issues/impacts. Cursory estimate is at least 7-10 years and upwards of $10 million dollars.

Unanswered Questions/Issues

While this study did provide some clarity on several key issues it should be noted that there are many unanswered questions/missing information that still may be necessary for final decision-making regarding the dam's future including:

- A more detailed analysis of a full range of issues related to removing the dam. Such an analysis may include the following: "Triple Bottom Line" approach, which would examine its social, environmental, and fiscal costs and benefits; the American Rivers process outlined in Section 9 of this report; a study of the economic value of nature's services[7]. Estimated 6 -18 months time period and $250,000 – 500,000.
- Business Case Evaluation to determine the least lifecycle cost of the options listed in Section 10 of this report.
- The positions of the co-owner (Falls Development Group), WDFW and the Tribes on dam removal and estuary restoration.
- Further study of the nexus between the restoration activities outlined in the Puget Sound Nearshore Estuary Restoration Plan and its desired intended outcome of habitat recovery. Estimated 6 – 18 months time period and $100,000 – 250,000.
- Legal and regulatory obligations with ongoing dam ownership or removal of the dam.
- Available funding sources to achieve the various options.
- A more detailed analysis of the impacts to the Chambers Creek Bridge and Steilacoom Sewer Force Main structures related to the various options.

More questions regarding decision-making for the dam's future are outlined in Appendix 9.

Possible Next Steps

While, this study did provide some valuable information that could be used for future decision-making, there are still several pieces of information, which were outside the scope of this study, that could be beneficial to know before a final course of action is decided upon including:

- Engage the potentially affected stakeholders to help validate assumptions and gain their perspective/interests on this issue (estimated cost $10,000 and 2-3 months time period).
- Truth the cost estimates for potential options and identify any missing feasible options (estimated cost $10,000 and 2-3 months time period).
- Consider and identify the best responsible party to proceed with each option and possible funding sources (estimated $10,000 cost and 2-3 months time period).
- Consider the full list of unanswered questions/issues identified in this report (estimated $10-500,000 cost and 6-18 months time period depending on scope).

[7] A New View of Puget Sound Economy, eartheconomics.org.

Appendix 1: Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) Proposals for Chambers Creek Estuary

The desired results of the restoration proposals below include enabling the free flow of tidal and fresh water into Chambers Creek, allowing unrestricted passage of fish and wildlife, and promoting a more natural estuarine environment for fish and terrestrial species. Advancement of either of the above plans would require significant funding to address acquisition of the Abitibi mill property, impacts to existing roads and rail facilities, displacement of an existing WDFW fish propagation/trapping facility, extensive environmental studies, resolution of existing contractual issues relating to dam ownership, permitting/regulatory costs, and other actions. Thus far, no funding source or entity has been identified that appears willing or capable of assuming such costs and responsibilities.

Full Restoration Proposal

- the Dam would be removed
- the existing railroad berm would be eliminated
- the existing rail road trestle would be re-constructed to span the entire inlet
- inactive railroad lines would be removed
- Chambers Creek Road would be relocated to the east and a new bridge would be built
- two culverted streams within the Abitibi mill property would be day-lighted
- the barrier beach (near the marina) would be restored by removing the armor, fill, marina docks, and boathouses, and associated structures
- riparian areas would be re-vegetated with native species

Partial Restoration Proposal

- the Dam would be removed
- some of the stream day-lighting would occur, as well as riparian area re-vegetation
- the railroad berm, trestle, and marina would be unaffected
- Chambers Creek Road would be moved and aligned with an inactive railway, and
- A new 200 foot long bridge would be constructed over Garrison Springs Creek.

Appendix 2: Potential Affected Stakeholders & Issues

Pierce County	
The PWU – Sewer & Water Utility division is the partial owner of the dam, per a 1931 Contract between the then-current owners of the Chambers Creek Property and Abitibi Mill *The PWU – Transportation Division would be responsible for any actions related to repair or replacement of the Chambers Creek Bridge*	• Repair and maintenance costs if dam is not removed • Keeping dam would be contrary residents' and Environmental Groups' desire to see dam removed and estuary restored • Replacement costs for Chambers Creek Bridge and associated infrastructure if dam is removed • Lose water rights associated with the impoundment if dam is removed • Potential costs to remove or stabilize residual dam components if the dam fails • Potential regulatory oversight
Pierce County Parks & Recreation Services Department	
Responsible for the maintaining the Chambers Creek Properties and their recreational amenities	• Could be impacts to recreational activities upstream if dam fails or is removed
Falls Development Group	
Owns the Abitibi Mill property adjacent to the Chambers Bay Properties owned by Pierce County and shares ownership of the dam structure	• Repair and maintenance costs if dam is not removed • Lose water rights associated with the impoundment if dam is removed • Potential costs to remove or stabilize residual dam components or replace existing infrastructure if the dam fails
WDFW Fish Acclimation Facility	
Owns and operates a fish propagation and acclimation facility at the impoundment behind the Chambers Creek Dam	• Impacts to fish acclimation facility functions if dam is removed or fails • Potential need to curtail sport and tribal fishing downstream if fish numbers decrease because of dam removal • Potential for less predation on juvenile fish if dam is removed • Dam removal would not address problems of water quality/temperature, contamination that may be responsible for low fish population in Chambers Creek
Chambers Creek Boat Owners Association	
The closest downstream business to the Chambers Creek dam, located approximately 4,000 feet southwest, at the mouth of the Chambers Creek estuary	• Perception that more silt would reach the marina if the dam was removed • Potential rechannelization of flows in the lower estuary
Town of Steilacoom	
Owns and operates a wastewater force main just south of the Chambers Creek Bridge in the area of the impoundment. Additionally, the Abitibi Mill site is located in Steilacoom and was a significant source of tax revenue when it was in operation	• Replacement of Steilacoom Waste Water Force Main • Perceived potential loss of suitable industrial-zoned property within town limits if the estuary was restored • Potential regulatory oversight
City of University Place	
Owns 50 percent of the Chambers Creek Bridge, which is in close proximity to the Chambers Creek dam	• Costs associated with replacement of Chambers Creek Bridge if the dam is removed or fails • Potential regulatory oversight
Burlington Northern Santa Fe (BNSF) Railroad Line	
A BNSF railroad line runs across the estuary mouth on land falling within the City of University Place and the Town of Steilacoom	• Unknown impacts from dam removal but would be impacted under PSNERP full estuary restoration proposal
Tribes	
Chambers Creek is within the Usual and Accustomed Fishing Areas of the Puyallup and Nisqually Tribes but may also be of interest to the Squaxin, Steilacoom and Muckleshoot Tribes	• If the dam was removed, fish migration could potentially increase in Chambers Creek, allowing for more fishing. • Removal of the WDFW facility could negatively impact fish runs
City of Lakewood	
Jurisdictional boundary on a portion of the south side of creek	• Potential regulatory oversight

Appendix 3: Water Rights

DESCRIPTION	STATUS OF WATER RIGHTS
Pierce County	
As the ultimate owner of the Glacier Gravel Property, Pierce County is the successor in interest for Glacier's water rights at the impoundment. From Glacier, Pierce County inherited Surface Water Rights Certificate 673, Reservoir Certificates 674 and 11374 (shared with Chambers Creek LLC).	The reservoir certificates likely remain active and valid, and Surface Water Certificate 673 is potentially subject to relinquishment for non-use that occurred in the 1980s, prior to county ownership. Currently, the county uses water from the impoundment for construction-related activities such as dust suppression and preloading.
Falls Development Group	
As the ultimate owner of Everett Pulp & Paper's Property at the West Tacoma Mill, Falls Development Group is the successor in interest for Everett Pulp & Paper's water rights at the impoundment. Falls Development Group inherited Surface Water Rights Certificates 10880 and 10881, and Reservoir Certificates 674 and 11374 (shared with Pierce County).	Only Reservoir Certificates 674 and 11734 remain active and valid. There has been no apparent use of the impoundment waters by previous owners of Falls Development Group's property and associated water rights for some time.
WDFW Fish Acclimation Facility	
The Washington Department of Fish and Wildlife (WDFW) has owned and operated a fish propagation and acclimation facility at the impoundment behind the Chambers Creek Dam since 1972. WDFW holds two non-consumptive water rights to Chambers Creek for the purpose of fish trapping, acclimatization, and hatchery support purposes. The WDFW non-consumptive surface water rights (S2-25165/ S2-28914)	Non-consumptive surface water rights S2-25165 and S2-28914 are active and valid.

Appendix 4: Property History

Glacier Sand & Gravel Property (Pierce County)	Glacier Sand & Gravel Company began its mining operations near Chambers Creek in 1910 under the name Glacier Gravel Company. It continued mining at the southern portion of the Chambers Creek Properties until the mid-1980s when it sold its land to Vader Holdings Company. After a series of sales, Pierce County eventually acquired the site, along with the former Pioneer Gravel Mines to the north, in 1992 from Oregon City Leasing Company. The County had previously acquired some of the property from Glacier Sand & Gravel Company in 1983 to construct the Chambers Creek Regional Wastewater Treatment Plant. After acquiring the rest of the site in 1992, the County leased the mine to Pioneer Northwest Aggregates until 2002. The County is the current owner of the property.
Everett Pulp & Paper Company's West Tacoma Mill Property (Falls Development Group)	Cascade Paper Company began its operations adjacent to Glacier Sand & Gravel Company's mining site in 1916. It closed its factory in 1930, and the property was acquired by Everett Pulp & Paper in 1931. Everett Pulp & Paper sold the mill to West Tacoma Pulp & Paper Company in 1946. West Tacoma Pulp & Paper Company enlarged the mill and continued its operations until 1969, when it sold the property to Boise Cascade Company. In 1985, Boise Cascade leased the mill to its partner Steilacoom Pulp Company, and conveyed the property to them in 1994. Steilacoom Pulp Company immediately sold the mill to Rainy River Forest Products. Rainy River Forest Products was ultimately absorbed into Abitibi Consolidated through a series of mergers. Abitibi owned the mill site until 2010, when it sold the property to Chambers Creek LLC. Chambers Creek LLC owned the property until 2013, when it sold the property to Falls Development Group.
Recent Ownership Change and Impact to Ownership/ Maintenance of Dam	Between 2010 and 2013, the Everett Pulp & Paper property was owned by Chambers Creek LLC, which was performing demolition/salvage activities on the site. However, in May of 2013, the site was sold to Falls Development Group, which is associated with the commercial real estate firm Managing Green LLC in Tacoma. It is yet unknown what Falls Development Group proposes to do with the property, and thus its position on its continuing need for the dam and impoundment are unknown, as is its awareness or intent to honor the 1931 contract.

Appendix 5: Regulations Applicable to Dam Safety and Removal

Entity	*Requirements*	*Estimated Cost*
Washington State Regulations and Permits	The following dam safety regulations apply to the Chambers Creek Dam:	
	• Develop and adhere to an acceptable Operations and Maintenance Plan and Manual	$25,000
	• Complete regular dam inspections	$12,500 (*annually for Pierce County's share (total annual inspection cost is $25,000)*
	Prior to dam removal, it would be necessary to obtain the following:	
	• Hydraulic Project Approval permit from the Washington Department of Fish and Wildlife (WDFW) o JARPA Application o Design/Drawings (Bore/site footprint) - Per JARPA Req. o Erosion/Sediment Control Design/Plan (BMPs)	$2,500
	• Critical Areas Reports (Geotech/Biological)	$60,000
	• State Environmental Protection Act (SEPA) review (supplemental studies listed and costed separately)	$2,000
	• National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit from the Department of Ecology	$100,000
	• Department of Ecology 401 Water Quality Certification/ Coastal Zone Management Consistency o JARPA Application o Critical Areas Studies/Design Documents o Surface Water Pollution Prevention Plan (SWPPP)	$100,000
Federal Regulations and Permits	In order to obtain the CWA Section 404 permit, the following must also be obtained:	$50,000
	• Rivers and Harbors Act Permit from the US Army Corps of Engineers	$10,000
	• Actions by the Corps may require the preparation of an Environmental Impact Statement (EIS) or Environmental Assessment pursuant to the National Environmental Policy Act	$10,000
	• As part of issuing their permits, the Corps may need to conduct the following consultations to meet the requirements of other Endangered Species Act Section 7 Consultation with the US Fish and Wildlife Service and/or the National Marine Fisheries Service (NMFS) regarding the impacts of dam removal on endangered species federal laws:	$10,000
	o Magnuson-Stevenson Act Consultation with the NMFS regarding the impact of dam removal on any Fishery Management Plan developed by a Regional Fishery Management Council	*(included in EIS cost above)*
	o National Historic Preservation Act Compliance Section 106 Review	$7,500 *(additional if needed)*
	o Water Quality Certification from Washington State Department of Ecology	$7,500 *(additional if needed)*
	o Coastal Zone Management Act certification from Washington State Department of Ecology	$7,500 *(additional if needed)*
	Required Federal Government Permits, Plans, and Studies: • Project-Specific SEPA –Environmental Impact Statement (EIS) • Cultural Resource Inventory/Monitoring Report • Biological Assessment/Biological Evaluation • National Environmental Policy Act	$200,000 *(for studies from this bulleted list as needed)*

Entity	*Requirements*	*Estimated Cost*
	• Cultural Resource Inventory/Monitoring Report • Baseline analysis/field surveys of fish use and distribution • Analysis of game fish and wildlife resources • Stream ecosystem response to dam removal • Sediment distribution, content, and transport • Hydrodynamics and Sediment Transport modeling • Wetland Delineation • Water Quality (CWA 303d listings) • Essential Fish Habitat • Fish Management Plan • Revegetation and Restoration Plan • Wildlife Mitigation Plan • Economic Analysis • Fishery/Flows Monitoring Plan • Morphology Studies –Freshwater System • Nearshore Substrate and Morphology • Effect on Floodplain Dynamics	
Local Government Regulations and Permits	The following local jurisdiction plans and regulations may apply to projects concerning the Chambers Creek Dam: • Building And Construction • Critical Areas Review • Aquifer Recharge Areas • Fish and Wildlife Habitat Areas • Flood Hazard Areas • Wetlands • Environmental Regulations • Shoreline Environments and Management • Instream Structures • Roads/Bridges/Right of Ways • Site Development • Capital Facilities	$20,000 – 100,000 *(for studies/permits from this bulleted list as needed)*
Other Required Plans and Studies	• Property Investigation/Survey • Topographic/Bathymetric Survey ($35,000) • Geotechnical Investigation ($40,000) • Cultural Resources Investigation • As-Built Documentation • Hydraulic Analysis/Modeling ($20,000) • Sediment Transport Study ($70,000) • Contaminant Survey ($155,000) • Fisheries ($50,000) • Habitat Modeling ($100,000) • Sea Level Change Protection • Beach Erosion • EDT Modeling ($180,000) • Dam Removal Design ($300,000)	$500,000 *(for studies from this bulleted list as needed)*

Appendix 6: Infrastructure Impacts

DESCRIPTION	ANTICIPATED IMPACTS OF DAM REMOVAL
Chambers Creek Bridge	
The Chambers Bay Bridge is located on Chambers Creek Road. The city and Pierce County share ownership of the bridge, with the city owning the northern half the county owning the southern half.	Would need longer span and deeper foundation – effectively, a completely new bridge, which would be subject to current requirements.
Chambers Creek Road	
Chambers Creek Road consists of two lanes and gravelly shoulders on each side. North of the bridge, Chambers Creek Road is under City of University Place jurisdiction. It becomes a Pierce County road south of the bridge for approximately one-half mile until it crosses the Town of Steilacoom boundary. Chambers Creek Road is the only access to the Chambers Creek Regional Waste Water Treatment Plant, with two entrances north of the dam.	The absence of the dam could affect the road where it crosses the bridge by requiring new bridge approaches and possible realignment.
Steilacoom Force Main (Sewer Pipe)	
Currently, the Steilacoom force main crosses Chambers Creek on its way to the Chambers Creek Regional Waste Water Treatment Plant.	Would likely need to be lengthened and additional support added. If a bridge replacement is required, is it likely that the force main would be relocated to the underside of the bridge as per current practice.
WDFW Fish Acclimation Facility	
The Washington State Department of Fish and Wildlife (WDFW) has operated a fish propagation and acclimation facility (also referred to as a "spawning shed") since 1972 that is located adjacent to the dam. The facility, which involves two fish trap/holding ponds, is also used for fish counting purposes.	The fish trapping function of the WDFW fish facility would be rendered useless. The daily salt water intrusion at high tide would increase salinity in the creek, requiring relocation of the fresh water intake or abandonment of the juvenile acclimation function and likely abandonment of the facility in its entirety.
Creek Water Pumps	
Pierce County and Chambers Creek LLC each acquired pumping infrastructure in the impoundment from their respective previous owners. Pierce County's pump and pump house are along the western bank. Chambers Creek LLC's are along the eastern bank, in an easement on land owned by the County. While Pierce County actively uses and maintains its pump, there is no evidence that the Chambers Creek LLC pump has been used in some time.	The creek pump intakes would likely be elevated above the resulting creek water level. They may also be in an area affected by salt water intrusion which renders the water unsuitable for irrigation and most other uses.

Appendix 7: American Rivers Dam Removal Process Elements

ECOLOGICAL ISSUES	
A	Upstream Flow and Habitat
B	Downstream Flow and Habitat
C	Fish and Wildlife
D	Passage and Movement of Fish and Other Species
E	Sediment Movement
F	Water Quality
G	Riparian Areas
H	Wetland Areas
I	Location of the Dam within the Watershed
J	*For more information*
ECONOMIC ISSUES	
A	Dam owner's Costs and Benefits
B	Societal Costs and Benefits
C	Recreational Costs and Benefits
D	Environmental Costs and Benefits
E	Property Values
F	Distribution of Costs and Benefits
G	Availability of Funding for Dam Repair or Removal
H	*For More Information*
SOCIETAL ISSUES	
A	Community Understanding of the Dam, the River, and Dam Removal
B	Service(s) Provided by the Dam
C	Who Benefits From and Who Bears the Cost of the Dam
D	Community Sentiments Toward the Dam and the River
E	Historical Role of the Dam
F	*For More Information*

TECHNICAL/ENGINEERING ISSUES	
A - Feasibility of Repairing and Maintaining the Dam	
A1	Safety Repairs or Upgrades
A2	Repairs or Upgrades to Continue Efficiently Providing the Dam's Intended Uses
A3	Mitigation of the Dams Environmental Impacts
B - Feasibility and Design of Dam Removal	
B1	Obtaining Dam Removal Permits
B2	Protecting Against Environmental Impacts
B3	Managing Sediment
B4	Removing Structures
B5	Protecting Infrastructure
B6	Restoring the Channel

Appendix 8: Proposed Options Cost Comparison Table

Potential Options for Chambers Creek Dam 8-19-13

Item	Option 1 Status Quo	Option 2 Transfer Ownership	Option 3 Repair and Maintain	Option 4 Bypass and Abandon	Option 5 Complete Removal	Option 6 New Dam	Option 7 Breach and Restoration
Estimated Pre-Construction Costs							
Scope of Work/Project Management	$25,000	$25,000	$100,000	$200,000	$200,000	$200,000	$200,000
SEPA Review City of University Place			$4,000	$4,000	$4,000	$4,000	$4,000
DNS/MDNS*			$10,000	$10,000	$10,000	$10,000	$10,000
DS/EIS/BA			$120,000	$120,000	$120,000	$120,000	$120,000
SSD City of University Place			$10,000	$10,000	$10,000	$10,000	$10,000
HPA Approval			$5,000	$5,000	$5,000	$5,000	$5,000
ACOE Approval			$15,000	$15,000	$15,000	$15,000	$15,000
Preliminary and Final Engineering			$200,000	$200,000	$200,000	$500,000	$200,000
Miscellaneous/Divest Asset		$150,000					
Subtotal Pre-Construction Costs	$25,000	$175,000	$464,000	$564,000	$564,000	$864,000	$564,000
Estimated Demolition Costs							
Chambers Creek Pump Station				$50,000	$50,000		$50,000
WDFW Fish Count Station					$50,000		$50,000
"Abitibi" Pump Station					$50,000		$50,000
Chambers Creek Dam Complete Removal					$2,000,000	$2,000,000	
Chambers Creek Dam Breaching Only							$1,000,000
Subtotal Pre-Construction Costs	$0	$0	$0	$50,000	$2,150,000	$2,000,000	$1,150,000
Estimated Construction Costs							
New Chambers Creek Bridge and Roadway					$10,000,000		$10,000,000
Repair Dam, New Sheet Metal and Gravity Block			$3,000,000				
Construct New Dam						$7,500,000	
New Permanent Bypass Channel				$3,000,000			
Temporary Bypass Channel			$1,500,000		$1,500,000	$1,500,000	
Remove and Relocate Existing Utilities				$75,000	$75,000	$75,000	$75,000
Dredging			$250,000	$250,000	$250,000	$500,000	$250,000
Subtotal Pre-Construction Costs	$0	$0	$4,750,000	$3,325,000	$11,825,000	$9,575,000	$10,325,000
Ongoing Maintenance and Operations/CFP Costs							
Operations/Maintenance Manual			$80,000	$80,000		$80,000	
Recurring Annual Inspections	$12,500		$12,500	$12,500		$12,500	
Recurring Annual CFP Budget Placeholder	$5,000		$5,000	$5,000		$5,000	$5,000
Subtotal O/M Costs	$17,500	$0	$97,500	$97,500	$0	$97,500	$5,000
Total Estimated Pre-Constuction Cost	$25,000	$175,000	$464,000	$564,000	$564,000	$864,000	$564,000
Total Estimated Demolition Cost	$0	$0	$0	$50,000	$2,150,000	$2,000,000	$1,150,000
Total Estimated Construction Costs	$0	$0	$4,750,000	$3,325,000	$11,825,000	$9,575,000	$10,325,000
Total Estimated O/M Manuals	$17,500	$0	$97,500	$97,500	$0	$97,500	$5,000
Grand Total	**$42,500**	**$175,000**	**$5,311,500**	**$4,036,500**	**$14,539,000**	**$12,536,500**	**$12,044,000**
50 year extended O/M and CFP Costs	$875,000.00	$0.00	$875,000.00	$875,000.00	$0.00	$875,000.00	$250,000.00
Total 50 year Costs	$917,500.00	$175,000.00	$6,186,500.00	$4,911,500.00	$14,539,000.00	$13,411,500.00	$12,294,000.00
* Delete if a DS is issued							

Appendix 9: Factors/Questions to Consider

- Dam Owners Costs and Benefits: Are the long-term costs of operating and maintaining the dam less or more than the costs of removing the dam? Do any benefits of the dam need to be replaced, and if so, by whom?
- Societal Costs and Benefits: Are others in the community responsible for any additional costs and benefits of maintaining or removing the dam?
- Environmental Costs and Benefits: Do the net environmental benefits of keeping the dam outweigh the net environmental costs (or benefits) of removing the dam?
- Property Values/Uses: Will dam removal positively or negatively affect property values or uses adjacent to the affected stream?
- Distribution of Costs and Benefits: Who benefits from and who bears the costs of retaining/removing the dam? And who will benefit and who will bear the cost of a restored river?
- Availability of Funding: What funds are available to pay for dam maintenance, repair or removal?
- Feasibility of Repairing and Maintaining the Dam: If expensive upgrades are needed to maintain the dam's services, is it more cost effective to remove the dam and find alternatives to replace those services?
- Mitigation of Dam's Impacts: If environmental mitigation measures are needed, is it more cost-effective to keep the dam and mitigate for its environmental impacts or remove the dam?
- Feasibility of Dam Removal: Will permitting requirement affect the design, cost, or feasibility of the removal.
- Upstream Flow and Habitat: Will the restored riparian habitat outweigh the loss of impounded habitat?
- Downstream Flow and Habitat: Is Dam removal necessary to restore natural flows to the river? Do the benefits of restored flows outweigh the impacts on species that prefer natural flows?
- Fish and Wildlife: Is the net impact of dam removal on fish and wildlife populations positive or negative?
- Passage of Fish/Other Species: Will dam removal improve safe passage of migrating fish and movement of resident fish and wildlife? Is dam removal necessary to accomplish this? Can dam removal be done without enabling the spread of undesirable species (or disease)?
- Sediment Movement: What is the current net impact of the accumulated sediment on the impoundment and downstream habitat? How will sediment released during dam removal impact the riparian and riverine habitats in the short and long term?
- Water Quality: Will dam removal have a net benefit on water quality, taking into account both short term and long term impacts and benefits?
- Riparian Areas: Will there be a net gain in the amount and quality of riparian habitat as a result of dam removal?
- Community/Decision-makers Understanding: Do the decision-makers and other concerned parties have sufficient information to make an informed decision about dam removal or dam retention?
- Dam Services: Does the dam provide any services, and are they as valuable as the services provided by a free flowing river?