APPENDIX A. PERMIT-EXEMPT WELL AND CONSUMPTIVE USE PROJECTIONS

1. INTRODUCTION

The Chehalis Basin (WRIA 22/23) Watershed Plan Addendum (Addendum) must include projects and actions that offset the consumptive use from future domestic permit-exempt well connections. Consumptive water use is water that is evaporated, transpired, consumed by humans, or otherwise removed from an immediate water environment. For watershed planning purposes, consumptive use is water that is drawn from groundwater via a domestic permit-exempt well and not replaced through the septic system, irrigation return flow, or by other means.

This appendix describes the methods used to project the number of permit-exempt domestic wells added to the watershed over the planning horizon and to estimate consumptive water use associated with the new permit-exempt well connections. Methodology is based on Appendix A of the Department of Ecology's (Ecology's) Net Ecological Benefit Guidance (Ecology, 2019).

2. PERMIT-EXEMPT WELL PROJECTION METHODOLOGY

The Addendum must estimate growth projections for the watershed for the period of January 2018 through January 2038 (at a minimum). For the Chehalis Basin, the selected planning horizon is to the year 2040 to align with population growth data. Based on the projected growth, the Addendum estimates the amount of rural growth and associated new permit-exempt wells. The methods used to estimate permit-exempt well connections address two primary questions:

- How many new single-family permit-exempt domestic wells connections will be installed throughout the basin over the next 20 years? (e.g. rural population growth), and
- Where will the well connections be installed (at the subbasin level)?

Population Growth Projections

Population growth projections are a foundational data source for estimating future permit-exempt well connections. The increase (or decrease) in number of people represents a predictable number of new single family residences that can be expected in each subbasin. The distribution of these expected new homes was projected as described below.

In Thurston County, the Thurston Regional Planning Council (TRPC) provides projections tailored to the land base, transportation network, and economic conditions. The TRPC methodology used a three-step process. First, the medium-series population forecast developed by the Washington State Office of Financial Management (OFM) was obtained. The second step was to estimate how many future dwelling units could be developed for each available parcel. These capacity estimates were based on adopted zoning observed housing densities, critical area constraints, existing development, and other factors such as employment center locations. Finally, countywide population growth was distributed to parcels where capacity is available, based upon residential development and permit trends. A more detailed description of the model methods and assumptions can be obtained through TRPC.

For Grays Harbor, Lewis, and Mason Counties, population projections were based directly on estimates provided by the OFM. Low, medium, and high estimates are provided on a countywide level. The medium level is the calculated estimate and the low and high estimates are considered lower and upper bounds of predicted error.

Domestic Permit-Exempt Well Connections Projection

The Chehalis Basin Partnership had several available data sources and methods to use as a basis for projecting new well connections including:

- Past building permit data for single family residences (SFRs) in areas reliant on permit-exempt wells for residential water supply or sometimes within water service areas
- Washington State Office of Financial Management (OFM) population projections
- County comprehensive planning, where available, that may inform where future growth is expected. Most county comprehensive plans utilize OFM projections as base data combined with other County-specific data.
- Regional planning organizations, in this case the TRPC, that provide tailored and detailed projections for some areas. Like County comprehensive plans, TRPC uses OFM population projections as base data.
- Land capacity or "developable lands" assessment that focuses on the amount of available rural land that could be developed for SFRs. Unless full buildout (all available parcels are built upon) is expected to occur within the 20-year RCW 90.94 (Streamflow Restoration law) planning horizon, land capacity would only provide an "outer limit" for what that 20-year projection could be. There are many uncertainties associated with a land capacity or developable lands assessment, including possible zoning changes to enable more dense development to occur and a buildable lands analysis confirming that a site is buildable (and as water available).
- Well logs for single domestic water wells
- Local knowledge about groundwater conditions and rural residential water sources

The four counties participating in the Addendum development each have a different set of factors that affect which data sources and methods are the best fit. Lewis, Mason, and Thurston Counties conduct comprehensive planning under the State Growth Management Act, which requires identification and protection of critical areas and natural resource lands, as well as areas expected to eventually be within city limits (urban growth areas or “UGAs”). For the purposes of Streamflow Restoration Act planning, areas within UGAs that are likely to receive public water over the 20-year planning horizon, and designated critical areas and natural resource areas are unlikely to develop. For Grays Harbor County, the projection relied more on past building rates, OFM projections, and the knowledge of county planning staff.

Most rural homes that are reliant on permit-exempt wells will be located outside city boundaries in unincorporated county regions. However in some cases SFRs within city boundaries or water service areas may rely on a permit-exempt well if water service to the site is not available. Based on well log screening in water services areas, the final permit-exempt well projections includes new wells in several water services areas.

Three methods were used to estimate permit-exempt well projections:

- Past trends based on building permit data
- OFM projections
- TRPC projection

The first step in all three methods was to remove areas that are known to receive water service from a Group A public or private water purveyor. These areas were identified by overlaying water service areas, distribution pipe network mapping (where available), sewer lines (where available) and municipal boundaries. Projections based on each method are shown in Table 1; detailed descriptions of each method are provided in the following sections.

Table 1. Projected New Permit-Exempt Well Connections for Chehalis Subbasins

Subbasin	Projected New Homes by 2040 Past Trends[1] Total	OFM Forecast[2] Low	OFM Forecast[2] Medium	OFM Forecast[2] High	TRPC Forecast[3] Total	Total Projected PE Wells[4,5]
Black River	414	-120	61	273	1,172	1,215
Chehalis - Salzer	44	-6	61	164	N/A	76
Chehalis Headwaters	16	-5	50	136	N/A	50
Cloquallum - N Delezene	115	-530	331	1,322	0	333
W Capitol Forest	5	-34	18	79	0	18
Elk - Johns River	25	-50	25	114	N/A	25
East Willapa	71	-18	126	346	218	350
Hanaford	12	-1	13	35	22	35
Hoquiam	21	-93	47	211	N/A	49
Humptulips	9	-1	1	3	N/A	13
Mox Chehalis	21	-100	51	228	2	51
Newaukum	209	-74	697	1,883	N/A	703
Satsop	62	-141	289	731	N/A	289
Scatter Creek	359	See note 6 below			526	526
Curtis	92	-18	168	454	N/A	168
Skookumchuck	87	-21	199	538	306	539
Northeast Willapa	25	-185	95	423	N/A	95
Wishkah	2	-6	3	13	N/A	2
Wynoochee	18	-16	8	36	N/A	18
WRIA 22/23 Total	**1,608**	**-1,419**	**2,243**	**6,988**	**2,246**	**4,555**

1. SFR building permit data obtained from OFM for 2009-2018. This data was intersected with subbasin areas and filtered to only consider SFR permits outside of UGAs and Group A water service areas. The average number of permits granted per year was calculated and multiplied to project new homes by 2040.
2. OFM forecasts prepared using data for each county provided by OFM in 2019; filters out households expected to be within UGAs and Group A water service areas. For Lewis and Mason Counties, OFM forecast was distributed based on proportion of historical building permits issued within WRIAs 22/23 over last ten years.
3. Forecasts provided by TRPC for each subbasin in 2019; filters out households expected to be within UGAs and large water service areas.
4. TRPC projections for Thurston County areas; greater of "Past Trends" and "OFM Medium" for other areas.
5. Subbasins that cross Thurston County boundaries use a weighted estimate of number of households combining TRPC forecast estimates for areas within the county, and the greater of either the Current Trend or OFM forecast for areas outside of Thurston County.
6. Scatter Creek subbasin is entirely within Thurston County; OFM projections were not calculated.

Projection Based on Building Permit Data

Data for all single family residence (SFR) building permits within the WRIA boundaries were obtained from OFM for 2008 through 2017 at a subbasin level. These were filtered to remove permits for demolitions and rebuilds, and permits that have been obtained, but the lots were not built upon. The annual number of permits for each subbasin was plotted and examined for trends such as an increasing/decreasing rate of building permit issuance; no clear patterns were identified. Then, the average number of permits per year was calculated for each subbasin and multiplied by 23 years to estimate the growth by 2040. Projections based on past trend results are shown in Table 1.

Projections Based on OFM Forecasts

OFM yearly population projections between 2017 and 2040 with significant developable land within WRIAs 22 and 23 (Grays Harbor, Mason, Thurston, and Lewis) were gathered for each of the four counties. OFM does not provide sub-county estimates, so forecasts for each subbasin were estimated based upon relative building permit density between the counties with jurisdiction over the subject subbasin.

Distributing Countywide OFM Forecasts to the Chehalis Basin

Because OFM forecasts are only available at the county level, the growth inside and outside the WRIA boundary had to be estimated for each county. For example, most of Thurston County's growth centers are in areas around Olympia and Tumwater, which are cities outside the Chehalis watershed. Therefore, only a portion of the OFM forecasted population should be used in the analysis and distributed amongst the Chehalis watershed subbasins. The distributions for each county was done as follows:

- Mason and Lewis Counties: OFM forecast data was allocated to the Chehalis Basin versus other WRIAs within each county based on SFR building permits for the period 2009 to 2018. For each of these counties, NHC obtained SFR building permits from OFM for the entire county. Once NHC obtained building data from 2009 to 2018 for counties, the average percentage of growth inside and outside the watershed was estimated. The analysis showed that 3.5% of Mason County's growth and 52% of Lewis County's growth occurred within the watershed. These percentages were then applied to the OFM countywide totals, in order to more accurately distribute population data across the subbasins.

- Grays Harbor County: Based on conversations with county officials and available Geographical Information Systems (GIS) data, the assumption was made that all of Grays Harbor's population growth will be within the WRIA 22 boundary. The only county area outside the basin is part of national forest and is sparsely inhabited with little or no population growth expected.

- Thurston County: Thurston County OFM projections were not further analyzed because Thurston County receives detailed forecasts from TRPC, and opted to focus on the TRPC forecast for permit-exempt well connection projections.

Distributing OFM Forecasts to Specific Subbasins within the Chehalis

Once the countywide OFM forecast data was narrowed to the portion applicable to the Chehalis Basin, it then had to be apportioned to specific subbasins following the methodology laid out below.

Step 1. Population projections were converted to estimated SFR for each county according to the average number of SFR occupants for each county:

- Thurston and Grays Harbor counties: 2.5 people per household
- Lewis County: 2.4 people per household
- Mason County: 2.75 people per household

Step 2. Using the OFM projections for each county apportioned to the Chehalis Basin, it was determined how the data should be distributed at a subbasin level. Since most of the subbasins cross county boundaries, the existing residential distribution was used to estimate how growth should be distributed. An estimate of existing SFRs was calculated from county parcel datasets based on standard Washington state land use codes. Multi-use and non-permanent residential codes were ignored as part of this exercise. Additionally, it was assumed that each parcel had only one residence. The parcel analysis provided a breakdown of how many residences are in each subbasin and how those are distributed across county boundaries.

Step 3. With a residential distribution for each subbasin determined, the growth in each subbasin could be calculated. The subbasin level growth determined from OFM permit data in Step 2 was sub-divided to the county areas within each subbasin using the previously determined residential distribution. Thus, an average number of new houses per year, per county within each subbasin was established. Adding these up to get total growth at a county level allowed for a calculation of growth within each subbasin for each county. Now, with a narrowed estimation of annual growth for each subbasin, within each county, the OFM growth projections could be calculated at a subbasin level.

For example, the Satsop subbasin lies in both Grays Harbor County and Mason County. Grays Harbor County is estimated to grow in population by 2,619 people by 2040 and Mason County is expected to have 21,786 new residents by 2040. Grays Harbor County assumes each single-family residence has 2.5 occupants and Mason County assumes an occupancy of 2.75. Thus Grays Harbor and Mason counties will have 1,048 and 7,922 new households by 2040, respectively. The SFR building permit data shows that 100% of Grays Harbor's growth is within the watershed and 3.5% of Mason County's growth is within the watershed. Now, the number of future residences in WRIAs 22/23 for Grays Harbor County and Mason County drop to 1,048 and 277, respectively. The parcel analysis in Step 2 provided that Grays Harbor County accounts for 38% of the existing residences in the subbasin and Mason County accounts for the other 62%. This is unsurprising since a large part of the subbasin lies within each county boundary. If Grays Harbor is assumed to account for 38% of the Satsop subbasin's growth annually, that translates to an average of 1.8 building permits per year. The total average number of building permits per year in Grays Harbor County is 14. So, the Satsop subbasin accounts for 13% of Grays Harbor County's total annual growth, which equates to 138 new single-family residences by 2040 based on OFM projections. By the same procedure, we estimate that 72% of the annual growth in Mason County would be in the Satsop subbasin, which equates to 201 new single-family residences by 2040.

Utilizing the process detailed above, the OFM population projections were distributed to each of the subbasins. These results are shown in Table 1.

Projections Based on Thurston Regional Planning Council (TRPC) Forecast

Thurston County population forecasts for each subbasin were provided directly by TRPC. Their projections are based on 2012 OFM Medium Projections, and are distributed using parcel data. For each parcel in Thurston County, a developable number of dwelling units is determined from zoning, existing development, housing density, and critical area data. Then countywide population growth is distributed based on residential permit trends and available capacity. The TRPC algorithm is specific to Thurston County data and therefore is only appropriate for subbasins in Thurston County. For other counties, the TRPC model will only distribute the 2012 OFM projections based on existing county populations, which is less current than the 2018 OFM data and likely less representative of future development trends.

Several subbasins cross county boundaries between either Thurston and Grays Harbor counties or Thurston and Lewis counties. Since the TRPC estimates outside of Thurston County are not reliable, those subbasins with split jurisdictions have a combined TRPC/OFM projection based on the percentage of growth in each county. Five subbasins are in this category:

- Split jurisdiction between Thurston and Grays Harbor counties: Black River, Mox Chehalis, and East Willapa
- Split jurisdiction between Thurston and Lewis County: Hanaford and Skookumchuck

The OFM and Building Permit estimates for each of the subbasins areas outside Thurston was calculated based on the percentage of growth within the Grays Harbor County or Lewis County portion of the subbasin and added to the TRPC projection for the area within Thurston County. The combined estimates were then used as the proposed number of permit-exempt wells (Table 1).

Other Considerations

Well Log Spot Check Within Water Service Areas and Urban Growth Areas

As stated earlier, the greatest number of new permit-exempt wells are expected in rural areas where water service from a public/private water purveyors is not available to residential landowners. However based on CBP member knowledge and investigations in other WRIAs, some permit-exempt wells are known to occur within water service areas. To assess the extent of this in the Chehalis Basin, the consultant team performed a well-log spot check to determine the magnitude of domestic permit-exempt wells drilled recently within large water service areas and Urban Growth Areas in the Chehalis watershed. Fifty percent of the well logs for wells drilled in these areas between 1998 and 2018 were reviewed to determine purpose of use for each well. Based on well log spatial data provided by Ecology, GIS was used to determine the number of recorded domestic water supply wells, then that data was used to project the rate of well increase in the next 23 years. This projection assumes that permit-exempt wells will continue to be drilled within the boundaries of water service areas in some parts of the Chehalis Basin. The results of the analysis are listed in Table 2, along with the City UGA where domestic permit-exempt wells were identified.

Table 2. Projected Permit-Exempt Wells within Water Service Areas based on Well Log Spot Check

Subbasins	Projected New Permit-Exempt Well Connections within UGA by 2040	City UGA (number of domestic wells from spot check)
Black	21	Tumwater (11)
Boistfort	2	Napavine (1)
Cloquallum	2	Elma (1)
Hoquiam-Wishkah	2	Hoquiam (1)
Humptulips	4	Ocean Shores (2)
Lincoln	16	Centralia (8)
Skookumchuck	90	Centralia (40), Grand Mound (4), Rochester (1), Tenino (1)
Upper Chehalis/Newaukum	19	Chehalis (7), Centralia (1), Napavine (2)
Wynoochee	0	
Totals	156	

City of Ocean Shores Permit-Exempt Irrigation Wells

It is common practice for single-family homes in the City of Ocean Shores to use city-supplied water for indoor uses and a private well for yard irrigation (Nick Bird, email communication with Cynthia Carlstad, 9/27/19). NHC consulted with Ecology on whether in this situation permit-exempt well projections should include those used solely for irrigation; Ecology advised that these wells should not be included in projections, in part because Ocean Shores is a peninsula with no associated freshwater habitat (personal communication with Tom Culhane, 1/6/20). No adjustments were made to the permit-exempt well projections as these wells had not been included previously.

Poor Groundwater or Lack of Groundwater as Limiting Factor for New Permit-Exempt Wells

Outside of alluvial aquifers in floodplain areas, potable groundwater in adequate quantities to reliably supply homes is limited in much of the Chehalis Basin. Areas known for limited available groundwater include areas around Pe Ell, Boistfort, North Fork and Middle Fork Newaukum, and Lincoln, Bunker, Garrard, and Independence Creek upland (Sue Kennedy, Sean Moerke, Jose Triana, 2020). According to the Lewis County Health Department, it is common for landowners to struggle to obtain a reliable water supply to SFRs, often drilling/deepening wells numerous times, relying on storage to supplement low-yield wells, and sometimes trucking water in during dry months.

The permit-exempt well projections were not reduced in any of these areas to recognize uncertainties about availability of potable groundwater. However, this was recognized as a factor in evaluating outdoor water use for the consumptive use estimate.

Comparison with Rate of Permit-Exempt Well Installations since 2018

As an additional validation step, the Partnership compared permit-exempt well projections based on OFM forecasts, building permits, and TRPC projections against the rate of permit-exempt well installations in each county since 2018. This comparison was also used to inform whether using an average or linear trend across the 10-year SFR building permit record would be a more appropriate metric upon which to base the permit-exempt well projections.

This cross-check showed that the annual rate of expected new permit-exempt well connections projected by building permit data was close in Thurston and Mason Counties, but only half of projected totals in Lewis and Grays Harbor Counties (Table 3).

Table 3. Comparison of Per-Year Permit-Exempt Well Estimates – County Well Fees Versus Projections Based on Building Permits, Based on County Data

County	2018-2019 Permit-Exempt Well Connections Based on Well Fees	Proposed Projection for New Permit-Exempt Well Connections Based on Average Trend	Proposed Projection for New Permit-Exempt Well Connections Based on Linear Trend
Grays Harbor	27	12	14
Lewis	63	22	33
Mason	2	2.3	4.2
Thurston	33	34	26

Final Permit-Exempt Well Projection for Plan Addendum

The sections above describe the data and analysis methods used to develop projections for new permit-exempt wells in the Chehalis Basin through 2040. The Partnership considered each of the methods and results described above, and evaluated which method and resulting projection they felt was the most solid. While certainty is not possible for the projection, the Partnership sought to use a projection that was both realistic to the local community and protective of streamflow impacts.

The selected permit-exempt well projection is shown in Table 4. For Thurston County, TRPC-based projections were selected as these align with the population and growth planning forecasts that Thurston County uses. For Lewis, Mason, and Grays Harbor Counties, the Partnership evaluated the building permit-based projections versus OFM-based projections. The Partnership had greater confidence in the building permit-based projections because they are tied to actual development activity. Actual growth in these three counties has tended to be below or at the OFM medium forecast historically, and periods of more rapid growth, as was forecast following the 2007 recession, did not materialize in Lewis County (State of Washington Office of Financial Management, 2018). However, to be more protective of streamflow, the Partnership selected the higher of the OFM medium and building permit-based projection for Lewis, Grays Harbor and Mason County portions of the basin. This decision also reflects that actual permit-exempt well installations over the last two years have been closer to the OFM projections than building permit projections in Lewis and Grays Harbor Counties.

Table 4. Proposed Permit-Exempt Well Projections

Subbasins	Projection for New Permit-Exempt Well Connections by 2040
Black	1,215
Chehalis - Salzer	76
Chehalis Headwaters	50
Cloquallum - N Delezene	333
W Capitol Forest	18
Elk - Johns	25
East Willapa	350
Hanaford	35
Hoquiam	49
Humptulips	13
Mox Chehalis	51
Newaukum	703
Satsop	289
Scatter	526
Curtis	168
Skookumchuck	539
Northeast Willapa	95
Wishkah	2
Wynoochee	18
Total WRIA 22 & 23	**4,555**

3. CONSUMPTIVE WATER USE ESTIMATION METHODOLOGY

Measurement of consumptive water use in any setting is difficult, and it is virtually impossible for residential groundwater use, which must account for both indoor and outdoor use. Permit-exempt wells are generally unmetered, so supply to each home is usually unknown, let alone the amount that is lost to the groundwater system. Therefore, we are limited to estimating consumptive use based upon projections of future growth, local patterns and trends in water use, and generally accepted and reasonable assumptions. Water use data from local water purveyors may be useful as a check on calculated estimates but must be used with caution. Homes that pay for municipal water tend to exhibit different water use behaviors such as water saving appliances and reduced landscape watering, that reduce usage compared to homes on wells.

The two main categories of household consumptive water use are indoor use and outdoor use. The methodology used to estimate these quantities for WRIA 22/23 are described in the following sections.

Indoor Consumptive Use

Indoor consumptive use was estimated using Ecology guidance, which was based on a per capita water user use study (DeOreo, et al., 2016) and an assumption that 10 percent of indoor domestic water use from homes on septic systems is consumptively used (similar assumptions made during some U.S. Geological Survey modeling in Washington). There are two basic elements to estimating indoor consumptive use:

- Amount of total water used. Ecology's guidance recommends an assumption of 60 gallons per person per day as a reasonable estimate of indoor total water use. To estimate indoor usage per well, the per capita usage was multiplied by the average rural household size, which was estimated for each county: 2.5 people per household for Thurston County and Grays Harbor County, 2.4 for Lewis County, and 2.75 for Mason County. For analysis areas spanning multiple counties, a weighted value was estimated based on the number of projected permit-exempt well connections in each county. Table 5 summarizes the household sizes for each subbasin and for the entire Chehalis basin.
- Percentage of total water used that is consumptive. Ecology's guidance recommends that 10% of the total indoor water use is considered consumptive when a home is on a septic system. (All indoor water use is considered consumptive for homes with sewer connections.) Areas projected to be served by permit-exempt wells are outside of sewer service areas, so the 10% assumption was applied for all projected indoor water use.

Table 5. Average Residents per Household for Chehalis Subbasins

Subbasin	% Projected Wells by County				Avg. People per Rural Household
	Lewis	Thurston	Grays Harbor	Mason	
Black River		95%	5%		2.50
Chehalis - Salzer	100%				2.40
Chehalis Headwaters	100%				2.40
Cloquallum - N Delezene			87%	13%	2.53
W Capitol Forest			100%		2.50
Elk - Johns River			100%		2.50
East Willapa	89%	8%	2%		2.41
Hanaford	100%	0%			2.40
Hoquiam			100%		2.50
Humptulips			100%		2.50
Mox Chehalis		1%	99%		2.50
Newaukum	100%				2.40
Satsop			38%	62%	2.66
Scatter Creek		100%			2.50
Curtis	100%				2.40
Skookumchuck	72%	28%			2.43
Northeast Willapa			100%		2.50
Wishkah			100%		2.50
Wynoochee			100%		2.50
WRIA 22/23 Total	**28%**	**49%**	**19%**	**4%**	**2.48**

Outdoor Consumptive Use

Outdoor water use is typically the larger portion of domestic single-family residential water use, with irrigation of lawn and garden areas being the dominant outdoor water use component. The NHC team conducted a subbasin-specific assessment to determine typical outdoor water use patterns, namely the typical size of irrigated lawn, garden, and landscaping areas associated with newer residential development, as well as irrigation water needs, which vary by crop and climate. The consumptive use estimate assumes that current rural residential landscaping practices will continue over the 23-year planning horizon.

Irrigated Footprint Analysis

The NHC team conducted an aerial photo-based analysis of irrigated lawn and garden areas for 296 parcels in the 19 Chehalis subbasins. Parcels used for the irrigated footprint analysis were selected based upon recent (2006-2017) building permits for new single-family residential homes not served by public or private water systems. Permits for accessory dwelling units (ADUs) or reconstruction/remodel were excluded. There were 760 permits in the basin meeting these criteria—more than could be reasonably evaluated for this project. For subbasins with more than 30 applicable building permits, a minimum 20-parcel sample per subbasin was targeted as a statistically representative sample size based on statistics from similar analyses in WRIAs 1,7, 8, and 9. The target sample size was set to provide a 95% confidence level (i.e. 95% certainty of the sample capturing the true mean of the population). Sample parcels were selected by assigning a random number to each building permit, and then evaluating sites in rank order up to the target sample size. Using a random selection from the permit list avoids the bias that could be introduced if selecting from the imagery. Table 6 shows the number of permits by subbasin and the targeted minimum sample size.

Table 6. Sample Size for Irrigated Footprint Analysis

Subbasin	Applicable Building Permits (2006-2017)	Target Minimum Sample Size
Black River	218	20
Chehalis - Salzer	15	15
Chehalis Headwaters	9	9
Cloquallum - N Delezene	49	20
W Capitol Forest	3	3
Elk - Johns River	15	15
East Willapa	30	20
Hanaford	4	4
Hoquiam	14	14
Humptulips	10	10
Mox Chehalis	9	9
Newaukum	91	20
Satsop	32	20
Scatter Creek	156	20
Curtis	42	20
Skookumchuck	39	20
Northeast Willapa	13	13
Wishkah	3	3
Wynoochee	8	8
WRIA 22/23 Total	**760**	**263**

Each parcel was evaluated visually in Google Earth for irrigated lawn areas. Google Earth's historical imagery collection utilized for clearer identification of irrigated areas by comparing aerial photos spanning multiple seasons and years. When aerial imagery showed that permitted parcels had either no changes, demolitions/reconstructions, or unfinished landscaping, those parcels were excluded from the analysis. Ultimately, this filtered approximately a quarter of the permitted parcels from the analysis. Late summer imagery was particularly helpful in determining boundaries of irrigated (green) vs. non-irrigated (brown) grass areas. More often than not, the parcels did not demonstrate such a clear-cut distinction between green and brown spaces. It appears that many homeowners irrigate enough to keep lawns alive but not to maintain lush growth (comparable to commercial turf grass/golf course green). Delineating these irrigated spaces is subjective, and the NHC team had one GIS analyst evaluate all of the selected parcels in the WRIA to maintain consistency in delineation judgements. The irrigated area was delineated for each parcel based on several key assumptions:

- Landscaped shrub/flower bed areas were included in the irrigated footprint (not just lawn areas).
- Homes that did not show visible signs of irrigation were tracked as zero irrigated footprint.
- Homes or landscaping still under construction in the most recent Google Earth imagery were excluded.
- Native forest or unmaintained grass/pasture were not included in the irrigated footprint.
- Pre-existing agricultural land use was not considered part of the residential irrigation footprint.

The irrigated area delineation underwent several iterations with input from the CBP Demand Forecast Work Group. Figure 1 shows examples of irrigated area delineation for two representative parcels in the Newaukum (left) and Humptulips (right) subbasins. On each photo, the parcel boundary is shown in yellow and the area identified as irrigated in white.

Figure 1. Example Irrigated Area Delineations

Results of the irrigated footprint analysis for all subbasins are summarized in Table 7. Due to small sample sizes, the subbasin-level results for 13 of the 19 subbasins (Chehalis-Salzer, Chehalis headwaters, W Capitol Forest, Elk-Johns River, Hanaford, Hoquiam, Humptulips, Mox Chehalis, Northeast Willapa, Wishkah, and Wynoochee) are not considered representative. The statistical margins of error in the remaining six subbasins are all greater than 50% of the subbasin mean, so it was determined that the most defensible approach would be to apply the average parcel size from the entire sample throughout the WRIA, rather than distinguishing by individual subbasins. Note that more parcels than the target minimum sample were analyzed in subbasins with larger numbers of permits. When identifying the random list for analysis, the NHC team identified ten additional sites beyond the target minimum of 20, to allow for dropping parcels that did not meet the analysis criteria (e.g. construction not completed). The full list was analyzed, resulting in a few parcels above the target minimum in each subbasin. Similarly, some of the parcels in subbasins with fewer than 20 permits had to be dropped, so the analyzed sample is smaller than the projected target. The lack of significant irrigation in many subbasins corroborated local knowledge regarding low-producing wells in some areas, like Chehalis-Salzer, and the general lack of significant landscaped yards in subbasins such as Humptulips, Hoquiam, and Satsop.

Table 7. WRIA 22/23 Irrigated Footprint Summary

Subbasin	Parcels Analyzed	Total Irrigated Area (ac)	Average Irrigated Area (ac)*	Applied Irrigated Area (ac)
Black River	19	1.06	0.056	0.074
Chehalis - Salzer	5	0.10	0.019	0.074
Chehalis Headwaters	7	0.36	0.052	0.074
Cloquallum - N Delezene	22	1.56	0.071	0.074
W Capitol Forest	2	0.00	0.002	0.074
Elk - Johns River	9	0.51	0.057	0.074
East Willapa	22	1.11	0.050	0.074
Hanaford	2	0.05	0.025	0.074
Hoquiam	8	0.01	0.001	0.074
Humptulips	4	0.31	0.079	0.074
Mox Chehalis	8	0.69	0.086	0.074
Newaukum	26	2.31	0.089	0.074
Satsop	18	0.80	0.044	0.074
Scatter Creek	28	2.04	0.073	0.074
Curtis	27	3.05	0.113	0.074
Skookumchuck	22	3.14	0.143	0.074
Northeast Willapa	10	0.95	0.095	0.074
Wishkah	1	0.00	0.000	0.074
Wynoochee	5	0.15	0.030	0.074
Full Analysis	**245**	**18.19**	**0.074**	

* Subbasin average from footprint analysis. Due to small sample sizes and large margins of error, overall average was used for consumptive use estimates.

Crop Irrigation Requirements

The amount of irrigation water required to grow and maintain vegetation depends on the crop, season, and local climate (temperature and precipitation) and thus this usage varies by location throughout the WRIA. The Washington Irrigation Guide (WAIG) (NRCS, 1997) includes an appendix listing net irrigation requirements for various common crops for 89 locations throughout Washington, derived from water use and meteorological data from the 1970s and 1980s. Since lawn can be a fairly water-intensive crop, and it is the most common target of residential irrigation, irrigation requirements for turf were used to estimate outdoor water needs.

Using the six WAIG stations within the Chehalis Basin (Aberdeen, Centralia, Elma, Hoquiam Airport, Oakville, and Olympia Airport) and surrounding stations to the north, south, and east, the NHC team spatially interpolated crop irrigation requirements (CIRs) across the basin by creating a triangulated irregular network (TIN) surface between the WAIG station points. Since there are no stations along the coast or moving into higher elevations in the Cascade foothills, bounding values were imposed along the coast and the Cascade crest to enforce reduction in CIR with increasing precipitation. Values of 6.5 and 8 inches per year were used for the coastal and Cascade boundary values, respectively; these are believed to be conservative based on additional station estimates from an unpublished irrigation data set being developed by Washington State University (Peters et al., 2019). Values from the resulting TIN surface were averaged over each subbasin to estimate the irrigation requirement for each subbasin. This analysis was performed for both annual and summer (June-July-August) irrigation requirements to provide information to compare peak summer water use to annual use estimates. Figure 2 shows the locations of the local WAIG irrigation data stations and the interpolated distribution of annual turf irrigation requirements across the basin. Table 8 summarizes the average values for both annual and summer CIRs for subbasins with projected permit-exempt well connections. Annual values were used for the consumptive use calculations described in this document.

The WAIG-based CIR estimates were compared to spatial distribution, based upon the unpublished WSU data, which has a more extensive network of stations. While CIR values did change, there was no systematic difference across the WRIAs and differences were predominantly in the range of plus or minus an inch. Consequently, the WAIG values were used for consistency with Ecology guidance and other planning efforts in western Washington.

The CIR is the net amount of external water required by the crop, accounting for precipitation inputs. Since irrigation systems are not 100% efficient, additional water must be supplied to ensure that crop needs are met. The application efficiency varies by the type of system (drip irrigation, microsprinklers, pivot sprinklers, etc.). For the Chehalis Basin, the Ecology-recommended value of 75% was used to determine the water applied for irrigation.

Outdoor water use for each home was then estimated as the applied water for irrigation (computed as a depth) times the average irrigation area. The consumptive use fraction is substantially higher for outdoor use than indoor use (to a septic system) because most of the applied water is taken up by plants or evaporated. Based on the Ecology guidance, a consumptive use fraction of 80% was applied to the total outdoor water use, meaning that 80% of water used for outdoor watering does not return to the local groundwater system.

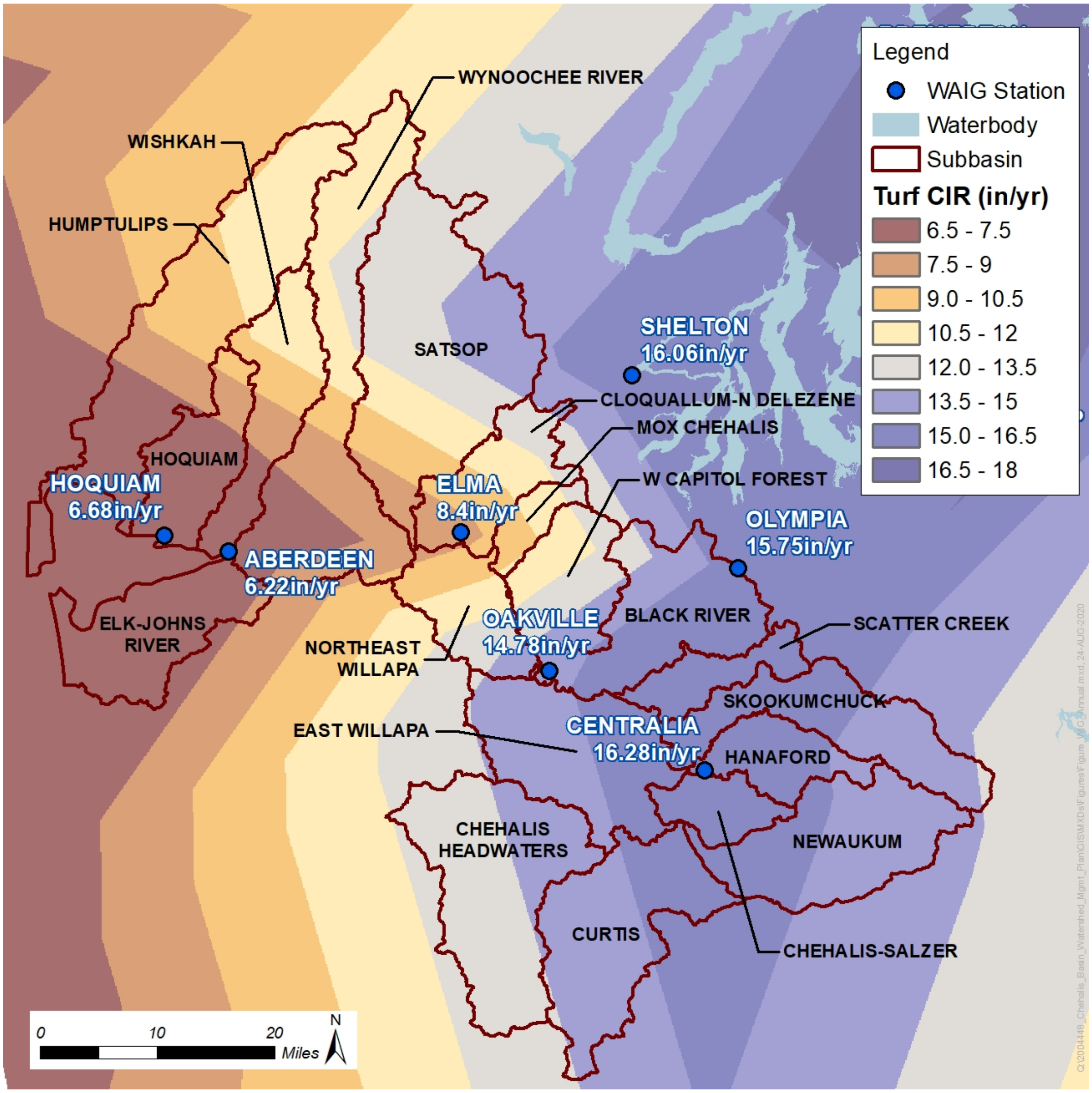

Figure 2. Spatial Distribution of Annual Turf Irrigation Requirement

Table 8. WRIA 22/23 Crop Irrigation Requirements

Subbasin	Annual Turf CIR (in)	Summer (JJA) Turf CIR (in)
Black River	15.06	12.22
Chehalis - Salzer	15.87	12.62
Chehalis Headwaters	13.19	10.87
Cloquallum - N Delezene	10.64	9.07
W Capitol Forest	12.58	10.47
Elk - Johns River	6.53	6.34
East Willapa	14.76	12.03
Hanaford	15.60	12.49
Hoquiam	7.17	6.75
Humptulips	9.07	8.18
Mox Chehalis	10.84	9.19
Newaukum	14.82	12.00
Satsop	12.21	10.31
Scatter Creek	15.94	12.74
Curtis	14.59	11.69
Skookumchuck	15.08	12.19
Northeast Willapa	11.37	9.66
Wishkah	9.21	8.22
Wynoochee	9.53	8.39
WRIA Average	**10.66**	**9.57**

4. TOTAL CONSUMPTIVE USE

The methods described above were used to compute indoor and outdoor consumptive use per permit-exempt well connection. Totals for each subbasin were then computed by multiplying per home values by the projected number of permit-exempt well connections in each subbasin. The NHC team developed a consumptive use calculator (Excel spreadsheet) to compute consumptive use for projected permit-exempt well connections for each subbasin and the basin as a whole. The consumptive use calculator was provided to the CBP Demand Forecast Work Group and used to calculate consumptive use under various scenarios. Table 9 summarizes the consumptive use estimates, which assumes one home with the estimated basin-average yard area per permit-exempt well. The consumptive use estimate for the Chehalis basin is 504.8 acre-feet per year.

Table 9. Annual Consumptive Use for One Home with Subbasin Average-Sized Yard

Subbasin	# PE Wells Anticipated in Subbasin	Irrigated Area per Well (ac)	Per Well Consumptive Use (gpd) Indoor	Outdoor	Total	Total Consumptive Use (af/yr)
Black River	1,215	0.074	15.0	88.7	103.7	141.1
Chehalis - Salzer	76	0.074	14.4	93.5	107.9	9.2
Chehalis Headwaters	50	0.074	14.4	77.7	92.1	5.2
Cloquallum - N Delezene	333	0.074	15.2	62.7	77.9	29.1
W Capitol Forest	18	0.074	15.0	74.1	89.1	1.8
Elk - Johns River	25	0.074	15.0	38.5	53.5	1.5
East Willapa	350	0.074	14.5	87.0	101.4	39.8
Hanaford	35	0.074	14.4	91.9	106.3	4.2
Hoquiam	49	0.074	15.0	42.2	57.2	3.1
Humptulips	13	0.074	15.0	53.4	68.4	1.0
Mox Chehalis	51	0.074	15.0	63.9	78.9	4.5
Newaukum	703	0.074	14.4	87.3	101.7	80.1
Satsop	289	0.074	15.9	71.9	87.9	28.4
Scatter Creek	526	0.074	15.0	93.9	108.9	64.2
Curtis	168	0.074	14.4	86.0	100.4	18.9
Skookumchuck	539	0.074	14.6	88.8	103.4	62.4
Northeast Willapa	95	0.074	15.0	67.0	82.0	8.7
Wishkah	2	0.074	15.0	54.3	69.3	0.2
Wynoochee	18	0.074	15.0	56.1	71.1	1.4
WRIA 22/23 Aggregated	**4,555**	**0.074**	**14.8**	**84.1**	**98.9**	**504.8**

† Calculated averages not used due to small sample size. Overall average substituted.

Consumptive Water Use Scenarios

The consumptive use calculator was also used to explore additional consumptive use scenarios. “Default” input parameters and values discussed in the methods section above can be modified to explore the effect of changes or uncertainties in individual assumptions. Two additional scenarios were computed, and annual consumptive use results are summarized in Table 10 and Table 11:

1. One home with legal maximum 0.5-acre irrigated lawn area per permit-exempt well. Assumes 60 gallons per day per person indoor use, and 0.5-acre outdoor irrigation use.

2. Water use of 950 gallons per day (annual average) per well connection for indoor and outdoor household use. Assumes 60 gallons per day per person and remainder to outdoor use.

Table 10. Annual Consumptive Use for One Home with 0.5-ac Yard

Subbasin	# PE Wells Anticipated in Subbasin	Irrigated Area per Well (ac)	Per Well Consumptive Use (gpd)			Total Consumptive Use (af/yr)
			Indoor	Outdoor	Total	
Black River	1,215	0.5	15.0	597.4	612.4	833.5
Chehalis - Salzer	76	0.5	14.4	629.6	644.0	54.8
Chehalis Headwaters	50	0.5	14.4	523.2	537.6	30.1
Cloquallum - N Delezene	333	0.5	15.2	422.2	437.4	163.2
W Capitol Forest	18	0.5	15.0	499.3	514.3	10.4
Elk - Johns River	25	0.5	15.0	259.1	274.1	7.7
East Willapa	350	0.5	14.5	585.7	600.2	235.3
Hanaford	35	0.5	14.4	618.7	633.1	24.8
Hoquiam	49	0.5	15.0	284.3	299.3	16.4
Humptulips	13	0.5	15.0	359.7	374.7	5.5
Mox Chehalis	51	0.5	15.0	430.1	445.1	25.4
Newaukum	703	0.5	14.4	588.2	602.6	474.5
Satsop	289	0.5	15.9	484.5	500.4	162.0
Scatter Creek	526	0.5	15.0	632.4	647.4	381.5
Curtis	168	0.5	14.4	579.0	593.4	111.7
Skookumchuck	539	0.5	14.6	598.1	612.7	370.0
Northeast Willapa	95	0.5	15.0	451.1	466.1	49.6
Wishkah	2	0.5	15.0	365.4	380.4	0.9
Wynoochee	18	0.5	15.0	377.9	392.9	7.9
WRIA 22/23 Aggregated	**4,555**	**0.5**	**14.8**	**566.3**	**581.1**	**2,965.1**

Table 11. Annual Consumptive Use for Annual Average 950 gpd Water Use per Connection

Subbasin	# PE Wells Anticipated in Subbasin	Irrigated Area per Well (ac)	Per Well Consumptive Use (gpd)			Total Consumptive Use (af/yr)
			Indoor	Outdoor	Total	
Black River	1,215	0.54	15.0	640.0	655.0	891.5
Chehalis - Salzer	76	0.51	14.4	644.8	659.2	56.1
Chehalis Headwaters	50	0.62	14.4	644.8	659.2	36.9
Cloquallum - N Delezene	333	0.76	15.2	638.4	653.6	243.8
W Capitol Forest	18	0.64	15.0	640.0	655.0	13.2
Elk - Johns River	25	1.23	15.0	640.0	655.0	18.3
East Willapa	350	0.55	14.5	644.3	658.8	258.3
Hanaford	35	0.52	14.4	644.8	659.2	25.8
Hoquiam	49	1.13	15.0	640.0	655.0	36.0
Humptulips	13	0.89	15.0	640.0	655.0	9.5
Mox Chehalis	51	0.74	15.0	640.0	655.0	37.4
Newaukum	703	0.55	14.4	644.8	659.2	519.1
Satsop	289	0.65	15.9	632.6	648.5	209.9
Scatter Creek	526	0.51	15.0	640.0	655.0	385.9
Curtis	168	0.56	14.4	644.8	659.2	124.1
Skookumchuck	539	0.54	14.6	643.5	658.0	397.3
Northeast Willapa	95	0.71	15.0	640.0	655.0	69.7
Wishkah	2	0.88	15.0	640.0	655.0	1.5
Wynoochee	18	0.85	15.0	640.0	655.0	13.2
WRIA 22/23 Aggregated	**4,555**	**0.58**	**14.8**	**641.2**	**656.1**	**3,347.7**

Daily usage rates shown in Table 9 through Table 11 represent annual average values. While indoor use generally does not vary much from month to month, outdoor water needs range from zero during the winter rainy season to more than three times the annual average during the peak of the summer. Since streamflows are lowest in late summer for most western Washington streams, the Partnership may consider peak summer water use along with annual use. This could be addressed through project implementation at a subbasin scale – focusing on subbasins where low flows are known to be a limiting factor for fish and projected new development is high.

It is important to remember that pumping rates do not directly equate to the stream depletion magnitude, however the Addendum assumes the full consumptive use impact on streamflow. Additionally, while Ecology's NEB Guidance recommends considering stream depletion impacts to be a steady-state equivalent, there may be circumstances within a watershed where that is not appropriate. Further investigations during implementation could increase understanding about where streamflows are most vulnerable to groundwater pumping, and the CBP could then prioritize project implementation in those areas.

Total Water Use and Comparison to Water Purveyor Data

Water use data from Thurston PUD were obtained as one benchmark for comparison with estimated permit-exempt well usage. Thurston PUD serves more than 1,200 connections in WRIAs 22 and 23, approximately half on Class B systems (up to 15 connections) most similar to permit-exempt well users. The PUD provided annual water use data for 2017 through 2019, for both metered and unmetered connections. Table 12 summarizes the data provided. Reported values are total water use, not consumptive use. For the Group B systems, the average annual use is approximately 190 gpd per household. This includes 39 flat rate connections, which averaged nearly double the annual water use per connection. This is consistent with observations that metered water users may exhibit more water conservation behaviors than unmetered users.

TABLE 12. THURSTON PUD GROUP B SYSTEM WATER USE

	Average Water Use per Connection (gpd)			
	2017	2018	2019	Average
All Group B (571 connections)	199	191	175	188
Flat Rate (39 connections)	458	358	317	378

Total water use breakdowns for the projected permit-exempt well scenarios are presented in Table 13. Average annual total use for permit-exempt wells estimated from this analysis (see Table 13) is fairly consistent with the Thurston PUD Group B data, falling between the overall average and the average for flat rate customers with unmetered service connections. It is worth noting that water usage provided by Thurston PUD is more volatile (from year to year and system to system) than water use on metered connections.

TABLE 13. ESTIMATED PERMIT-EXEMPT WELL TOTAL WATER USE

Scenario	Average Annual Water Use (gpd)	Average Indoor Use (gpd)	Average Annual Outdoor Use (gpd)
1 home, average measured yard	254	148	105
1 home, 0.5 ac yard	856	148	708
1 home using 950 gpd (annual average)	950	148	802
Note: Reported values are total water use, not consumptive use.			

5. REFERENCES

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Water Research Foundation, 2016. Residential End Uses of Water, Version 2. Executive Report. Published April 2016.

APPENDIX B - Project List

Project ID	Project Name	Project Type		
		Water Right Acquisition	Non-Acquisition Water	Habitat/ Other
Black River		1	3	6
B-00	TC #91 Holm Farm Ditch Removal and Floodplain Reconnection		x	x
B-01	Allen Creek MAR		x	
B-02	Cooke Aquaculture Water Right - Black River Reach	x		
B-03	Black River Basin Project Development: Oregon Spotted Frogs, Farms & Wetlands Project			x
B-04	Black River Confluence			x
B-05	Albany Street Stormwater Pond		x	
B-06	Beaver Creek Conservation Easement			x
B-07	Seiler Conservation Easement - Mima Creek			x
B-08	Jones Road Culvert Replacement			x
Chehalis-Salzer		0	2	3
CS-00	Coal Creek Floodplain Storage - City of Chehalis		x	x
CS-01	Berwick Creek at Labree Fish Passage Design			x
CS-02	Flood Hazard Reduction Master Plan and Chehalis Wastewater Treatment Plant Project		x	x
Chehalis Headwaters		0	0	1
CH-00	Marker 19 Oxbow Restoration			x
Cloquallum - N. Delezene		0	0	5
CD-00	Cloquallum Creek LWD Construction			x
CD-01	Upper Middle Fork Wildcat Creek Restoration			x
CD-02	Sam's Canal Culvert Removal and Restoration			x
CD-03	McConkey Lane Channel Naturalization			x
CD-04	Wildcat Road Barrier Construction			x
Elk - Johns River		0	1	1
EJ-00	Newskah Road Fish Barrier Correction			x
EJ-01	Grays Harbor County Forest Practices and Flow Assessment		x	x
East Willapa		0	2	2
EW-00	Garrard Creek Floodplain Restoration Opportunity Assessment		x	x
EW-01	Convert Galvin to Centralia Water		x	
EW-02	Scammon Creek Hamilton Fish Passage Construction			x
Hanaford		0	1	2
H-00	China Creek Flood and Habitat Mitigation Phase 2		x	x
H-01	Port Blakely Hanaford Acquisition			x
Hoquiam		0	1	6
HQ-00	Port Blakely West Hoquiam Acquisition			x
HQ-01	2020 West Hoquiam Acquisitions			x
HQ-02	Middle Fork Hoquiam Tidal Restoration			x
HQ-03	Grays Harbor County Forest Practices and Flow Assessment		x	x
HQ-04	East Hoquiam - Granberg Acquisition			x
HQ-05	East Hoquiam - Griswold Acquisition			x

APPENDIX B - Project List

Project ID	Project Name	Water Right Acquisition	Non-Acquisition Water	Habitat/ Other
		Project Type		
Humptulips		0	2	2
HT-00	Kirkpatrick Road Fish Barrier Correction Design			x
HT-01	Grays Harbor County Forest Practices and Flow Assessment		x	x
HT-02	Ocean Shores Water Reclamation and Reuse		x	
Newaukum		0	5	13
N-00	City of Chehalis Alternate Water Supply Intake		x	x
N-01	MF Newaukum Trib-Kruger Fish Passage Construction			x
N-02	Newaukum Lake Restoration & Enhancement Planning		x	x
N-03	MF Newaukum at Centralia Alpha Fish Passage Construction			x
N-04	South Fork Newaukum Early Action Reach			x
N-05	Lucas Creek Trib MP 4.39 - Fish Passage Construction			x
N-06	Lucas Creek Trib MP 4.24 - Fish Passage Construction			x
N-07	Berwick Creek at Hogue Fish Passage Construction			x
N-08	Berwick Creek at Borovec Fish Passage Construction			x
N-09	Newaukum MAR Concepts		x	
N-10	Knutsen Fish Barrier Correction and BDAs			x
N-11	Berwick Creek at Bishop Fish Passage Construction			x
N-12	Beaver Dam Analog Pilot Implementation		x	x
N-13	Berwick Creek Flood Reduction Restoration (Port of Chehalis)		x	x
Satsop		0	2	4
S-00	Satsop/Wynoochee Tributary Assessment		x	x
S-01	Tree Fever Conservation Easement			x
S-02	Lower Satsop Restoration, Protection, and Aquifer Recharge-Phase II		x	x
S-03	East Fork Satsop RM 8 Early Action Reach			x
Scatter Creek		1	4	5
SC-00	TC #118/119 Scatter Creek Water Right & Streamflow Augmentation	x		x
SC-01	TC #90 Weins Farm Restoration		x	x
SC-02	TC #89 Upper Scatter Creek MAR		x	x
SC-03	TC #81 Sampson Wetlands Restoration and MAR		x	x
SC-04	TC #127 Scatter Creek Upper Basin Forestry		x	x
Curtis		0	0	1
C-00	South Fork/Stillman Creek Early Action Reach			x
Skookumchuck		2	0	2
SK-00	TransAlta Water Right Acquistion	x		
SK-01	Skookumchuck Dam Release	x		x
SK-02	Skookumchuck Early Action Reach			x
Northeast Willapa		1	0	0
NW-00	Satsop Business Park Water Right to Reclaimed Water	x		

APPENDIX B - Project List

Project ID	Project Name	Project Type		
		Water Right Acquisition	Non-Acquisition Water	Habitat/ Other
Wishkah		0	1	1
W-00	Grays Harbor County Forest Practices and Flow Assessment		x	x
Wynoochee		0	2	3
WY-00	Wynoochee River RM 14 Early Action Reach			x
WY-01	Grays Harbor County Forest Practices and Flow Assessment		x	x
WY-02	Satsop/Wynoochee Tributary Assessment		x	x
Basinwide Concepts		1	5	5
BW-00	Beaver Dam Analog Implementation		x	x
BW-01	Chehalis Basin Cooperative Weed Management			x
BW-02	Agricultural Irrigation Efficiencies & Water Conservation		x	x
BW-03	Eager Beaver Collaboration		x	x
BW-04	Managed Aquifer Recharge Opportunity Assessment		x	
BW-05	Stormwater Recharge Opportunity Assessment		x	
BW-06	Trust Water Rights Acquisitions	x		
BW-07	USGS Groundwater Discharge Zone Delineation			x

PROJECT INFORMATION SHEET

Project Name:	**Holm Farm Ditch Removal with Floodplain Reconnection and Stream Re-Meandering (Thurston County ID 91)**
Project ID:	**B-00**
Project Location:	Project is located northwest of the north end of Crockett St NW in central Thurston County. Black River management unit: Blooms Ditch subbasin. Project includes unnamed tributary ditches feeding Blooms Ditch. Project is in the Black CBP unit. Lat/long: 46.930241, -122.979312
Project Description:	This project concept envisions removing incised ditches and possible drain tiles feeding Blooms Ditch, while creating a new re-meandered channel for Blooms Ditch itself. These actions are expected to bring the entire site hydrologic system closer to probable historic drainage. See the attached figure for the conceptual configuration of this project's new channels and the area where groundwater elevation is likely to rise. Ditch removal will force winter streamflows to slow as they pass through hydraulicly-rough wetlands complexes, supporting a higher water table with additional groundwater storage. Water quality and temperature improvements are expected via additional water flow through soils and the shallow aquifer. There is the expectation for improved wetland habitat through the creation of some new areas of saturated soils. Engineered re-meandering of the Blooms Ditch channel is expected to reconnect the stream's flood flows to the historic floodplain. This will increase the hydraulic roughness of the channel and floodplain at flood stage and allow flooding at a lower stage. The location of the project area is on undeveloped or agricultural land including mapped wetlands – but potentially accessible by farm ditch crossings. Blooms Ditch has weak perennial flow (13-15 cfs from the NHD Plus Mean Annual flow statistic (QaMA) shown on the attached figure). The two ditches are intermittent and have been largely ditched/compressed into nearly linear segments to drain a large area of wetlands and shallow groundwater. Capitol Land Trust owns part of the project area. Note that restoration actions are most likely feasible on the Land Trust-owned portions of the property but would need to be developed to ensure the benefits of the parcel for salmon conservation purpose. Importantly, this project largely allows continued agricultural land use, but some ag lands may have a

	higher water table after the project. Adjacent and affected landowners would need to be closely involved in project development. Groundwater infiltration would occur seasonally. MODFLOW groundwater modeling exists across this project site and can be used to test project concepts. In addition, significant LiDAR data are available for project assessment (one-foot LiDAR topography). Initial water offset/benefit calculations indicate: 1. Area of higher water table = 135.7 acres 2. Average projected groundwater rise = 1.0 feet 3. Effective porosity (gravity-drained) = 0.2 (20%) 4. Annual new water storage 135.7 x 1.0 x 0.2 = 27.14 acre-feet 5. Loss to evaporation, estimated (50%) = 0.5 (50%) 6. Qa (annual water offset, approx.) = 13.5 acre-feet Calculations of the above quantities required numerous assumptions and simplifications. This raw water Qa total might be improved by, for example, beaver habitat/ponding, woody structures in the channels/floodplain, or mature forest land cover. Because the water table is already shallow below most of the area, water storage as groundwater is somewhat limited, vertically. This limits the effective storage potential of, for example, Managed Aquifer Recharge (MAR) technologies that require a thick unsaturated zone.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	• The project would: o Produce approx. 13.5 acre-feet of new streamflow in Blooms Ditch, the Black River, and the Chehalis River o Raise the water table over approx. 135.7 acres to support additional water storage and wetlands o Remove approx. 9,992 linear feet of ditches o Construct approx. 5,264 linear feet of new meandered stream channel o Benefit Coho Salmon, Winter Steelhead, Cutthroat Trout, and Rainbow Trout in Blooms Ditch (SWIFD) o Produce water offset benefits in the Blooms Ditch subwatershed and the Black River

	o Preserve most of the existing site agricultural lands, except near the stream channel o Potentially provide flood control benefits (not quantified) o Potentially provide wetland/habitat benefits, including beaver o Be mostly constructed on otherwise difficult-to-develop wetlands • These benefits would require quantification. • The project would improve streamflow later in the year, i.e. groundwater seepage that would subsequently provide stream base flow. • The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process.
Is Water Quantity a Limiting Factor In this Subbasin?	Yes, Water Quantity is a Tier 1 concern in the Black River. Habitat assessments would be required to best understand current conditions.
Location & Spatial Extent of Benefits:	The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process. The benefit location would be Blooms Ditch, tributary to the Black River.
Anticipated Water Offset (if applicable):	Conceptually, this project could provide storage and release of 13.5 acre-feet of water across the rainy season. These offset estimates would require assessment and refinement during the Feasibility Study process.
Project-Type Specific Information	Water Storage and Retiming Projects • How much water is likely to be stored? o 13.5 af • Has the surface water source for the project been evaluated and, if so, what is that source? o Sources are unnamed ditches. These sources have not been evaluated. • During what period(s) can water be diverted? o Rainy season • What stream reach likely would benefit from this project and what is the anticipated benefit to that reach? o Blooms Ditch and Black River • What fish species will benefit? o Coho Salmon, Winter Steelhead, Cutthroat Trout, and Rainbow Trout in Blooms Ditch (SWIFD).
Estimated Project Cost:	+$800,000, estimate based on professional experience (K. Hansen, 7/15/2020)

Performance Goals & Measures:	Streamflow and groundwater level monitoring would probably be required; water sampling might also be required. Other permit-related requirements are likely.
Anticipated Local and Partner Support & Barriers to Completion:	Capitol Land Trust owns part of the project area. Acquisition of these parcels received local support through the Chehalis Basin Lead Entity process for its salmon benefits, and through the Aquatic Species Restoration Plan for its Oregon Spotted Frog benefits. Barriers to completion would be conflict between maximizing management of the site to benefit salmonids and Oregon Spotted Frog. The barrier would have to be overcome by careful coordination between USFWS staff, salmon biologists, and hydrologists. Permitting may also be an issue. Due to potential increase in flooding of lands surrounding the site, adjacent agricultural landowners would need to be engaged and supportive of the final project.
Project Sponsor, Implementation Start Date and End Date:	Not yet sponsored. Feasibility study start date 7/1/2021 or as soon as funding obtained. Project end date 1/1/2025.

Figure 1 – Site Location

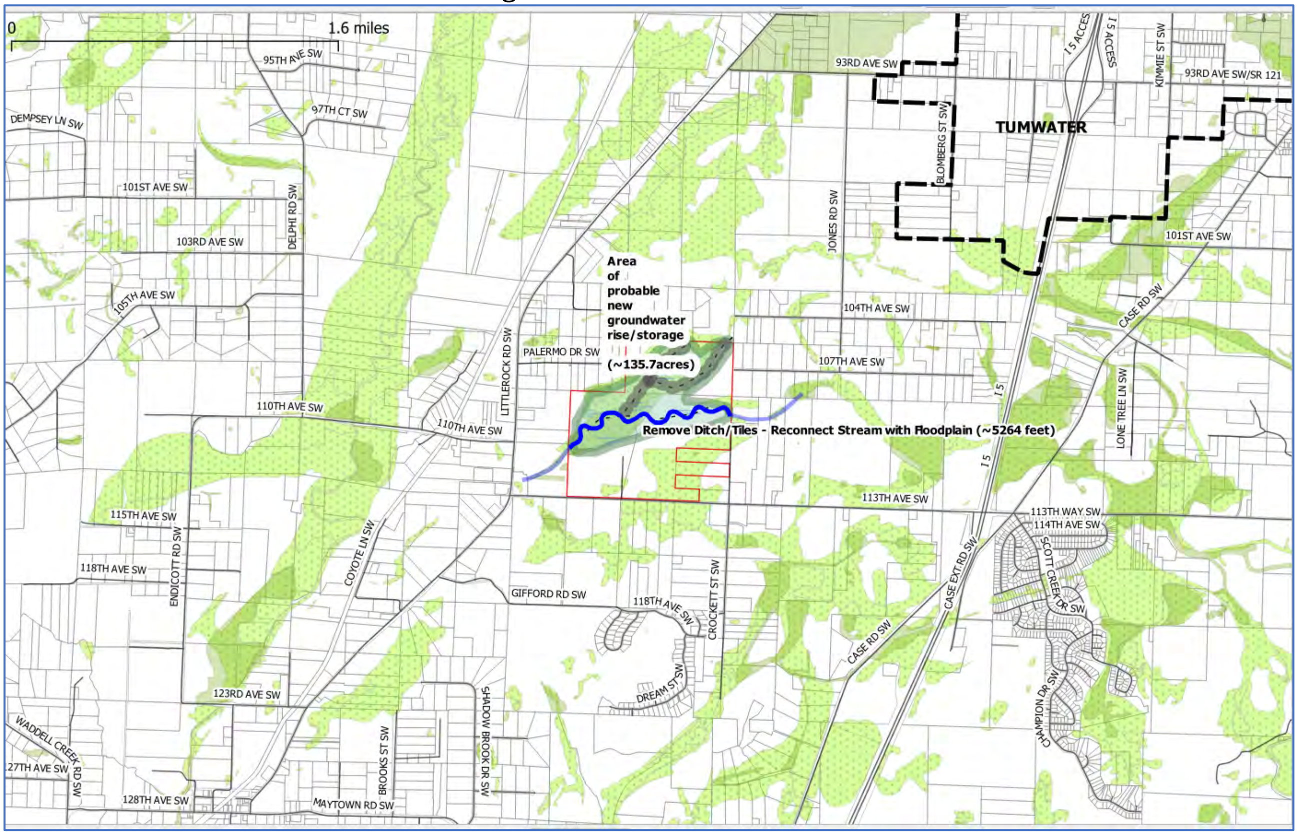
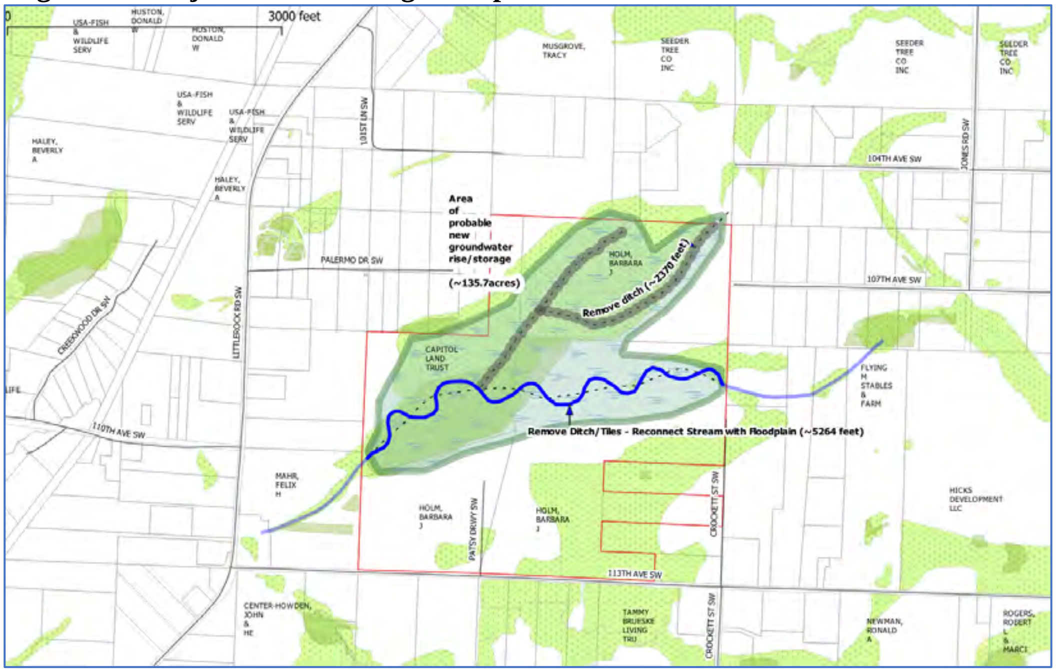


Figure 2 – Project Area showing conceptual ditch removals and stream restoration



PROJECT INFORMATION SHEET

Project Name:	Allen Creek MAR site (Thurston County ID 84). Assessment/Design/Acquisition/Construction.
Project ID:	B-01
Project Location:	Project is located east of Crockett St SW in central Thurston County. Black River management unit: Beaver Creek subbasin. Project includes unnamed tributary ditches feeding Allen Creek. Lat/long: 46.915593, -122.958451
Project Description:	This project concept envisions collecting 10% (1.0 cfs) winter high flow in ditches draining to Allen Creek, and infiltrating part of that water into a new Managed Aquifer Recharge (MAR) site. The location for the MAR facilities is on a single undeveloped parcel 'landlocked' by surrounding wetlands – but potentially accessible by a farm ditch crossing. Allen Creek is an intermittent creek that has been largely ditched/compressed into nearly linear segments to drain a large area of wetlands and shallow groundwater. Other habitat protection projects have been envisioned nearby, including Allen Creek Restoration Project (Habitat Work Schedule project ID 12-1109) by Wild Fish Conservancy but encountered land development pressures. Conceptually, the project includes the diversion of cold winter water from an existing ditch, conveyance by ~500 feet of new pipeline, infiltration into the shallow aquifer via a new gallery constructed for the project, with slow drainage feeding water into Allen Creek during drier months. Numerous related habitat improvement and flood-control projects could be envisioned. Importantly, this project largely avoids impairing continued agricultural land use. The project location and concept are presented in Figures 1 and 2, with a closeup of the concept in Figure 3. Supporting modeling information is also appended. MAR infiltration would occur seasonally, between the months of November and March, to avoid impairments to surface water rights holders. MODFLOW groundwater modeling exists across this project site and can be used to test project concepts. In addition, significant LiDAR data are available for project assessment (one-foot LiDAR topography).

Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	Conceptually, this project could provide off-channel storage and release of more than 26 acre-feet of water, through repeated diversions, potentially during each of multiple flooding events across the rainy season. These benefits would require further analysis as part of the Ecology-required Feasibility Study. Wild Fish Conservancy considered Pacific Coast Chum Salmon, ESA Listed Salmon/Steelhead, and Southwest Washington Coho Salmon to be potential beneficiaries of their past project concept on nearby tributaries to Beaver Creek (Not Warranted). Drainage of the feeder area is about 421 acres. The project would improve streamflow later in the year, i.e. groundwater seepage that would subsequently provide stream base flow. The project could also provide flood control benefits and wetland/habitat benefits including beaver. Beaver Creek watershed and the Black River would receive water offset benefits. The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process, and monitoring during operation. Habitat could be incrementally improved along the Chehalis River floodplain.
Is Water Quantity a Limiting Factor In this Subbasin?	Yes, Water Quantity is a Tier 1 concern in the Black Management Unit. The 2011 Lead Entity strategy states: "Withdrawals within Beaver Creek drops water quantity below set minimum instream flows." (*http://www.chehalisleadentity.org/documents/*) New habitat assessments would be required to assess current conditions, although it can be assumed that conditions have not improved.
Location & Spatial Extent of Benefits:	The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process.
Anticipated Water Offset (if applicable):	The project is estimated to provide 26 acre-feet per year of water offset (based on 50% of recharge calculated by STRMDEPL08; modeling results appended below). The project could divert 1.0 cfs from the tributary ditch off Allen Creek, feeding an MAR system whenever ditch flows meet a minimum of 10 cfs – between November and March. This concept would divert no more than 10% of winter flows from the ditch, and then only when ditch flows exceeded 10 cfs. Using the 2020 water year as an example (a dry, late year), HEC-HMS modeling indicated perhaps 93 to 166 acre-feet of water

	is available from ditch flows when flow was in excess of ~10cfs (storm flows, primarily). However, much less than this total could be infiltrated. The project targets about 1.0 cfs, representing 10% or less of total ditch flow, for ditch flows above 10 cfs. HEC-HMS analysis of runoff from the ~421-acre catchment indicates that ~1.0 cfs could be diverted from the most downstream ditch segment on Figure 2, from about November 1st to about April 1st (to avoid impairing downstream water rights). Groundwater infiltration/mounding capacity is limited, with depths to groundwater of 2-3 feet depending on topographic position relative to the stream. A long diversion pipe run may be needed (+500 feet) to achieve enough separation from the feeder diversion (i.e. in order to find a suitable MAR location and thicker unsaturated zone with aquifer storage/mounding capacity). Calibrated MODFLOW modeling indicates a Kxy of ~76 ft/day so the aquifer is sufficiently permeable to accept additional recharge. The overlying aquifer material may be thin, limiting recharge/storage and mounding capacity. Ground surface seepage face formation is probable, which may affect permitting and design. **Site hydrogeology** 1. **Depth to water:** 2-3 on average feet below ground (seasonally averaged depth) from steady-state MODFLOW model v198. 2. **Hydraulic conductivity:** K_{xy} = 76 ft/d, layer 1 of MODFLOW model 198. 3. **Groundwater velocity:** v = ((76) x (0.00194))/(0.15) = 0.98 ft/day 4. **Distance and direction**: ~500 feet from MAR site to stream, along groundwater streamline determined from steady-state MODFLOW model v195. 5. **Estimated travel time:** Project-level calculations required. 6. **Stream connection to aquifer:** Partial connection - Project-level calculations required 7. **Estimated fraction of recharge that discharges to nearest stream:** Project-level calculations required 8. **Initial estimate of streamflow benefit timing:** Project-level calculations required
Project-Type Specific Information	Water Storage and Retiming Projects • Has the surface water source for the project been evaluated, and, if so, what is that source? o Tributary ditch to Allen Creek with tributary area of about 421 acres. Source evaluation not yet completed.

	• During what period(s) can water be diverted?
	  o November through April; stream closed 1 May – 1 October
	• Is there an instream flow?
	  o No
	• How often is the flow above the minimum instream flow?
	  o N/A
	• What is the proposed rate of diversion?
	  o 1.0 cfs from November through April
	• What type of water rights would need to be acquired to provide water from that source?
	  o Surface water diversion and ASR permit
	• What stream reach likely would benefit from this project and what is the anticipated benefit to that reach?
	  o Beaver Creek tributary of Black River would see improved base flow
	• What fish species will benefit?
	  o Steelhead, Coho; resident coastal Cutthroat and rainbow trout downstream of project site
	• If this is a managed aquifer recharge (MAR) project, is the geology suitable and is the land available?
	  o Geology is suitable – shallow sand gravel above bedrock. Land availability is not currently known.
	• Has a feasibility study been conducted, and, if so, have the anticipated timing of streamflow benefits been estimated? What is the potential diversion method(s)?
	  o Feasibility study to be conducted. Timing has been through for modeling assessment; diversion methods unknown.

Estimated Project Cost:	To be determined.
Performance Goals & Measures:	Streamflow monitoring already occurs on Beaver Creek by Thurston County (stream gage at Case Rd SW). Instream Flow Restoration - Water Storage Change in Water Flow
Anticipated Local and Partner Support & Barriers to Completion:	Other habitat protection projects have been envisioned nearby, including Allen Creek Restoration Project (Habitat Work Schedule project ID 12-1109) by Wild Fish Conservancy but encountered land development pressures. Multiple partners could be considered.
Project Sponsor, Implementation Start Date and End Date:	Not yet sponsored. Feasibility study start 7/1/2021 or as soon as funding is obtained. End date 1/1/2027.

Figure 1 – Site Location

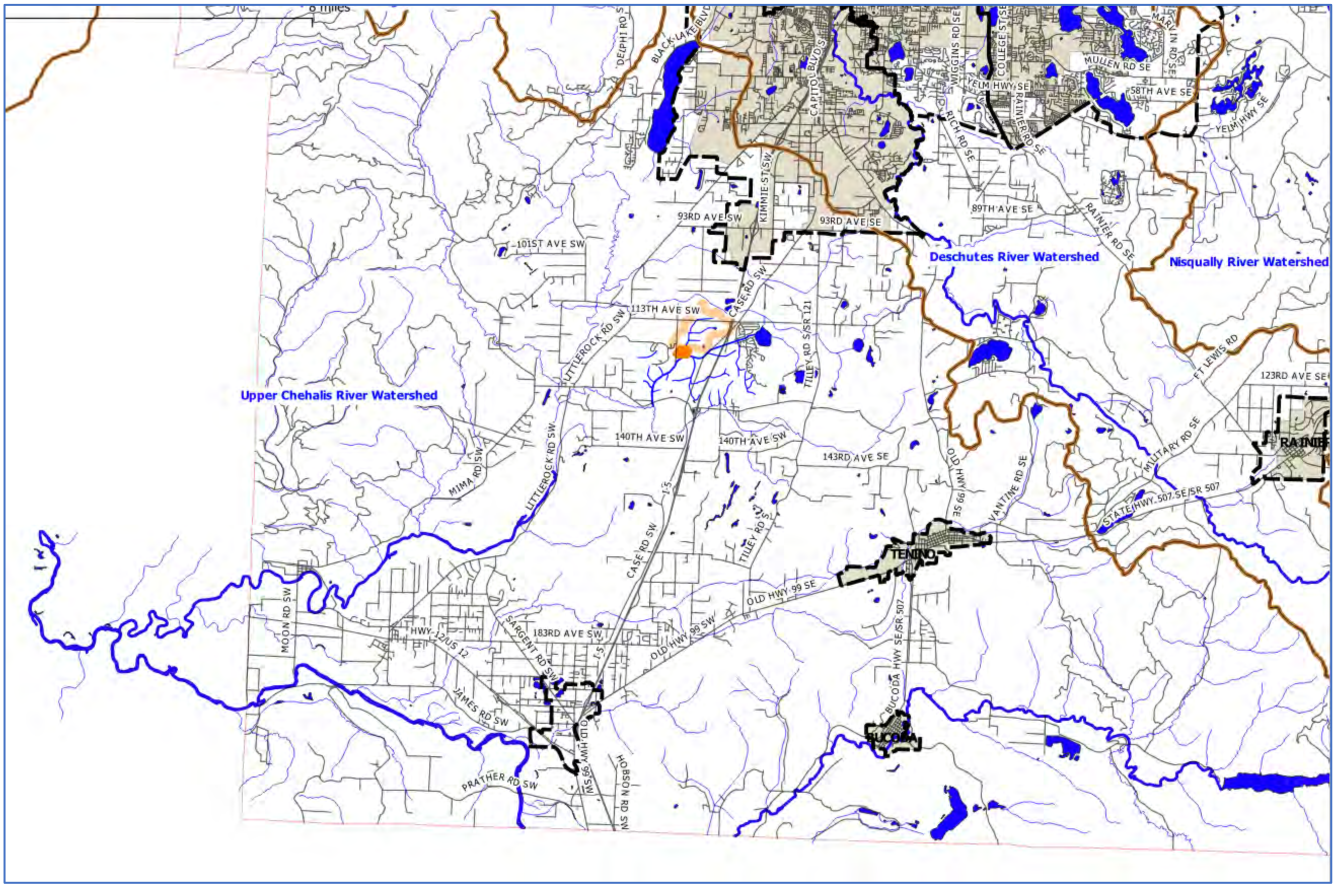


Figure 2 – Project Area showing conceptual Managed Aquifer Recharge (MAR) site fed by ~421 acres of catchment cut by ditches

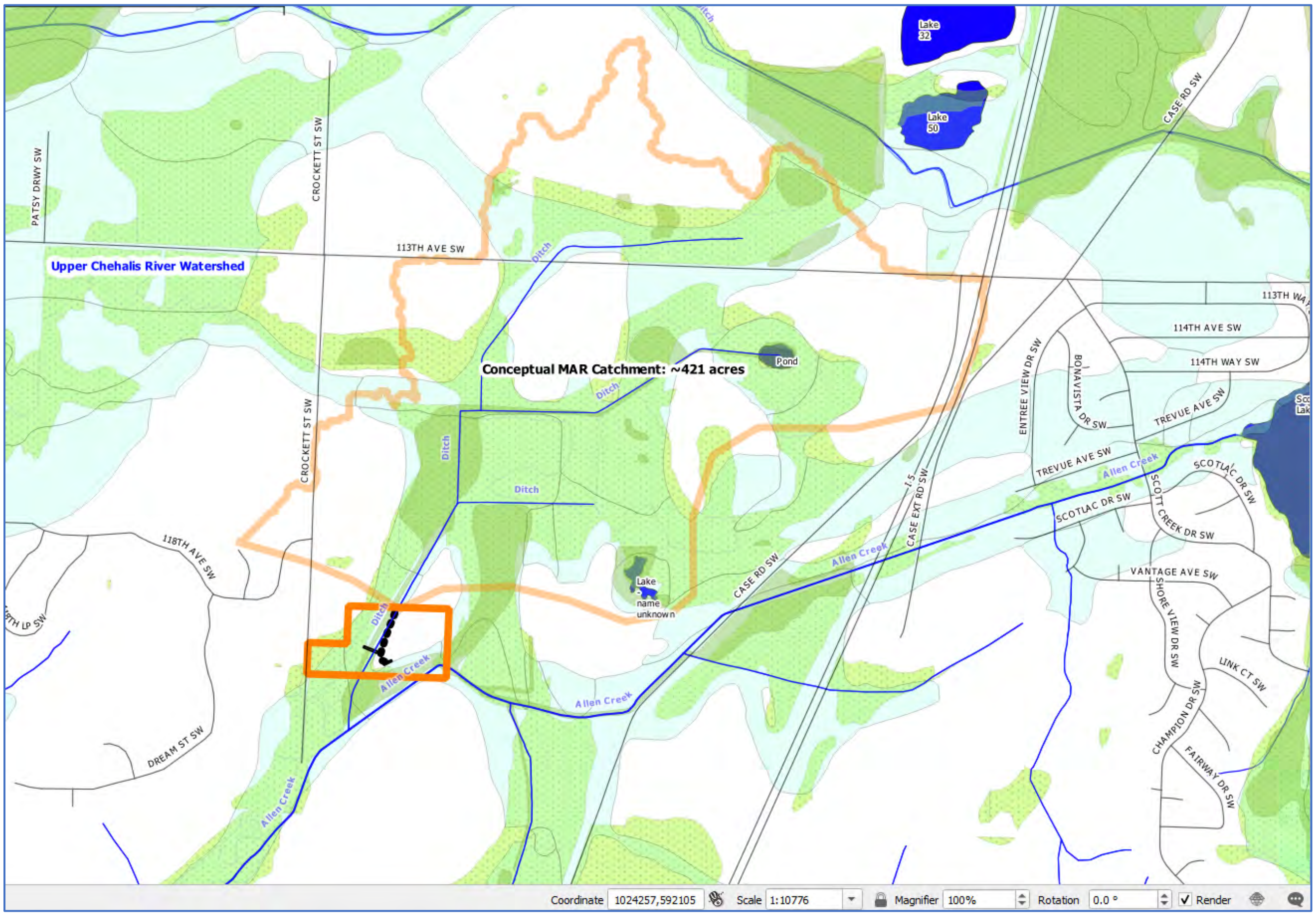


Figure 3 – Closeup of conceptual Project Area showing Managed Aquifer Recharge (MAR) features

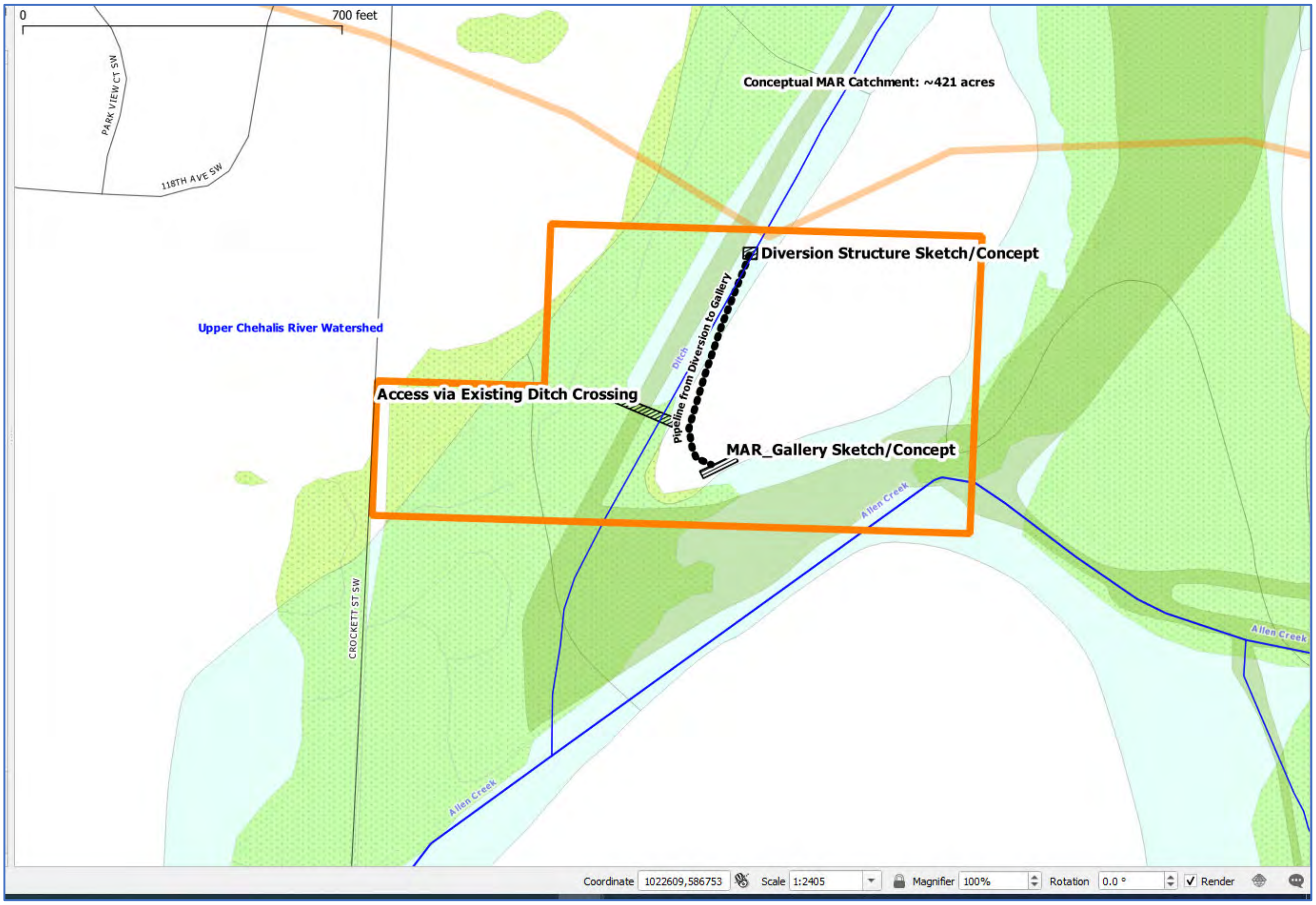


Figure 4 – HEC-HMS Hydrologic Model setup

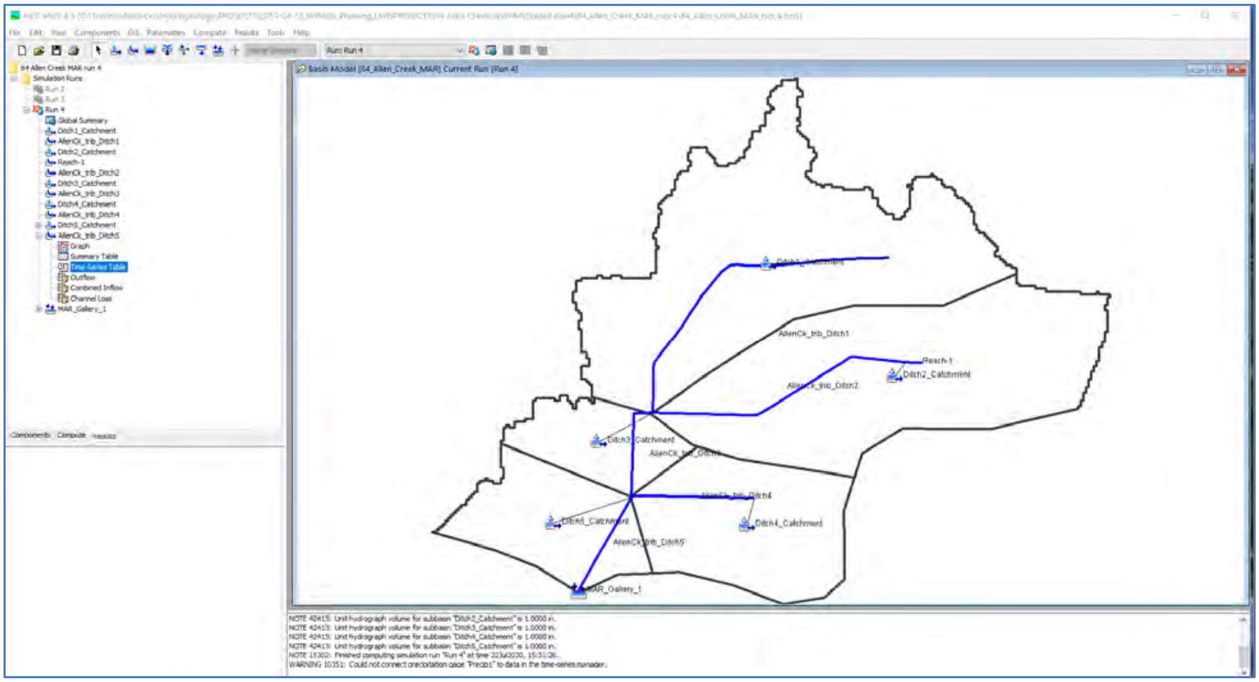
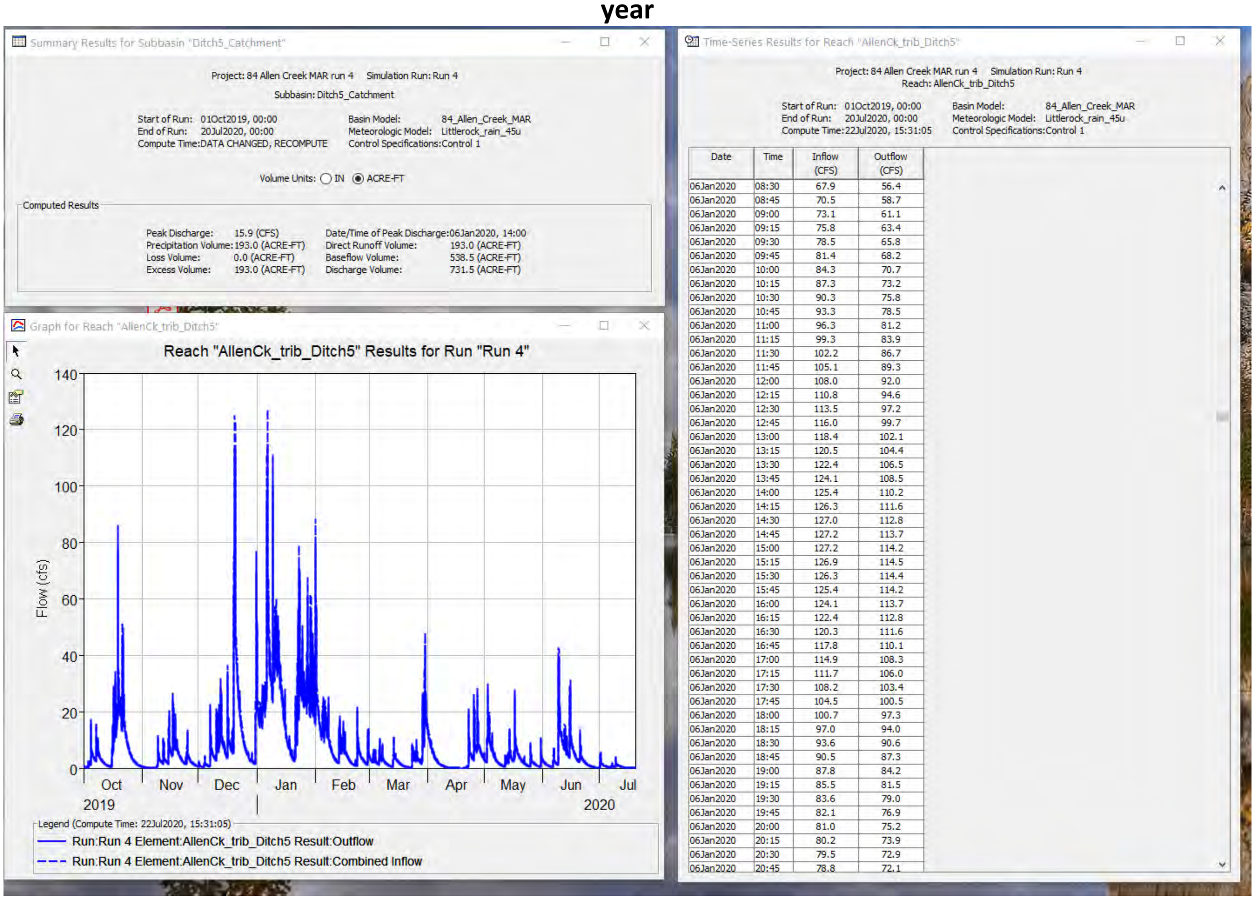


Figure 5 – HEC-HMS Hydrologic Model Output showing discharge from MAR catchment for 2020 water year



Date	Time	Inflow (CFS)	Outflow (CFS)
06Jan2020	08:30	67.9	56.4
06Jan2020	08:45	70.5	58.7
06Jan2020	09:00	73.1	61.1
06Jan2020	09:15	75.8	63.4
06Jan2020	09:30	78.5	65.8
06Jan2020	09:45	81.4	68.2
06Jan2020	10:00	84.3	70.7
06Jan2020	10:15	87.3	73.2
06Jan2020	10:30	90.3	75.8
06Jan2020	10:45	93.3	78.5
06Jan2020	11:00	96.3	81.2
06Jan2020	11:15	99.3	83.9
06Jan2020	11:30	102.2	86.7
06Jan2020	11:45	105.1	89.3
06Jan2020	12:00	108.0	92.0
06Jan2020	12:15	110.8	94.6
06Jan2020	12:30	113.5	97.2
06Jan2020	12:45	116.0	99.7
06Jan2020	13:00	118.4	102.1
06Jan2020	13:15	120.5	104.4
06Jan2020	13:30	122.4	106.5
06Jan2020	13:45	124.1	108.5
06Jan2020	14:00	125.4	110.2
06Jan2020	14:15	126.3	111.6
06Jan2020	14:30	127.0	112.8
06Jan2020	14:45	127.2	113.7
06Jan2020	15:00	127.2	114.2
06Jan2020	15:15	126.9	114.5
06Jan2020	15:30	126.3	114.4
06Jan2020	15:45	125.4	114.2
06Jan2020	16:00	124.1	113.7
06Jan2020	16:15	122.4	112.8
06Jan2020	16:30	120.3	111.6
06Jan2020	16:45	117.8	110.1
06Jan2020	17:00	114.9	108.3
06Jan2020	17:15	111.7	106.0
06Jan2020	17:30	108.2	103.4
06Jan2020	17:45	104.5	100.5
06Jan2020	18:00	100.7	97.3
06Jan2020	18:15	97.0	94.0
06Jan2020	18:30	93.6	90.6
06Jan2020	18:45	90.5	87.3
06Jan2020	19:00	87.8	84.2
06Jan2020	19:15	85.5	81.5
06Jan2020	19:30	83.6	79.0
06Jan2020	19:45	82.1	76.9
06Jan2020	20:00	81.0	75.2
06Jan2020	20:15	80.2	73.9
06Jan2020	20:30	79.5	72.9
06Jan2020	20:45	78.8	72.1

Figure 6 – Groundwater modeling results (1 of 2). STRMDEPL08 groundwater model for the Allen Creek MAR conceptual project site. Graph shows streamflow benefit from a conceptual MAR gallery receiving diversion from the most downstream ditch at 1.0 cfs (86,400 cubic feet per day) for 15 days, assuming late March typical conditions.

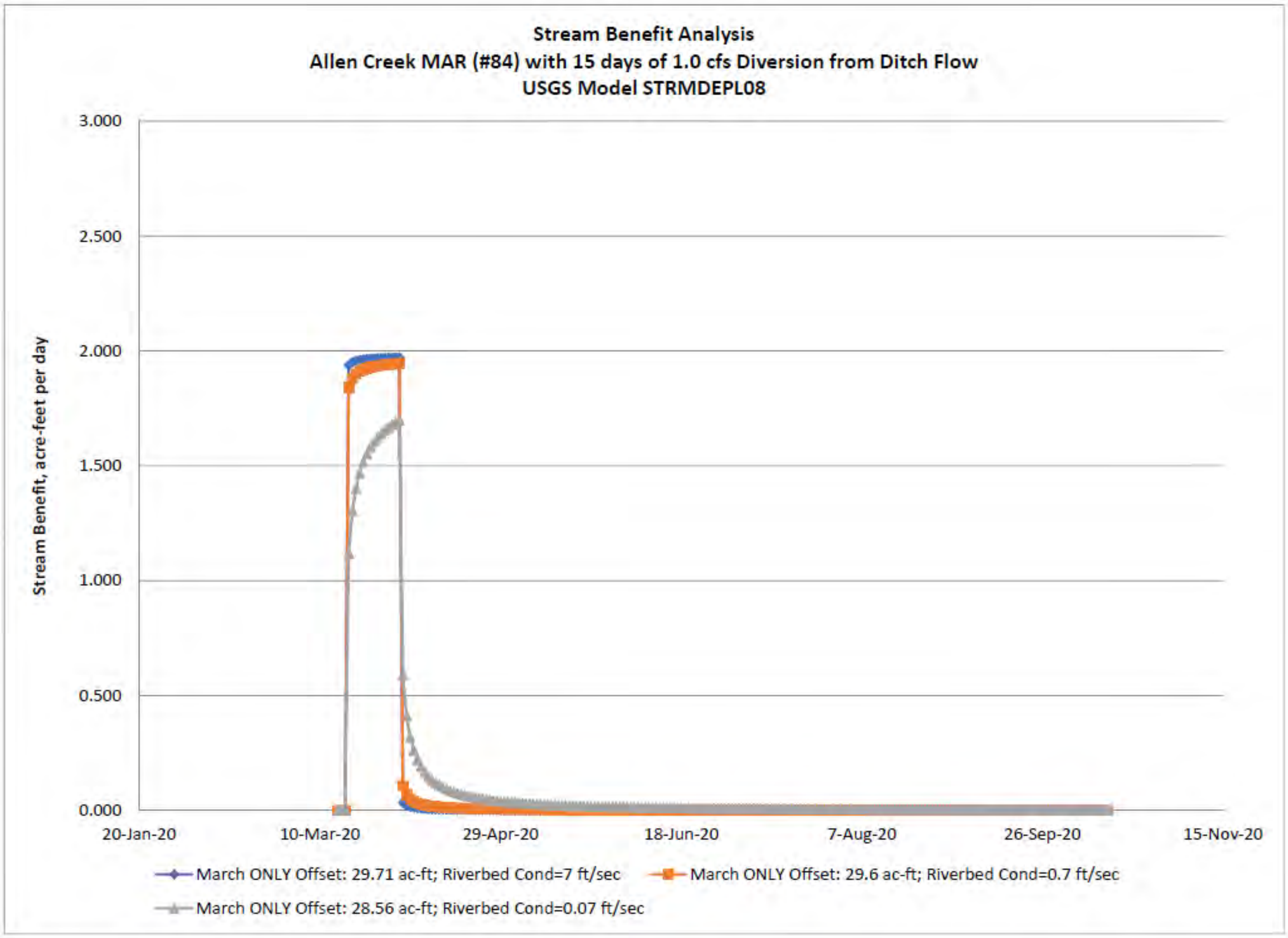
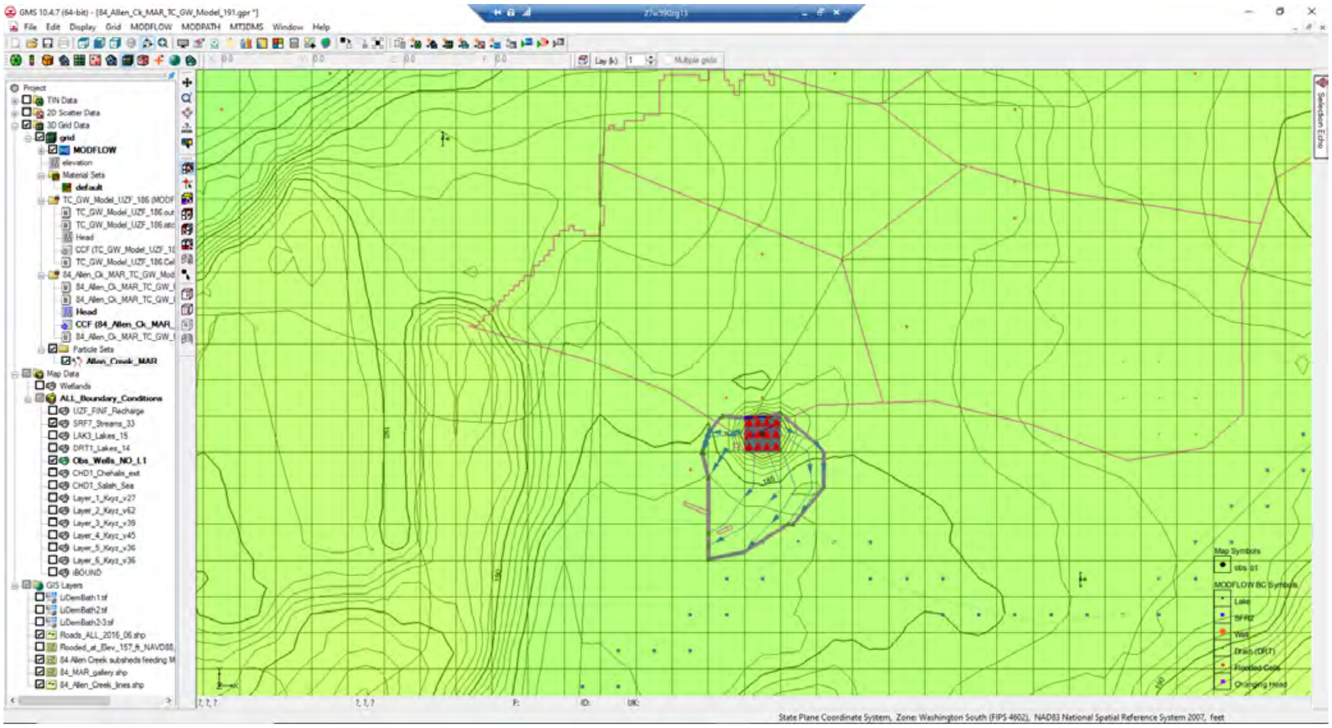


Figure 7 – Groundwater modeling results (2 of 2). MODFLOW v191 Steady-state groundwater model for the Allen Creek MAR conceptual project site. Graphic shows groundwater flow streamlines, radius of effects from a conceptual MAR gallery receiving diversion from the most downstream ditch at 1.0 cfs (86,400 cubic feet per day). Flooded cells indicate probable seepage face formation.



PROJECT INFORMATION SHEET

Project Name:	**Cooke Aquaculture Water Right – Black River Reach**
Project ID:	**B-02**
Project Location:	The Black River facility is located at 11405 Gate Road SW in Thurston County Lat/long: 46.8436/-123.1200
Project Description:	Cooke Aquaculture's Black River fish hatchery used large amounts of groundwater under Groundwater certificate G2-24677. The water right provided for 4,800 gpm with an unspecified annual quantity for fish propagation. Water was last used on the site in 2012, and based on the water right holders estimates that 4,800 gpm and 7,000 acre-feet per year were used, this amount has been placed in Temporary Trust for the purposes of groundwater preservation/instream flow purposes This facility in no longer in operation and the rights are protected by their trust water status and are available to purchase. Should increasing flows in the Black River be a goal of the planning group, the best option to utilize the Cooke Water Rights would be to increase withdrawals at the existing facility and develop a direct flow augmentation program by discharging water directly into the Black River.
Project Type:	☑ Water Right Acquisition ☐ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	The Black River has high temperatures and low dissolved oxygen levels during summer low flow conditions. The Black River is utilized by Fall Chinook, Coho, Chum and Winter steelhead. Additional cold water discharge will alleviate low flow and high temperature conditions during the summer low flow period, improving water quality and providing cold water refuge for spring Chinook.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes, the Black River is a Tier 1 with Water Quantity as a Limiting Factor.
Location & Spatial Extent of Benefits:	Flows could be increased in the Black River from the location of the Cooke Aquaculture hatchery downstream to its confluence with the Chehalis River, then onward to Grays Harbor.

<table>
<tr><td></td><td>The most significant temperature reduction benefits would occur at the discharge point and downstream on the Black River.</td></tr>
<tr><td>Anticipated Water Offset (if applicable):</td><td>Only a portion of the Cooke Aquaculture water right would be needed to provide significant benefit. The project proposes application of 141 acre-feet per year, which would provide 0.8 cfs flow augmentation during a three-month low flow period. This corresponds with projected consumptive use from permit-exempt wells in the Black River subbasin of 141 acre-feet per year.

The Cooke Aquaculture water right could provide as much as 4,800 gpm or 7,000 acre-feet per year.</td></tr>
<tr><td>Project-Type Specific Information</td><td>Water Right Acquisitions
Has the water right been put to beneficial use? Are there any relinquishment concerns?
To be determined in feasibility study
Has work already been conducted to estimate consumptive use, and, if so, what is the estimated consumptive use?
No
Is the water right uninterruptible (that is, senior to instream flow rules or other senior water rights)?
To be determined in feasibility study
Where is it anticipated that the benefits would occur?
Black River downstream of Cooke Aquiculture hatchery
What is the anticipated rate and volume of the benefits? If possible, describe hydraulic connectivity with nearby streams, relative importance of streamflow as a limiting factor for fish, information about species present in nearby stream, etc.
Rate and volume of benefits to be determined in feasibility study. Fall Chinook, Chum, Winter Steelhead and Coho use the mainstem Black River and would benefit from increased instream flow.</td></tr>
<tr><td>Estimated Project Cost:</td><td>Conceptual Project</td></tr>
<tr><td>Performance Goals & Measures:</td><td>Acre Feet Of Water Purchased
Cfs (Cubic Feet Per Second) Of Water Purchased
Change In Water Flow</td></tr>
<tr><td>Anticipated Local and Partner Support & Barriers to Completion:</td><td>Thurston County would be a partner and potential sponsor. Cooke Aquaculture will need to be engaged and supportive of this project for it to proceed. Project will need additional hydrogeological review to assess the interactions between surface water effects and groundwater withdrawals.</td></tr>
</table>

	Any acquired water right would need to be placed in Trust and permanently donated to Ecology via a protracted and expensive process. The purpose of use would need to be changed to allow for instream flow augmentation. A determination as to extent and validity would need to be made, as would a finding that the new use would not impair instream flows or existing water users.
Project Sponsor, Implementation Start Date and End Date:	Conceptual, sponsor not yet identified. Feasibility study could begin as early as 7/1/2021. End date 1/1/2030

PROJECT INFORMATION SHEET

Project Name:	**Black River Basin Oregon Spotted Frogs, Farms & Wetlands Project**
Project ID:	**B-03**
Project Location:	Black River Management Unit Black River Lat/long: 46.914656, -123.016214
Project Description:	This program will work with at least 10 landowners in the Black River sub-basin to identify barriers and opportunities to improve habitat conditions on their properties, with a focus on Oregon Spotted Frog, while also maintaining viable agricultural operations or other land uses (participation will not be limited to agricultural properties). It will focus on working with and learning from willing landowners with appropriate habitat conditions or potential habitat for target species. This program focuses on achieving the following: 1. increase community awareness and support for habitat (OSF) restoration 2. identify barriers and opportunities to engage private landowners effectively in actions that benefit OSF and other specie 3. design projects in partnership with landowners, WDFW biologists, and USFWS 4. develop monitoring and adaptive management framework for projects 5. implement projects on private land with cooperation of landowners 6. increase available habitat for endangered Oregon Spotted Frog and on private properties. While this initiative will focus on habitat restoration opportunities it could also result in benefits to water quantity and streamflow based on changes in landowner tolerance for seasonal flooding or other wetland-tolerant actions. Given the current lack of landowner engagement in stewardship actions there is a need to identify the barriers to participation, as well as the incentives or innovative tools that might make desired stewardship actions more acceptable to private landowners. This effort will specifically note gaps in current incentive opportunities and unaddressed needs that, if addressed, could increase participation. This effort will explore these issues with landowners directly to determine a practical and effective path forward.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other

Description of Benefits:	Riparian, wetland and upland habitat type. This project will be benefitting amphibian species. This potentially can benefit bank protection and flood plain connectivity, water quality and quantity.
Is Water Quantity a Limiting Factor In this Subbasin?	Yes.
Location & Spatial Extent of Benefits:	All projects will be within the Black River basin. Exact locations will not be identified until the program is developed.
Anticipated Water Offset (if applicable):	There may be indirect benefits as the program may increase landowner tolerance of increased flooding on their lands, which would have groundwater recharge benefits.
Project-Type Specific Information	The project falls outside pre-defined categories.
Estimated Project Cost:	Conceptual.
Performance Goals & Measures:	Change in Flow • Bank protection • Floodplain connectivity • Water quality and quantity
Anticipated Local and Partner Support & Barriers to Completion:	Thurston Conservation District has strong relationships in the communities in this area. They can be expected to work only in areas with existing local support, and then further increase support for this type of work as a result of their successes.
Project Sponsor, Implementation Start Date and End Date:	Thurston Conservation District. Start: 7/1/2021 or as soon as funding is available. End: 1/1/2025

PROJECT INFORMATION SHEET

Project Name:	**Black River Confluence**
Project ID:	**B-04**
Project Location:	Confluence of Black and Chehalis Rivers Lat/long: 46.821109, -123.218675
Project Description:	A geomorphic and hydraulic reach assessment will be developed to compile adequate information describing the reach and associated problems in the context of salmon recovery. Specific components of the assessment will include: characterizing the distribution and relative function of floodplain habitats, assess historical changes in channel pattern and riparian conditions, Evaluate locations and describe to what degree riparian processes have been degraded by land use activity, identify locations where channel-floodplain dynamics and habitat forming processes are impaired by bank armoring or levees, and with hydraulic modeling tools assess the frequency of floodplain connectivity and side channel engagement that could be achieved by removal or modification of existing impairments such as rip rap along the bank of the Chehalis River near the confluence of the Black River.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Bank erosion and flooding, instream and riparian benefits. The project should benefit Spring and fall Chinook, Chum, Coho, Summer and Winter Steelhead, and Sea-run Cutthroat species. Cutthroat stocks are unknown in this stretch of the Black River. Summer Steelhead stocks are unknown in this stretch of the Mainstem Chehalis. Spring Chinook stocks are depressed in these stretches. Fall Chinook are marked as Healthy/Depressed in this section of the Chehalis Mainstem. The salmonid limiting factors are the biological processes, channel structure and complexity, floodplain connectivity and function, and large woody debris recruitment.
Is Water Quality a Limiting Factor In This Subbasin?	Yes. It is a Tier 1 concern in the Black River.
Location & Spatial Extent of Benefits:	The confluence of the Chehalis River and Black River.

Anticipated Water Offset (if applicable):	None.
Project Type Specific Information:	This is an assessment that could lead to the following project types: Floodplain and Channel Migration Zone Restoration / Side Channel and Off Channel Habitat / Instream Habitat Restoration
Estimated Project Cost:	Conceptual.
Performance Goals & Measures:	• Total riparian acres treated • Acres of off-channel/floodplain connected or added • Acres of riparian area treated. • Acres of shoreline treated for armor modification/removal • Floodplain: acres reconnected • Number of miles of streambank treated • Total miles of instream habitat treated
Anticipated Local and Partner support & Barriers to Completion:	Owned by Confederated Tribes of the Chehalis Reservation
Project Sponsor, Implementation Start Date and End Date:	Chehalis Tribe. Start 7/1/2020 or as soon as funding is available. End 1/1/2038 end of planning horizon

PROJECT INFORMATION SHEET

Project Name:	**Albany Street Stormwater Pond (Thurston County ID 65)**
Project ID:	**B-05**
Project Location:	Project is located immediately west of the intersection of Albany St SW with Littlerock Rd SW, in the unincorporated town of Rochester, in southwest Thurston County. Black River management unit: Black River subbasin, WRIA 23. Lat/long: 46.826812, -123.094227
Project Description:	The Albany Street Pond is an engineered and landscaped stormwater infiltration pond receiving runoff routed through new conveyances and a stormwater pond in Rochester near US-12/Main Street to drain a 30-acre area of nearby streets in the unincorporated town of Rochester. The main project site is a triangle shaped plot directly across the street from the Rochester Community Park and Garden. This project is a 2019 Thurston County Stormwater Utility Capital Facilities Plan (CFP) project. The project met Streamflow Restoration Act requirements and received a $1,194,619 Streamflow Restoration Act grant from Ecology in 2019 for construction, with a modeled water offset benefit of 23 acre-feet annually during the wet season. The property cost, and design and construction of community amenities is paid for by $310,000 of County stormwater fees. Design and construction were overseen by Storm and Surface Water Utility personnel. As described in Water Resources Technical Memo #36, the project benefits were calculated using both surface water modeling (MGSFlood) and groundwater modeling (MODFLOW). Water recharged by this project benefits the Black River (WRIA 23), with a significant groundwater flow lag time, as described in the Technical Memo #36. Surface water modeling was used during project design to assess the expected project hydrology. In the design, water that was previously ponded (as problematic floodwater) was routed to the new landscaped stormwater pond. MGSFlood modeling indicated a new (increased) recharge to groundwater as a seasonal 23.8 acre-feet per year (Herrera, Inc. design report). MODFLOW groundwater modeling was used to assess the receiving stream and the timing of benefits. The receiving stream for site recharge is the Black River, based on particle track analysis, with an approximate 5-year delay before benefits reach the Black River.

	Following an extensive public engagement process, the final design was completed in 2018 to include features asked for by the community, including landscaping, a walking path and crosswalk connecting to the nearby community park area, and amphitheater-style seating. Construction was completed in 2019-2020 (see photos below).
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	This project is currently providing recharge to the Black/Chehalis Rivers (Scatter Creek Aquifer), following construction in 2019-2020. Because the project was constructed as designed, we expect the streamflow benefit of +23 acre-feet per year to have been accrued during the 2020 water year (2019-2020) and to continue indefinitely with Storm and Surface Water Utility maintenance. Community amenities were provided, including landscaping, a walking path and crosswalk connecting to the nearby community park area, and amphitheater-style seating.
Is Water Quantity a Limiting Factor In this Subbasin?	Yes. Water Quantity is a Tier 1 concern in this subbasin. Habit assessments would likely improve understanding of this limiting factor.
Location & Spatial Extent of Benefits:	This project is currently providing recharge to the Black/Chehalis Rivers (Scatter Creek Aquifer), following construction in 2019-2020.
Anticipated Water Offset (if applicable):	Suggested Plan benefit for this project is 11.9 afy, based on 50% of recharge calculated by MGSFlood modeling during civil design process (see further information below). Because the project was constructed as designed, we expect the streamflow benefit to have been accrued during the 2020 water year (2019-2020) and to continue indefinitely with Stormwater Utility maintenance. As described in Water Resources Technical Memo #36, the project benefits were calculated at 23.8 afy using both surface water modeling (MGSFlood) and groundwater modeling (MODFLOW). Water recharged by this project benefits the Black River (WRIA 23), with a significant groundwater flow lag time, as described in the Technical Memo #36. **Site hydrogeology** 1. **Aquifer and thickness:** ~70-100 feet of coarse glacial outwash (sand/gravel/cobbles) overlying Miocene claystone/sandstone 2. **Depth to water:** 17 to 23 feet below ground (seasonal minimum depth)

	3. Hydraulic conductivity: K_{xy} = 2,000 to 4,000 feet per day **4. Groundwater velocity:** v = ((4,000) x (0.000919))/(0.3) = 12.25 ft/day 5. **Distance and direction**: ~ 23,390 feet from recharge site to stream, along groundwater streamline determined from steady-state MODFLOW model v195 *6.* **Estimated travel time:** travel time average of about 1,909 days or about 5.23 years from recharge to discharge. No significant pressure wave nor kinematic wave can be assumed (i.e. particle tracking is the best estimate of benefit timing at the receiving stream). Because of this long travel time, a steady-state assumption is appropriate *(general note: identify whether pressure wave, kinematic wave or steady-state was assumed).* 7. **Stream connection to aquifer:** Partial connection to the Black River, with an assumption of no significant streambed conductance losses. 8. **Estimated fraction of recharge that discharges to nearest stream:** 50% based on the assumption that half of recharged water is lost to evapotranspiration or pumping in transit 9. **Initial estimate of streamflow benefit timing:** Steady-state 10. **Suggested Plan benefit estimate:** 11.9 afy, based on 50% of recharge calculated by MGSFlood modeling during civil design process. 11. **Probability of benefit:** High (i.e. use 100% of the calculated 11.9 afy benefit) 12. **Probability of construction:** High (construction completed)

Project-Type Specific Information	Water Storage and Retiming Projects
	• How much water is likely to be stored/retimed?
	  o 23 af/year
	• Has the surface water source for the project been evaluated, and, if so, what is that source?
	  o Stormwater runoff from 30-acre developed catchment.
	• During what period(s) can water be diverted?
	  o Pond receives water from any storm runoff, so the majority is stored and infiltrated during the winter but additional infiltration can occur throughout the year.
	• Is there an instream flow?
	  o No, flow source is not a stream.
	• How often is the flow above the minimum instream flow?
	  o n/a
	• What is the proposed rate of diversion?
	  o n/a
	• What type of water rights would need to be acquired to provide water from that source?

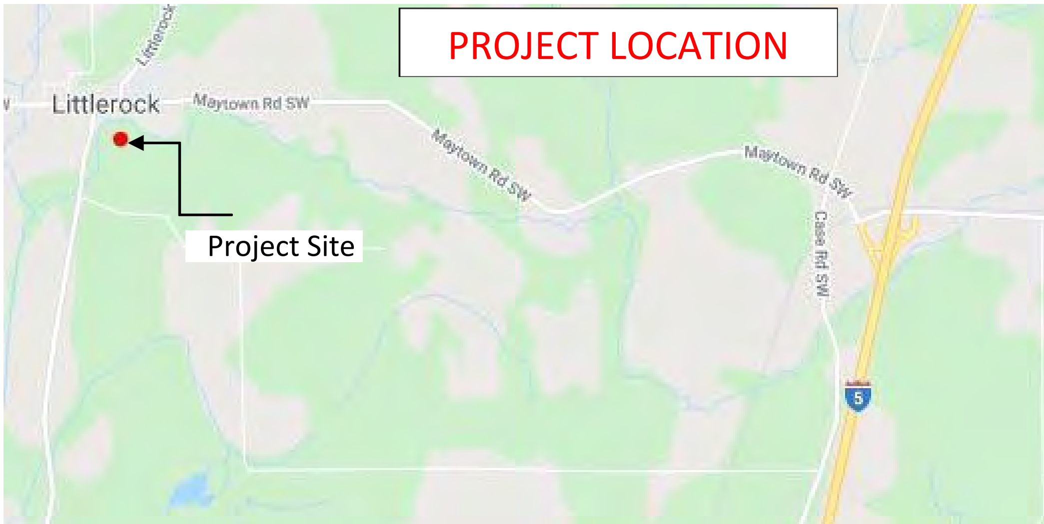
	o None • What stream reach likely would benefit from this project and what is the anticipated benefit to that reach? o Project provides groundwater recharge to Scatter Creek aquifer that will provide benefit to the Black River. • What fish species will benefit? o Unknown.
Estimated Project Cost:	Approximately $1.5M.
Performance Goals & Measures:	System inspections and maintenance by the Storm and Surface Water Utility Change in Flow = 23 af/y
Anticipated Local and Partner Support & Barriers to Completion:	This project sought local support through an extensive public engagement process. The final design was completed in 2018 to include features asked for by the community, including landscaping, a walking path and crosswalk connecting to the nearby community park area, and amphitheater-style seating.
Project Sponsor, Implementation Start Date and End Date:	Design and construction were overseen by Thurston County Public Works, through Storm and Surface Water Utility personnel. Start: 1/12017 End: 6/30/2020.

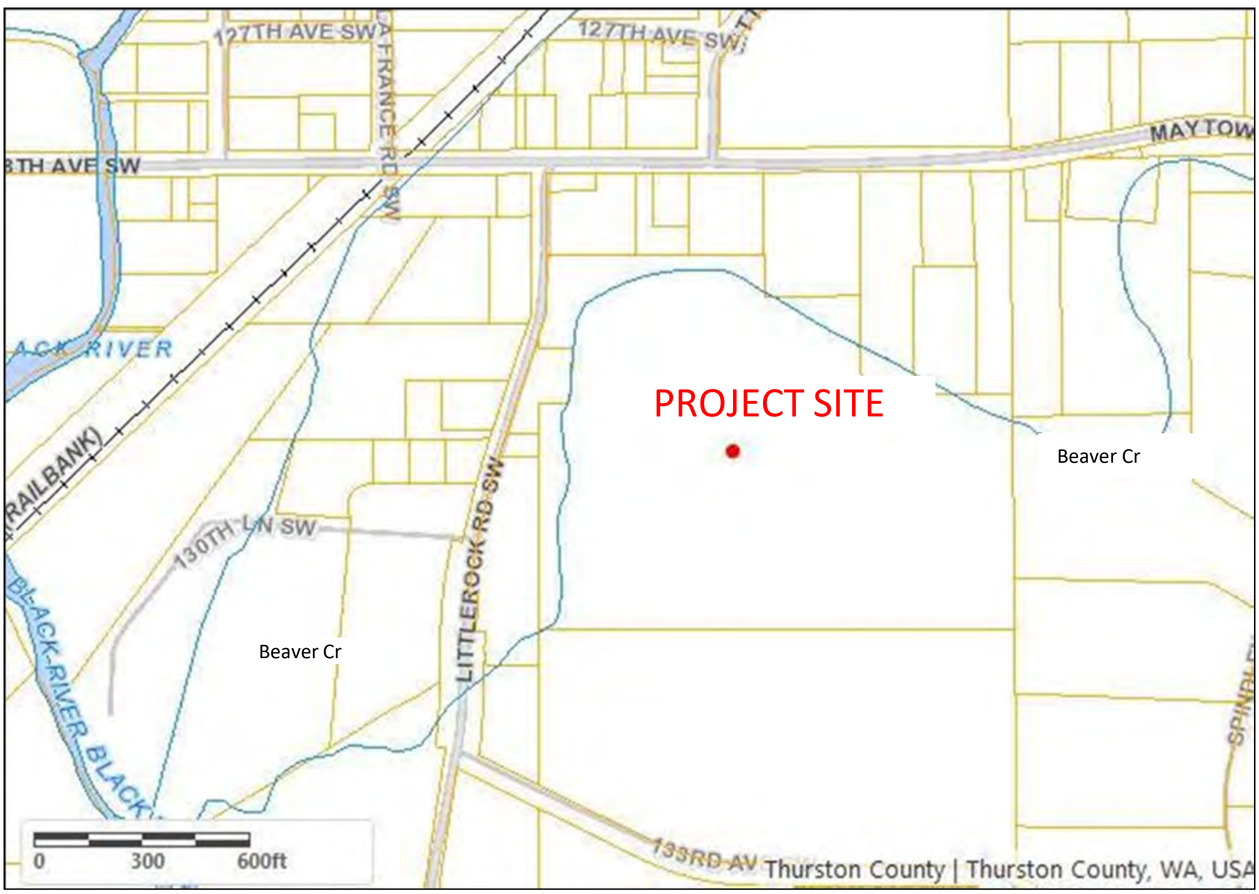
Construction Photos

PROJECT INFORMATION SHEET

Project Name:	**Beaver Creek Conservation Easement**
Project ID:	**B-06**
Project Location:	Black River watershed, vic. Littlerock community Access from Littlerock Rd. and 133rd St SW. Lat/long: 46.8972, -123.016
Project Description:	The project will acquire a perpetual conservation easement of 27+ acres of young forest and mature riparian forest adjacent to a portion of Beaver Creek. Beaver Creek is used by coast Chinook salmon, fall and winter chum, coho and steelhead. This creek flows into the Black River approx. 2 miles from this site.
Project Type:	☐ Water Right Acquisition ☐Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	A perpetual conservation easement will maintain the existing riparian zone, improve the adjacent forest, and allow the forest to mature and contribute to a stable aquifer. The site will help protect the creek waters and fish habitat. The site includes Category I, II and III Critical Aquifer Recharge areas. This area of Thurston county is zoned residential 1/20.
Is Water Quantity a Limiting Factor In this Subbasin?:	Surface withdrawals are a Tier 1 concern for the Black River. Unregulated water withdrawals, especially for gravel mining and agriculture, may be a significant contribution to the problem.
Location & Spatial Extent of Benefits:	1,825 feet of Beaver Creek will be protected from development
Anticipated Water Offset (if applicable):	None.
Project-Type Specific Information	The town of Littlerock is very rural but developed parcels in this vicinity tend to be smaller than current zoning; this area of Thurston county is zoned residential 1/20. The number of septic systems and small agricultural projects in the vicinity impact the aquifer. The soils in the

	parcel are 56% Alderwood gravelly sandy loam and 34% normal silt loam. The easement site includes type II and III aquifer recharge zones per county zoning data. Beaver Creek is used by several salmon species, frogs and other aquatic species, otter, mink, and other wildlife. Beaver analogs are not expected to improve the current situation, but should upstream conditions change this could be considered. The riparian area consists of 70'± tall trees with smaller trees in the interior of the parcel; these trees will mature and contribute to the local aquifer and habitat.
Estimated Project Cost:	TBD, but the owner has a connection with the Rose Foundation which may contribute stewardship funding.
Performance Goals & Measures:	Agricultural practices and fish farming impact water quantity (Tier 1 Concern). Withdrawals within Beaver Creek drops water quantity below set minimum instream flows. As the forest in this parcel matures, it has the potential to increase or maintain current water levels. Development of LWD such as logjams can improve instream channel structure and habitat diversity, and we can educate the landowners on importance of leaving LWD in river.
Anticipated Local and Partner Support & Barriers to Completion:	The landowner is engaged in the easement process and the local community may support the project as it will contribute to the forested aspect of the area just north of this parcel. No barriers are known at this time.
Project Sponsor, Implementation Start Date and End Date:	Chehalis River Basin Land Trust is the sponsor. Start: Feb. 2020 End: Unknown (easement development requires many hours of discussion and rewrites until the deed is accepted by both parties.)


PROJECT LOCATION
Littlerock
Maytown Rd SW
Project Site
Case Rd SW
5


127TH AVE SW
LAFRANCE RD SW
MAYTOWN
PROJECT SITE
Beaver Cr
LITTLEROCK RD SW
130TH LN SW
BLACK RIVER
133RD AV
0 300 600ft
Thurston County | Thurston County, WA, USA

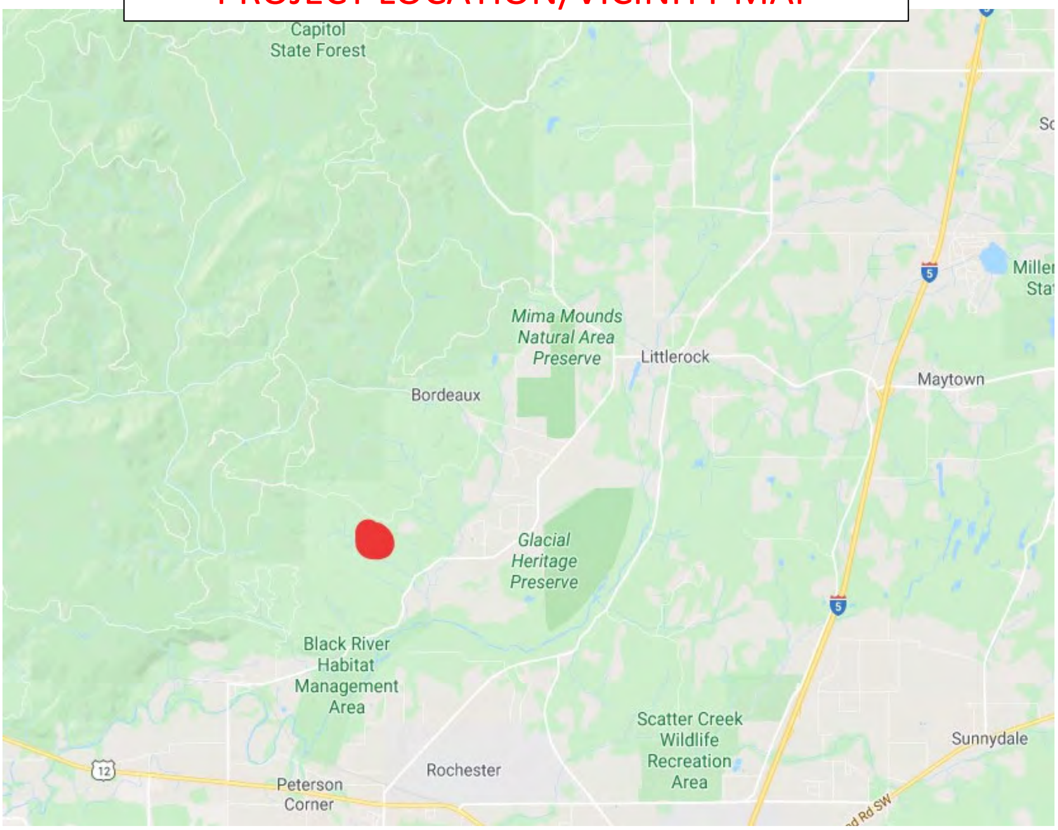
PROJECT INFORMATION SHEET

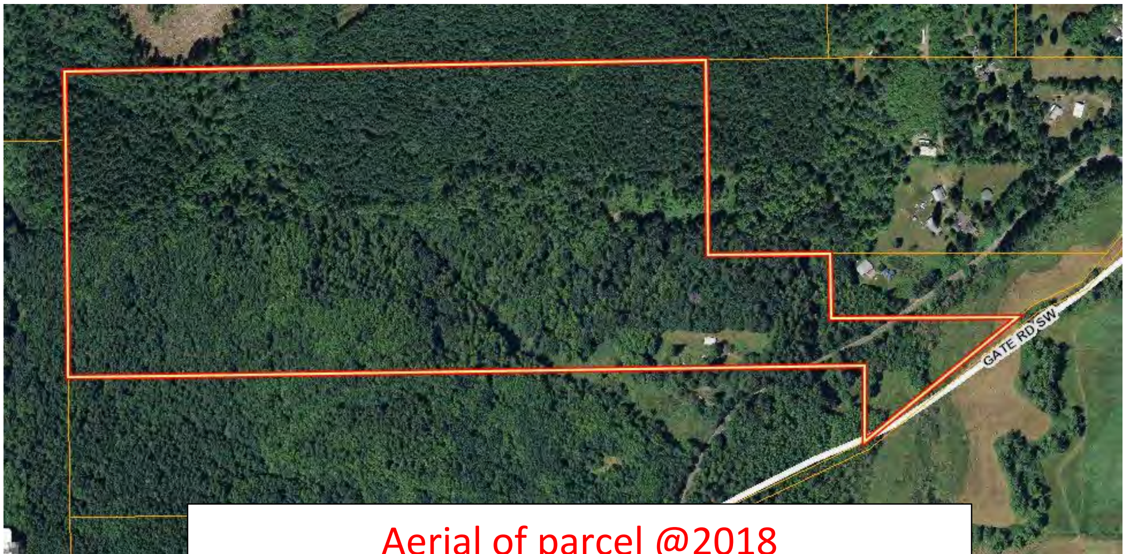
Project Name:	**Seiler Conservation Easement**
Project ID:	**B-07**
Project Location:	The project site is west of Mima Gate Road (between Littlerock and Rochester) in the Black River subbasin. Lat/long: 46.8648, -123.088
Project Description:	The owner wishes to partner with the Chehalis River Basin Land Trust and grant a perpetual conservation easement on the parcel. David Seiler worked in salmon studies for the WA DNR many years. He has an approved timber management plan and continues work to improve the diverse forest on the parcel.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Thurston County's population continues to grow and home sites such as this entice buyers. This parcel might be subdivided into small home sites if not protected and the current owners do not have a succession plan or heirs that have an interest in owning the parcel. A perpetual conservation easement will protect the site, which includes mature forest and two small streams. The parcel is adjacent to the south border of the Capitol State Forest and will provide excellent habitat and stream protection. The 28+ acre site is mostly mature mixed forest; there is a management plan in place, and there are 2 stream channels that flow into Mima Creek. Benefits to fish are for coho (on the site), and chum, steelhead in Mima Creek, and fall chinook, coho, chum, cutthroat, and winter steelhead in the Black River.
Is Water Quantity a Limiting Factor In this Subbasin?:	Surface withdrawals are a Tier 1 concern for the Black River. Unregulated water withdrawals, esp. for gravel mining and agriculture, may be a significant contribution to the problem. Although the streams crossing this parcel are small, they do contribute to the flow and potential development with permit exempt wells would potentially decrease the current flows.
Location & Spatial Extent of Benefits:	Unnamed tributaries to Mima Creek; lower 0.87 mile reach of Mima Creek, Black River downstream of junction with Mima Creek.
Anticipated Water Offset (if applicable):	None. This is primarily a habitat project. Nonetheless, it could provide some potential water offset by preventing the development of exempt

	wells that would otherwise accompany development of the site, as well as the benefits to stream hydrology from maintaining this parcel as mature forest.
Project-Type Specific Information	Riparian and Upland Conservation and Restoration • Is the land proposed for conservation/restoration part of the riparian, floodplain and/or channel migration zone? o The parcel includes riparian forest. • Is the riparian or upland conservation/restoration part of a larger project funded by other sources? o No. • If applicable, what is the mechanism for protection (e.g. conservation easement, fee simple, transfer to public lands)? o Conservation easement. • If applicable, is the proposed restoration passive (e.g. fencing), active (e.g. plantings) or both? o N/A • For protection projects, is the protection temporary or permanent? o Permanent. • For protection projects, is the site under imminent threat? o This parcel is zoned for forestry and rural development of homes. o For protection, tell us more about the threat: aka, likeliness of subdivision, purchase for development, timber harvest plans, etc. The current owner plans to steward the site once in Conservation Easement. o The protection is from future development/subdivision when he is no longer able to care for the parcel.
Estimated Project Cost:	Creating the deed of conservation easement, review by attorneys, recording, and stewardship funding are unknown at this time.
Performance Goals & Measures:	Upland Acres protected = 28 Miles stream protected = 0.076 Leads to: Protection for fall chinook, coho, chum, cutthroat, and winter steelhead in the Black River.
Anticipated Local and Partner Support & Barriers to Completion:	The Confederated Tribes of the Chehalis, the town of Rochester and others are expected to support this project. The Thurston County Conservation Futures program may also provide support. There are no known barriers.

Project Sponsor, Implementation Start Date and End Date:	Chehalis River Basin Land Trust Start: June 2020 End: unknown

PROJECT LOCATION/VICINITY MAP





Aerial of parcel @2018

PROJECT INFORMATION SHEET

Project Name:	Jones Road at Salmon Creek Culvert Replacement
Project ID:	B-08
Project Location:	Jones Road at Salmon Creek, Thurston County (Black River subbasin) Lat/long: 46.94593638, -122.96059914
Project Description:	Thurston County Public Works seeks to remove two culverts and replace with a single bridge. The culverts pose a partial barrier to fish passage, primarily for coho and sea-run cutthroat, into an area of 250 acres of over-wintering and rearing habitat. Spawning gravels will be added as spawning substrate in the area beneath the new structure.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The current culverts under Jones Road at Salmon Creek have been identified by WDFW as a 33% passable barrier due primarily to excess velocity. Currently, there is one main culvert and one parallel overflow culvert under Jones Road. While the culvert(s) are passable during some flows, high rainfall events contribute to high velocities through the culverts, blocking passage, especially for juveniles. This project will replace the culverts with a structure designed according to WDFW fish passage stream simulation guidelines, possibly a single span bridge. Removal of these barriers would open over 5 miles of Salmon Creek for spawning and over 250 acres of over-wintering and rearing habitat for coho, cutthroat, and searun cutthroat. Some segments are also potential Oregon Spotted Frog habitat.
Is Water Quantity a Limiting Factor In this Subbasin?:	Salmon Creek is within the Black Subbasin, which is ranked as a Tier 1 for water quantity. The hydrology of the Black River has been severely altered after the Black Lake Ditch was excavated at the north end of Black Lake in 1922, 1952, and 1976. Wetlands near the upper Black River have slowly filled in, resulting in greatly decreased flows into Black River.
Location & Spatial Extent of Benefits:	Black River Subbasin, Salmon Creek; 5 miles upstream from project location including 250 acres of wetlands. Previous work on Salmon Creek has removed fish-passage barriers upstream and downstream of the project area. In 2014, Thurston County replaced the bridge over Salmon Creek on Littlerock Road, including enhanced habitat features for salmon and Oregon Spotted Frogs. A barrier

<table>
<tr><td></td><td>culvert on Blomberg Rd (upstream) was also replaced with a fish passable structure in 2014 under the FFFPP program.</td></tr>
<tr><td>Anticipated Water Offset (if applicable):</td><td>N/A</td></tr>
<tr><td>Project-Type Specific Information</td><td>Fish Passage.
Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)?
Unknown.
To what extent is the existing structure a barrier (33%, 67%, 100%)? 33%.
What species and fish life stages are affected?
coho, cutthroat, and searun cutthroat; all life stages
What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains?
This project will open 5 miles upstream from project location including 250 acres of wetlands.
What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score/ Tier concern in new Chehalis Basin Lead Entity barrier prioritization tool)?
This culvert ranked 181 out of 2600 in the Chehalis culvert ranking in 2007. Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23, Sub-Watershed Management Unit Documents, in which correcting barrier culverts is a Tier 2 Concern for the Black River system, of which Salmon Creek is a tributary.
Are there upstream or downstream barriers that still have to be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur?
Unknown.</td></tr>
<tr><td>Estimated Project Cost:</td><td>$700,000 (This project has been fully funded)</td></tr>
<tr><td>Performance Goals & Measures:</td><td>5 miles of stream made accessible
250 acres of wetland made accessible
2 culverts removed
1 bridge constructed</td></tr>
<tr><td>Anticipated Local and Partner Support & Barriers to Completion:</td><td>This project was constructed and completed in 2020. The majority of the funding is from Thurston County’s Fish Passage Enhancement Program (real estate tax funded), which requires a very tight timeline for completion of projects.</td></tr>
</table>

	Technical expertise has been received from USFWS, Lewis County Conservation District, and the WDFW Fish Barrier Removal Board.
Project Sponsor, Implementation Start Date and End Date:	Thurston County in affiliation with 2019 Salmon Recovery Funding Board. Start: 1/1/2019 End: 1/1/2020

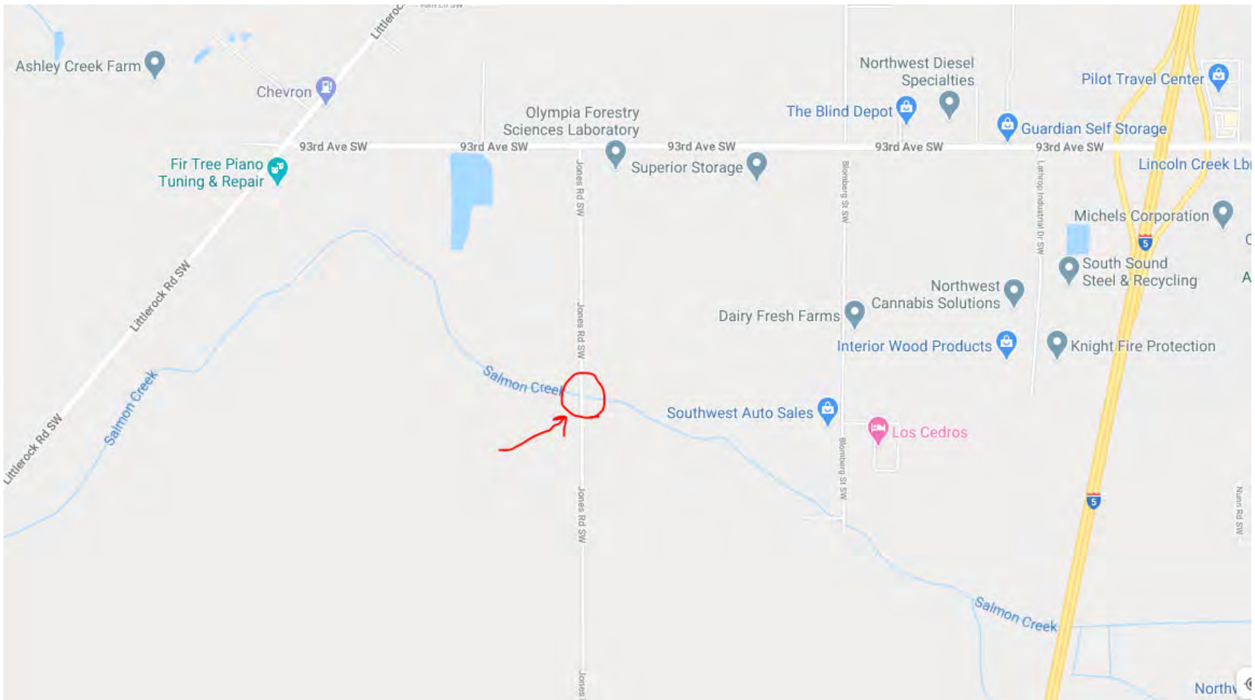


Figure: Jones Road Culvert location inside red circle

PROJECT INFORMATION SHEET

Project Name:	**Coal Creek Floodplain Storage**
Project ID:	**CS-00**
Project Location:	Sections 20, Township 14 North, Range 2 West, Willamette Meridian; Coal Creek in the Chehalis-Salzer subbasin adjacent to National Avenue near Chehalis, Lewis County, WA. Lat/long: 46.684734, -122.964353
Project Description:	The City of Chehalis owns an 80-acre parcel of land adjacent to National Avenue in Chehalis. Coal Creek flows through the center of the parcel. The site has been proposed as a potential site for floodplain storage and restoration.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Connection and enhancement of storage in low-lying floodplain areas adjacent to the creek would provide peak flood flow reduction as well as potential creation and enhancement of wetland and off-channel habitat. Water offset benefits could be obtained by creating a controlled outlet to meter releases back to Coal Creek and extend flow availability into the summer. Large wood could be used to control storage and promote lateral infiltration to raise local groundwater levels. This project is currently conceptual, and no design has been proposed for the site.
Is Water Quantity a Limiting Factor In this Subbasin?:	Water Quantity is listed as a Tier 1 concern in Coal Creek per the Chehalis Lead Entity Strategy.
Location & Spatial Extent of Benefits:	The project will cover approximately 80 acres of currently vacant land adjacent to Coal Creek.
Anticipated Water Offset (if applicable):	Water offset is expected but there is insufficient information at this time to quantify potential benefits. Based on existing topography, a storage footprint of approximately 60 acres may be achieved on this site. Typical storage capacity available to contribute to summer flow releases will depend on available depth, outlet control, and inflow volumes.
Project-Type Specific Information:	Floodplain Restoration/Water Storage. Project is conceptual so details are not yet available.

Estimated Project Cost:	Conceptual
Performance Goals & Measures:	• Acres Riparian Area Treated • Change in Flow
Anticipated Local and Partner Support & Barriers to Completion:	The property is owned by the City of Chehalis and they could be a potential partner or sponsor. If the project feasibility study indicates potential flood reduction benefits, support may be provided by surrounding businesses, the Chehalis Basin Flood Authority, Lewis County, and Office of the Chehalis Basin. Barriers: There are many unknowns to developing a project here, which will need to be assessed during a feasibility study.
Project Sponsor, Implementation Start Date and End Date:	Site is currently owned by the City of Chehalis. Project does not yet have a sponsor. Feasibility study can start 7/1/2021 or as soon as funding is obtained. Project completion by 1/1/2038, end of planning horizon.

PROJECT INFORMATION SHEET

Project Name:	**Berwick Creek at Labree Fish Passage Design/Construction**
Project ID:	**CS-01**
Project Location:	Berwick Creek/ Labree Rd MP 0.459 46.62288, -122.93439
Project Description:	The project proposes to replace a 12' wide x 5' tall concrete box culvert, which is only 33 percent passable due to a depth barrier (2 inches) at low flows, with a fish passable structure. Replacement of this culvert will restore unimpeded access to 1.06 linear miles of potential habitat for the Southwest Washington ESU of coho and 1.00 linear mile of potential habitat for the Southwest Washington DPS of winter steelhead once the downstream barrier is removed. According to the SWIFD layers provided in the DRAFT – Chehalis Fish Passage Barrier Prioritization interactive mapper total accessible habitat above this culvert, once upstream barriers are removed, is 11.42 liner miles for the Southwest Washington ESU of coho and 9.38 linear miles for the Southwest Washington DPS of winter steelhead. The proposed project would improve fish passage, sedimentation, and water quality as well as provide access to areas with high quality riparian cover.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Instream fish habitat will be restored. Fish passage and floodplain connectivity and function are limiting factors to be addressed. Steelhead, cutthroat and coho species will benefit from this project. The project will open up currently unavailable habitat for coho and winter steelhead.
Is Water Quantity a Limiting Factor In this Subbasin?	No.
Location & Spatial Extent of Benefits:	Berwick Creek. Benefits are fish passage to improved habitat and extend up to 11.42 miles upstream for Coho, and 9.38 miles for Steelhead.
Anticipated Water Offset (if applicable):	None.

Project-Type Specific Information:	Fish Barrier Removal
	• Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)?
	  o No
	• To what extent is the existing structure a barrier (33%, 67%, 100%)?
	  o 33%
	• Is the barrier eligible for streamflow restoration funding?
	  o Yes.
	• What seasons and fish life stages are affected?
	  o Project will allow for fish passage of all life stages.
	• What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains?
	  o Replacement of this culvert will restore unimpeded access to 1.06 linear miles of potential habitat for the Southwest Washington ESU of Coho and 1.00 linear mile of potential habitat for the Southwest Washington DPS of Winter steelhead once the downstream barrier is removed. Once upstream barriers are removed, is 11.42 liner miles for the Southwest Washington ESU of Coho and 9.38 linear miles for the Southwest Washington DPS of Winter steelhead.
	• What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score)?
	  • This is Tier 2 using the new barrier rating system
	• Are there upstream or downstream barriers that still have to be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur?
	  • Yes, there are barriers upstream and downstream, but the County is coordinating with the Port of Chehalis and Lewis Conservation District to address all barriers by 2025.

Estimated Project Cost:	$119,622 for design has been funded by the SRFB. Construction costs will be determined during the design phase and funding will be sought from all appropriate sources.
Performance Goals & Measures:	The 2011 Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23 lists Tier 1 concerns in Berwick Creek and its tributaries to be sedimentation, fish passage and riparian cover. Tier 2 concerns are water quality and large woody debris. Removing the current culvert barriers and replacing them with properly designed fish passable structures will allow for fish passage of all life stages. Increasing the hydraulic opening will reduce sedimentation by slowing velocity through

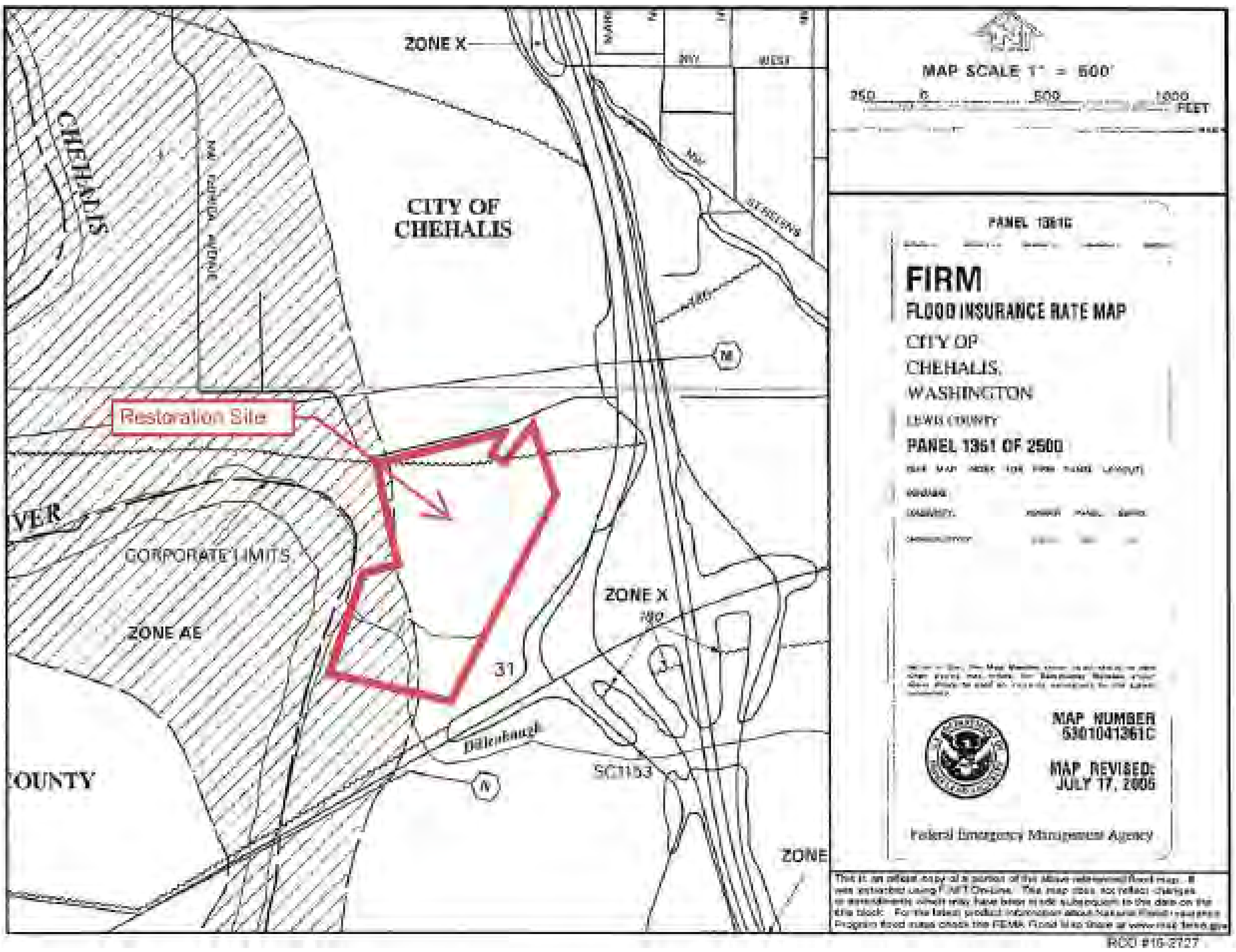
	the project area and improve floodplain connectivity by allowing water to move freely through the channel into the floodplain.
Anticipated Local and Partner Support & Barriers to Completion:	Culverts within Lewis County ROW; adjacent landowners are Balmelli LP. Signed landowner acknowledgement forms have been received from all property owners.
Project Sponsor, Implementation Start Date and End Date:	Ann Weckback, Lewis County Public Works Design Start: January 2021 End: July 2022. Construction TBD.

PROJECT INFORMATION SHEET

Project Name:	**Flood Hazard Reduction Master Plan and Chehalis Wastewater Treatment Plant (WWTP) Project**
Project ID:	**CS-02**
Project Location:	City of Chehalis in Lewis County, between the Chehalis River and Louisiana Avenue, and between Highway 6 and Airport Road; Section 38, Township 14 North, Range 2 West Lat/long: 46.66501, -122.96952
Project Description:	City of Chehalis will develop a master plan and banking proposal for flood hazard reduction and storage for a 156-acre basin located between the Chehalis River and Louisiana Avenue, and between Highway 6 and Airport Road in Chehalis. The City will demolish the old WWTP to create flood storage capacity in the floodplain of the Chehalis River. Phase I of this project included a grading plan with hydraulic analysis to demonstrate the positive impacts to the Chehalis River during flood stage. The project consists of the following four major Phases: 1. Demo/remove wastewater facility. 2. Create 10-acres wetland habitat. 3. Monitor wetland/flood storage. 4. Install recreational amenities.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The ultimate goal of the project is to return the 10-acre WWTP site to its original wetland status as land adjacent to the Chehalis River. The primary impact of for the Chehalis River Valley is storage and slow release of flood water. The depressed elevation and sponge-like quality of healthy wetland soil traps floodwater and provides a slow release of flood volume, diminishing flood water speed and level. Additionally, urban and agricultural contaminants are naturally filtered by wetlands. The master plan will include an evaluation of the potential flood storage volume within this area to determine resulting reduction of flood stages nearby, estimate storage volumes, estimate cost to construct, determine required permitting, and determine environmental impacts and mitigation. Schematic plans will also be provided. The City intends to use a portion of the created flood storage as a “Compensatory Excavation Bank.”

Is Water Quantity a Limiting Factor In this Subbasin?:	Yes, water quantity is a Tier 1 concern for the Chehalis River mainstem per the Lead Entity Strategy
Location & Spatial Extent of Benefits:	The WWTP project will restore approximately 10 acres of wetland adjacent to the Chehalis River. The master plan covers a 156-acre storage basin.
Anticipated Water Offset (if applicable):	Water offset is expected but there is insufficient information at this time to quantify potential benefits. The project will create floodplain storage that will allow flood flows to be stored and later released back to the stream, shifting a portion of the late winter/spring high flows to early summer.
Project-Type Specific Information:	Water Storage and Retiming Projects • How much water is likely to be stored? o To be determined during feasibility study. • Has the surface water source for the project been evaluated, and, if so, what is that source? o No • During what period(s) can water be diverted? Is there an instream flow? o Water will flow into the site during flood events • What is the proposed rate of diversion? o N/A. Influx is through flooding • What type of water rights would need to be acquired to provide water from that source? o N/A • What stream reach likely would benefit from this project and what is the anticipated benefit to that reach? What fish species will benefit? o The project is immediately adjacent to the mainstem Chehalis River, thus all species of salmon that use the Chehalis Basin will benefit from any groundwater recharge/retimed water benefits
Estimated Project Cost:	Master Plan: $25,000 WWTP Phase 1: $2,823,380 Monitoring: Unknown
Performance Goals & Measures:	Change in Flow. Given the habitat restoration element of the WWTP project, one-, three-, five-, and ten-year monitoring plans will be implemented by the City's partners to ensure restoration success. Site maintenance will be minimal.

Anticipated Local and Partner Support & Barriers to Completion:	If the current flood storage feasibility work finds flood storage benefits to be substantial, then the project will likely have support from the Chehalis Basin Flood Authority.
Project Sponsor, Implementation Start Date and End Date:	City of Chehalis as sponsor. Project feasibility scoping began 1/1/2017. Full project could be complete by 2028




NW Louisiana Ave
NW St Helens Ave
NW Brace St
NW Shoreline Dr
PARCEL #
005794001000
9.29 ACRES
PARCEL #
005790001000
0.69 ACRES
NW Quincy Pl
Main St
5
6
SW Riverside Dr
SW Elzina St
SKILLINGS
CONNOLLY
SEWAGE TREATMENT PLANT
VICINITY MAP
RCO #16-2727

PROJECT INFORMATION SHEET

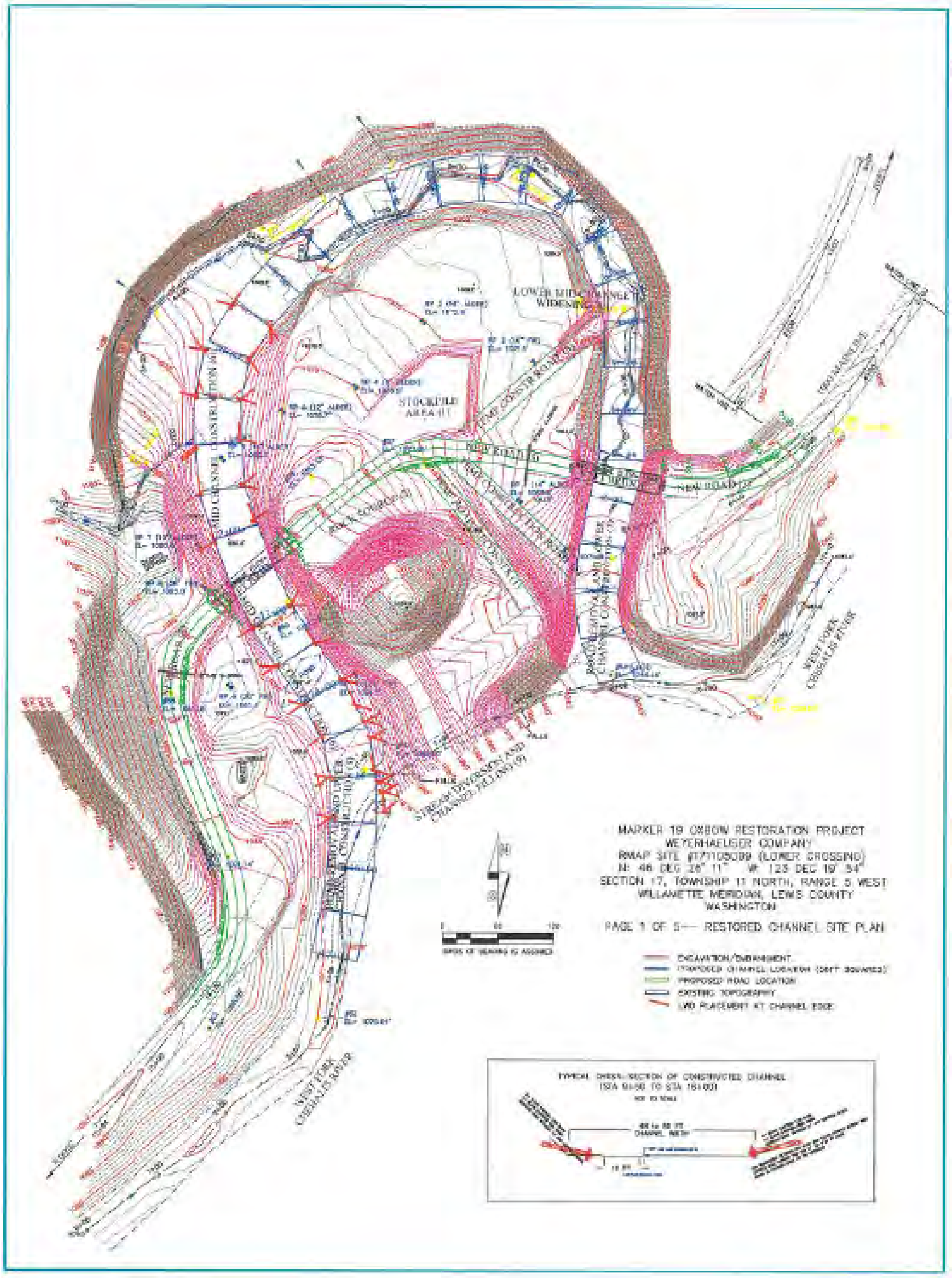
Project Name:	**Marker 19 Oxbow Restoration Project**
Project ID:	**CH-00**
Project Location:	West Fork Chehalis River in the Chehalis Headwater Subbasin; Section 17, Township 11N, Range 05W, W.M. Lat/long: 46.436389, -123.331667
Project Description:	The West Fork of the Chehalis River was rechanneled as part of forest road construction in the early 1960's, bypassing approximately 1500 feet of stream channel. The manmade channel includes an impassable bedrock cascade, which prevents anadromous fish (Coho/Steelhead and possibly spring and fall Chinook) access to over seven miles of high-quality habitat. This project proposes to relocate the forest road and restore the river to its original channel at this location. The re-connected relic channel will have wood structures installed along the edges to create habitat diversity. The goal of this project is to allow anadromous fish of all ages to migrate upstream past the existing man-made barrier. This will allow adults to migrate past the current blockage point in the fall to spawn in the upper headwaters of the Chehalis River. It will also allow juvenile Coho, Steelhead and Spring Chinook to migrate up and downstream through this reach of the river during their early life stages. The project will put the river back in its historic channel, allowing aquatic inhabitants to utilize approximately 1500 feet of high-quality habitat that humans had historically blocked from usage. The project site is part of Weyerhaeuser Company's Pe Ell tree farm, a 180,000-acre parcel of industrial timberland. It will continue to be managed by Weyerhaeuser for timber production under Forest Practices and Shoreline Management regulations. The stream segments will be protected long-term by the Riparian Regulations and development restrictions of these bodies of law. Weyerhaeuser will also sign a 10- year landowner agreement to maintain the project.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The project will remove a fish passage barrier and reconnect historic channel to allow for passage of multiple salmon species to utilize over seven miles of pristine habitat for spawning and rearing above the West Fork Chehalis River falls.

	This project will restore access to over 7 miles of high functioning riparian areas and instream habitat to improve ecosystem processes. The project will also put the Chehalis River back in an old relic channel to return this segment to historic conditions and restore ecosystems processes. This project will continue to develop a cooperative relationship with working lands (such as commercial forestry) to enable protection of ecosystems, unique habitats, and critical ecosystem functions.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes, the Chehalis River mainstem is a tier 1 concern per the Lead Entity Strategy
Location & Spatial Extent of Benefits:	The project will restore approximately 1,500 feet of a relic stream channel and allow fish passage to 7 miles of stream.
Anticipated Water Offset (if applicable):	N/A

Project-Type Specific Information	Instream Habitat Restoration
	• What is the problem the instream habitat project proposes to correct?
	  o The West Fork of the Chehalis River was rechanneled as part of forest road construction in the early 1960's, bypassing approximately 1500 feet of stream channel. The manmade channel includes an impassable bedrock cascade, which prevents anadromous fish (coho/steelhead and possibly spring and fall chinook) access to over seven miles of high-quality habitat.
	• What are the existing and proposed channel forms and cross-sections? (May be conceptual).
	  o Current channel is disconnected from the main stem. The project will engineer a way to reconnect the channel and make this the main body of the river.
	• How would the proposed channel modifications restore habitat-forming processes and/or historical conditions?
	  o By reconnecting the river to the relic channel, the project returns the river to historic conditions. There is currently a complete fish passage barrier at the site. The project will return fish passage to 7 miles of habitat.

Estimated Project Cost:	$1,100,000. The project has been fully funded.
Performance Goals & Measures:	Miles of Habitat Made Accessible

Anticipated Local and Partner Support & Barriers to Completion:	Weyerhaeuser and Lewis Conservation District are partnering on this project. The project has been supported by the Chehalis Basin Lead Entity and Aquatic Species Restoration Plan.
Project Sponsor, Implementation Start Date and End Date:	Lewis Conservation District, Start: June 2020 End: June 2021



PROJECT INFORMATION SHEET

Project Name:	**Cloquallum Creek LWD Construction**
Project ID:	**CD-00**
Project Location	17910 W Cloquallum Road, Elma, WA 98541 Lat/long: 47.096261, -123.370348
Project Description:	This reach of Cloquallum Creek has incised greatly in the past few decades and lacks instream structure. This has caused the creek to be relatively straight and has limited habitat types. This project seeks to construct a LWD installation to help restore natural channel function to 0.7 miles of the creek. Depending on the project design, infrastructure protection could be an additional benefit to this project.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Benefits are to the instream habitat to be restored. Channel structure and complexity and sediment are limiting factors to be addressed. Improved sediment sorting, increased pool frequency, increased cover and increased side-channel length are to be expected. Species that will benefit are coho, chum, winter steelhead, sea-run cutthroat, and fall chinook. The sea-run cutthroat trout has an unknown stock status. Infrastructure protection will be addressed.
Is Water Quantity a Limiting Factor In this Subbasin?	Water Quantity is a Tier 1 concern in Cloquallum Creek.
Location & Spatial Extent of Benefits:	Benefits will primarily affect the 0.7 miles of Cloquallum Creek on the subject property but may extend downstream.
Anticipated Water Offset (if applicable):	N/A
Project-Type Specific Information:	• What is the problem the project proposes to correct? o This reach of Cloquallum Creek has incised greatly in the past few decades and lacks instream structure. • How will the project create, reconnect, or enhance existing habitat? o This project seeks to construct a LWD project that will restore natural channel functions to this reach.

	• What type(s) of channel(s) will be restored or created (flow-through, backwater, groundwater, floodplain ponds)? o Likely flow-through
Estimated Project Cost:	$400,000 for construction
Performance Goals & Measures:	• Acres of Streambank treated • Acres of Off-Channel • Floodplain Connected or Added • Acres of Riparian Area Treated
Anticipated Local and Partner Support & Barriers to Completion:	The project is sponsored by the Mason Conservation District, with likely support from the Chehalis Basin Lead Entity and Aquatic Species Restoration Plan program.
Project Sponsor, Implementation Start Date and End Date:	Mason Conservation District. Start: September 1, 2024 End: June 30, 2026

Cloquallum CREEK LWD Project Area

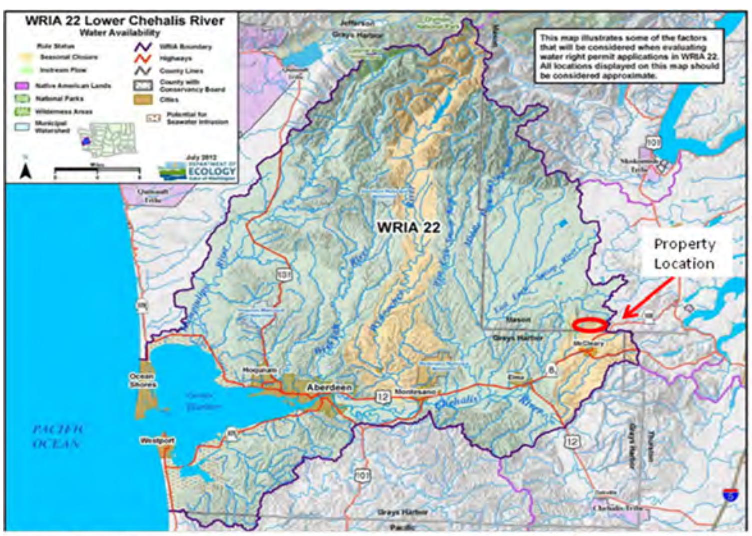
PROJECT INFORMATION SHEET

Project Name:	**Upper Middle Fork Wildcat Creek Restoration**
Project ID:	**CD-01**
Project Location:	Cloquallum subbasin Lat/long: 47.089781, -123.249071
Project Description:	There are two creeks on the property—the main channel and a tributary. Both channels have been historically ditched and straightened for agricultural purposes. The channel completely lacks woody habitat and instream complexity. The majority of riparian habitat along both waterways has been converted to pasture. There is a mapped wetland on-site directly adjacent to the main channel and tributary that is minimally apparent under current conditions as it has been converted to pasture. There are five culverts across the project reach, three on the main channel and two on the tributary; two of the five have been identified as partial barriers, one as a full barrier, and two as unknown. This project will allow the design and construction of multiple complementary stream restoration practices. Restoration practices include: • restoration of the natural sinuosity of the stream to create instream habitat complexity required for salmonid spawning and rearing • woody habitat feature installation to facilitate instream habitat complexity and provide shade and cover for salmonids until the riparian buffer becomes established • establishment of a 15-acre riparian buffer to provide, shade, nutrients, and wood to the stream; • restoration of the wetland on site to provide salmonid rearing habitat as well as provide the wildcat drainage with additional water storage; • removal of the five culverts to allow full fish passage within the project reach. The project reach contains good gravels and cool waters, though it has been heavily degraded through past land use practices. Implementation of these restoration actions would provide salmonids with a cool water refugia for spawning and rearing in an otherwise fairly degraded and warm watershed. All restoration actions proposed for this project coincide with recommended actions identified in the “Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23” for the Cloquallum subbasin management unit.

Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Goals: support the recovery and sustained health of salmonid populations in Wildcat Creek by: • improving instream, riparian, and wetland habitat conditions within the Middle Fork Wildcat Creek • improving both water quality and quantity within the Middle Fork Wildcat Creek Objectives: develop the designs for and complete the construction of five restoration practices including: • restore natural sinuosity on up to 2,000’ of stream • install woody habitat features in up to 2,000’ of stream • establish 15 acres of riparian habitat • restore a 0.63 acre wetland • remove five culverts Species benefitting: coho, steelhead This project intends to address water quantity/quality along with other biological habitat needs in the Middle Fork of Wildcat Creek. Past research suggests that hydraulic retention may be increased by 50-100% following flow obstruction in small sand-bedded streams (Stofleth, Jr, & Fox, 2008), suggesting that these methods are viable to achieve the restoration goal of increased surface transient storage of water (hydraulic retention) in the Wildcat Creek basin. Furthermore, water temperature might be decreased as hyporheic exchange is induced by structure placement (Hester, Doyle, & Poole, 2009), further addressing water temperature issues (current and projected) within the basin. This project also intends to remove five culverts, some with fish passage issues.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes. Water Quantity is a Tier 1 limiting factor in the Cloquallum subbasin.
Location & Spatial Extent of Benefits:	Middle Fork Wildcat Creek, from project location downstream.
Anticipated Water Offset (if applicable):	None anticipated. Some water offset benefits could come in the form of surface and hyporheic transient storage.
Project-Type Specific Information:	Instream Habitat Restoration • What is the problem the instream habitat project proposes to correct?

	- Both channels have been historically ditched and straightened for agricultural purposes. - What are the existing and proposed channel forms and cross-sections? (May be conceptual). - Existing = ditch/ proposed = sinuous - How would the proposed channel modifications restore habitat-forming processes and/or historical conditions? - All actions lead to achieving historic conditions, including re-establishing riparian vegetation, removing blockages, and kick-starting processes through channel realignment.
Estimated Project Cost:	$147,500 (Project is fully funded)
Performance Goals & Measures:	Fish Passage Improvement Fish passage blockages removed or altered (C.2.c.1) Number of Blockages/Impediments/Barriers Removed/Altered (C.2.c.2) — 5 Instream Habitat Project Channel reconfiguration and connectivity (C.4.c.1) Miles of Stream Treated for channel reconfiguration and connectivity (C.4.c.3) — 0.37 Miles of Off-Channel Stream Created or Connected (C.4.c.4) — 0.04 Acres Of Channel/Off-Channel Connected Or Added (C.4.c.5) — 2.0 Channel structure placement (C.4.d.1) Miles of Stream Treated for channel structure placement (C.4.d.3) — 0.37 Pools Created through channel structure placement (C.4.d.5) — 10 Number of structures placed in channel (C.4.d.7) — 10 Riparian Habitat Project Planting (C.5.c.1) Acres Planted in riparian (C.5.c.3) — 15.0 Wetland Project Wetland improvement/ restoration (C.8.e.1) Acres of wetland Improved/Restored (C.8.e.2) — 0.6 Permits Obtain permits

	Number of permits required for implementation of project: 1 Riparian Habitat Project Planting (C.5.c.1) Miles of streambank planted (C.5.c.4): 0.60 Fish Passage Improvement Number of blockages / impediments / barriers impeding passage (C.2.b.4): 5 Riparian Habitat Project Planting (C.5.c.1) Average Riparian Width: 180
Anticipated Local and Partner Support & Barriers to Completion:	Landowner is very supportive. This project received funding from NRCS.
Project Sponsor, Implementation Start Date and End Date:	Mason Conservation District. Design Started: 1/1/2019 End: 6/30/2021



1 - WRIA 22 Watershed boundaries with property location circled in red (Image source. WA ECY Publication Number: 11-11-027)

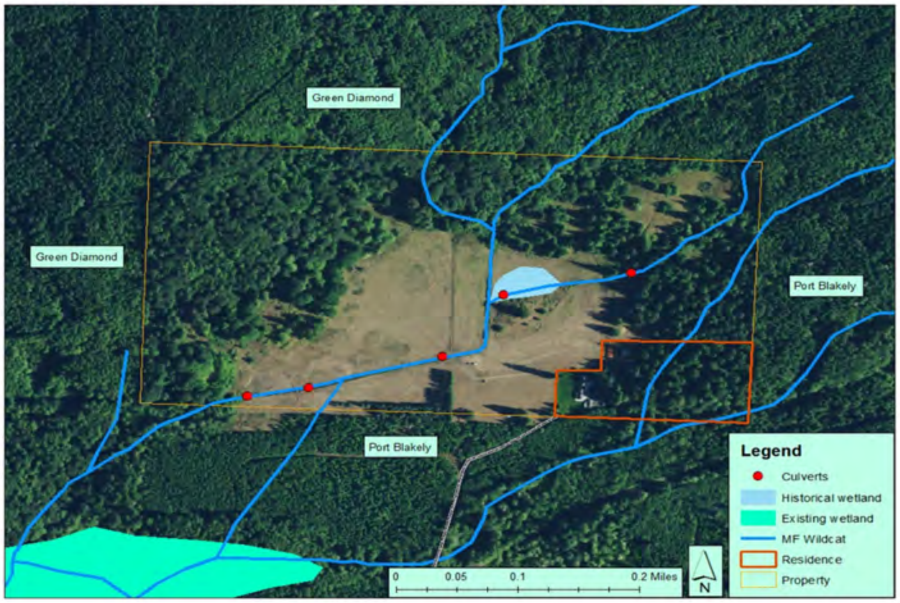


Figure i. Zoomed in view of project location.

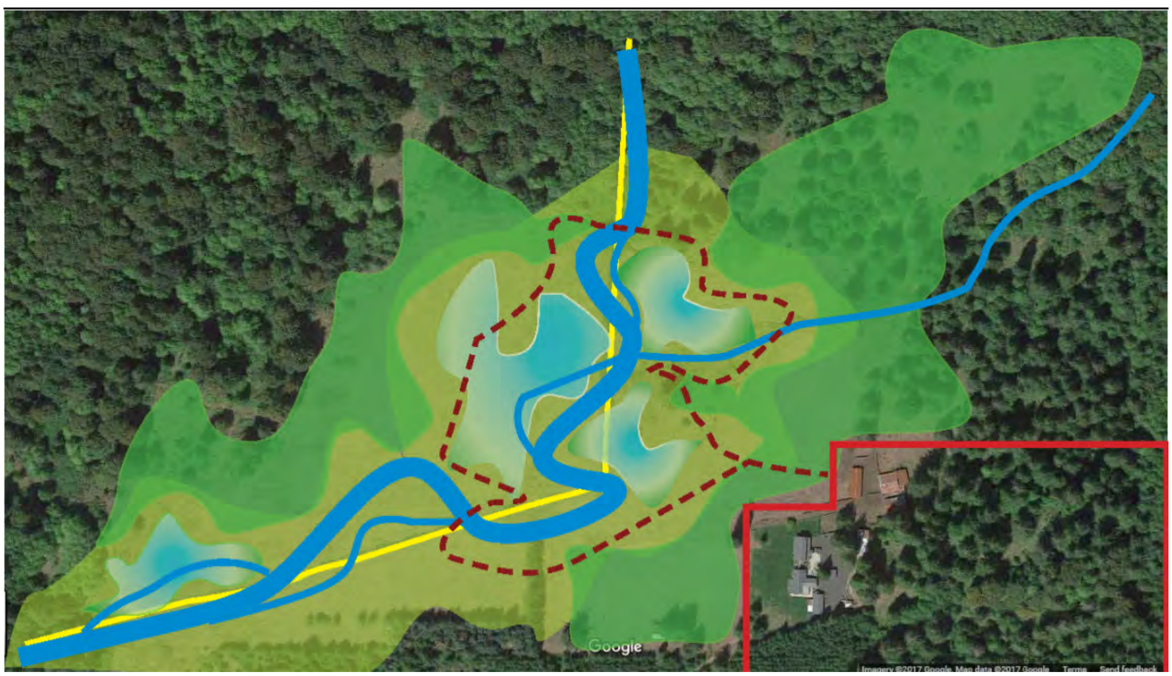


Figure ii. Concetptual design at project location. Wood placement would occur in appropriate locations throughout the site.

Hester, E. T., Doyle, M. W., & Poole, G. C. (2009). *The influence of in-stream structures on summer water temperatures via induced hyporheic exchange*. *54*(1), 355–367.

Stofleth, J. M., Jr, F. D. S., & Fox, G. A. (2008). *Hyporheic and total transient storage in small , sand-bed streams*. *1894*(September 2007), 1885–1894. https://doi.org/10.1002/hyp

PROJECT INFORMATION SHEET

Project Name:	**Sam's Canal Culvert Removal and Restoration**
Project ID:	**CD-02**
Project Location:	Canal connecting to the East Fork Wildcat Creek. Project location is beneath/adjacent to Maple Street between 3rd and 7th streets in McCleary, Washington. Wildcat Creek drains to the Chehalis River via Cloquallum Creek. Lat/long: 47.054515, -123.268007
Project Description:	This project seeks to restore instream habitat in an unnamed tributary (referred to as Sam's Canal) to the East Fork of Wildcat Creek by daylighting a buried culvert.
Project Type:	☐ Water Right Acquisition ☐Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	In 1979, Sam's Canal was diverted from the East Fork of Wildcat Creek through two 54-inch, 1,765-foot-long culverts buried beneath/adjacent to Maple Street between 3rd and 7th streets in McCleary. The proposal to restore instream habitat is to remove the culverts, daylight the canal, and establish native riparian vegetation. Removing the culverts could also restore groundwater recharge along this stretch of the tributary. Two existing debris racks, one of which poses an impassible barrier to juvenile fish, would be removed.
Is Water Quantity a Limiting Factor In this Subbasin?:	Cloquallum Creek is ranked as a Tier 1 for water quantity. Closed to new consumptive water appropriations, which strongly suggests that low flows are a problem for fish use in the summer months.
Location & Spatial Extent of Benefits:	Cloquallum-N. Delezene Subbasin, East Fork of Wildcat Creek; within the project area and upstream.
Anticipated Water Offset (if applicable):	N/A, though removing impervious culvert may encourage groundwater recharge.
Project-Type Specific Information:	Instream Habitat Restoration. • What is the problem the instream habitat project proposes to correct? o 1,765 feet of an unnamed tributary to Wildcat Creek is buried within a culvert.

	• What are the existing and proposed channel forms and cross-sections? (May be conceptual). o The existing channel is a straightened ditch within an impervious culvert; the proposed condition would add instream complexity to promote quality fish habitat and groundwater recharge. • How would the proposed channel modifications restore habitat-forming processes and/or historical conditions? o Removing the culverts would put water in direct contact with native soils; daylighting the tributary would create new riparian habitat; removing the culvert would negate the need for debris racks, which currently impeded passage of juvenile fish.
Estimated Project Cost:	N/A - would need to be determined during project scoping.
Performance Goals & Measures:	Miles of Stream Made Accessible. ~1,765 feet of instream and riparian habitat Two fish-passage barriers eliminated.
Anticipated Local and Partner Support & Barriers to Completion:	There would be support from the City of McCleary. Barriers include the extensive infrastructure changes needed – to roads, pipelines, utilities, etc. This would all need to be determined during a feasibility phase.
Project Sponsor, Implementation Start Date and End Date:	City of McCleary as sponsor. Start feasibility work 7/1/2021 or as soon as funding is obtained. End 1/1/2038 at end of planning period.

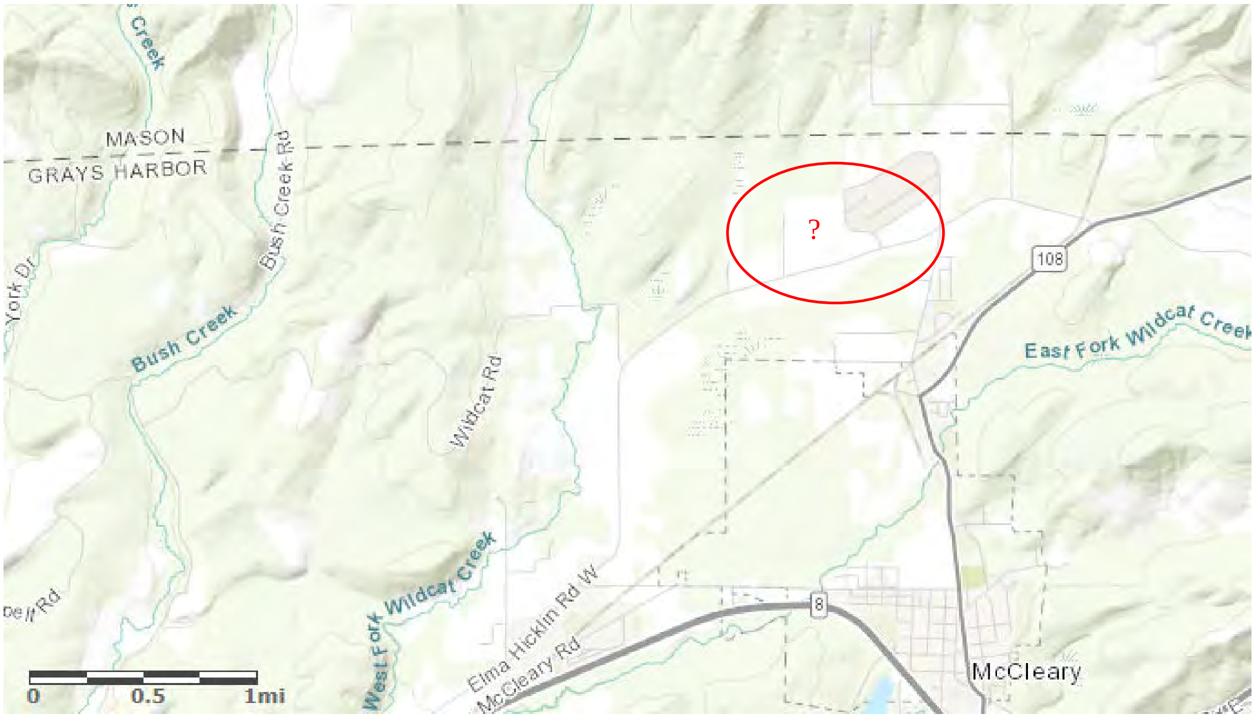
PROJECT INFORMATION SHEET

Project Name:	**McConkey Lane Channel Naturalization (unnamed branch of the West Fork Wildcat Creek)**
Project ID:	**CD-03**
Project Location:	Along an unnamed branch of the West Fork of Wildcat Creek, near McConkey Lane, north of McCreary. Wildcat Creek drains to the Chehalis River via Cloquallum Creek. Lat/long: 47.075999, -123.280815
Project Description:	Conversion of a natural channel into a diked and straightened ditch has resulted in loss of aquifer recharge area and scour and erosion along Elma Hicklin Road. This project would convert portions of the ditch to more natural conditions to improve instream habitat, reduce erosion risk to the roadway, and promote aquifer recharge. A planning grant is needed to develop the technical details of this project and build community partnerships.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Prior to being a development, the project area was open prairie and subject to seasonal flooding, which created a significant recharge area for the aquifer. This project seeks to regain some of that capacity by improving hydraulics within the stream. This will have additional benefits to fish habitat and reduce flooding impacts to the roadway. Goals: support the recovery and sustained health of salmonid populations in Wildcat Creek by: • improving instream, riparian, and wetland habitat conditions within an unnamed branch of the West Fork of Wildcat Creek • improving both water quality and quantity within the subbasin Objectives: develop the designs for and complete the construction of the restoration project.
Is Water Quantity a Limiting Factor In this Subbasin?:	Closed to new consumptive water appropriations, which strongly suggests that low flows are a problem for fish use in the summer months. Cloquallum Creek is ranked as a Tier 1 for water quantity.
Location & Spatial Extent of Benefits:	Cloquallum-N. Delezene Subbasin, West Fork Wildcat Creek; from project location downstream.

Anticipated Water Offset (if applicable):	N/A

Project-Type Specific Information	Instream Habitat Restoration
	• What is the problem the instream habitat project proposes to correct?
	    o Conversion of a natural channel into a diked and straightened ditch
	• What are the existing and proposed channel forms and cross-sections? (May be conceptual).
	    o Existing – straight ditch. Proposed = sinuous channel
	• How would the proposed channel modifications restore habitat-forming processes and/or historical conditions?
	    o Improve hydraulics within the stream; greater connection of stream with its floodplain; greater area for slowing of water and groundwater recharge

Estimated Project Cost:	Conceptual.
Performance Goals & Measures:	• Total Riparian Miles Streambank Treated • Miles of Stream Treated for channel reconfiguration and connectivity
Anticipated Local and Partner Support & Barriers to Completion:	Grays Harbor County, Mason Conservation District, Grays Harbor Conservation District, City of McCleary, private landowners.
Project Sponsor, Implementation Start Date and End Date:	No current sponsor. Currently conceptual. Feasibility to begin 7/1/2021, or as soon as funding is obtained. Completion by 1/1/2025 assuming funding.


MASON
GRAYS HARBOR
Bush Creek Rd
York Dr
Bush Creek
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East Fork Wildcat Creek
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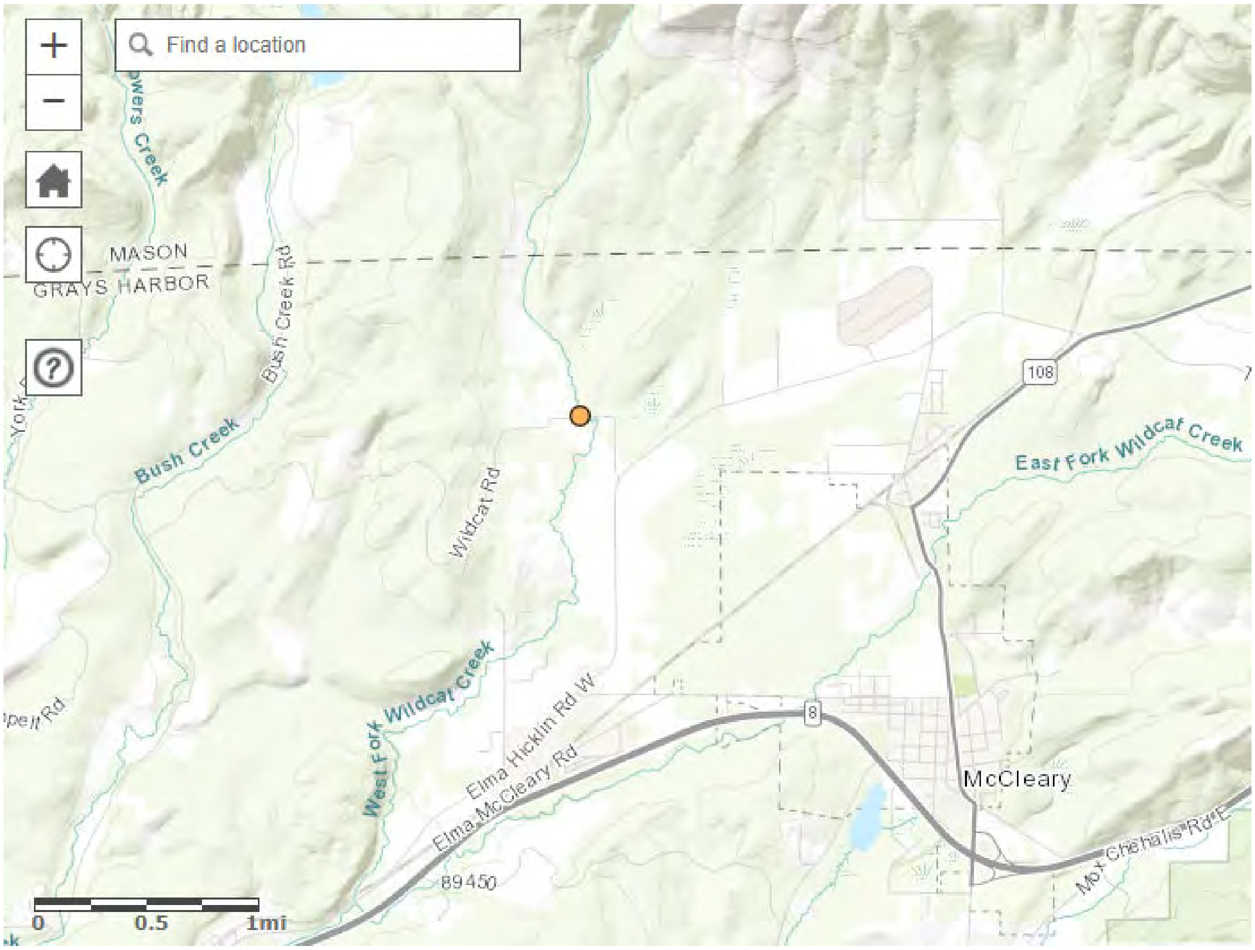
PROJECT INFORMATION SHEET

Project Name:	**Wildcat Road Barrier Construction**
Project ID:	**CD-04**
Project Location:	West Fork Wildcat Creek at Wildcat Road (road mile 0.43 and stream mile 3.1; north of McCleary, Washington. Wildcat Creek drains to the Chehalis River via Cloquallum Creek. Lat/long: 47.073890, -123.300830
Project Description:	The problem is a 33% passable fish barrier under Wildcat Road. The solution is to remove the barrier and replace it with a structure that is passable to all species and life stages of salmonids and other aquatic species. The subject barrier consists of two shotgun corrugated steel pipe arch culverts, each 5 feet wide by 4.7 feet high by 40 feet long. Together, they are undersized for the 16-foot-wide channel. High velocities are also a problem, according to Grays Harbor County records, as evidenced by regular overtopping of the road during high-flow events.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The project would benefit coho salmon, steelhead, and cutthroat trout spawning and rearing by providing unimpeded access to 7.29 miles of excellent habitat on a significant branch of a large tributary to the Chehalis River. The project would also resolve flood-related impacts to the roadway.
Is Water Quantity a Limiting Factor In this Subbasin?:	Cloquallum Creek is ranked as a Tier 1 for water quantity. Closed to new consumptive water appropriations, which strongly suggests that low flows are a problem for fish use in the summer months.
Location & Spatial Extent of Benefits:	Cloquallum-N. Delezene Subbasin, West Fork Wildcat Creek; From project area upstream.
Anticipated Water Offset (if applicable):	N/A
Project-Type Specific Information	Fish Passage. • Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)? o Unknown.

	• To what extent is the existing structure a barrier (33%, 67%, 100%)? o 33%. • What species and fish life stages are affected? o Coho, steelhead and cutthroat trout: all life stages. • What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains? o Unimpeded access to 7.29 miles of excellent habitat on a significant branch of a large tributary to the Chehalis River. • What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score/ Tier concern in new Chehalis Basin Lead Entity barrier prioritization tool)? o Unknown. • Are there upstream or downstream barriers that still have to be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur? o Unknown.
Estimated Project Cost:	$350,000 (this project has been fully funded)
Performance Goals & Measures:	7.29 Miles of stream made accessible 2 culverts removed
Anticipated Local and Partner Support & Barriers to Completion:	This project was supported by the Chehalis Basin Lead Entity's Habitat Work Group.
Project Sponsor, Implementation Start Date and End Date:	Chehalis Basin Fisheries Task Force in affiliation with 2019 Salmon Recovery Funding Board. Start: December 12, 2019 End: December 31, 2021


Find a location
MASON
GRAYS HARBOR
Bush Creek Rd
Bush Creek
Wildcat Rd
West Fork Wildcat Creek
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PROJECT INFORMATION SHEET

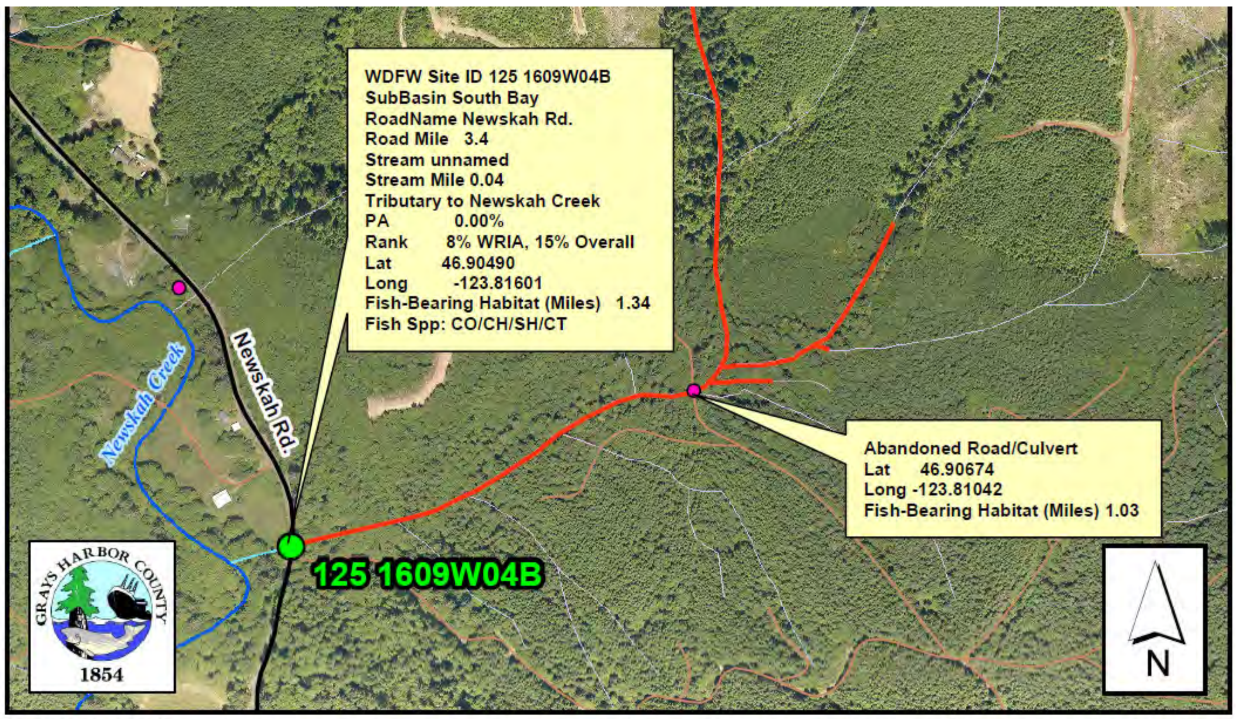
Project Name:	**Newskah Road #2 Fish Barrier Correction Design/Construction**
Project ID:	**EJ-00**
Project Location:	South of Aberdeen in the South Bay subbasin, beneath Newskah Creek Road where it crosses an unnamed stream, approximately 250 feet from its confluence with Newskah Creek at mile 4.75 of Newskah Creek. Lat/long: 46.90519428; -123.81622712
Project Description:	This project will correct an impassable fish barrier by completing a Correction Analysis Form to review design alternatives, estimate costs, identify a preferred alternative, complete designs, and submit permit applications. Removing the barrier will reconnect Newskah Creek with its floodplain, improving habitat conditions for the salmonids.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The problem is a 0% passable fish passage barrier culvert beneath Newskah Road at road mile 3.4 on an unnamed tributary to Newskah Creek. The culvert is round corrugated steel, 3-foot x 50-foot, with a 3 foot outfall drop, 1 foot inlet drop, 2.21% slope, and 12-foot bankfull width (BFW). WDFW determined that it is a barrier due to both slope and outfall drop. Velocities are also a problem at this culvert due to the pipe being undersized for the bankfull width. The degraded watershed processes this project addresses are fish migration access to upstream spawning and rearing habitat and floodplain connectivity. The solution is to design and permit a project to remove the barrier culvert and replace it with a structure that is passable to all species and life stages of salmonids and other aquatic species in the tributary. Coho salmon, steelhead and cutthroat trout are expected to use the stream once passage is provided. Project components include evaluating correction alternatives, identifying a preferred alternative, estimates costs, and completing design drawings and permitting for the barrier correction. The resulting materials will be used to apply for future grants for project construction.
Is Water Quantity a Limiting Factor In this Subbasin?:	The South Bay subbasin is ranked as a Tier 3 for water quantity.

Location & Spatial Extent of Benefits:	Project location and upstream.
Anticipated Water Offset (if applicable):	N/A

Project-Type Specific Information	Fish Barrier Removal.
	• Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)?
	  o No
	• To what extent is the existing structure a barrier (33%, 67%, 100%)? 0%.
	• What species and fish life stages are affected?
	  o Coho and Chum salmon, cutthroat and searun cutthroat trout, and steelhead: all life stages.
	• What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains?
	  o 1.34 miles of excellent upstream spawning and rearing habitat.
	• What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score/ Tier concern in new Chehalis Basin Lead Entity barrier prioritization tool)?
	  o Fish passage barrier culverts are identified as a Tier 1 limiting factor in Chehalis River tributaries in the South Harbor Subbasin where Newskah Creek is located.
	• Are there upstream or downstream barriers that still have to be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur?
	  o Green Crow has agreed to correct the fish passage barrier 0.31 miles upstream from the project site during 2020 or 2021. 18 other barriers have been corrected in the South Bay Subbasin, including 5 upstream of this project.

Estimated Project Cost:	$36,000 (Design and Permitting – Fully Funded); $390,000 (Construction - Needed)
Performance Goals & Measures:	1.34 Miles of stream made accessible 1 culvert removed
Anticipated Local and Partner Support & Barriers to Completion:	The Chehalis Basin Lead Entity's Habitat Work Group supports this project. There are no barriers or opposition to project completion.

Project Sponsor, Implementation Start Date and End Date:	Grays Harbor County and the Chehalis Basin Fisheries Task Force in affiliation with 2019 Salmon Recovery Funding Board. Start design: December 12, 2019 End: June 30, 2021. Start construction: July 1, 2024 End: September 30, 2024



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PROJECT INFORMATION SHEET

Project Name:	**Grays Harbor County Forest Practices and Flow Assessment**
Project ID:	**EJ-01, HQ-03, HT-01, W-00, WY-01**
Project Location:	Grays Harbor County.
Project Description:	The Grays Harbor County Forestry Department manages approximately 36,000 acres of land. These holding are distributed across the county with significant blocks of acreage in the Humptulips, Hoquiam, Wishkah, and Elk-Johns subbasins, and a smaller holding in the Wynoochee subbasin. The County proposes to evaluate these tracts and determine if changes to forest management can be used to increase flow contributions in the targeted subbasins. This project will quantify the potential streamflow benefits from forest management practice opportunities throughout the County's holdings. The effort will include: • Review of existing GHC forest management plans for potential opportunities, by assessing existing harvest cycles and harvest/planting plans to establish baseline conditions. • GIS analyses to map key subbasin, tributary, soils, and hydrogeologic features. • Identification of up to approximately 550 acres for enhanced management practices (approximately 2% of the County's managed lands). • VELMA modeling to quantify streamflow benefits from proposed changes in forestry practices.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	For all five subbasins, the goal is to improve instream flows and enhance the natural complexity of instream habitat. Grays Harbor County manages approximately 36,000 acres of forestland, a portion of which is located within WRIAs 22 and 23. Intentional management of this land may have significant favorable effects on the water budget of the Humptulips, Hoquiam, Wishkah, Elk-Johns, and Wynoochee drainages. The Visualizing Ecosystem Land Management Assessments (VELMA) ecohydrological model is a predictive tool created to assess potential

	improvements in water quality and flow to streams, rivers, and estuaries via changes in land management (EPA, 2018). This model couples hydrological and biogeochemical processes at plot- to entire watershed-scales to dynamically predict the impacts on streamflow from forestland management. VELMA modeling of changes in forest practices has successfully demonstrated that increasing harvest cycle duration, or withholding stands from harvest, provides net benefits to streamflow when compared to stand rotations less than 40 years. Forty years has been identified as a critical threshold for forest stand age, in which anything younger is faster growing with higher groundwater uptake, and negatively impacts stream flows while uptake declines as stands mature beyond 40 years, providing increasing benefit to streamflow with stand age (Hall et al., 2018). Proposed changes will be evaluated using a VELMA analysis to quantify improvements to instream flows. Assuming similar results to the VELMA modeling completed for the Nisqually Plan Addendum of 0.13 to 0.15 ac-ft/yr benefit per acre of improved management, 550 acres would result in approximately 72 to 83 ac-ft/year benefit to the watershed.
Is Water Quantity a Limiting Factor In this Subbasin?:	Humptulips – Tier 3 with low summer flows in the mainstem constitutes a major problem. Low flows are also noted in the major tributaries including Big Creek. Hoquiam– Tier 3 Wishkah– Tier 3 Wynoochee – Tier 3 flows dip below established base flows in the summer months Elk-Johns – Tier 3
Location & Spatial Extent of Benefits:	Numerous sites located across Grays Harbor County
Anticipated Water Offset (if applicable):	Water offset for the Elk-Johns subbasin is estimated at 23 acre-feet per year, as described below. Water offset results presented in the Nisqually Watershed Plan Addendum suggest that if a 40-year-old forest is allowed to mature to become a 100-year-old forest, then the September low flow in the basin would increase by 9 cfs (from 2 cfs to 11 cfs; or 6,514 acre-feet) over the 60-year period for a 53,760-acre basin. The annualized streamflow benefit for this type of project (Tables 4.2 and 4.3 of the Plan Addendum)

	present a range from 0.13 to 0.15 ac-ft/year per acre benefit (Nisqually Watershed Planning Unit, 2019, Addendum to the Watershed Management Plan). As flow benefits compound after 40-years, it is difficult to determine the exact magnitude of streamflow benefit in Grays Harbor County as forest stand ages are unknown at this phase of the project. However, estimates of benefits for each sub-basin within WRIA 22 containing county-managed forestland is provided below, based on a range of 0.13 to 0.15 ac-ft/year streamflow benefit per acre of enhanced forest management. Using this metric, the following describes the potential quantities that could be mitigated based on enhanced management of 2% of the GHC forestland acreage within each sub-basin. • <u>Humptulips:</u> 7,586.9 acres of managed forest, 2% could mitigate up to 19.7 to 22.8 ac-ft/yr. • <u>Hoquiam:</u> 6,369.6 acres of managed forest, 2% could mitigate up to 16.6 to 19.1 ac-ft/yr. • <u>Wishkah</u>: 3,759 acres of managed forest, 2% could mitigate up to 9.8 to 11.3 ac-ft/yr. • <u>Elk-Johns:</u> 8,933.1 acres of managed forest, 2% could mitigate up to 23.2 to 26.8 ac-ft/yr • <u>Wynoochee</u>: 873.8 acres of managed forest, 2% could mitigate up to 2.3 to 2.6 ac-ft/yr In total, a change to the management of 2% of GHC's holding could result in a combined 72 to 83 ac-ft/year of increased streamflow contributions. Depending on actual forest stand age distribution, these numbers could over- or under-predict actual benefits to streamflow. This is meant to serve as an order of magnitude estimate and could be refined with more data in a future study.
Project-Type Specific Information	This is a streamflow augmentation project, based on the supportable premise that forest management can result in increased flows to surface water bodies. Further assessment would need to be done to identify the specific reaches.
Estimated Project Cost:	TBD but could be grant funded and would involve an assessment of GHC's holdings for suitability coupled with use of the USGS VELMA model to confirm a range of flow benefits.
Performance Goals & Measures:	• Change in Water Flow • Miles of stream with increased flows

Anticipated Local and Partner Support & Barriers to Completion:	Grays Harbor County owns and manages this property.
Project Sponsor, Implementation Start Date and End Date:	Grays Harbor County. Feasibility study can begin by 7/1/2021 or as soon as funding is obtained. Project complete by 1/1/2038 - end of planning horizon.

References

Hall, J., Kane, J., Swedeen, P., Blair, G., Webster, M., Hodgson, S., Ellings, C., Benson, L., Stonington, D., McKane, R., Barnhart, B., Brookes, A., Halama, J., Pettus, P., and Djang, K. (May 2018). Nisqually Community Forest VELMA modeling to evaluate effects of forest management scenarios on streamflow and salmon habitat.

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Smith, Carol and Wanger, Mark. May 2001. Chehalis Basin and Nearby Drainages, Water Resource Inventory Areas 22 and 23. Washington State Conservation Commission.

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PROJECT INFORMATION SHEET

Project Name:	**Garrard Creek Floodplain Restoration Opportunity Assessment**
Project ID:	**EW-00**
Project Location:	Garrard Creek, Mattson Rd. Lat/long: 46.813652, -123.249261
Project Description:	A geomorphic and hydraulic reach assessment will be developed to compile adequate information describing the reach and associated problems in the context of salmon recovery. Specific components of the assessment will include: • characterizing the distribution and relative function of floodplain habitats • assessing historical changes in channel pattern and riparian conditions • evaluating locations and to what degree riparian processes have been degraded by land use activity • identifying locations where channel-floodplain dynamics and habitat forming processes are impaired by bank armoring or levees, and • using hydraulic modeling tools to assess the frequency of floodplain connectivity and side channel engagement that could be achieved by removal or modification of existing impairments, such as the abandoned railroad grade disconnecting the floodplain near the Garrard Creek confluence.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Riparian and In-Stream habitat type. This project will benefit Coho, Winter Steelhead, Chum, Searun Cutthroat. Chehalis Lead Entity Strategy states that Chum were present in Garrard Creek in the past but depressed as of late. Biological processes, channel structure and complexity, stream substrate, water quality, sediment floodplain connectivity and function, large woody debris recruitment, water quantity and stream flow are all salmonid limiting factors to be addressed. Bank erosion and water quality are also to be addressed.
Is Water Quantity a Limiting Factor In this Subbasin?	Water Quantity is a Tier 2 concern.

Location & Spatial Extent of Benefits:	Garrard Creek and side channel habitat off the mainstem Chehalis River
Anticipated Water Offset (if applicable):	Estimated water offset is 5 acre-feet per year. Offset is based on planned installation of two beaver dam analog installations with a benefit of 2.5 acre-feet per year (Dittbrenner, 2019). Reference: Dittbrenner, Benjamin J., 2019. Restoration potential of beaver for hydrological resilience in a changing climate, PhD Dissertation, University of Washington, 164 p.
Project-Type Specific Information	This is an assessment which could result in the following project types: Floodplain and Channel Migration Restoration/ Side Channel and Off-Channel Offset/ Beaver Reintroduction or Beaver Dam Analogs/ Fish Barrier Removal.
Estimated Project Cost:	$70,000 for initial assessment work. Construction cost unknown.
Performance Goals & Measures:	• Miles of Stream Made Accessible • Total Riparian Acres Treated • Acres of Off-Channel/Floodplain Connected Or Added • Floodplain: acres reconnected • Total Miles of Instream Habitat Treated
Anticipated Local and Partner Support & Barriers to Completion:	Project is sponsored by the Chehalis Tribe to support the Tribe's interests. Outreach will likely occur to neighbors.
Project Sponsor, Implementation Start Date and End Date:	Confederated Tribes of the Chehalis Reservation Start: 6/1/2020. End: 1/1/2025

PROJECT INFORMATION SHEET

Project Name:	**Convert Galvin to Centralia Water**
Project ID:	**EW-01**
Project Location:	Galvin, WA – East Willapa subbasin Area around Galvin Road and Lincoln Creek Road Lat/long: 46.74139, -123.02750
Project Description:	Extend Centralia water system to unincorporated Galvin to remove approximately 40 homes from permit-exempt wells. Wells in this area are generally shallow and may be subject to septic contamination.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	Conversion of Galvin area to city water would remove approximately 40 existing permit-exempt wells from production, reducing draw on local groundwater. Since many existing wells are shallow, there would be potential public health benefits in removing potential for septic system contamination of drinking water supply.
Is Water Quantity a Limiting Factor In this Subbasin?:	Tier 2 in the mainstem of the Chehalis River
Location & Spatial Extent of Benefits:	Galvin is located between Lincoln Creek and the Chehalis River mainstem, so reduced draw on the local aquifer would most likely be reflected in the Chehalis River mainstem. Benefits of this project may be too small to be directly measurable.
Anticipated Water Offset (if applicable):	4.5 acre-feet per year. Estimated based on approximate count of 40 residential parcels and calculated consumptive use for East Willapa basin of 0.1137 af/yr per PE well.
Project-Type Specific Information:	This project would be a source switch but would not impact existing water rights. Project will proceed only if Centralia has sufficient capacity under existing water rights to add to its service area. Galvin water currently comes from permit-exempt wells.
Estimated Project Cost:	$3M - $4M for design and construction
Performance Goals & Measures:	Wells abandoned, drinking water quality, groundwater levels.

Anticipated Local and Partner Support & Barriers to Completion:	City of Centralia is willing to explore the project. Level of interest of Galvin residents not known at this time; some of have expressed interest but possibly not until existing wells fail.
Project Sponsor, Implementation Start Date and End Date:	City of Centralia. Start feasibility 7/1/2021 or as soon as funding is obtained. End 1/1/2038, end of planning period.

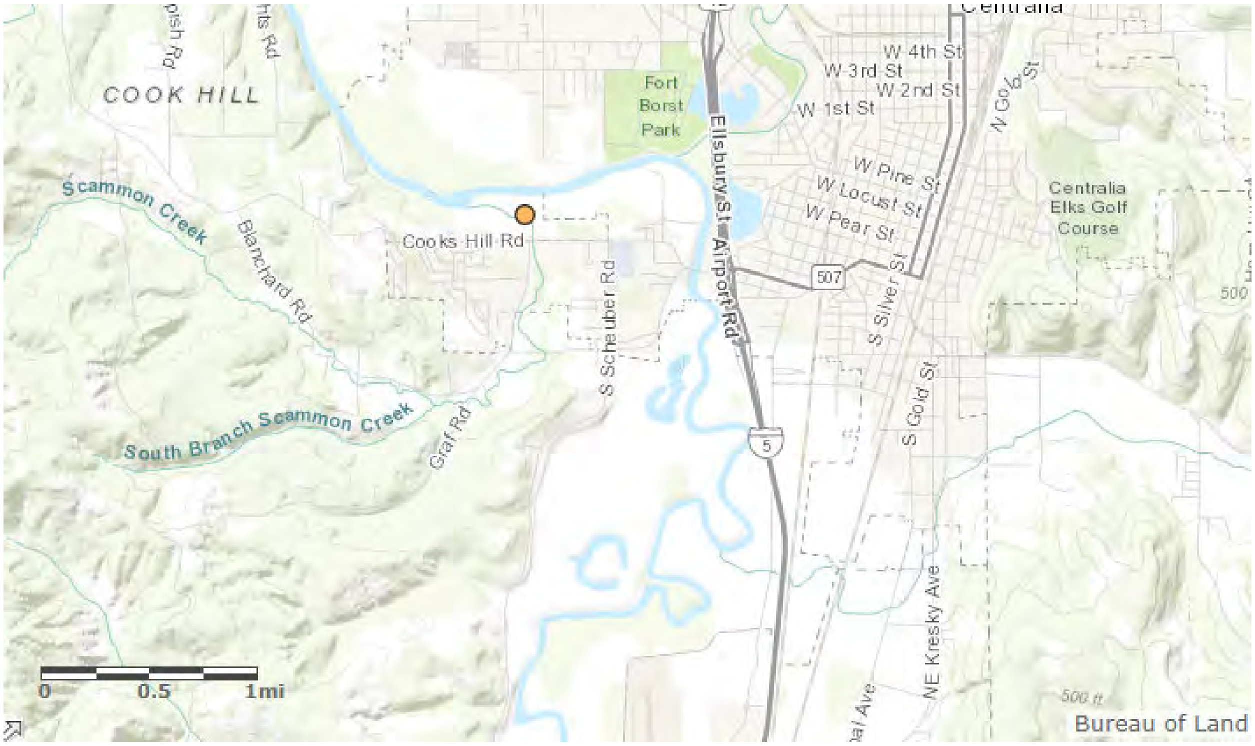
PROJECT INFORMATION SHEET

Project Name:	**Scammon Creek Hamilton Fish Passage Construction**
Project ID:	**EW-02**
Project Location:	West of Centralia, on Scammon Creek, approximately 1,600 feet upstream of the confluence with the Chehalis River Lat/long: 46.71547, -122.99506
Project Description:	Removal of a barrier culvert on Scammon Creek. This is the lowest privately owned fish-passage barrier on Scammon Creek. Lewis County is working to remove the county-owned road barriers directly upstream of this site.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Removal of this barrier, in concert with barrier removals being performed by Lewis County, will open 4.18 miles of instream habitat to coho, cutthroat, and steelhead. Salmon Recovery Portal: http://hws.ekosystem.us/project/120/82141
Is Water Quantity a Limiting Factor In this Subbasin?:	Low flows have been an identified limiting factor in Scammon Creek (Phinney and Bucknell, 1975). Scammon Creek is ranked as a Tier 2 for water quantity.
Location & Spatial Extent of Benefits:	East Willapa Subbasin, Scammon Creek watershed
Anticipated Water Offset (if applicable):	N/A

Project-Type Specific Information	Fish Barrier Removal.
	• Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)?
	  o Unknown.
	• To what extent is the existing structure a barrier (33%, 67%, 100%)?
	  o Unknown.
	• What species and fish life stages are affected?
	  o Coho, cutthroat, and steelhead: all life stages.

	• What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains?
	  o This project will open 4.18 miles of instream habitat.
	• What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score/ Tier concern in new Chehalis Basin Lead Entity barrier prioritization tool)?
	  o This project is ranked number 7 using the Priority Indexes Chehalis Basin Phase 2- Amendment 5 (Verd, 2007) criteria. This project was ranked 12th for funding from the Brian Abbott Fish Recovery Board.
	• Are there upstream or downstream barriers that still have to be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur?
	  o Yes. Lewis County is planning to remove upstream barriers.

Estimated Project Cost:	$100,000 (this project has been fully funded)
Performance Goals & Measures:	Miles of stream made accessible Barrier culverts removed
Anticipated Local and Partner Support & Barriers to Completion:	Private landowner. This project was supported by the Chehalis Basin Lead Entity's Habitat Work Group.
Project Sponsor, Implementation Start Date and End Date:	Lewis Conservation District in affiliation with 2019 Salmon Recovery Funding Board. Start: June 2020 End: June 2021


COOK HILL
Scammon Creek
Blanchard Rd
Cooks Hill Rd
Graf Rd
South Branch Scammon Creek
Fort Borst Park
S Scheuber Rd
Ellsbury St
Airport Rd
W 4th St
W 3rd St
W 2nd St
W 1st St
N Gold St
W Pine St
W Locust St
W Pear St
507
S Silver St
S Gold St
5
NE Kresky Ave
Centralia Elks Golf Course
500
500 ft
0
0.5
1mi
Bureau of Land

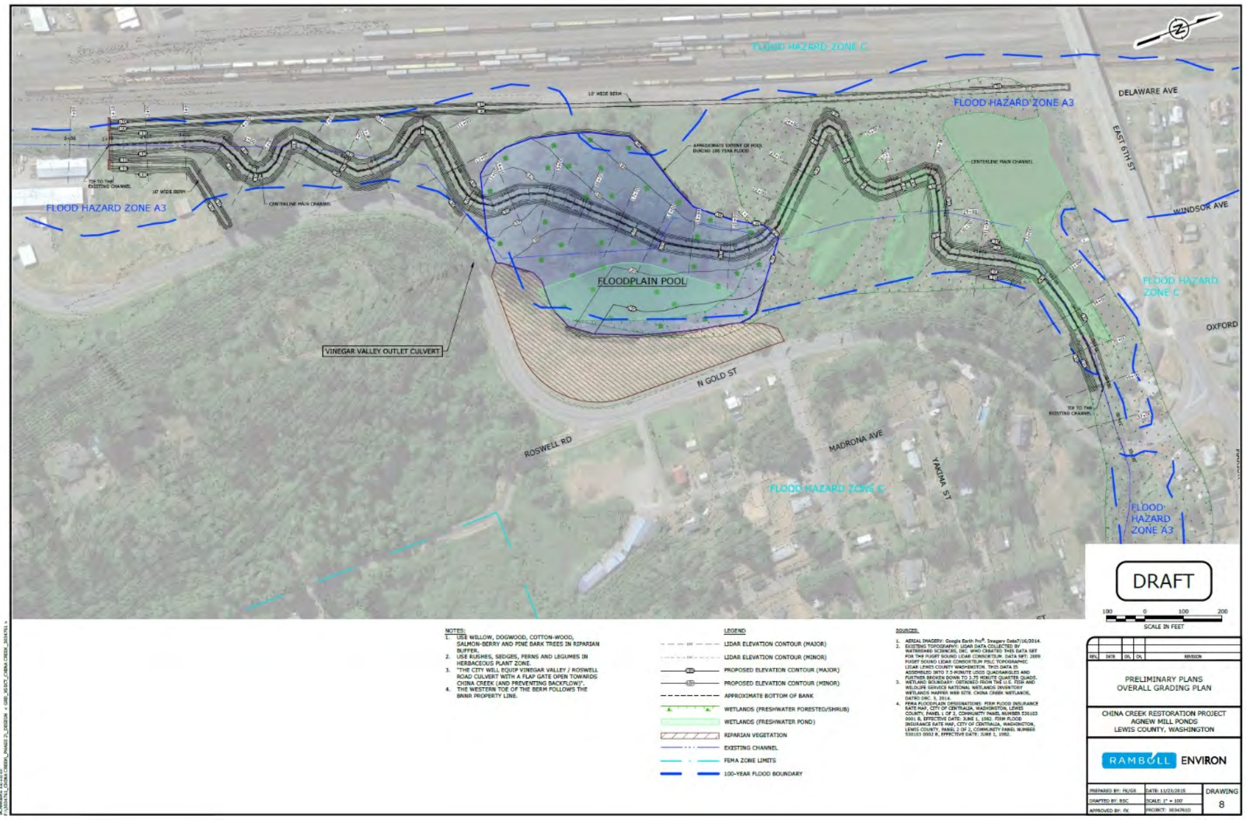
PROJECT INFORMATION SHEET

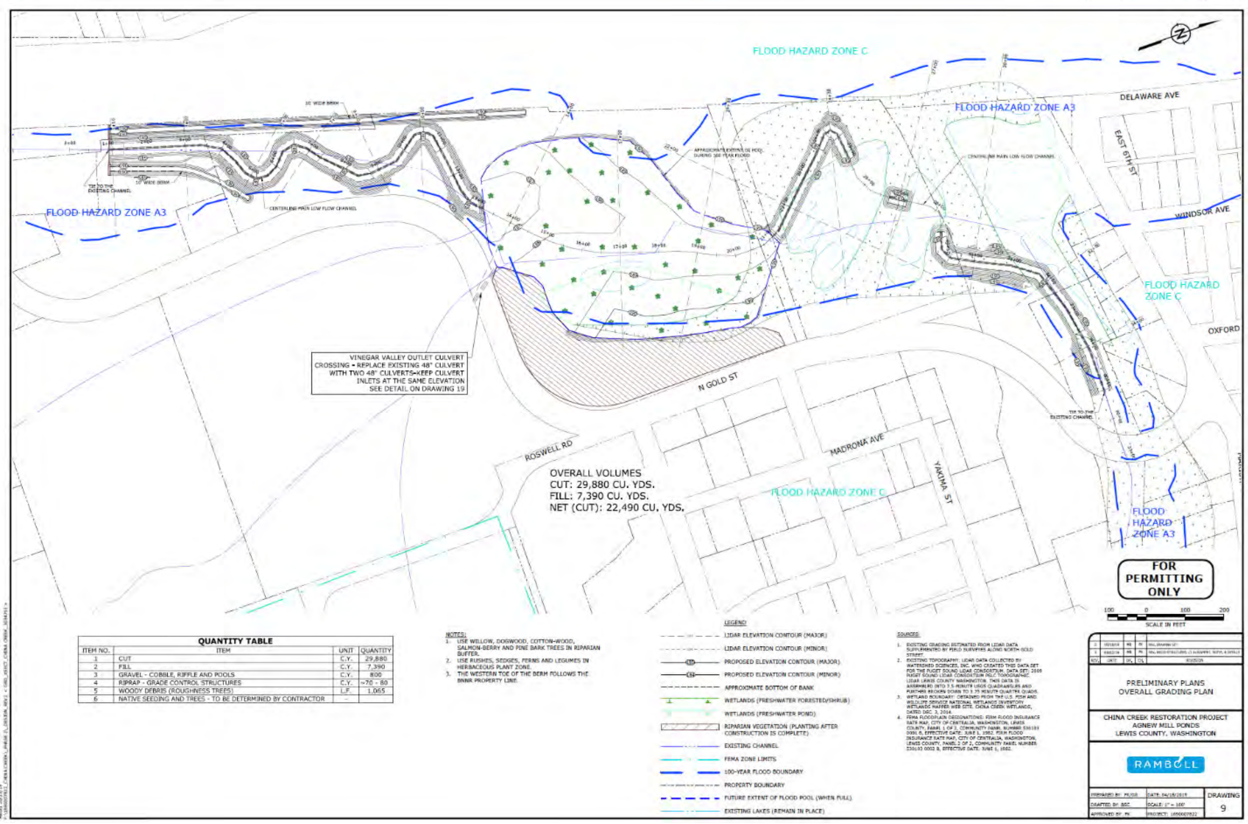
Project Name:	**China Creek Flood and Habitat Mitigation Phase 2**
Project ID:	**H-00**
Project Location:	Hanaford subbasin. Project is just outside downtown Centralia, parallel to N. Gold Street between Roswell Road and Marion Street. Lat/long: 46.725828, -122.947219
Project Description:	Phase 2 of the project will raise the storage level of the Agnew mill ponds to enhance storage downstream of the Phase 1 project, thereby reducing or eliminating flooding of downtown businesses and main travel corridors. The project will also enhance fish and wildlife habitat of the China Creek ecosystem within the project boundary.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The flood benefits of the project include reduced or eliminated flooding of downtown businesses and preserving access along main travel corridors for emergency vehicles and the public. Phase 2 of this project will raise the storage level of the Agnew mill ponds to enhance storage downstream of the Phase 1 project. The project will also enhance fish and wildlife habitat of the China Creek ecosystem within the project boundary. The project intends to use excavated naturally shaped landforms, stream channel friction, and natural in-stream fish habitat features to slow down and store runoff from the upper China Creek watershed during high flow runoff events. The delay will reduce the peak of the flow hydrograph thereby reducing the frequency and/or intensity of flooding downstream.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes, China Creek is a Tier 1 concern per the Lead Entity Strategy
Location & Spatial Extent of Benefits:	The project will restore 3,500 linear feet of meandering channel.
Anticipated Water Offset (if applicable):	The project may produce a water offset of approximately 3 acre-feet per year on average. Stored floodwater will have a controlled release back to the main channel and some infiltration is also likely. Hydraulic modeling of the proposed concept (by Ramboll) indicates that the project would store (and later release back to the stream)

	approximately 2-3 acre-feet in smaller floods that could be expected to occur one or more times per year. For the 100-year flood, the project would store about 12 acre-feet.

Project-Type Specific Information	Floodplain and Channel Migration Zone Restoration
	• What is the floodplain or channel migration problem?
	    o China Creek was channelized decades ago to flow in a ditch along the south side of Little Hanaford Road.
	• What is/are the proposed restoration action(s), and how will the action(s) address the floodplain or channel migration problem?
	    o This project proposes restoring China Creek to something approximating its original meandering channel. It is intended to use excavated naturally shaped landforms, stream channel friction and natural in stream fish habitat features to slow down and store runoff from the upper China Creek watershed during high flow runoff events.
	• Will the project increase floodplain inundation?
	    o Yes.

Estimated Project Cost:	$3,000,000. This project is mostly funded by the Chehalis Basin Flood Authority. A portion of funding has been requested from the Streamflow Restoration program
Performance Goals & Measures:	Ideally, the project will require little ongoing maintenance and will create a natural, self-sustained channel and floodplain.
Anticipated Local and Partner Support & Barriers to Completion:	The Chehalis Tribe is a likely supporter. Both phases of this project have been supported by the Chehalis Basin Flood Authority.
Project Sponsor, Implementation Start Date and End Date:	City of Centralia Start date 1/1/2020; End date 12/1/2021


FLOOD HAZARD ZONE C
FLOOD HAZARD ZONE A3
DELAWARE AVE
EAST 6TH ST
WINDSOR AVE
FLOOD HAZARD ZONE C
OXFORD
FLOODPLAIN POOL
FLOOD HAZARD ZONE A3
VINEGAR VALLEY OUTLET CULVERT
N GOLD ST
ROSWELL RD
MADRONA AVE
YAKIMA ST
FLOOD HAZARD ZONE C
FLOOD HAZARD ZONE A3
DRAFT
PRELIMINARY PLANS
OVERALL GRADING PLAN
CHINA CREEK RESTORATION PROJECT
AGNEW MILL PONDS
LEWIS COUNTY, WASHINGTON
RAMBOLL ENVIRON
DRAWING
8


FLOOD HAZARD ZONE C
FLOOD HAZARD ZONE A3
DELAWARE AVE
EAST 6TH ST
WINDSOR AVE
FLOOD HAZARD ZONE C
OXFORD
FLOOD HAZARD ZONE A3
VINEGAR VALLEY OUTLET CULVERT
CROSSING • REPLACE EXISTING 48" CULVERT
WITH TWO 48" CULVERTS•KEEP CULVERT
INLETS AT THE SAME ELEVATION
SEE DETAIL ON DRAWING 19
N GOLD ST
ROSWELL RD
OVERALL VOLUMES
CUT: 29,880 CU. YDS.
FILL: 7,390 CU. YDS.
NET (CUT): 22,490 CU. YDS.
MADRONA AVE
YAKIMA ST
FLOOD HAZARD ZONE C
FLOOD HAZARD ZONE A3
FOR PERMITTING ONLY
QUANTITY TABLE
ITEM NO. | ITEM | UNIT | QUANTITY
1 | CUT | C.Y. | 29,880
2 | FILL | C.Y. | 7,390
3 | GRAVEL - COBBLE, RIFFLE AND POOLS | C.Y. | 800
4 | RIPRAP - GRADE CONTROL STRUCTURES | C.Y. | ~70 - 80
5 | WOODY DEBRIS (ROUGHNESS TREES) | L.F. | 1,065
6 | NATIVE SEEDING AND TREES - TO BE DETERMINED BY CONTRACTOR | - |
PRELIMINARY PLANS
OVERALL GRADING PLAN
CHINA CREEK RESTORATION PROJECT
AGNEW MILL PONDS
LEWIS COUNTY, WASHINGTON
RAMBOLL
DRAWING
9

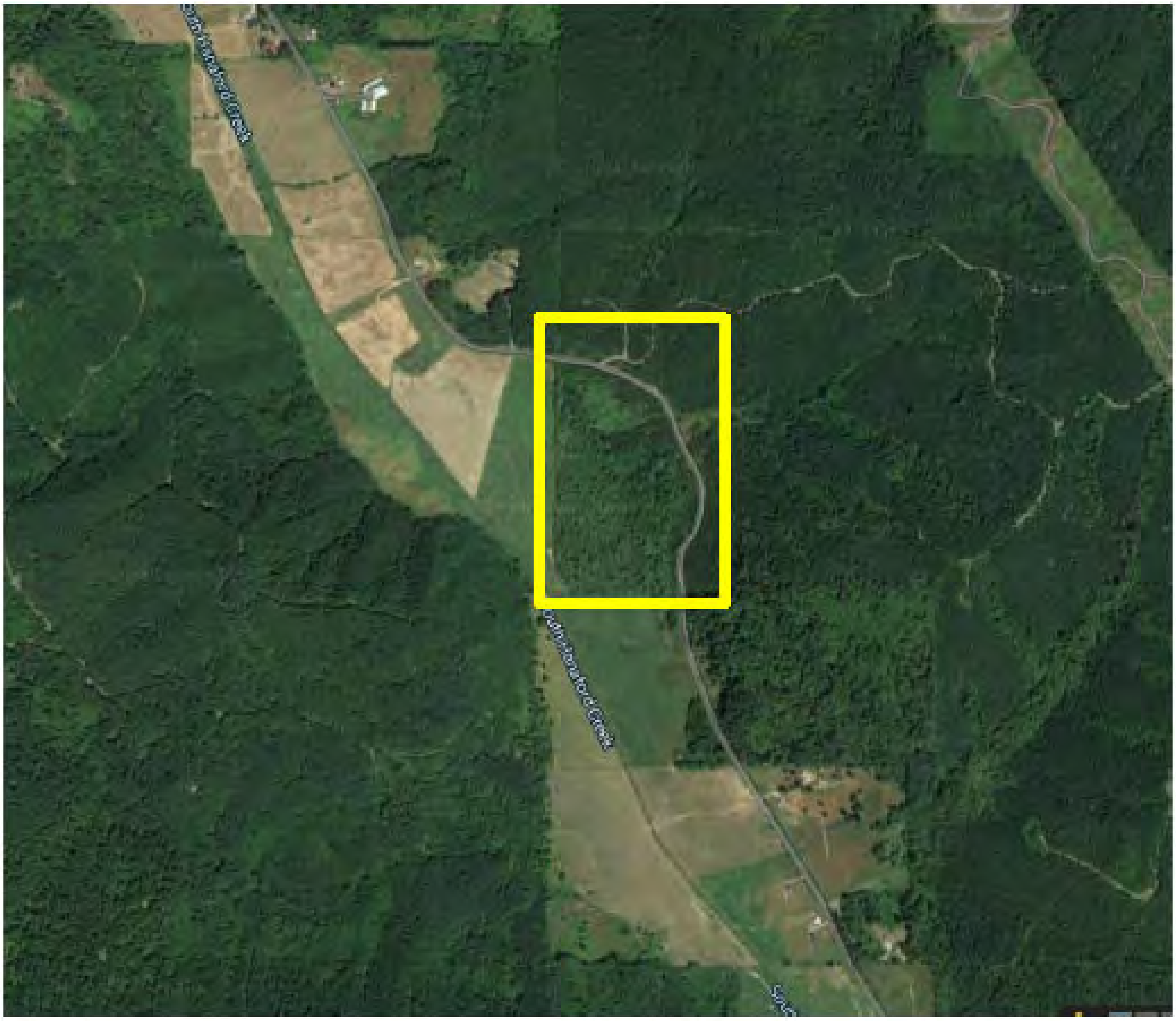
PROJECT INFORMATION SHEET

Project Name:	**Port Blakely Hanaford Acquisition**
Project ID:	**H-01**
Project Location:	Sections 36, Township 15 North, Range 2 West, Willamette Meridian; South Hanaford Creek in the Hanaford subbasin adjacent to Teitzel Road near Centralia, Lewis County, WA. Lat/long: 46.744541, -122.885725
Project Description:	Port Blakely has offered to sell 33 acres of forested land to a grant qualifiable NGO as an offset project. Adjacent bottomlands have largely been converted to agriculture uses. A small non-fish bearing stream flows through the center of the parcel. Lewis County critical area records show wetlands and hydric soils delineated.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The project would preserve 33 acres of forest land adjacent to South Hanaford Creek, preventing residential or agricultural development. This would provide water quality (including possibly temperature) benefits to the creek and preserve wetland and riparian habitat on the site.
Is Water Quantity a Limiting Factor In this Subbasin?:	Hanaford Creek is not identified as quantity-limited in the Chehalis Basin Lead Entity Strategy.
Location & Spatial Extent of Benefits:	The project will cover approximately 33 acres of forested land adjacent to South Hanaford Creek. Temperature and other water quality benefits may extend downstream.
Anticipated Water Offset (if applicable):	None anticipated.

Project-Type Specific Information	Riparian and Upland Conservation and Restoration
	• Is the land proposed for conservation/restoration part of the riparian, floodplain and/or channel migration zone?
	  o Riparian.
	• Is the riparian or upland conservation/restoration part of a larger project funded by other sources?
	  o No
	• If applicable, what is the mechanism for protection (e.g. conservation easement, fee simple, transfer to public lands)?
	  o Fee Simple

	• If applicable, is the proposed restoration passive (e.g. fencing), active (e.g. plantings) or both?
	  o N/A
	• For protection projects, is the protection temporary or permanent?
	  o Permanent
	• For protection projects, is the site under imminent threat?
	  o No
	• For protection, tell us more about the threat: aka, likeliness of subdivision, purchase for development, timber harvest plans, etc.
	  o The property is currently owned by a timber company so will be sold for timber harvest if not sold for conservation.

Estimated Project Cost:	Conceptual
Performance Goals & Measures:	• Upland Acres Protected • Riparian Acres Protected • Miles of Streambank Protected By Land or Easement Acquisition
Anticipated Local and Partner Support & Barriers to Completion:	Port Blakely is seeking a partner for sale of this parcel to a grant-qualifiable NGO as an offset project. No interested partners have yet been identified.
Project Sponsor, Implementation Start Date and End Date:	Project currently does not have a sponsor. Port Blakely is seeking a partner for potential sale.



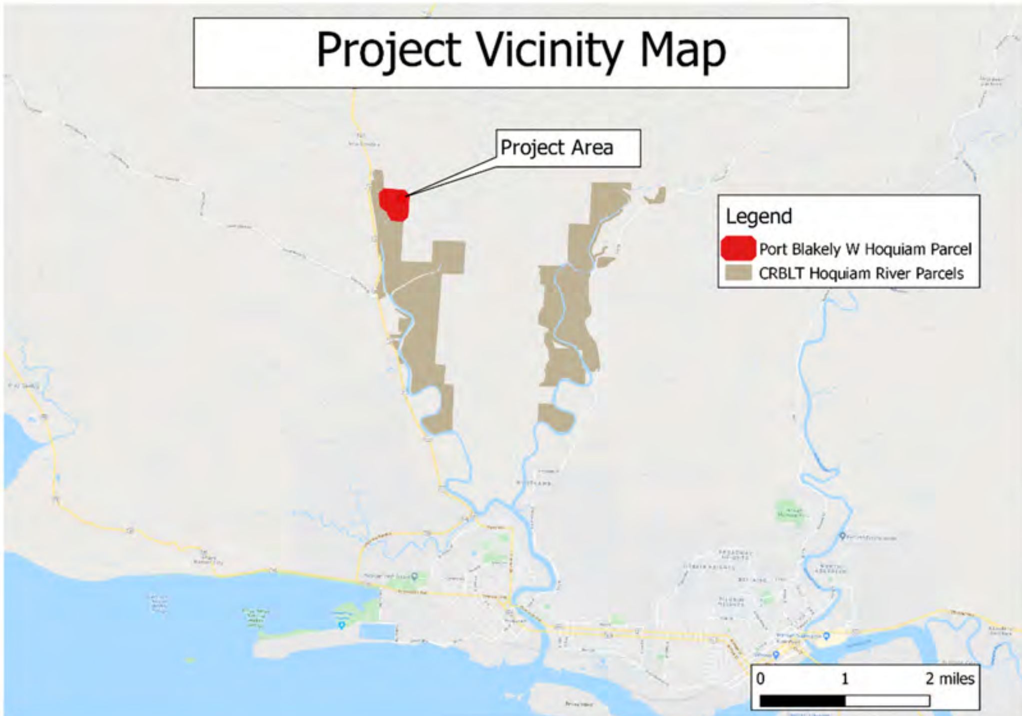
PROJECT INFORMATION SHEET

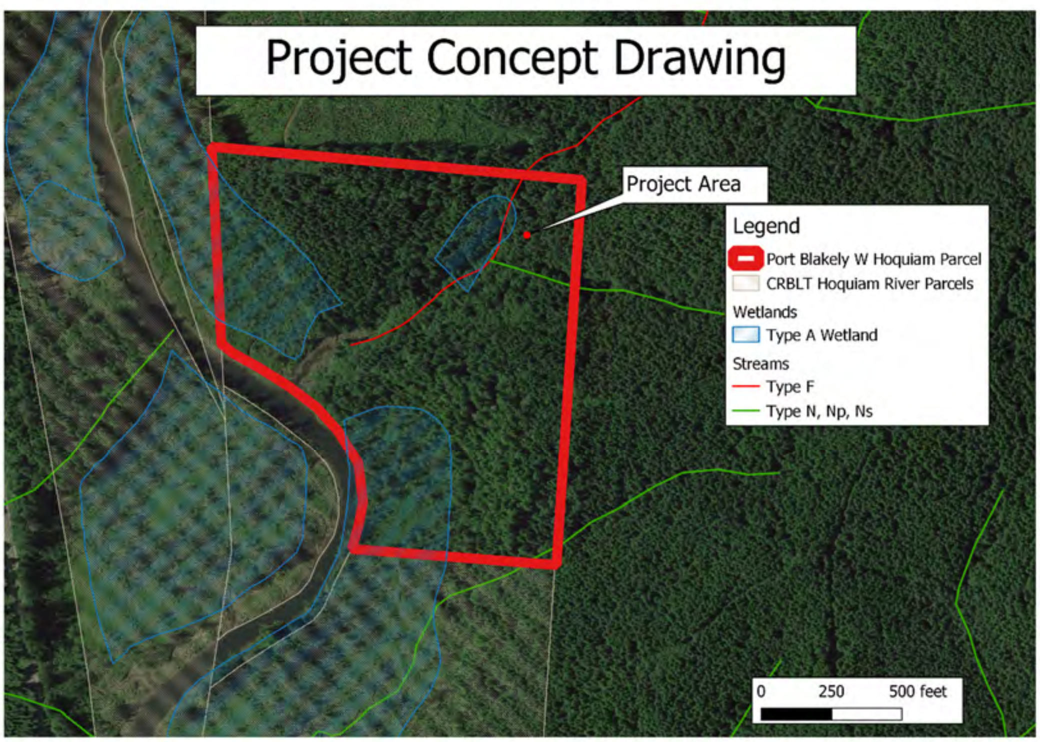
Project Name:	**Port Blakely West Hoquiam Acquisition**
Project ID:	**HQ-00**
Project Location:	SW1/4NW1/4 Section 15, Township 18 North, Range 10 West, W.M. on the West Hoquiam River in the Hoquiam-Wishkah Management Unit of the Chehalis River Basin. The project is approximately 3.75 miles north of the City of Hoquiam. Lat/long: 47.02496, -123.55117
Project Description:	The purpose of this project is to protect streamflow in the West Hoquiam River through the acquisition 34 acres of land containing 10.7 acres of wetlands, 23 acres of second growth forest, 0.2 mile of shoreline, and .25 miles of fish bearing stream on the West Hoquiam River north of the City of Hoquiam. The project will also protect high quality surge plain and riparian habitats critical to rearing depressed salmon stocks of Hoquiam Fall Chinook and Hoquiam Winter Steelhead, as well as Coho, Chum and Coastal Cutthroat. The parcel is adjacent to 712 acres protected with salmon recovery funds through the West Hoquiam River Surge Plain Acquisition project, including the Middle Fork Tidal Habitat Restoration Project.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The project addresses water quantity concerns in the West Hoquiam River. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23 rates the water quantity in the watershed as poor due to the low percentage (21% to 37%) of mid-to-late seral stage forest available. Protecting key riparian properties through fee simple purchase is recommended as a general action in the Strategy. This project will also improve conditions for salmon by implementing actions addressing identified Tier 1 Concerns for the Hoquiam River in the Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23. Fee simple purchase of riparian areas is recommended by the Basin Strategy to address the Water Quality and Riparian Tier 1 Concerns identified in the Strategy. Water Quality Concerns. The Basin Strategy identifies that the Hoquiam River contains Class B waters due to industrial and urban development, and that the river is a significant contributor to fecal coliform in Grays

	Harbor. Protection of these parcels will preclude further degradation of water quality due to residential or commercial development, or timber harvest near the river. The upland area adjacent to the wetland areas contains a merchantable stand of timber. Reserving this area from harvest will protect the hydrologic integrity and water quality in the wetlands and fish bearing stream on the site. Riparian Concerns. Commercial and residential development are significant contributors to the loss of riparian habitat in the Hoquiam River system. The Basin Strategy identifies that in the lower 5.2 miles of the mainstem Hoquiam the riparian area has been developed and is rated as poor riparian conditions. Further, the Basin Strategy states that the middle and W. Fork Hoquiam has poor conditions with 62% classified as non-forested, open, or deciduous and 36% classified as conifer or mixed conifer in mid to late seral stages. This parcel contains high quality riparian vegetation that must be protected to prevent further degradation of the Hoquiam watershed.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23 states that the land cover conditions for the E. Fork, W. & Middle Forks of the Hoquiam WAUs have 21% to 37% land cover in mid-to-late seral. This equates to a poor rating for Water Quantity." Water Quantity is a Tier 3 concern.
Location & Spatial Extent of Benefits:	The project will protect 10.7 acres of wetlands, 23 acres of upland forest, and 0.2 miles of shoreline along the West Hoquiam River between the mouth of the Middle Fork Hoquiam River and the Highway 101 bridge.
Anticipated Water Offset (if applicable)	N/A
Project-Type Specific Information	The project provides water quantity, water quality and riparian habitat benefits. Water quantity will be enhanced by reserving 21 acres of merchantable second growth timber from harvest, allowing this area to eventually develop mid-to-late seral land cover characteristics. There may be upland sites appropriate for beaver analogs (TBD). Preserving the parcel from residential or commercial development, or industrial forestry use will protect water quality on the West Hoquiam River. Protecting the shoreline of the West Hoquiam River and the fish bearing stream in the parcel will also protect high quality surge plain and riparian

	habitats critical to rearing depressed salmon stocks of Hoquiam Fall Chinook and Hoquiam Winter Steelhead, as well as Coho, Chum and Coastal Cutthroat
	
	Riparian and Upland Conservation and Restoration
	• Is the land proposed for conservation/restoration part of the riparian, floodplain and/or channel migration zone?
	  o Yes
	• Is the riparian or upland conservation/restoration part of a larger project funded by other sources?
	  o No
	• If applicable, what is the mechanism for protection (e.g. conservation easement, fee simple, transfer to public lands)?
	  o Fee simple
	• For protection projects, is the protection temporary or permanent?
	  o Permanent
	• For protection projects, is the site under imminent threat?
	  o Yes
	• For protection, tell us more about the threat: aka, likeliness of subdivision, purchase for development, timber harvest plans, etc.
	  o Residential or commercial development or industrial forestry if sold to other buyer.

Estimated Project Cost:	TBD
Performance Goals & Measures:	Upland Acres Protected= 23 Riparian Acres Protected= 10.7 Miles of Streambank Protected By Land or Easement Acquisition =0.2 Improve riparian habitat and biological processes to benefit fall chum and winter steelhead. ESU maps report this area for pacific coast Chinook, chum, coho and steelhead.
Anticipated Local and Partner Support & Barriers to Completion:	The Quinault Indian Nation, Coast Salmon Partnership, Port Blakely Timber Co. There are no known barriers
Project Sponsor, Implementation Start Date and End Date:	Chehalis River Basin Land Trust Start: Winter 2021 End: 1/1/2025


Project Vicinity Map
Project Area
Legend
Port Blakely W Hoquiam Parcel
CRBLT Hoquiam River Parcels
0
1
2 miles

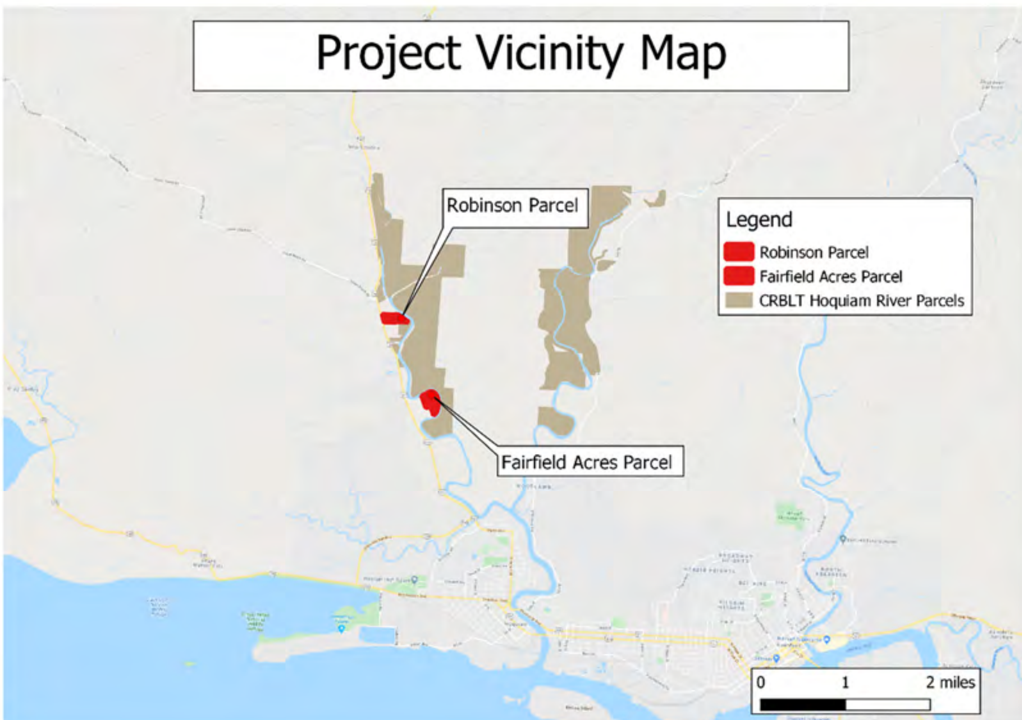

Project Concept Drawing
Project Area
Legend
Port Blakely W Hoquiam Parcel
CRBLT Hoquiam River Parcels
Wetlands
Type A Wetland
Streams
Type F
Type N, Np, Ns
0
250
500 feet

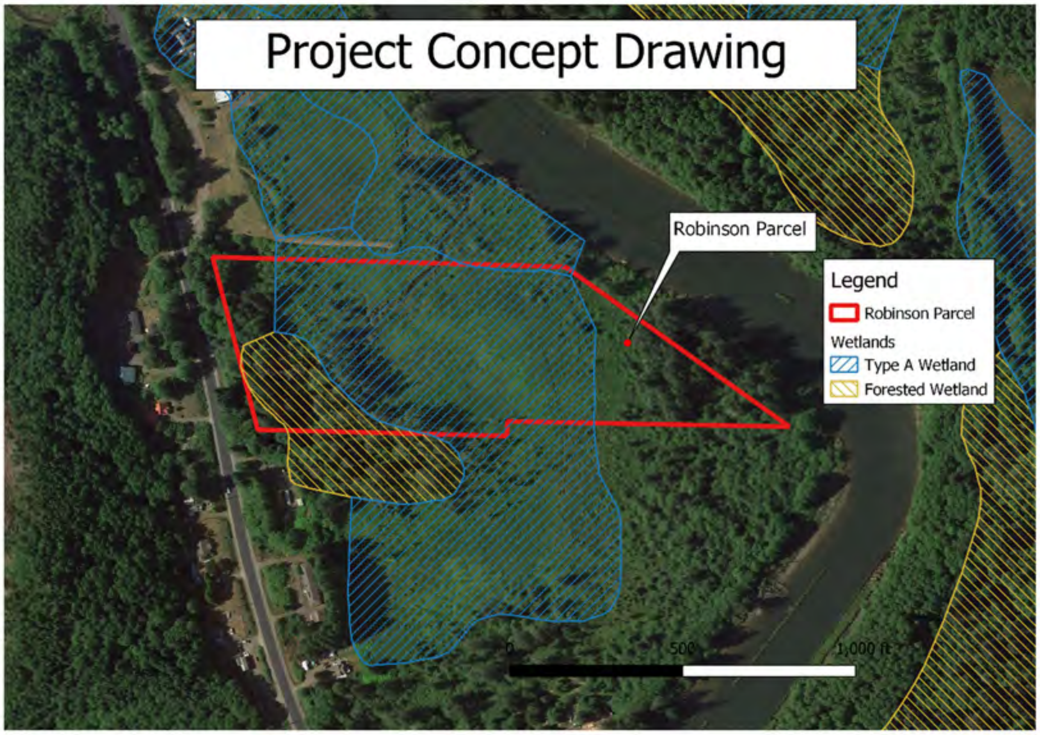
PROJECT INFORMATION SHEET

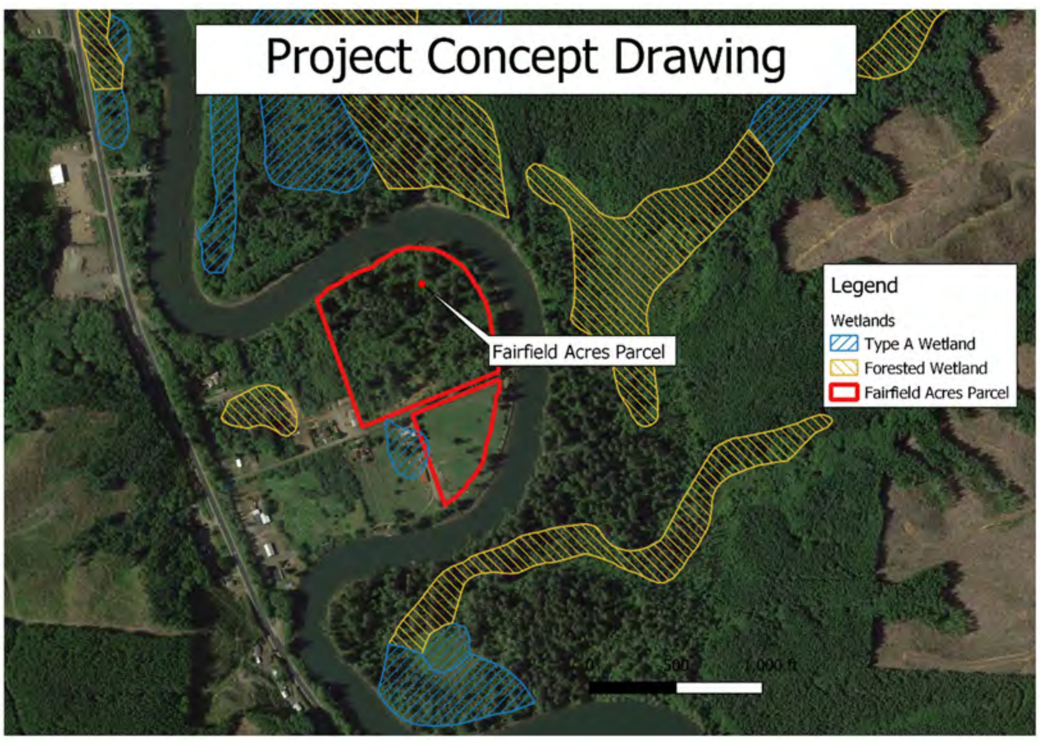
Project Name:	**2020 West Hoquiam Acquisitions**
Project ID:	**HQ-01**
Project Location:	Part SE1/4 Section 27, Township 18 North, Range 10 West, W.M. and part SW1/4 Section 22, Township 18 North, Range 10 West, W.M. on the West Hoquiam River in the Hoquiam-Wishkah Management Unit of the Chehalis River Basin. The project is approximately 2 miles north of the City of Hoquiam. Lat/long: 47.01125 -123.54581
Project Description:	The purpose of this project is to protect streamflow in the West Hoquiam River through the acquisition of two parcels of land comprising 39 acres containing 10 acres of wetlands, and 0.5 mile of shoreline on the West Hoquiam River north of the City of Hoquiam. The project will also protect high quality surge plain and riparian habitats critical to rearing depressed salmon stocks of Hoquiam Fall Chinook and Hoquiam Winter Steelhead, as well as Coho, Chum and Coastal Cutthroat. The parcel is adjacent to 712 acres protected with salmon recovery funds through the West Hoquiam River Surge Plain Acquisition project, including the Middle Fork Tidal Habitat Restoration Project.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The project addresses water quantity concerns in the West Hoquiam River. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23 rates the water quantity in the watershed as poor due to the low percentage (21% to 37%) of mid-to-late seral stage forest available. Protecting key riparian properties through fee simple purchase is recommended as a general action in the Strategy. This project will also improve conditions for salmon by implementing actions addressing identified Tier 1 Concerns for the Hoquiam River in the Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23. Fee simple purchase of riparian areas is recommended by the Basin Strategy to address the Water Quality and Riparian Tier 1 Concerns identified in the Strategy. Water Quality Concerns. The Basin Strategy identifies that the Hoquiam River contains Class B waters due to industrial and urban development, and that the river is a significant contributor to fecal coliform in Grays

	Harbor. Protection of these parcels will preclude further degradation of water quality due to residential or commercial development. Reserving this area from development will protect the hydrologic integrity and water quality in the wetlands along the West Hoquiam River. Riparian Concerns. Commercial and residential development are significant contributors to the loss of riparian habitat in the Hoquiam River system. The Basin Strategy identifies that in the lower 5.2 miles of the mainstem Hoquiam the riparian area has been developed and is rated as poor riparian conditions. Further, the Basin Strategy states that the middle and W. Fork Hoquiam has poor conditions with 62% classified as non-forested, open, or deciduous and 36% classified as conifer or mixed conifer in mid to late seral stages. This parcel contains high quality riparian vegetation that must be protected to prevent further degradation of the Hoquiam watershed.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23 states that the land cover conditions for the East Fork and West & Middle Forks of the Hoquiam WAUs have 21% to 37% land cover in mid-to-late seral. This equates to a poor rating for water quantity.”
Location & Spatial Extent of Benefits:	The project will protect 10 acres of wetlands, and 0.5 miles of shoreline along the West Hoquiam River between the mouth of the Middle Fork Hoquiam River and the Highway 101 bridge.
Anticipated Water Offset (if applicable):	N/A
Project-Type Specific Information	The project provides water quality and riparian habitat benefits. Preserving the parcel from residential or commercial development, or industrial forestry use will protect water quality on the West Hoquiam River. Protecting the shoreline of the West Hoquiam River and the fish bearing stream in the parcel will also protect high quality surge plain and riparian habitats critical to rearing depressed salmon stocks of Hoquiam Fall Chinook and Hoquiam Winter Steelhead, as well as Coho, Chum and Coastal Cutthroat.
Estimated Project Cost:	$209,409
Performance Goals & Measures:	Acquisition of 39 acres of land containing 0.5 miles of shoreline on the West Hoquiam River. Restoration of 5 acres of degraded riparian habitat

Anticipated Local and Partner Support & Barriers to Completion:	Grays Harbor Marine Resource Committee and Grays Harbor Audubon Society have provided letters of support. Grays Harbor Stream Team has offered volunteer resources for restoration and maintenance of the site. Ducks Unlimited is a secondary sponsor of the project. The project is recommended for funding by the Chehalis Basin Habitat Work Group.
Project Sponsor, Implementation Start Date and End Date:	Chehalis River Basin Land trust is the primary sponsor. Ducks Unlimited is the secondary sponsor. Start: October 1, 2020 End: December 31, 2023




Project Concept Drawing
Robinson Parcel
Legend
Robinson Parcel
Wetlands
Type A Wetland
Forested Wetland
0
500
1,000 ft

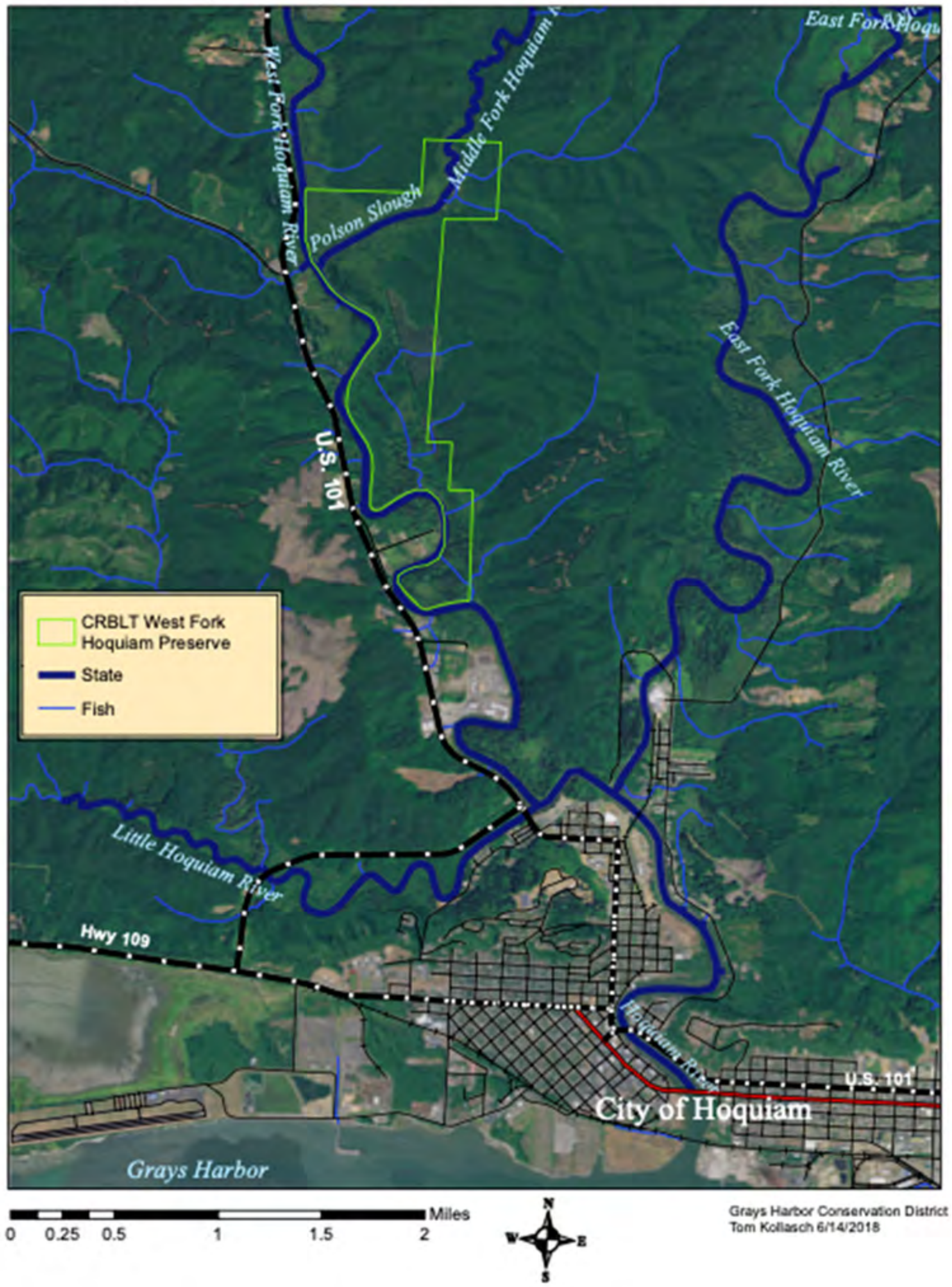

Project Concept Drawing
Fairfield Acres Parcel
Legend
Wetlands
Type A Wetland
Forested Wetland
Fairfield Acres Parcel
0
500
1,000 ft

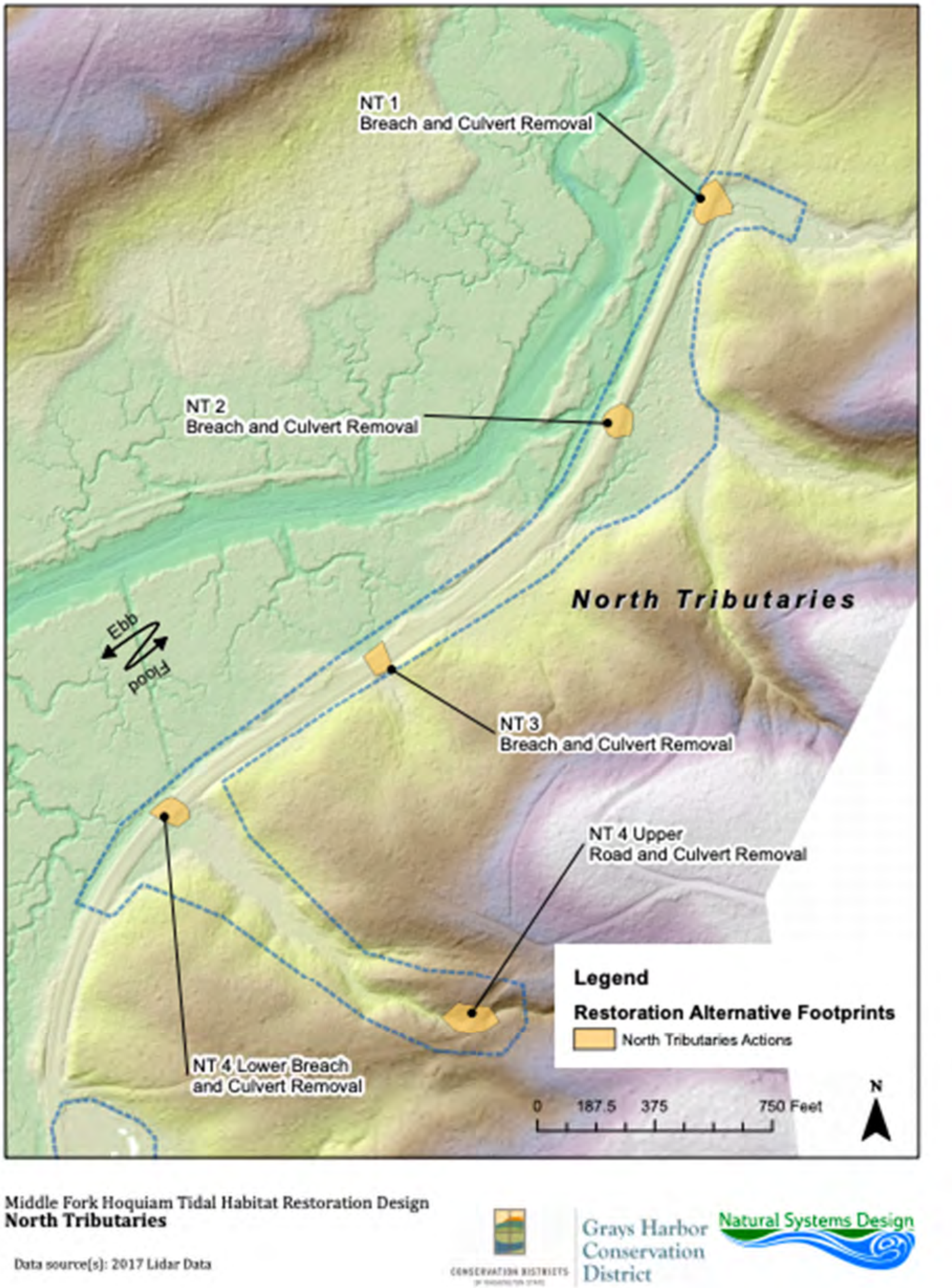
PROJECT INFORMATION SHEET

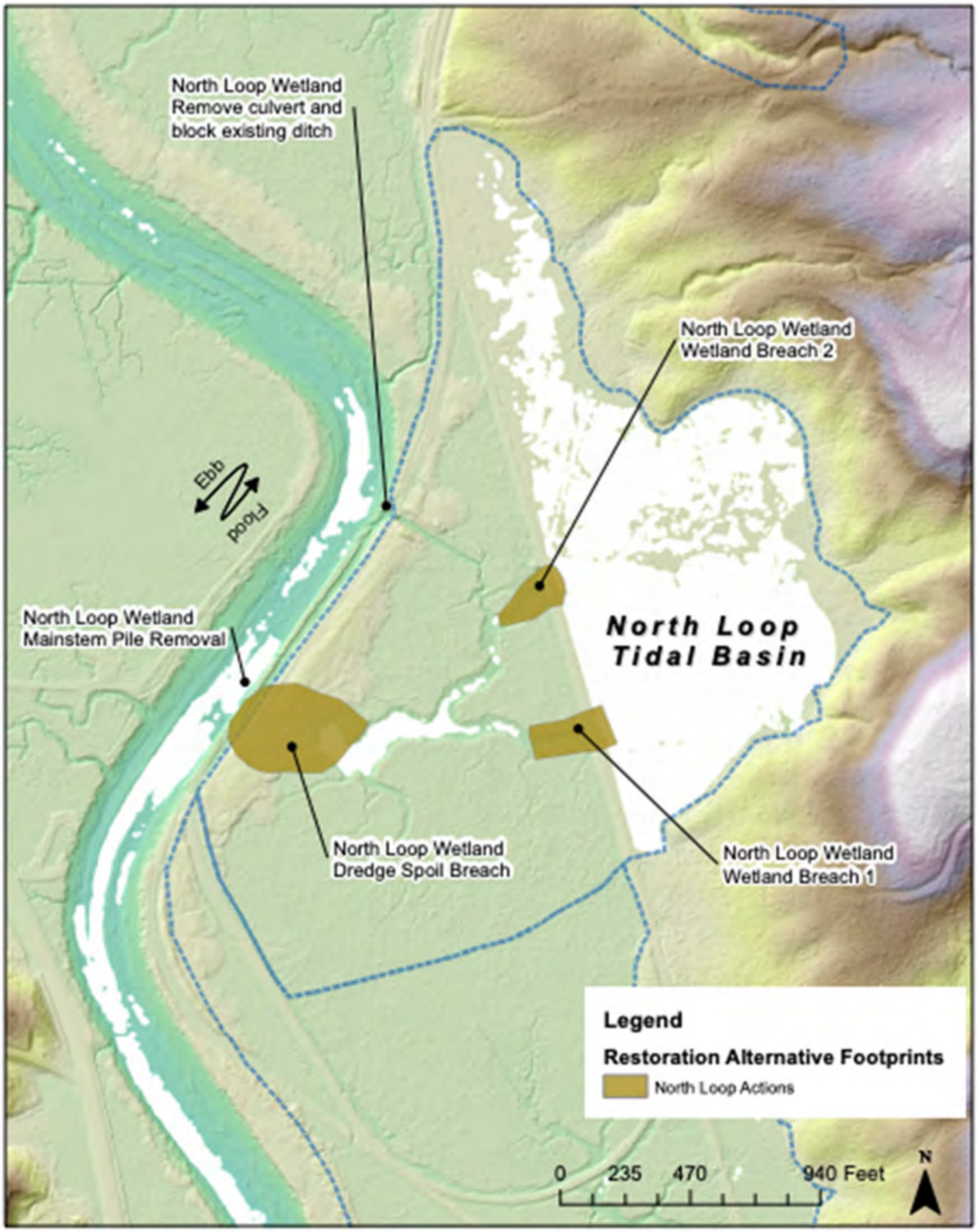
Project Name:	**Middle Fork Hoquiam Tidal Restoration**
Project ID:	**HQ-02**
Project Location:	Hoquiam sub-basin Lat/long: 47.020918, -123.911830
Project Description:	The project will restore full tidal function to 113 acres and remove 10 fish barrier culverts that block fish access to tidal wetlands. Pilings will also be removed from the main Hoquiam channel at the mouth of the largest channel to be reopened. The tidal openings are in three areas, the Northern Tributaries, the Southern Loop wetland, and the Northern Loop wetland. Three culverts will be removed from the Northern Tributaries and one site filled back in to focus tidal flows to the two streams there. One main tidal channel will be opened at the Southern Loop and three for the Northern Loop, including one very large excavation to reopen the mouth of that channel. All these tidal culverts and channels will be opened to match the channel size and adjacent tidal benches will be excavated to facilitate full tidal function. Other sections of the railroad berm will be left intact. Three other non-tidal fish barrier culverts will be opened between the Northern Tributaries and the Northern Loop area.
Project Type;	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Freshwater tidal Sitka spruce swamps are among the most productive and important habitats for salmon rearing. An assessment conducted by Wild Fish Conservancy in the early 2010s found that the West Fork, Middle Fork and East Fork Hoquiam estuary is a significant rearing area for juvenile salmonids, especially for coho. These habitats are also rare. Much of this type of habitat has been lost to diking and drainage, which also complicates our ability to restore functional tidal habitat quickly. The estuaries in this area retain large portions of their original habitat complexity, though this project presents an opportunity to restore significant amounts of habitat, improve long term ecosystem function and provide access for juvenile salmonids to large areas of new or underutilized habitat. This site offers a rare opportunity to restore this valuable habitat where the tidal channel system is still largely intact, and the habitat is already recovering from disturbance. Simply reopening the channels will achieve most of the restoration benefit.
Is Water Quantity a Limiting Factor In this Subbasin?:	Water Quantity is a Tier 3 concern for the Hoquiam

Location & Spatial Extent of Benefits:	1.5 to 3 miles north of Hoquiam, across river from Highway 101. Benefits are to lower miles of the Middle Fork Hoquiam river.
Anticipated Water Offset (if applicable):	N/A
Project-Type Specific Information	Primary species benefitting: Chinook, coho, steelhead, chum, cutthroat. Benefits the following limiting factors: fish passage, floodplain connectivity/function, and estuarine and nearshore habitat. Fall Chinook and winter steelhead are depressed stocks for the Hoquiam.
Estimated Project Cost:	$2,250,000 (funded 2 million through WCRRI; pending 250k from SRFB 2020)
Performance Goals & Measures:	• Acres Planted in riparian: 7.0 • Riparian Acres Treated for forestry practices/stand management: 40.5 Miles of Dikes Modified/Removed: 0.06 • Acres of Habitat Made Available to Salmonids through dike or berm modification/removal: 48.0 • Number of Culverts Modified/Removed to Allow Fish Passage: 8 • Acres Opened to Fish Passage through culvert modification/removal: 64.9 • Acres Treated for debris removal: 0.1 • Miles of stream made accessible by road crossing removal: 3.5 • Number of road-crossings: 2 Miles of streambank planted: 1.01 • Number of blockages / impediments / barriers impeding passage: 2
Anticipated Local and Partner Support & Barriers to Completion:	Support: Chehalis River Basin Land Trust (landowner); Chehalis Basin Lead Entity's Habitat Work Group
Project Sponsor, Implementation Start Date and End Date:	Grays Harbor Conservation District. Start construction: 2021 End: October 31, 2021

Vicinity Map - Hoquiam Tidal Restoration Project



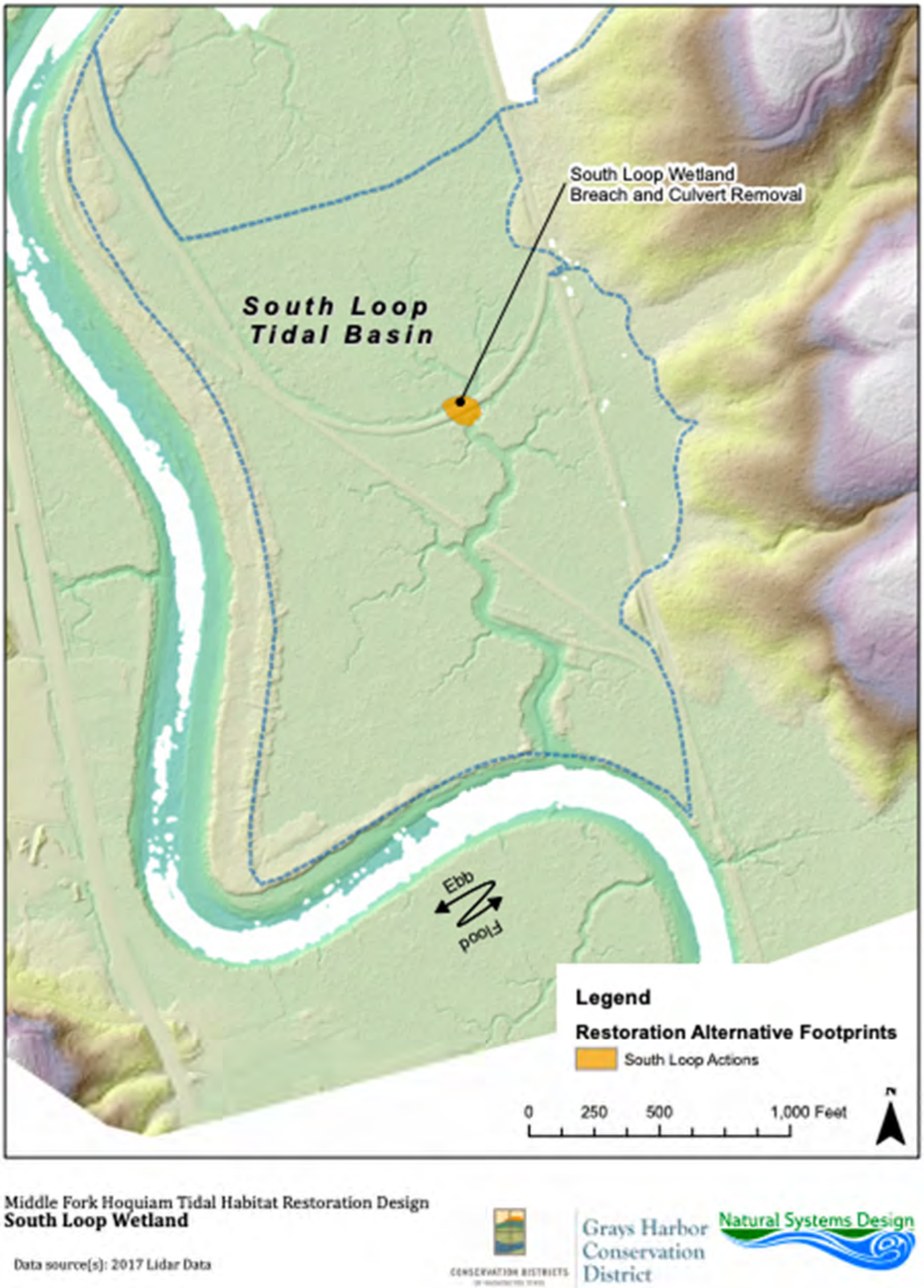

NT 1
Breach and Culvert Removal
NT 2
Breach and Culvert Removal
North Tributaries
Ebb
Flood
NT 3
Breach and Culvert Removal
NT 4 Upper
Road and Culvert Removal
NT 4 Lower Breach
and Culvert Removal
Legend
Restoration Alternative Footprints
North Tributaries Actions
0
187.5
375
750 Feet
N
Middle Fork Hoquiam Tidal Habitat Restoration Design
North Tributaries
Data source(s): 2017 Lidar Data
Grays Harbor Conservation District
Natural Systems Design



Middle Fork Hoquiam Tidal Habitat Restoration Design
North Loop Wetland

Data source(s): 2017 Lidar Data

Conservation Districts of Washington State
Grays Harbor Conservation District
Natural Systems Design


South Loop Wetland
Breach and Culvert Removal
South Loop
Tidal Basin
Ebb
Flood
Legend
Restoration Alternative Footprints
South Loop Actions
0
250
500
1,000 Feet
Middle Fork Hoquiam Tidal Habitat Restoration Design
South Loop Wetland
Data source(s): 2017 Lidar Data
Grays Harbor
Conservation
District
Natural Systems Design

PROJECT INFORMATION SHEET

Project Name:	**Grays Harbor County Forest Practices and Flow Assessment**
Project ID:	**EJ-01, HQ-03, HT-01, W-00, WY-01**
Project Location:	Grays Harbor County.
Project Description:	The Grays Harbor County Forestry Department manages approximately 36,000 acres of land. These holding are distributed across the county with significant blocks of acreage in the Humptulips, Hoquiam, Wishkah, and Elk-Johns subbasins, and a smaller holding in the Wynoochee subbasin. The County proposes to evaluate these tracts and determine if changes to forest management can be used to increase flow contributions in the targeted subbasins. This project will quantify the potential streamflow benefits from forest management practice opportunities throughout the County's holdings. The effort will include: • Review of existing GHC forest management plans for potential opportunities, by assessing existing harvest cycles and harvest/planting plans to establish baseline conditions. • GIS analyses to map key subbasin, tributary, soils, and hydrogeologic features. • Identification of up to approximately 550 acres for enhanced management practices (approximately 2% of the County's managed lands). • VELMA modeling to quantify streamflow benefits from proposed changes in forestry practices.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	For all five subbasins, the goal is to improve instream flows and enhance the natural complexity of instream habitat. Grays Harbor County manages approximately 36,000 acres of forestland, a portion of which is located within WRIAs 22 and 23. Intentional management of this land may have significant favorable effects on the water budget of the Humptulips, Hoquiam, Wishkah, Elk-Johns, and Wynoochee drainages. The Visualizing Ecosystem Land Management Assessments (VELMA) ecohydrological model is a predictive tool created to assess potential

	improvements in water quality and flow to streams, rivers, and estuaries via changes in land management (EPA, 2018). This model couples hydrological and biogeochemical processes at plot- to entire watershed-scales to dynamically predict the impacts on streamflow from forestland management. VELMA modeling of changes in forest practices has successfully demonstrated that increasing harvest cycle duration, or withholding stands from harvest, provides net benefits to streamflow when compared to stand rotations less than 40 years. Forty years has been identified as a critical threshold for forest stand age, in which anything younger is faster growing with higher groundwater uptake, and negatively impacts stream flows while uptake declines as stands mature beyond 40 years, providing increasing benefit to streamflow with stand age (Hall et al., 2018). Proposed changes will be evaluated using a VELMA analysis to quantify improvements to instream flows. Assuming similar results to the VELMA modeling completed for the Nisqually Plan Addendum of 0.13 to 0.15 ac-ft/yr benefit per acre of improved management, 550 acres would result in approximately 72 to 83 ac-ft/year benefit to the watershed.
Is Water Quantity a Limiting Factor In this Subbasin?:	Humptulips – Tier 3 with low summer flows in the mainstem constitutes a major problem. Low flows are also noted in the major tributaries including Big Creek. Hoquiam– Tier 3 Wishkah– Tier 3 Wynoochee – Tier 3 flows dip below established base flows in the summer months Elk-Johns – Tier 3
Location & Spatial Extent of Benefits:	Numerous sites located across Grays Harbor County
Anticipated Water Offset (if applicable):	Water offset for the Hoquiam subbasin is estimated at 17 acre-feet per year, as described below. Water offset results presented in the Nisqually Watershed Plan Addendum suggest that if a 40-year-old forest is allowed to mature to become a 100-year-old forest, then the September low flow in the basin would increase by 9 cfs (from 2 cfs to 11 cfs; or 6,514 acre-feet) over the 60-year period for a 53,760-acre basin. The annualized streamflow benefit for this type of project (Tables 4.2 and 4.3 of the Plan Addendum)

	present a range from 0.13 to 0.15 ac-ft/year per acre benefit (Nisqually Watershed Planning Unit, 2019, Addendum to the Watershed Management Plan). As flow benefits compound after 40-years, it is difficult to determine the exact magnitude of streamflow benefit in Grays Harbor County as forest stand ages are unknown at this phase of the project. However, estimates of benefits for each sub-basin within WRIA 22 containing county-managed forestland is provided below, based on a range of 0.13 to 0.15 ac-ft/year streamflow benefit per acre of enhanced forest management. Using this metric, the following describes the potential quantities that could be mitigated based on enhanced management of 2% of the GHC forestland acreage within each sub-basin. • Humptulips: 7,586.9 acres of managed forest, 2% could mitigate up to 19.7 to 22.8 ac-ft/yr. • Hoquiam: 6,369.6 acres of managed forest, 2% could mitigate up to 16.6 to 19.1 ac-ft/yr. • Wishkah: 3,759 acres of managed forest, 2% could mitigate up to 9.8 to 11.3 ac-ft/yr. • Elk-Johns: 8,933.1 acres of managed forest, 2% could mitigate up to 23.2 to 26.8 ac-ft/yr • Wynoochee: 873.8 acres of managed forest, 2% could mitigate up to 2.3 to 2.6 ac-ft/yr In total, a change to the management of 2% of GHC's holding could result in a combined 72 to 83 ac-ft/year of increased streamflow contributions. Depending on actual forest stand age distribution, these numbers could over- or under-predict actual benefits to streamflow. This is meant to serve as an order of magnitude estimate and could be refined with more data in a future study.
Project-Type Specific Information	This is a streamflow augmentation project, based on the supportable premise that forest management can result in increased flows to surface water bodies. Further assessment would need to be done to identify the specific reaches.
Estimated Project Cost:	TBD but could be grant funded and would involve an assessment of GHC's holdings for suitability coupled with use of the USGS VELMA model to confirm a range of flow benefits.
Performance Goals & Measures:	• Change in Water Flow • Miles of stream with increased flows

Anticipated Local and Partner Support & Barriers to Completion:	Grays Harbor County owns and manages this property.
Project Sponsor, Implementation Start Date and End Date:	Grays Harbor County. Feasibility study can begin by 7/1/2021 or as soon as funding is obtained. Project complete by 1/1/2038 - end of planning horizon.

References

Hall, J., Kane, J., Swedeen, P., Blair, G., Webster, M., Hodgson, S., Ellings, C., Benson, L., Stonington, D., McKane, R., Barnhart, B., Brookes, A., Halama, J., Pettus, P., and Djang, K. (May 2018). Nisqually Community Forest VELMA modeling to evaluate effects of forest management scenarios on streamflow and salmon habitat.

Nisqually Watershed Planning Unit (2019). Nisqually Watershed Response to the 2018 Streamflow Restoration Act (RCW 90.94): Addendum to the Nisqually Watershed Management Plan. Olympia, WA.

Smith, Carol and Wanger, Mark. May 2001. Chehalis Basin and Nearby Drainages, Water Resource Inventory Areas 22 and 23. Washington State Conservation Commission.

Washington Department of Ecology. May 2011. Humptulips River Temperature Monitoring 2010. Publication No. 11-10-045.

Washington Department of Fish and Wildlife. 2002. Salmonid Stock Inventory (SaSI).

Washington Department of Fish and Wildlife. June 2000. Salmonid Stock Inventory, Coastal Cutthroat Trout.

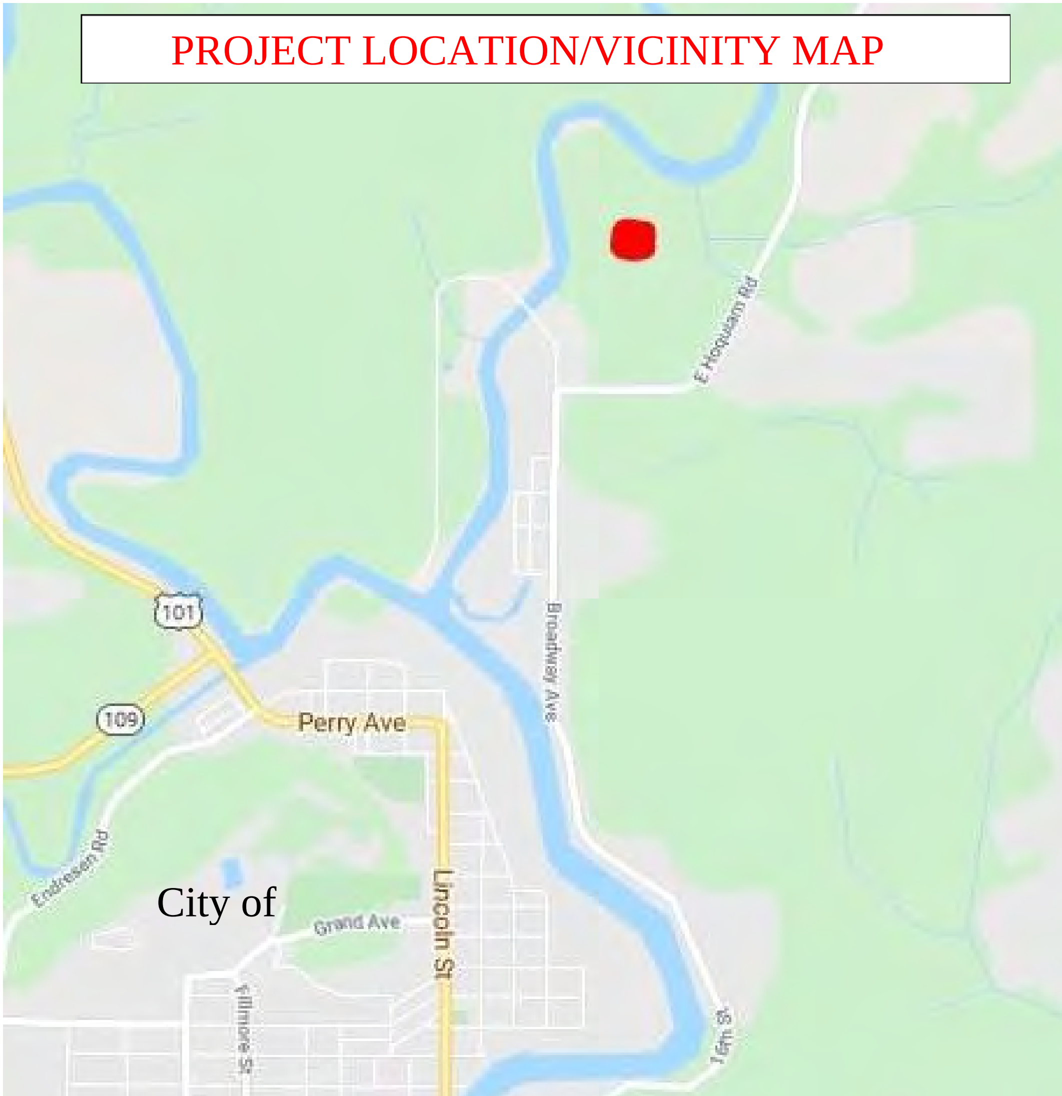
Washington Department of Fish and Wildlife. October 2004. Salmonid Stock Inventory, Bull Trout/Dolly Varden.

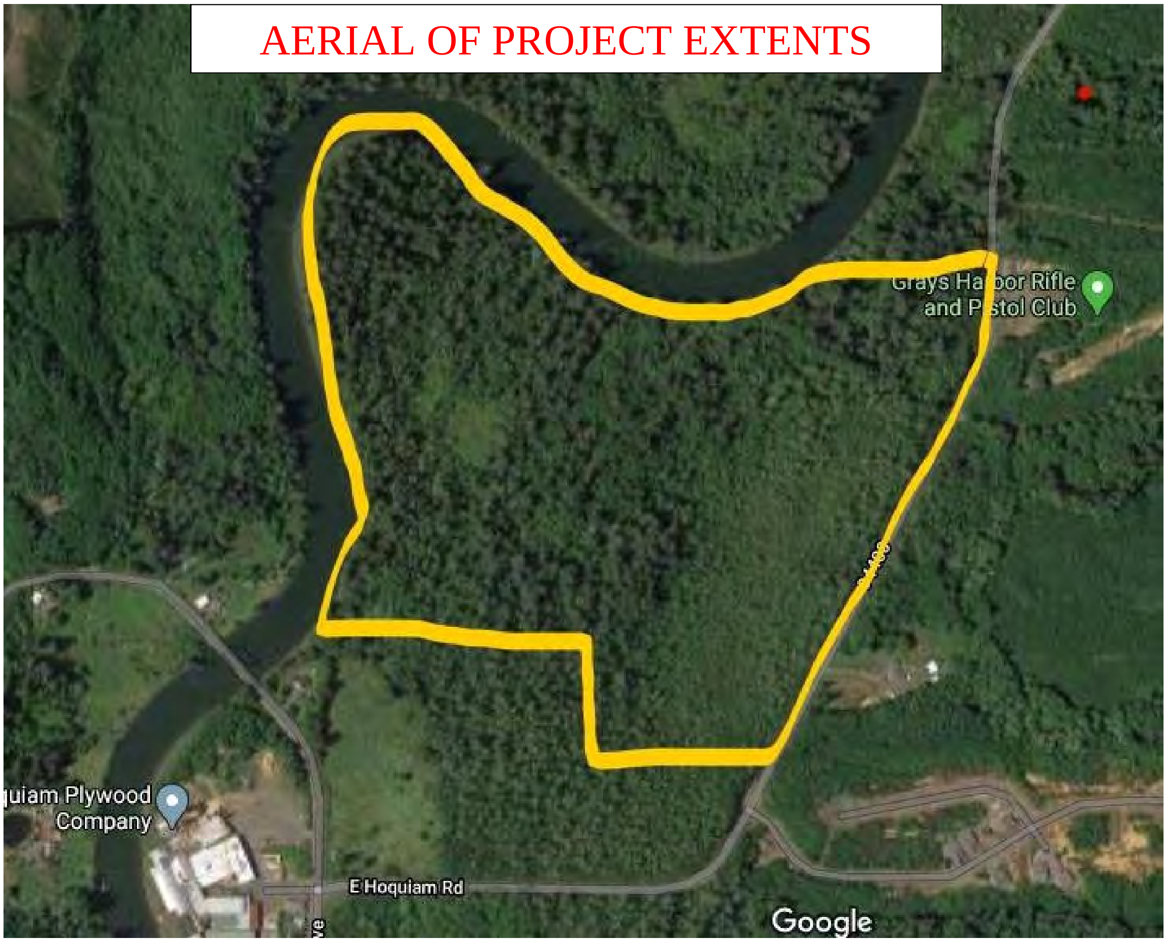
Washington State Department of Fisheries. 1975. A catalog of Washington streams and salmon utilization, 4 vols. http://docs.streamnetlibrary.org/Washington/DFW/StreamCatalog/22-23-WRIA.pdf

PROJECT INFORMATION SHEET

Project Name:	**Granberg Acquisitions**
Project ID:	**HQ-04**
Project Location:	East Hoquiam River West of East Hoquiam Road Lat/long: 47.072, -123.822
Project Description:	The purpose of this project is to protect streamflow in the East Hoquiam River through the acquisition 78+ acres of land containing 15.7 acres of wetlands, 53 acres of second growth forest, and 0.75 mile of shoreline on the East Hoquiam River north of the City of Hoquiam. The project will address habitat and water quality concerns. The project will also protect high quality surge plain and riparian habitats critical to rearing depressed salmon stocks of Hoquiam Fall Chinook and Hoquiam Winter Steelhead, as well as Coho, Chum and Coastal Cutthroat. The project is adjacent to 660 acres of land protected by CRBLT through previous SRFB funded acquisition projects. The location is in the lower watershed within the tidally-influenced reach is part of the Hoquiam Surge-Plain. This project will improve conditions for salmon by implementing actions identified as Tier 1 Concerns for the Hoquiam River in *The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23*. Fee simple purchase of riparian areas is recommended by the Basin Strategy to address the Water Quality and Riparian Tier 1 Concerns identified in the Strategy. <u>Water Quality Concerns</u>. The Basin Strategy identifies that the Hoquiam River contains Class B waters due to industrial and urban development, and that the river is a significant contributor to fecal coliform in Grays Harbor. Protection of this parcel will preclude further degradation of water quality due to residential or commercial development of the site. Protecting riparian vegetation on the site will protect against increased summer water temperatures in the streams on the site.
Project Type:	☐Water Right Acquisition ☐Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The East and West Hoquiam rivers are home to several salmon species and this project will address Tier 1 concerns of water quality, fish passage, and riparian health. In this area the wetlands, sloughs, and riparian areas

	are used for juvenile refuge and habitat. Many other species both aquatic and terrestrial use this area.
Is Water Quantity a Limiting Factor In this Subbasin?:	No. However, the CBP data on the Hoquiam shows a Tier 1 rating for water quality, riparian habitat, and fish passage. The riparian zone appears very good along the river, and the stream is known to have fish.
Location & Spatial Extent of Benefits:	On the project site. East Hoquiam River
Anticipated Water Offset (if applicable)	N/A
Project-Type Specific Information	This project will result in fee simple ownership and perpetual protection/conservation of the habitat including riverbank, wetlands, and healthy riparian vegetation. The project is adjacent to 660 acres of land protected by CRBLT through previous SRFB funded acquisition projects. The location is in the lower watershed within the tidally-influenced reach is part of the Hoquiam surge plain.
Estimated Project Cost:	$132,000
Performance Goals & Measures:	Biological processes, water quality, and floodplain connectivity/function. Benefitting species include Chinook, Chum, Coho, Cutthroat, and Steelhead.
Anticipated Local and Partner Support & Barriers to Completion:	The owner is a willing seller, while we expect support from the Wild Fish Conservancy, Coast Salmon Partnership, City of Hoquiam, and Ducks Unlimited. The largest barrier will be ranking high enough for grant funding. Perpetual stewardship funding is also required.
Project Sponsor, Implementation Start Date and End Date:	Chehalis River Basin Land Trust Start: Winter 2022 End: Summer 2022


PROJECT LOCATION/VICINITY MAP
E Hoquiam Rd
Broadway Ave
101
109
Perry Ave
Endresen Rd
City of
Grand Ave
Lincoln St
Fillmore St
16th St

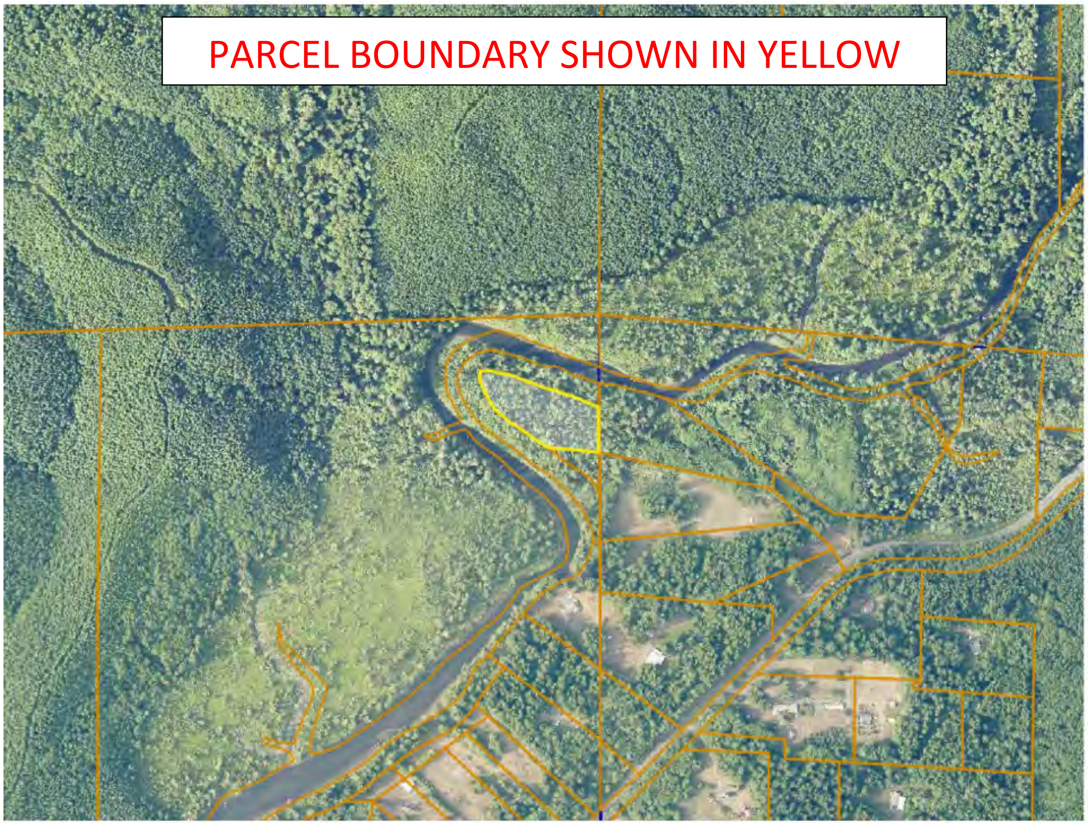

AERIAL OF PROJECT EXTENTS
Grays Harbor Rifle and Pistol Club
uiam Plywood Company
E Hoquiam Rd
Google

PROJECT INFORMATION SHEET

Project Name:	**Griswold Acquisition**
Project ID:	**HQ-05**
Project Location:	This project is located in the Hoquiam subbasin several miles north of Hoquiam. Lies about ¼ mile west of East Hoquiam Rd. Lat/long: 47.051633, -123.862169
Project Description:	This project will purchase about three acres of wetland with some scattered second growth spruce. The parcel lies on a peninsula surrounded by the East Hoquiam River and Chehalis River Basin Land Trust (CRBLT) property (with the exception of the east boundary). This parcel lies adjacent to parcels owned by the CRBLT on both sides of the river at this location and would fill a void in this block of parcels further enhancing the preservation and protection of this section of the East Hoquiam River.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The Land Trust owns several other parcels in this area and has had encroachment problems including building of unauthorized docks on our parcel. Acquiring this parcel should reduce similar problems. The Griswold parcel covers the rest of the parcel. The East Hoquiam river is excellent habitat for Coho, Fall Chinook, Fall Chum and Winter Steelhead; acquisition of this parcel will help protect tidal habitat. Protecting habitat through land acquisition is identified in chapter 4 of the *Washington Department of Fish and Wildlife's Stream Habitat Restoration Guidelines* as the most cost-effective approach to conserving the integrity of biological communities.
Is Water Quantity a Limiting Factor In this Subbasin?:	No The goal of this project is to prevent loss of riparian habitat and degradation of water quality due to development. Protecting riparian habitat and water quality are Tier 1 Concerns for the Hoquiam River identified in the *Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23*.
Location & Spatial Extent of Benefits:	This three-acre parcel is located approximately 3.5 miles from the junction with the Hoquiam river. The wetlands of the parcel contribute to approximately 0.4 miles of riverbank.

Anticipated Water Offset (if applicable):	N/A
Project-Type Specific Information	The Chehalis River Basin Land Trust is seeking to purchase a small parcel that is surrounded by lands previously acquired with SRFB funding. The project is located on the East Hoquiam River approximately 3.5 miles north of the City of Hoquiam, and a quarter mile west of the East Hoquiam Road. The location is in the lower watershed within the tidally-influenced reach that is part of the Hoquiam surge plain. The overall goal is to preserve salmon habitat in the river through maintaining water quality, biological diversity, healthy riparian and floodplain conditions and to increase protected lands in the Hoquiam Surge-Plain. The priority species to protect by this acquisition include Chinook, Chum, Coho, and Steelhead. This project will increase the permanently protected surge plain lands of the Hoquiam River. This acquisition will increase the ecological value of the other protected surge plain lands. Surge plains, with their great diversity and daily tidal bathing, are vital rearing habitat for salmon. This reach of the river is in very good condition, with a mix of mature and young forest, conifers and deciduous trees extending to the shoreline and providing shade for the river. Chinook breed in the river mainstem and juveniles spend some time nearby before heading downstream to the Grays Harbor estuary. In fact, the 2011 – 2014 Grays Harbor Nearshore Juvenile Fish Use Assessment found that the tidally-influenced reaches of the Hoquiam River had the highest densities of young-of-the-year (YOY) juvenile Coho and significant use by YOY Chinook. Surge plains will be of great value in the future also as the Chehalis Basin experiences sea level rise; they will provide replacement habitat for organisms displaced by inundation of shallow-water habitat in and around Grays Harbor. Also, protecting large reaches of the Hoquiam River helps to protect Grays Harbor from excessive sedimentation, high water temperatures and flooding.
Estimated Project Cost:	The estimated purchase price is $20,000 (Grays Harbor assessed value) as well as $2,000 for stewardship in the future.
Performance Goals & Measures:	Upland Acres Protected, Riparian Acres Protected, Miles of Streambank Protected By Land or Easement Acquisition
Anticipated Local and Partner Support & Barriers to Completion:	Partners may include neighboring property owners, GH Audubon Society, and the Quinault Indian Nation. Barriers: lack of capacity or grant application not strong enough to qualify.

Project Sponsor, Implementation Start Date and End Date:	Chehalis River Basin Land Trust Start: Winter 2021 End: July 2021


PARCEL BOUNDARY SHOWN IN YELLOW

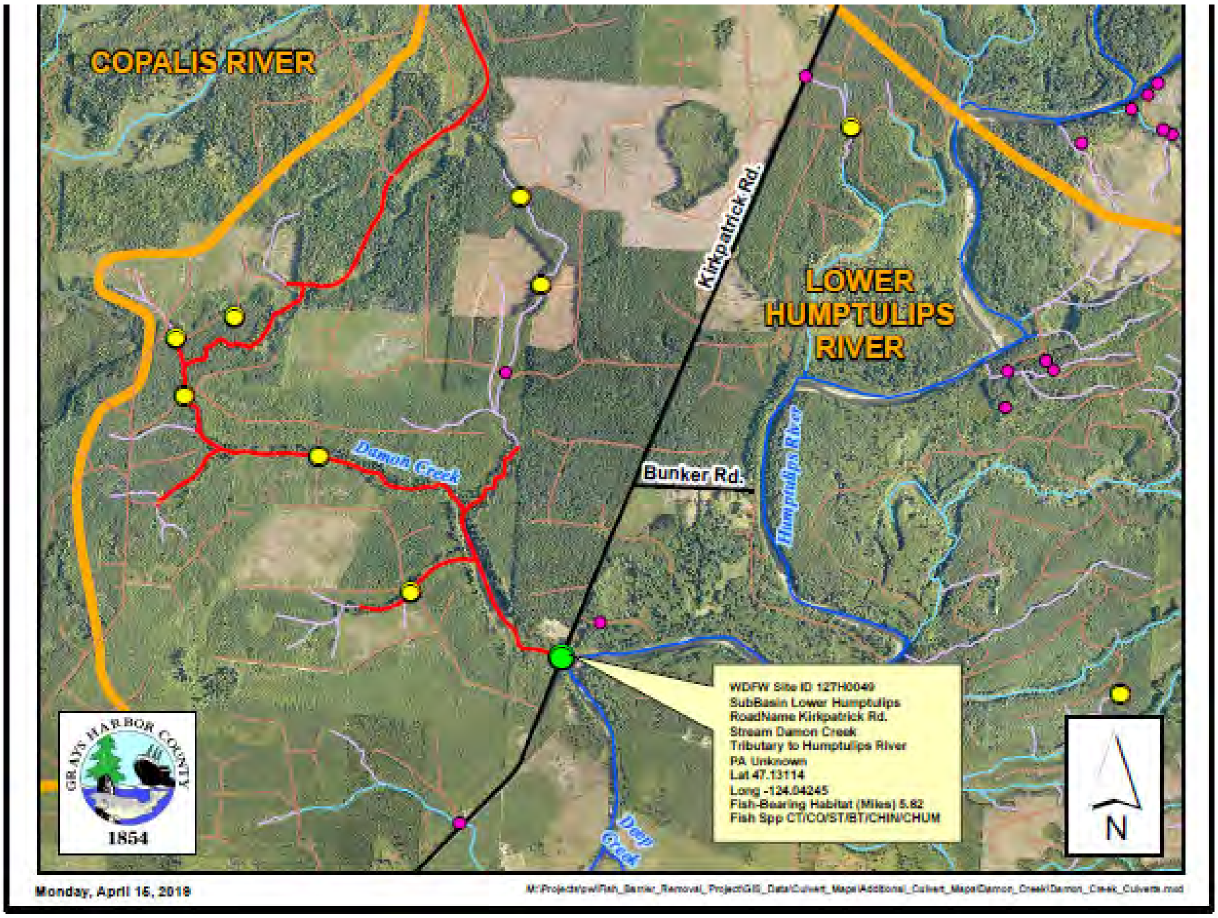
PROJECT INFORMATION SHEET

Project Name:	**Kirkpatrick Road Fish Barrier Correction**
Project ID:	**HT-00**
Project Location:	North of Aberdeen in the Humptulips Subbasin, on county-owned Kirkpatrick Road at road mile 2.05 where it crosses the mouth of Damon Creek. Damon Creek meets the Humptulips River at river mile 10.3. Lat/long: 47.13119125; -124.04243318
Project Description:	This project is to design and permit a complete a fish barrier culvert correction design at the mouth of Damon Creek with construction of a bridge measuring 109 ft. long and 30 ft. wide. The existing barrier consists of a squash corrugated steel culvert, 7 feet wide, 5 feet high and 100 feet long. It is undersized for the 25 feet wide channel and creates a 33% passable fish barrier due to shallow water depth in the culvert according to an evaluation completed by WDFW in 2018.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The problem is an undersized culvert that acts as a 33% passable fish barrier under Kirkpatrick Road at road mile 2.05 at the mouth of Damon Creek on the Humptulips River at river mile 10.3. The degraded watershed processes this project addresses is fish migration access to upstream spawning and rearing habitat and floodplain connectivity. The solution is to remove the barrier and replace it with a structure that is passable to all species and life stages of salmonids and other aquatic species in Damon Creek to benefit coho, steelhead and cutthroat trout spawning and rearing, as well as Chinook rearing, chum spawning, and Bull trout rearing.
Is Water Quantity a Limiting Factor In this Subbasin?:	Damon Creek is part of the Humptulips Subbasin, which is ranked as a Tier 3 for water quantity.
Location & Spatial Extent of Benefits:	Damon Creek is a low gradient stream which flows through commercial forestland. Riparian vegetation is generally healthy as buffers are maintained in compliance with Forests and Fish regulations. Damon Lake is located at stream mile 0.15; it is approximately 2,600 feet long and 150 feet wide and would provide excellent salmonid rearing habitat. Upstream from the lake and on the south tributary to the lake, the stream corridor consists of gravel substrate interspersed with low-

<table>
<tr><td></td><td>gradient rearing habitat. The project would benefit coho salmon and rainbow trout, which are noted as utilizing Damon Creek on the PHS website.</td></tr>
<tr><td>Anticipated Water Offset (if applicable):</td><td>N/A</td></tr>
<tr><td>Project-Type Specific Information</td><td>Fish Passage.

Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)?
No
To what extent is the existing structure a barrier (33%, 67%, 100%)?
33%.
What species and fish life stages are affected?
coho, steelhead and cutthroat trout: all life stages.
What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains?
Unknown.
What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score/ Tier concern in new Chehalis Basin Lead Entity barrier prioritization tool)?
This project is included in the Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23, Grays Harbor County Lead Entity Habitat Work Group, 2011. Listed as a Tier 1, fish passage, also in top third on ranked list (top 4%). Floodplain restriction is a Tier 2 limiting factor in the Humptulips Subbasin.
Are there upstream or downstream barriers that still have to be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur?
Previously, six upstream barriers on forestland were corrected on Damon Creek. One barrier is present 5.31 miles upstream (timeframe unknown).
</td></tr>
<tr><td>Estimated Project Cost:</td><td>$79,000 (Design and Permitting – Fully Funded) Construction cost TBD</td></tr>
<tr><td>Performance Goals & Measures:</td><td>1 culvert removed
1 bridge constructed</td></tr>
<tr><td>Anticipated Local and Partner Support & Barriers to Completion:</td><td>Chehalis Basin Fisheries Task Force. This project was supported by the Chehalis Basin Lead Entity’s Habitat Work Group.</td></tr>
</table>

Project Sponsor, Implementation Start Date and End Date:	Chehalis Basin Fisheries Task Force in affiliation with 2019 Salmon Recovery Funding Board. Start: February 7, 2020 End: September 12. 2021



PROJECT INFORMATION SHEET

Project Name:	**Grays Harbor County Forest Practices and Flow Assessment**
Project ID:	**EJ-01, HQ-03, HT-01, W-00, WY-01**
Project Location:	Grays Harbor County.
Project Description:	The Grays Harbor County Forestry Department manages approximately 36,000 acres of land. These holding are distributed across the county with significant blocks of acreage in the Humptulips, Hoquiam, Wishkah, and Elk-Johns subbasins, and a smaller holding in the Wynoochee subbasin. The County proposes to evaluate these tracts and determine if changes to forest management can be used to increase flow contributions in the targeted subbasins. This project will quantify the potential streamflow benefits from forest management practice opportunities throughout the County's holdings. The effort will include: • Review of existing GHC forest management plans for potential opportunities, by assessing existing harvest cycles and harvest/planting plans to establish baseline conditions. • GIS analyses to map key subbasin, tributary, soils, and hydrogeologic features. • Identification of up to approximately 550 acres for enhanced management practices (approximately 2% of the County's managed lands). • VELMA modeling to quantify streamflow benefits from proposed changes in forestry practices.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	For all five subbasins, the goal is to improve instream flows and enhance the natural complexity of instream habitat. Grays Harbor County manages approximately 36,000 acres of forestland, a portion of which is located within WRIAs 22 and 23. Intentional management of this land may have significant favorable effects on the water budget of the Humptulips, Hoquiam, Wishkah, Elk-Johns, and Wynoochee drainages. The Visualizing Ecosystem Land Management Assessments (VELMA) ecohydrological model is a predictive tool created to assess potential

	improvements in water quality and flow to streams, rivers, and estuaries via changes in land management (EPA, 2018). This model couples hydrological and biogeochemical processes at plot- to entire watershed-scales to dynamically predict the impacts on streamflow from forestland management. VELMA modeling of changes in forest practices has successfully demonstrated that increasing harvest cycle duration, or withholding stands from harvest, provides net benefits to streamflow when compared to stand rotations less than 40 years. Forty years has been identified as a critical threshold for forest stand age, in which anything younger is faster growing with higher groundwater uptake, and negatively impacts stream flows while uptake declines as stands mature beyond 40 years, providing increasing benefit to streamflow with stand age (Hall et al., 2018). Proposed changes will be evaluated using a VELMA analysis to quantify improvements to instream flows. Assuming similar results to the VELMA modeling completed for the Nisqually Plan Addendum of 0.13 to 0.15 ac-ft/yr benefit per acre of improved management, 550 acres would result in approximately 72 to 83 ac-ft/year benefit to the watershed.
Is Water Quantity a Limiting Factor In this Subbasin?:	Humptulips – Tier 3 with low summer flows in the mainstem constitutes a major problem. Low flows are also noted in the major tributaries including Big Creek. Hoquiam– Tier 3 Wishkah– Tier 3 Wynoochee – Tier 3 flows dip below established base flows in the summer months Elk-Johns – Tier 3
Location & Spatial Extent of Benefits:	Numerous sites located across Grays Harbor County
Anticipated Water Offset (if applicable):	Water offset for the Humptulips subbasin is estimated at 20 acre-feet per year, as described below. Water offset results presented in the Nisqually Watershed Plan Addendum suggest that if a 40-year-old forest is allowed to mature to become a 100-year-old forest, then the September low flow in the basin would increase by 9 cfs (from 2 cfs to 11 cfs; or 6,514 acre-feet) over the 60-year period for a 53,760-acre basin. The annualized streamflow benefit for this type of project (Tables 4.2 and 4.3 of the Plan Addendum)

	present a range from 0.13 to 0.15 ac-ft/year per acre benefit (Nisqually Watershed Planning Unit, 2019, Addendum to the Watershed Management Plan). As flow benefits compound after 40-years, it is difficult to determine the exact magnitude of streamflow benefit in Grays Harbor County as forest stand ages are unknown at this phase of the project. However, estimates of benefits for each sub-basin within WRIA 22 containing county-managed forestland is provided below, based on a range of 0.13 to 0.15 ac-ft/year streamflow benefit per acre of enhanced forest management. Using this metric, the following describes the potential quantities that could be mitigated based on enhanced management of 2% of the GHC forestland acreage within each sub-basin. • Humptulips: 7,586.9 acres of managed forest, 2% could mitigate up to 19.7 to 22.8 ac-ft/yr. • Hoquiam: 6,369.6 acres of managed forest, 2% could mitigate up to 16.6 to 19.1 ac-ft/yr. • Wishkah: 3,759 acres of managed forest, 2% could mitigate up to 9.8 to 11.3 ac-ft/yr. • Elk-Johns: 8,933.1 acres of managed forest, 2% could mitigate up to 23.2 to 26.8 ac-ft/yr • Wynoochee: 873.8 acres of managed forest, 2% could mitigate up to 2.3 to 2.6 ac-ft/yr In total, a change to the management of 2% of GHC's holding could result in a combined 72 to 83 ac-ft/year of increased streamflow contributions. Depending on actual forest stand age distribution, these numbers could over- or under-predict actual benefits to streamflow. This is meant to serve as an order of magnitude estimate and could be refined with more data in a future study.
Project-Type Specific Information	This is a streamflow augmentation project, based on the supportable premise that forest management can result in increased flows to surface water bodies. Further assessment would need to be done to identify the specific reaches.
Estimated Project Cost:	TBD but could be grant funded and would involve an assessment of GHC's holdings for suitability coupled with use of the USGS VELMA model to confirm a range of flow benefits.
Performance Goals & Measures:	• Change in Water Flow • Miles of stream with increased flows

Anticipated Local and Partner Support & Barriers to Completion:	Grays Harbor County owns and manages this property.
Project Sponsor, Implementation Start Date and End Date:	Grays Harbor County. Feasibility study can begin by 7/1/2021 or as soon as funding is obtained. Project complete by 1/1/2038 - end of planning horizon.

References

Hall, J., Kane, J., Swedeen, P., Blair, G., Webster, M., Hodgson, S., Ellings, C., Benson, L., Stonington, D., McKane, R., Barnhart, B., Brookes, A., Halama, J., Pettus, P., and Djang, K. (May 2018). Nisqually Community Forest VELMA modeling to evaluate effects of forest management scenarios on streamflow and salmon habitat.

Nisqually Watershed Planning Unit (2019). Nisqually Watershed Response to the 2018 Streamflow Restoration Act (RCW 90.94): Addendum to the Nisqually Watershed Management Plan. Olympia, WA.

Smith, Carol and Wanger, Mark. May 2001. Chehalis Basin and Nearby Drainages, Water Resource Inventory Areas 22 and 23. Washington State Conservation Commission.

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Washington Department of Fish and Wildlife. 2002. Salmonid Stock Inventory (SaSI).

Washington Department of Fish and Wildlife. June 2000. Salmonid Stock Inventory, Coastal Cutthroat Trout.

Washington Department of Fish and Wildlife. October 2004. Salmonid Stock Inventory, Bull Trout/Dolly Varden.

Washington State Department of Fisheries. 1975. A catalog of Washington streams and salmon utilization, 4 vols. http://docs.streamnetlibrary.org/Washington/DFW/StreamCatalog/22-23-WRIA.pdf

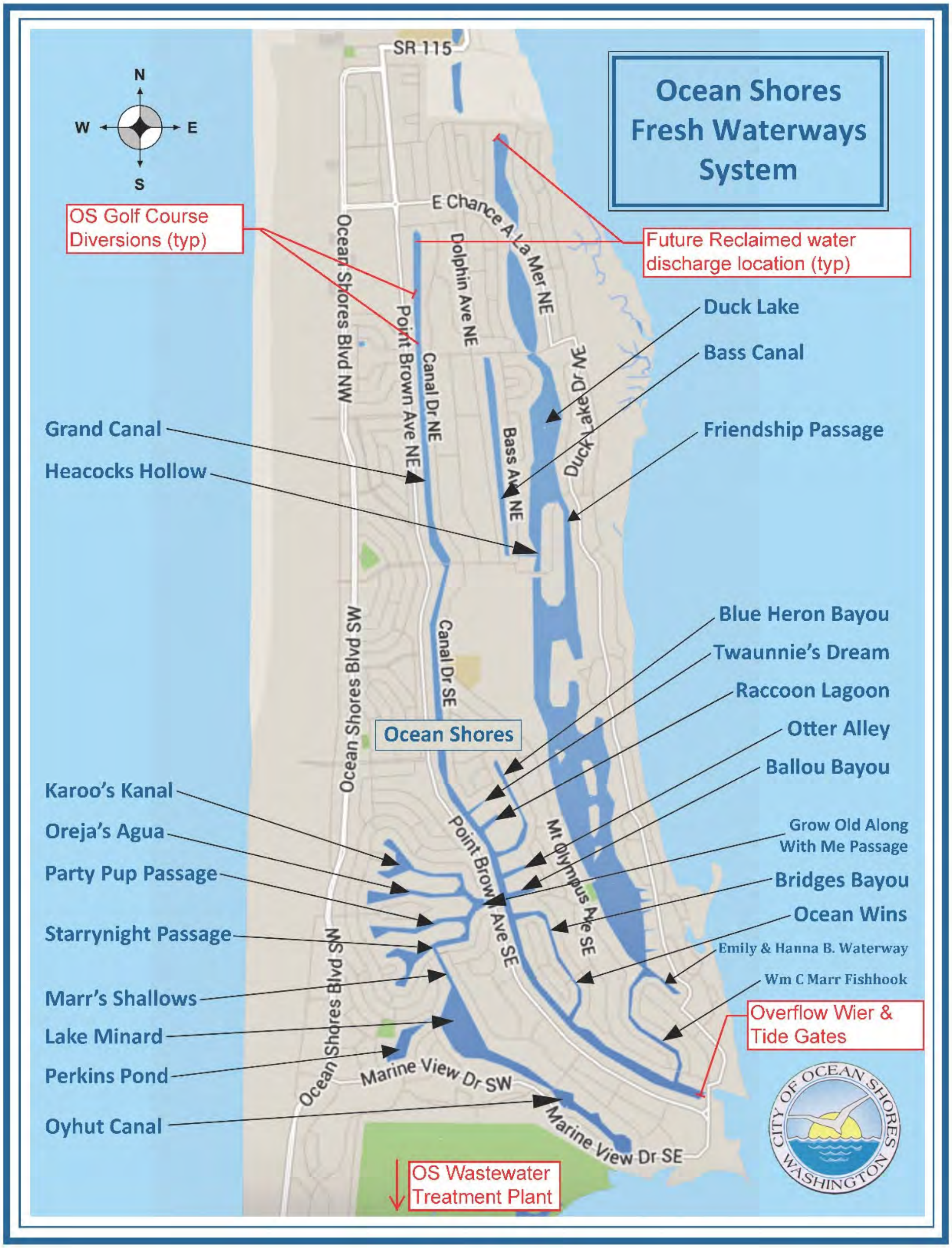
PROJECT INFORMATION SHEET

Project Name:	**Ocean Shores Wastewater Reclamation and Reuse**
Project ID:	**HT-02**
Project Location:	Reclaimed water would be discharged at multiple points in the Ocean Shores freshwater system. The city is located in the Humptulips planning subbasin. Lat/long: 47.0, -124.15
Project Description:	The City of Ocean Shores utilizes groundwater for potable water use. After the potable water is used, the waste product is collected and delivered to the Ocean Shores Wastewater Treatment Plant. After the liquid stream is processed, it is discharged to the mouth of Grays Harbor and ultimately to the Pacific Ocean. As a result, we are discharging freshwater to saltwater. The City intends to work towards reuse of the freshwater for irrigation purposes and discharge to the influent of the freshwater systems at the north end of the City.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	The Ocean Shores Wastewater Treatment Plant discharges over 200 Million Gallons of water per year (roughly 635 AF/yr). Water offset activities such as introduction into the freshwater system or in lieu of surface water diversions for irrigation use will not occur year-round. During the low flow season (April/May – September/October) the water level is below the overflow weir, resulting in stagnant water throughout the system. Discharge of reclaimed water to the head end of the waterways will raise the water level system wide and provide a much better opportunity for continuation of flow through the low flow months. Implementation of the project is anticipated to result in a more sustainable water cycle. Almost anything can improve upon the current practice of use and discharge. Volume expectations are on the high side as our production/demand numbers are traditionally much higher during the summer months than the winter months, which will translate to a higher benefit for the waterways.
Is Water Quantity a Limiting Factor In this Subbasin?:	No.
Location & Spatial Extent of Benefits:	100% of the Ocean Shores freshwater system will benefit from this activity.

Anticipated Water Offset (if applicable):	No water offset counted toward the Plan for this project, as water saved would not provide streamflow benefits, and projected consumptive use did not include new wells in Ocean Shores. For planning purposes, it can be assumed between 25% and 50% of the annual discharge total (200 million gallons/ roughly 635 acre-feet) can be reused, or approximately 160 – 320 AF/yr.

Project-Type Specific Information:	• Does the existing facility discharge treat wastewater into the Chehalis River?
	  o No, treated water is discharged to the mouth of Grays Harbor on outgoing tides.
	• Is the current reclaimed water already needed for other uses?
	  o N/A
	• What is the current capacity of the facility and is the facility meeting that capacity?
	  o The current capacity of the existing WWTP is 2.0 MGD. Current needs are well below capacity.
	• What purple pipe infrastructure already exists in relation to the proposed water user or infiltration facility?
	  o No purple pipe infrastructure is in place. The City retained an abandoned forcemain from the north end of the City to the WWTP. The majority of that trunk line is currently suitable for conveyance use along Pt. Brown Avenue from nearly Chance A La Mer to the Wastewater Treatment Plant.
	• If providing an alternative water source to replace an existing water right that would be acquired for the trust water rights program, what water right? What amount? And where is the streamflow benefit?
	  o N/A

Estimated Project Cost:	Cost to be determined.
Performance Goals & Measures:	Volume of plant effluent discharged to freshwater system
Anticipated Local and Partner Support & Barriers to Completion:	Members of the community that are aware of this idea completely support implementation. Capital and annual costs have not been developed and traditionally function as barriers in our community.
Project Sponsor, Implementation Start Date and End Date:	The City of Ocean Shores will be the sponsor. The City is ready to proceed with planning activities but does not yet have the resources available to initiate the action.


Ocean Shores Fresh Waterways System
N
W
E
S
SR 115
OS Golf Course Diversions (typ)
Future Reclaimed water discharge location (typ)
E Chance A La Mer NE
Ocean Shores Blvd NW
Point Brown Ave NE
Canal Dr NE
Dolphin Ave NE
Bass Ave NE
Duck Lake Dr NE
Duck Lake
Bass Canal
Friendship Passage
Grand Canal
Heacocks Hollow
Ocean Shores Blvd SW
Canal Dr SE
Ocean Shores
Blue Heron Bayou
Twaunnie's Dream
Raccoon Lagoon
Otter Alley
Ballou Bayou
Grow Old Along With Me Passage
Bridges Bayou
Ocean Wins
Emily & Hanna B. Waterway
Wm C Marr Fishhook
Overflow Wier & Tide Gates
Karoo's Kanal
Oreja's Agua
Party Pup Passage
Starrynight Passage
Marr's Shallows
Lake Minard
Perkins Pond
Oyhut Canal
Point Brown Ave SE
Mt Olympus Ave SE
Marine View Dr SW
Marine View Dr SE
OS Wastewater Treatment Plant
City of Ocean Shores Washington

PROJECT INFORMATION SHEET

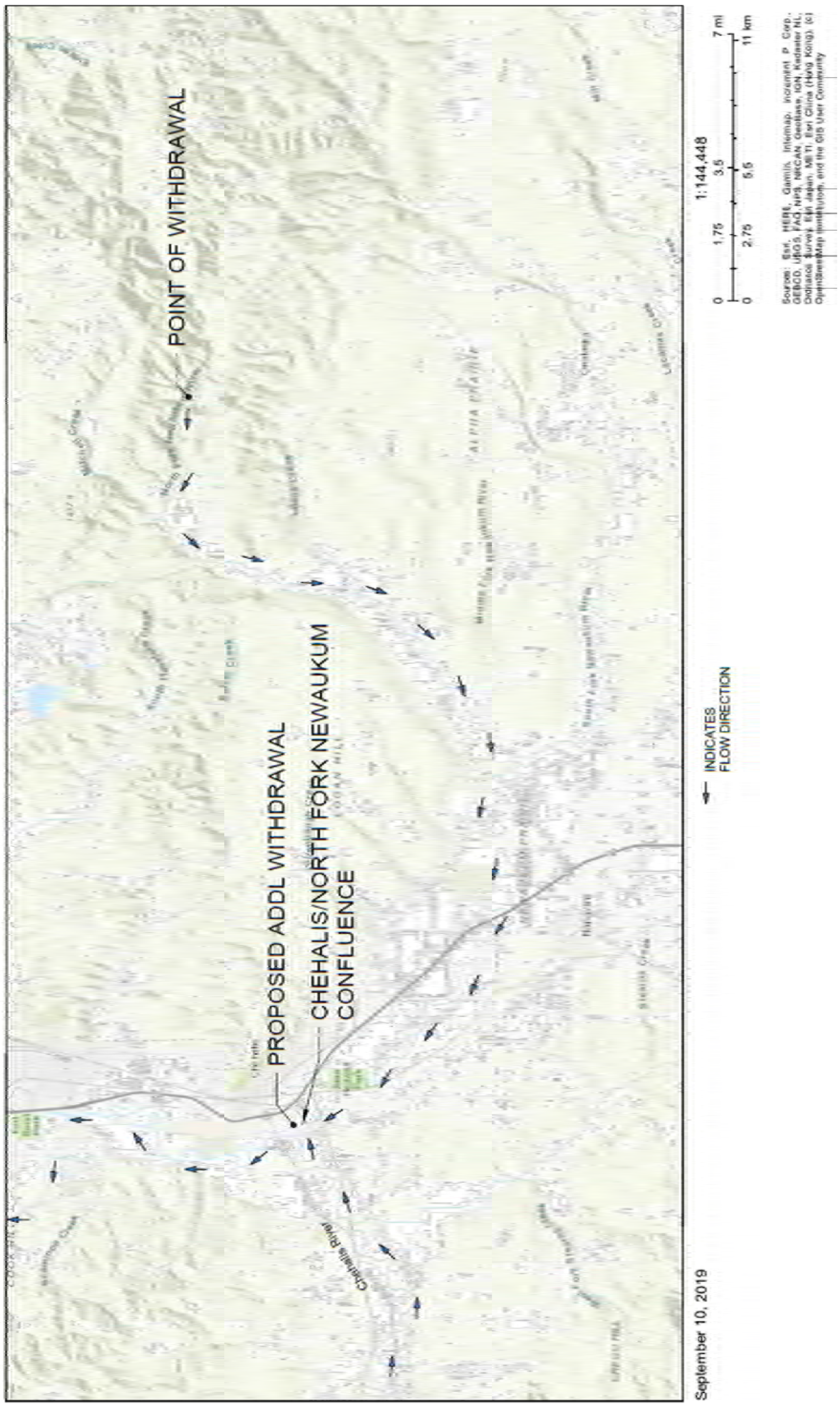
Project Name:	**City of Chehalis Alternate Water Supply Intake**
Project ID:	**N-00**
Project Location:	Chehalis, WA – Newaukum Subbasin City of Chehalis water supply diversion (SW ¼ of SE ¼ Section 20, T14N, R1E WM) Lat/long: 46.67845, -122.70550
Project Description:	Develop an alternate withdrawal location for the City of Chehalis's Newaukum River water right from the Newaukum River to downstream of confluence with the Chehalis River. The Newaukum River is the city's primary water source and currently provides 2/3 of water needs during the summer. Water is pumped 17.5 miles from the Newaukum River intake to the City's treatment plant. Ability to divert allocated water from the Newaukum is currently limited by the pipeline capacity. The City has a second water right and intake on the Chehalis River, approximately 1.5 miles from the treatment plant. The City is proposing to improve the pipeline from the Chehalis diversion to provide sufficient capacity to draw both the Chehalis and Newaukum water right allocations at the downstream Chehalis intake. This would leave more flow in the lower 17 miles of the Newuakum River.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Relocation of the Newaukum water withdrawal would leave an additional 1.5 cfs in the lower Newaukum River during critical summer low flows. Water quantity is a limiting factor on the Newaukum River. Additional flow would increase wetted habitat and likely reduce summer stream temperatures. Reducing pumping distance from the intake to the treatment plant would also reduce ancillary water losses along the raw water pipeline (likely to be small).
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes, Tier 1.
Location & Spatial Extent of Benefits:	Flow would be increased by as much as 1.5 cfs in the 18-mile reach between the City's two current intake points. This would add flow to the lower 17 miles of the Newaukum River to the proposed new withdrawal location downstream of the Chehalis River confluence.

Anticipated Water Offset (if applicable):	Accounting only for the summer flow increases, Newaukum flow volume would increase by approximately 280 acre-feet per year. Streamflow volume in the Newaukum River, which is water quantity limited, would increase by approximately 1.5 cfs per day during the summer, based on the City's estimate of pumping about a million gallons per day from the Newaukum intake, and unknown amounts during other times of the year. There would be no net change in water use in the system.

Project-Type Specific Information:	Water Right Source Switches
	• What water right would be changed?
	  o City of Chehalis's Newaukum River water right from Newaukum River to downstream of confluence with the Chehalis River
	• What would the original point of diversion and the new point of diversion/withdrawal be?
	  o Original = Newaukum; New = Chehalis River (where there is an existing point of diversion for the city)
	• What stream reach would likely benefit and what would the anticipated benefit to that reach be?
	  o Relocation of the water supply intake would leave an additional 1.5 cfs in the lower Newaukum River during critical summer low flows
	• Is this a groundwater right that's potentially in hydraulic continuity to any surface water (and subject to impairment issues)?
	  o No

Estimated Project Cost:	Estimated cost to replace the Chehalis River pipeline up to the water filtration plant is $10M. The old Chehalis pipeline would be abandoned. Annual operation and maintenance costs would be expected to decrease due to reduced pumping distances.
Performance Goals & Measures:	Change in Newaukum River flow, stream temperature, wetted habitat area (summer).
Anticipated Local and Partner Support & Barriers to Completion:	City of Chehalis is exploring options to improve supply efficiency and reliability.
Project Sponsor, Implementation Start Date and End Date:	City of Chehalis is the project sponsor and is currently seeking funding. Hoping to start by 2022.

North Fork Newaukum and Chehalis Confluence

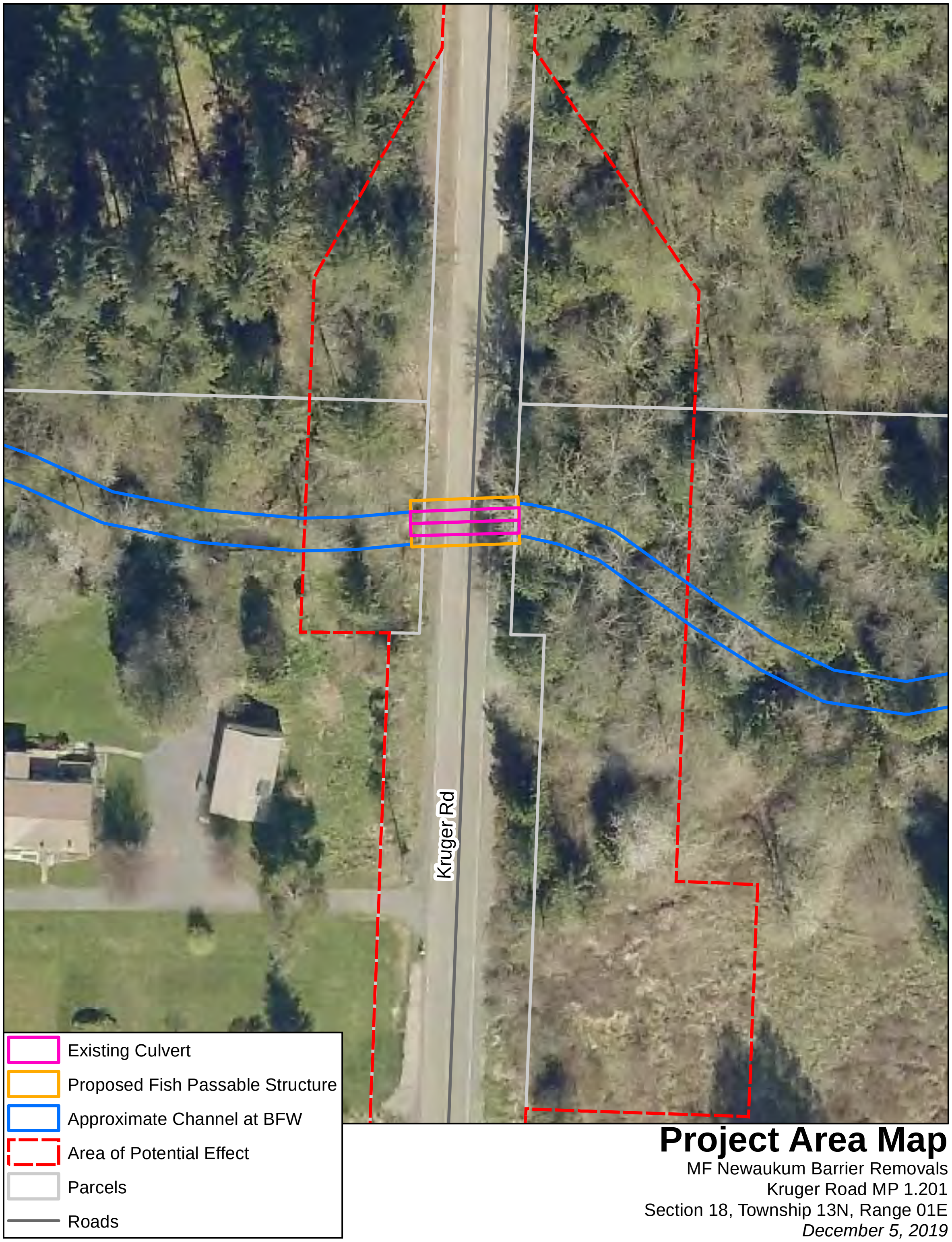


PROJECT INFORMATION SHEET

Project Name:	**MF Newaukum Trib-Kruger Fish Passage Construction**
Project ID:	**N-01**
Project Location:	Unnamed Trib to Middle Fork Newaukum River/Kruger Road MP 1.201 Lat/long: 46.610022, -122.729902
Project Description:	The project proposes to replace two existing 5-foot wide by 3.5-foot tall by 41-foot long fish passage barrier culverts with an approximate 6.40 m (21 ft) wide x 3.05 m (10 ft) tall split box culvert 13.11 m (43 ft) in length. Additional construction is anticipated to include the placement and removal of a temporary bypass road; a channel regrade; excavation of pools; placement of streambed within the culvert and channel regrade area; and placement of large woody debris (LWD). Replacement of this culvert is anticipated to restore immediate unimpeded access to 1.30 linear miles of potential habitat for the Southwest Washington DPS of Winter Steelhead and the Southwest Washington ESU of Coho as well as Searun Cutthroat trout and resident cutthroat trout. An additional 1.79 linear miles of potential habitat will be accessible to winter steelhead and 3 linear miles of potential habitat will be accessible Coho as well as cutthroat trout once upstream culverts are replaced with fish passable structures. The proposed project would improve fish passage, sedimentation, and water quality as well as provide access to areas with high quality riparian cover.
Project type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Fish passage and floodplain connectivity and function are limiting factors to be improved by this project. Coho, Cutthroat and Sockeye will benefit from increased access to quality upstream habitat.
Is Water Quantity a Limiting Factor In this Subbasin?	Yes, Water Quantity is a Tier 2 concern in the Middle Fork Newaukum.
Location & Spatial Extent of Benefits:	Tributary to Middle Fork Newaukum. Project extents are about 1000 feet up and downstream of Kruger Road.
Anticipated Water Offset (if applicable):	None.

Project-Type Specific Information:	Fish Barrier Removal
	• Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)?
	    • No
	• To what extent is the existing structure a barrier (33%, 67%, 100%)?
	    o 33
	• Is the barrier eligible for streamflow restoration funding?
	    o Yes.
	• What seasons and fish life stages are affected?
	    o Project will allow for fish passage of all life stages
	• What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains?
	    o Project will restore unimpeded access to 1.33 miles of potential habitat once downstream barriers have been removed. Once upstream barriers are removed total accessible habitat will be 1.79 linear miles of potential habitat will be accessible to Winter Steelhead and 3 linear miles to Coho as well as Cutthroat trout.
	• What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score)?
	    o Tier 2 using the new prioritization system
	• Are there upstream or downstream barriers that still have to be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur?
	    o Yes, this proposed project is downstream of other high priority barriers sponsored by Lewis County (PRISM # 17-1148), and Lewis Conservation District (PRISM # 18-1496 & 19-1280).

Estimated Project Cost:	$1,018,357 Design funding has been secured in the amount of $68,200 from FBRB WP #19-1559. Construction funds are being requested from ASRP in the amount of $203,671 and FBRB in the amount of $814,686.
Performance Goals & Measures:	Miles of Stream Made Accessible = 1.79
Anticipated Local and Partner Support & Barriers to Completion:	Culverts are within Lewis County Right of Way; adjacent landowners are Gabriel and Laura Stajduhar and Elizabeth Tanner. Signed landowner acknowledgement forms have been received from all property owners.
Project Sponsor, Implementation Start Date and End Date:	Lewis County Public Works. Start: June 2022 end: October 2023


Kruger Rd
Existing Culvert
Proposed Fish Passable Structure
Approximate Channel at BFW
Area of Potential Effect
Parcels
Roads
Project Area Map
MF Newaukum Barrier Removals
Kruger Road MP 1.201
Section 18, Township 13N, Range 01E
December 5, 2019

PROJECT INFORMATION SHEET

Project Name:	**Newaukum Lake Restoration & Enhancement Planning**
Project ID:	**N-02**
Project Location:	Newaukum subbasin Lat/long: 46.663563, -122.474786
Project Description:	Pond and wet meadow restoration via wood/other structure placement in outlet channels at Newaukum Lake/ponds. A planning grant is needed to develop this project technically and to build partner support.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	This project will generate measurable water storage in the southern headwater area of the South Fork Newaukum River through the placement of wood, BDAs, or other instream structures within the egress channels of Newaukum Lake proper and three adjacent (and connected ponds). This project intends to address water quantity/quality along with other biological habitat needs in the headwaters of the South Fork Newaukum River. Past research suggests that hydraulic retention may be increased by 50-100% following flow obstruction in small sand-bedded streams (Stofleth, Jr, & Fox, 2008), suggesting that these methods are viable to achieve the restoration goal of increased surface transient storage of water (hydraulic retention) in the South Fork Newaukum basin. Furthermore, water temperature might be decreased as hyporheic exchange is induced by structure placement (Hester, Doyle, & Poole, 2009), further addressing water temperature issues (current and projected) within the basin. Additionally, much interest has been placed in wet meadow restoration as a strategy to increase late-summer streamflow globally. However, work done by Nash et al. (2018) suggests that the opposite may be true, that late-summer streamflow might be decreased due to “likely substantial” losses to increased transpiration, lower hydraulic gradients, and less laterally drainable pore volume. These observations may make the restoration/enhancement of surface water storage areas (like Newaukum Lake) more desirable given the more easily quantified results. Resident Rainbow and Cutthroat trout might further benefit from restoration actions in these headwater habitats where they reside.

Is Water Quantity a Limiting Factor In this Subbasin?:	Yes
Location & Spatial Extent of Benefits:	South Fork Newaukum River, from headwaters on downstream.
Anticipated Water Offset (if applicable):	Water offset is expected but there is insufficient information at this time to quantify potential benefits. Measurements taken from aerial photos suggest that restoration of the outlet of pond #2 would increase its surface area from a currently estimated 3 acres to a historic maximum of about 4.4 acres.

Project-Type Specific Information:	Water Storage and Retiming Projects
	• How much water is likely to be stored?
	    o Increase surface storage over 1.4 acres. Volume unknown
	• Has the surface water source for the project been evaluated, and, if so, what is that source?
	    o Source is headwaters of South Fork Newaukum
	• During what period(s) can water be diverted?
	    o No constructed diversion. More storage after winter rainy season
	• Is there an instream flow? How often is the flow above the minimum instream flow? What is the proposed rate of diversion? What type of water rights would need to be acquired to provide water from that source?
	    o N/A
	• What stream reach likely would benefit from this project and what is the anticipated benefit to that reach? What fish species will benefit?
	    o Benefits resident trout in watershed headwaters. If downstream flow benefits are achieved, they will benefit South Fork Newaukum and all resident and anadromous species, notably, Spring Chinook.

Estimated Project Cost:	Conceptual Project
Performance Goals & Measures:	Change in Flow
Anticipated Local and Partner Support & Barriers to Completion:	Partnerships would need to be developed to start this project. Support would be needed by private timber companies for completing a project on their lands.

Project Sponsor, Implementation Start Date and End Date:	Conceptual

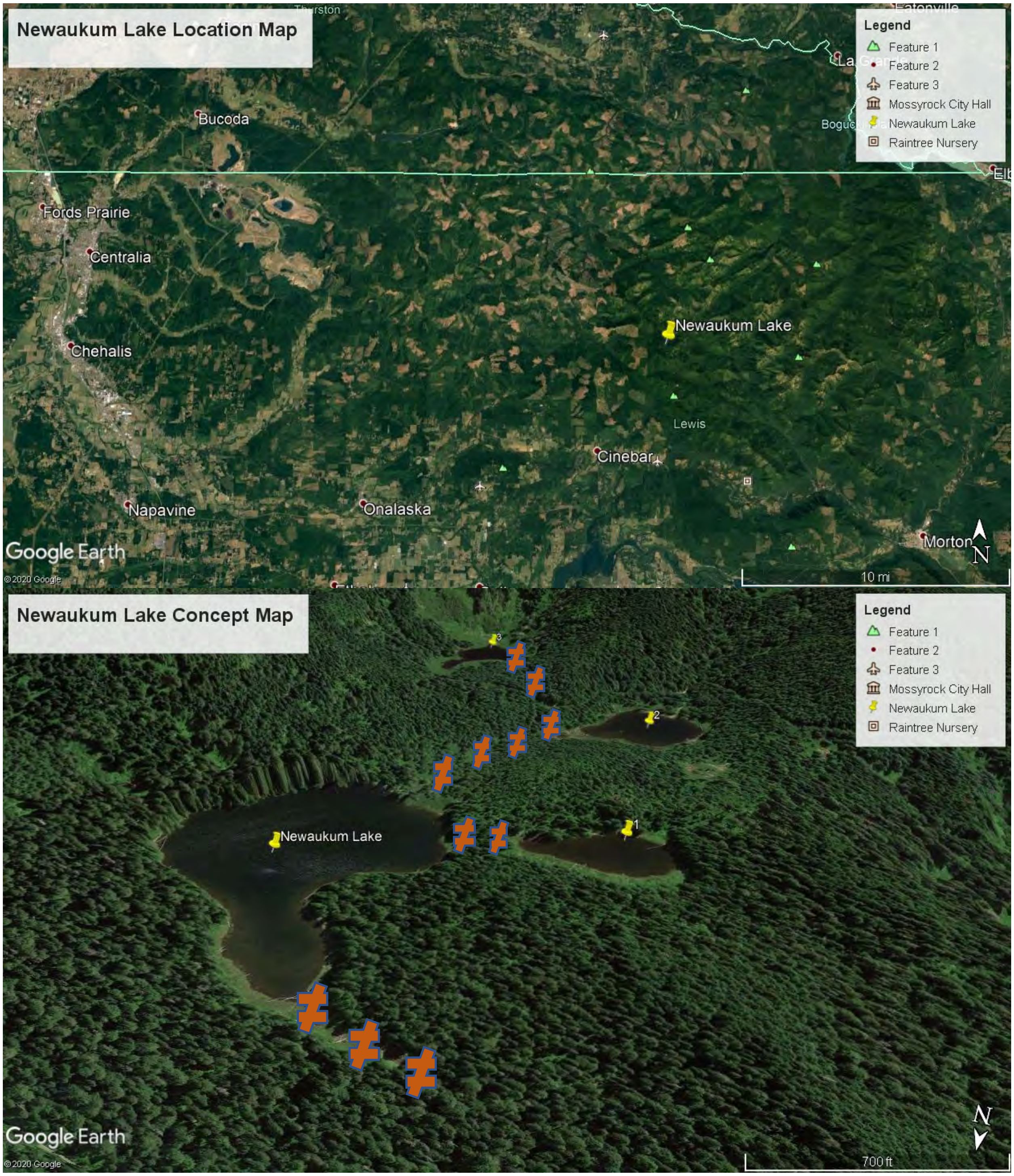


Figure i: Conceptual locations of wood/instream structure placement to enhance both surface and hyporheic transient storage of water and nutrients. Ponds (and their egress channels) #2 and #3 were logged to their banks during the 1980's.

Hester, E. T., Doyle, M. W., & Poole, G. C. (2009). *The influence of in-stream structures on summer water temperatures via induced hyporheic exchange*. *54*(1), 355–367.

Stofleth, J. M., Jr, F. D. S., & Fox, G. A. (2008). *Hyporheic and total transient storage in small , sand-bed streams*. *1894*(September 2007), 1885–1894. https://doi.org/10.1002/hyp

Nash, CS, Selker, JS, Grant, GE, Lewis, SL, Noël, P. A physical framework for evaluating net effects of wet meadow restoration on late-summer streamflow. *Ecohydrology*. 2018; 11:e1953. https://doi.org/10.1002/eco.1953

PROJECT INFORMATION SHEET

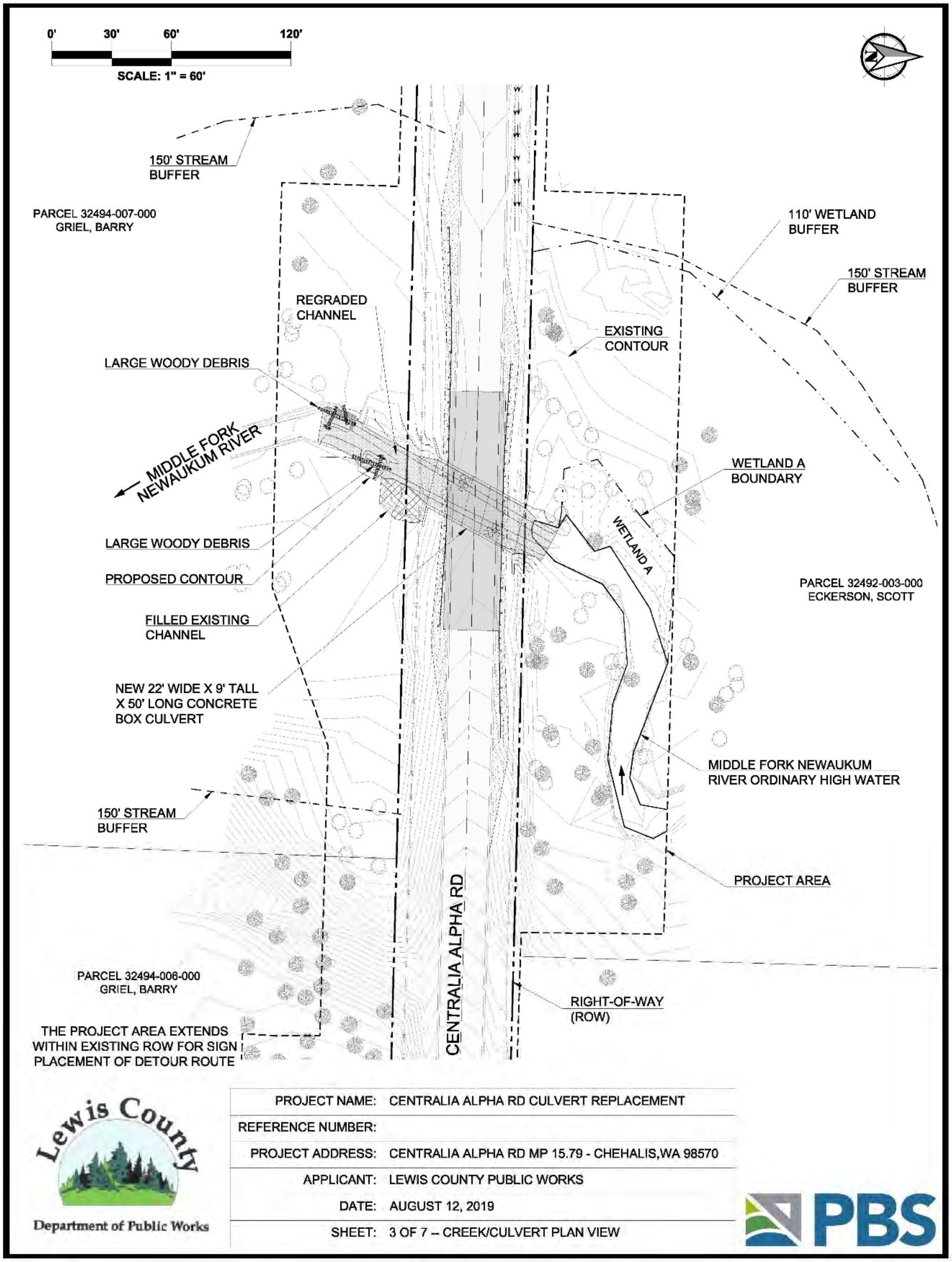
Project Name:	**MF Newaukum Centralia (C.) Alpha Fish Passage Construction**
Project ID:	**N-03**
Project Location:	Middle Fork Newaukum River/Centralia Alpha Road MP 15.79 Lat/long: 46.615526, -122.675614
Project Description:	The project proposes to replace the existing 7-foot wide by 5-foot tall by 57-foot long fish passage barrier culvert, Site ID 021(94001)(15790) with a fish-passable 22-foot wide by 9-foot tall by 50-foot long precast concrete box culvert. Additional construction will include the placement and removal of a temporary bypass road; the regrade of approximately 130 feet of channel; excavation of pools; placement of streambed within the culvert and channel regrade area; and placement of large woody debris (LWD). Replacement of this culvert is anticipated to restore immediate year round access to an additional 2.63 linear miles of potential habitat for the Southwest Washington DPS (distinct population segment) of winter steelhead and 3.5 linear miles of potential habitat for the Southwest Washington ESU (evolutionary significant unit) of Coho salmon as well as searun cutthroat and resident cutthroat trout The proposed project would improve fish passage, sedimentation, and water quality as well as provide access to areas with high quality riparian cover.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Instream habitat to be restored. Fish passage and floodplain connectivity and function will be restored to more natural condition. Coho, Cutthroat and Steelhead are species to benefit from this project. There are also infrastructure benefits. While the existing culvert is functioning, a new culvert will have a longer life expectancy than that which currently exists.
Is Water Quantity a Limiting Factor In this Subbasin?	Water Quantity is a Tier 2 concern in the Newaukum tributaries and Tier 1 in the lower mainstem.
Location & Spatial Extent of Benefits:	Benefits will be for coho and steelhead to access quality habitat up to 3.5 miles above the project site.

Anticipated Water Offset (if applicable):	None.

Project-Type Specific Information	Fish Barrier Removal
	• Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)?
	  o No
	• To what extent is the existing structure a barrier (33%, 67%, 100%)?
	  o 67
	• Is the barrier eligible for streamflow restoration funding?
	  o Yes.
	• What seasons and fish life stages are affected?
	  o Project will allow for fish passage of all life stages.
	• What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains?
	  o Replacement of the culvert will allow for a total accessible habitat of 2.63 linear miles of potential habitat for the Southwest Washington DPS (distinct population segment) of winter steelhead and 3.5 linear miles of potential habitat for the Southwest Washington ESU (evolutionary significant unit) of Coho salmon as well as searun cutthroat and resident cutthroat trout
	• What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score)?
	  o Tier 2
	• Are there upstream or downstream barriers that still have to be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur?
	  o Yes, this proposed project is downstream of other high priority barriers sponsored by Lewis County (PRISM # 17-1148), and Lewis Conservation District (PRISM # 18-1496 & 19-1280).

Estimated Project Cost:	$872,744. This project has not been funded.
Performance Goals & Measures:	Miles of Stream Made Accessible = 3.5
Anticipated Local and Partner Support & Barriers to Completion:	Culverts within Lewis County Right of Way; adjacent landowners are Scott Eckerson and Barry Griel. Signed landowner acknowledgement forms have been received from all property owners.

Project Sponsor, Implementation Start Date and End Date:	Ann Weckback, Lewis County Public Works (360) 740-1440. Start: June 2022 End: October 2023



PROJECT INFORMATION SHEET

Project Name:	**South Fork Newaukum Early Action Reach Restoration Project**
Project ID:	**N-04**
Project Location:	South Fork Newaukum River. – River Mile 10.9 to 13.0; Lat/long: 46.5964, -122.85
Project Description:	The South Fork Newaukum reach project will increase salmon and steelhead productivity by taking a series of actions along around three miles of the river. Restoration actions will include installing instream large wood structures, supporting banks, creating side channels, creating backwater alcoves, and planting trees on the stream bank. Removing bank armor and reconnecting floodplains are the primary mechanisms by which river processes may be re-established in the project reach, and the associated ecologic and flooding benefits realized. These actions will help protect existing high-quality habitat and add additional habitat complexity to support fish.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The South Fork Newaukum River supports anadromous runs of winter steelhead, fall Chinook salmon, spring Chinook salmon, and Coho Salmon. The primary controls on habitat suitability are the result of the low baseflows and high velocities associated with the simplified channel and floodplain typical of the study reach. Improvements in stream function, and habitat quality and quantity, will likely need to come from rehabilitation.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes, Tier 1
Location & Spatial Extent of Benefits:	South Fork Newaukum R. RM 10.9-13.0
Anticipated Water Offset (if applicable):	N/A
Project-Type Specific Information:	Floodplain and Channel Migration Zone Restoration • What is the floodplain or channel migration problem? o Bank armoring with riprap, channel simplification, agricultural land use, wood removal, and riparian area

	clearing have all impacted channel migration rates in the project area. • What is/are the proposed restoration action(s), and how will the action(s) address the floodplain or channel migration problem? o Restoration actions include large wood structures, bank treatments (S. Fork Newaukum R. EAR only), floodplain reconnection, riprap removal, off channel habitat creation (side channels and alcoves), and riparian and upland vegetation management (planting natives, removing invasive species). In several areas, riprap will be replaced with large wood and riparian plantings to restore more natural bank conditions. • Will the project increase floodplain inundation? o Yes, the project will increase floodplain inundation during winter high flows and moderate floods (e.g. 1-yr to 10-year return period events). However, to comply with current County and Federal (FEMA) floodplain management regulations as well as landowner interests the project is designed to not increase the regulatory base flood elevation (i.e. the 100-year flood elevation). Side Channel and Off Channel Habitat • What is the problem the side channel and/or off-channel habitat project proposes to correct? o Existing side channel habitat in the project reach is limited due to bank armoring that prevents lateral channel migration, channel simplification, and lack of large wood. • How will the project create, reconnect, or enhance existing habitat? o The project will increase frequency of inundation in existing floodplain areas through floodplain and inlet channel grading. New side channel and alcove habitat will be created through grading and large wood placement. Mainstem complexity will be improved with large wood placements and bank treatments. Riparian revegetation will be used to improve the long-term ecological trajectory of the site. • What type(s) of channel(s) will be restored or created (flow-through, backwater, groundwater, floodplain ponds)? o Flow-through side channels and backwater alcoves. • What valley and reach-scale features indicate potential for side channel or off channel habitat restoration? o Floodplain depressions, relic channels, and existing side channels. Instream Habitat Restoration • What is the problem the instream habitat project proposes to correct?

	o Lack of in-stream complexity and wood due to channel simplification and wood removal. • What are the existing and proposed channel forms and cross-sections? o Pool-riffle channel form under existing and proposed conditions. o Existing conditions single thread channel at bankfull, proposed conditions split flow (active side channels) at bankfull. • How would the proposed channel modifications restore habitat-forming processes and/or historical conditions? o Adding large wood will restore habitat-forming processes such as sediment sorting and pool scour, while moderating accelerated bank migration rates. Increasing floodplain connectivity reduces shear stress in the main channel promoting more sediment deposition rather than transport, which is dominant under existing conditions. This will lead to improved bedform diversity and habitat complexity.
Estimated Project Cost:	Construction costs are currently estimated at $5,473,500. As of Final Preliminary Designs, May 2020. Funding has already been secured through the Office of the Chehalis Basin/Chehalis Basin Strategy.
Performance Goals & Measures:	Total Riparian Acres Treated= 33.6 acres Total Riparian Miles Streambank Treated= 2.8 river miles of habitat enhancement Acres of Upland Habitat Area Treated= 32.6 acres Floodplain acres planted= 30.0 acres Floodplain: Acres reconnected= 4.1 acres Total Miles of Instream Habitat Treated= 2.8 river miles Floodplain Areas Protected = ~40+ acres, though we have not quantified what the protected acreage would be.
Anticipated Local and Partner Support & Barriers to Completion:	The project concept was developed by Inter-Fluve in collaboration with the landowners, the Lewis Conservation District, the Chehalis Basin Lead Entity, and the Washington Department of Fish & Wildlife as part of the Chehalis Basin ASRP Pilot Project Design contract for Early Action Project Reach assessment, evaluation, and design.
Project Sponsor, Implementation Start Date and End Date:	Sponsor = Washington Department of Fish and Wildlife. Start: June 2019 End: December 2021.

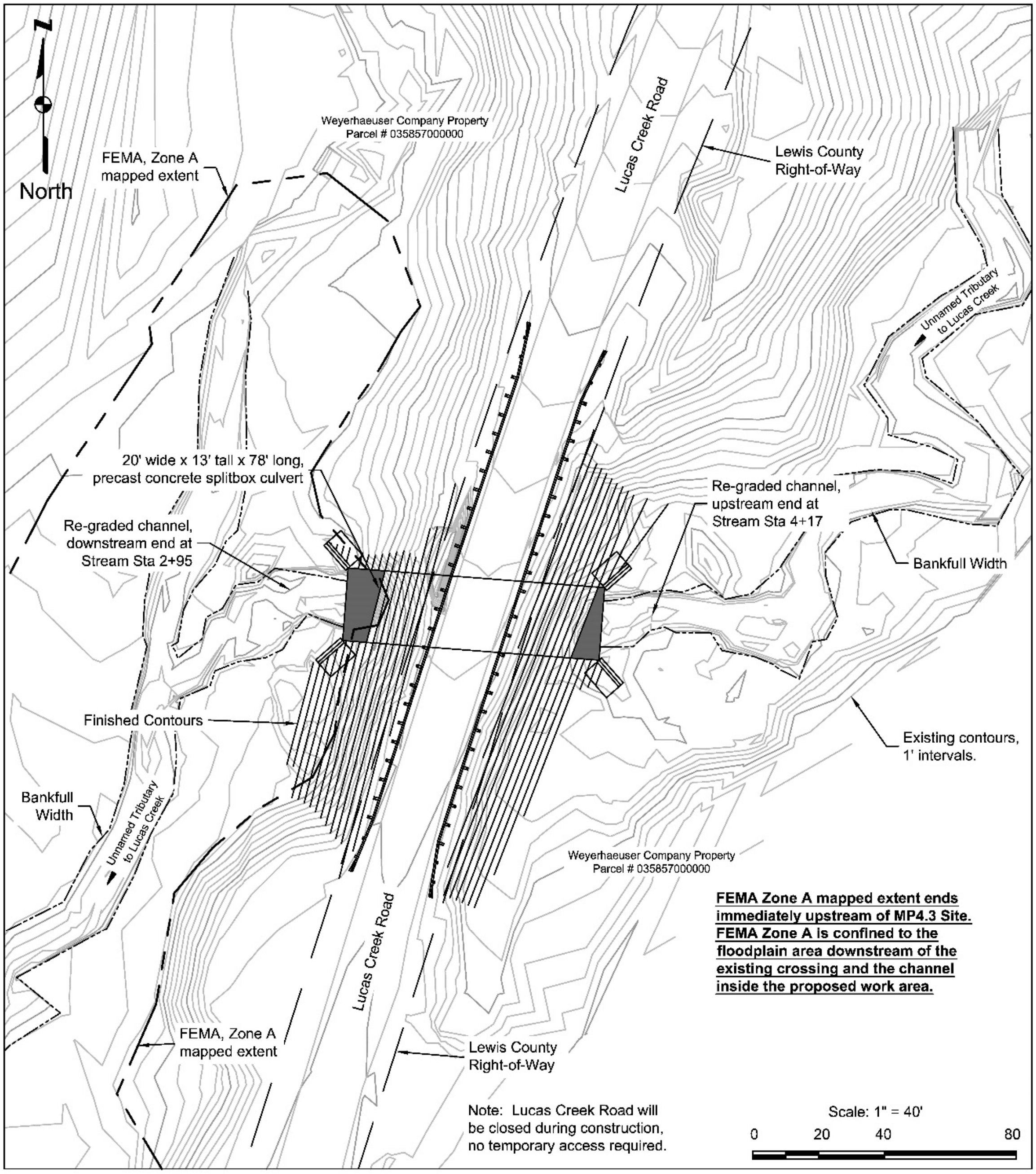

Concept Designs - Overview
Early Action Reach RM 10.9 to 13.0
South Fork Newaukum River, WA
Chehalis Basin ASRP Design
Map 1
Map 2
DRAFT
interfluve

PROJECT INFORMATION SHEET

Project Name:	**Lucas Creek Trib MP 4.39 - Fish Passage Construction**
Project ID:	**N-05**
Project Location	Lucas Creek/Lucas Creek Road MP 4.39 Lat/long: 46.6494751, -122.7043762
Project Description:	The project proposes to replace the existing 6-foot wide by 4-foot tall corrugated steel pipe arch, Site ID 021(46005)(4386) with a fish-passable 20-foot wide by 13-foot tall by 78-foot long precast concrete box culvert. Additional construction will include the placement and removal of a temporary bypass road; the regrade of approximately 120 feet of channel and placement of streambed within the culvert and channel regrade area. Replacement of this culvert is anticipated to restore immediate year round access to an additional 1.74 linear miles of potential habitat for the Southwest Washington DPS (distinct population segment) of winter steelhead and 1.88 linear miles of potential habitat for the Southwest Washington ESU (evolutionary significant unit) of Coho salmon as well as Searun cutthroat and resident cutthroat trout. The proposed project would improve fish passage, sedimentation, and water quality as well as provide access to areas with high quality riparian cover.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Instream habitat to be restored. Fish passage and floodplain connectivity and function will be restored to more natural conditions. Coho, Cutthroat and Steelhead are species to benefit from this project. This will replace a roadway culvert. While the existing culvert is functioning, a new culvert will have a longer life expectancy than that which currently exists.
Is Water Quantity a Limiting Factor In this Subbasin?	No.
Location & Spatial Extent of Benefits:	Project benefits in Lucas Creek are full fish access to quality habitat up to 1.88 linear miles above the project site.
Anticipated Water Offset (if applicable):	None.

Project-Type Specific Information	Fish Barrier Removal
	• Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)?
	  o No
	• To what extent is the existing structure a barrier (33%, 67%, 100%)?
	  o 67
	• Is the barrier eligible for streamflow restoration funding?
	  o Yes.
	• What seasons and fish life stages are affected?
	  o Project will allow for fish passage of all life stages.
	• What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains?
	  o Replacement of the culvert will allow for 1.74 linear miles of potential habitat for the Southwest Washington DPS (distinct population segment) of winter steelhead and 1.88 linear miles of potential habitat for the Southwest Washington ESU (evolutionary significant unit) of Coho salmon as well as searun cutthroat and resident cutthroat trout.
	• What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score)?
	  o Tier 1 in the new barrier rating system
	• Are there upstream or downstream barriers that still have to be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur?
	  o Yes, this proposed project is downstream of other high priority barriers sponsored by Lewis County (PRISM # 17-1148), and Lewis Conservation District (PRISM # 18-1496 & 19-1280).

Estimated Project Cost:	$1,052,089 Project has not been funded.
Performance Goals & Measures:	Miles of Stream Made Accessible
Anticipated Local and Partner Support & Barriers to Completion:	This culvert is within Lewis County Right of Way so the County supports this project. A signed landowner acknowledgement form has been received from the adjacent landowner.
Project Sponsor, Implementation Start Date and End Date:	Ann Weckback, Lewis County Public Works (360) 740-1440. Start: June 2022 End: October 2023



Project Name:	Lucas Creek Fish Passage Improvement
Reference Number:	
Project Address:	Lucas Creek Road, Milepost 4.2-4.3, Chehalis, WA 98532
Applicant:	Lewis County Public Works
Date:	October 2, 2019
Sheet:	Sheet 5 of 8, Plan View MP 4.3 Site

PROJECT INFORMATION SHEET

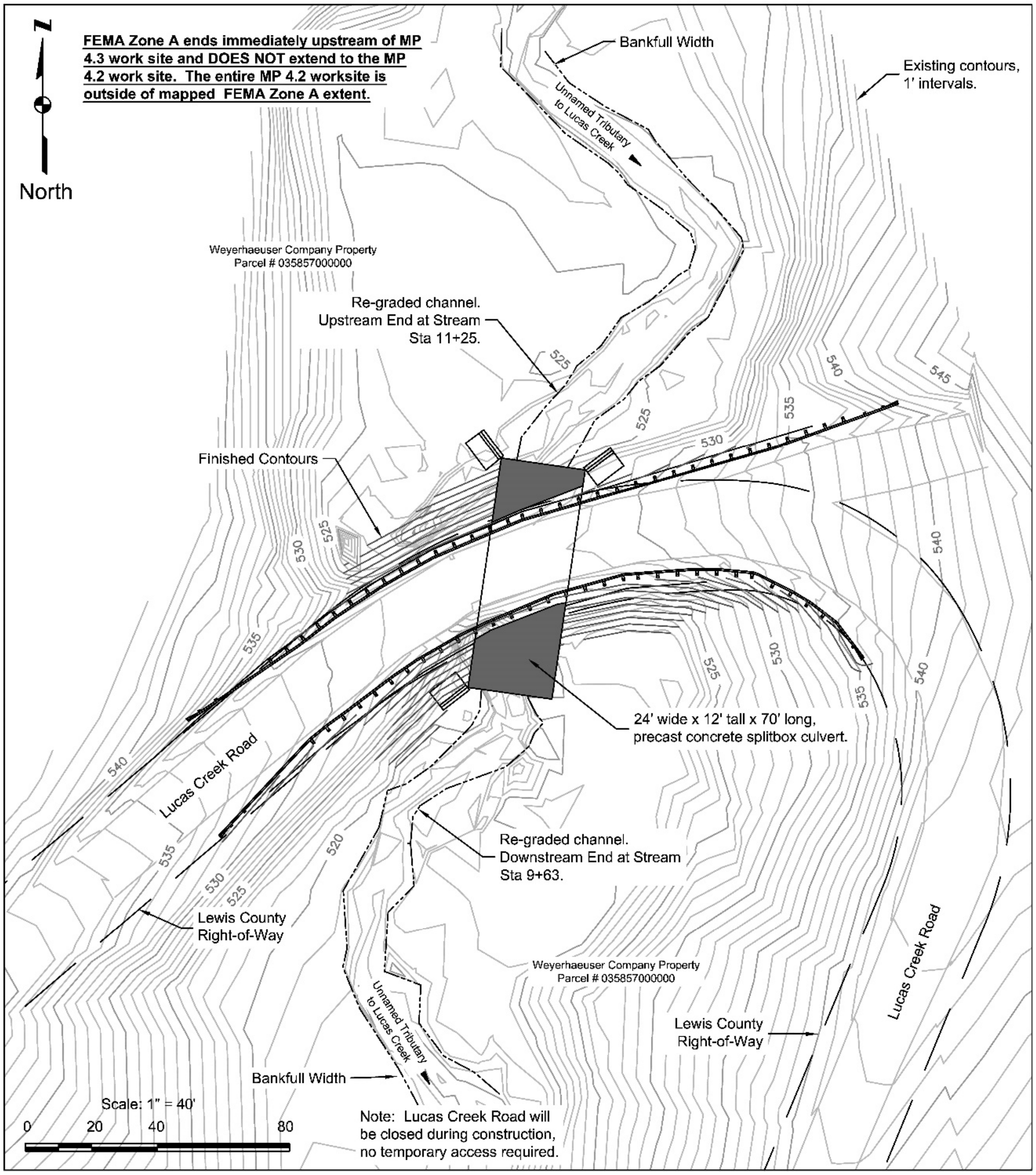
Project Name:	**Lucas Creek Trib MP 4.24 - Fish Passage Construction**
Project ID:	**N-06**
Project Location:	Lucas Creek/Lucas Creek Road MP 4.24 Lat/Long: 46.651062, -122.704155
Project Description:	The project proposes to replace the existing 3-foot diameter pipe, Site ID 021(46005)(04239), which is precast concrete on the upstream end and corrugated steel on the downstream end, with a fish-passable 24-foot wide by 12-foot tall by 70-foot long precast concrete box culvert. Additional construction will include the placement and removal of a temporary bypass road; the regrade of approximately 160 feet of channel and placement of streambed within the culvert and channel regrade area. Replacement of this culvert is anticipated to restore immediate year round access to an additional 1.36 linear miles of potential habitat for the Southwest Washington DPS (distinct population segment) of winter steelhead and 1.22 linear miles of potential habitat for the Southwest Washington ESU (evolutionary significant unit) of Coho salmon as well as Searun cutthroat and resident cutthroat trout. The proposed project would improve fish passage, sedimentation, and water quality as well as provide access to areas with high quality riparian cover.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Instream habitat to be restored. Fish passage and floodplain connectivity and function are the limiting factors to be addressed. Coho, Cutthroat and Steelhead are species to benefit from this project. This will replace a roadway culvert. While the existing culvert is functioning, a new culvert will have a longer life expectancy than that which currently exists.
Is Water Quantity a Limiting Factor In this Subbasin?	No.
Location & Spatial Extent of Benefits:	Lucas Creek. Project extents are approximately 0.7 miles up and downstream of Lucas Creek Road.

Anticipated Water Offset (if applicable):	None.

Project-Type Specific Information	Fish Barrier Removal
	• Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)?
	  o
	• To what extent is the existing structure a barrier (33%, 67%, 100%)?
	  o
	• Is the barrier eligible for streamflow restoration funding?
	  o Yes.
	• What seasons and fish life stages are affected?
	  o Project will allow for fish passage of all life stages.
	• What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains?
	  o Project will restore 1.36 linear miles of potential habitat for the Southwest Washington DPS (distinct population segment) of winter steelhead and 1.22 linear miles of potential habitat for the Southwest Washington ESU (evolutionary significant unit) of Coho salmon as well as Searun Cutthroat and resident Cutthroat trout.
	• What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score)?
	  o High
	• Are there upstream or downstream barriers that still must be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur?
	  o Yes, this proposed project is downstream of other high priority barriers sponsored by Lewis County (PRISM # 17-1148), and Lewis Conservation District (PRISM # 18-1496 & 19-1280).

Estimated Project Cost:	$1,208,650 Propose to request $966,920 from FBRB and $241,730 from ASRP.
Performance Goals & Measures:	The 2011 Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23 lists Tier 1 concerns in the North Fork Newaukum River and its tributaries to be sedimentation, fish passage and riparian cover. Tier 2 concerns are water quality and water quantity. Removing the current culvert barriers and replacing them with properly designed fish passable structures will allow for fish passage of all life stages. Increasing the hydraulic opening will reduce sedimentation by

	slowing velocity through the project area and improve floodplain by allowing water to move freely through the channel into the floodplain.
Anticipated Local and Partner Support & Barriers to Completion:	This culvert is within Lewis County ROW. A signed landowner acknowledgement form has been received from the adjacent landowner.
Project Sponsor, Implementation Start Date and End Date:	Ann Weckback, Lewis County Public Works (360) 740-1440. Start: June 2022 End: October 2023



Project Name:	Lucas Creek Fish Passage Improvement
Reference Number:	
Project Address:	Lucas Creek Road, Milepost 4.2-4.3, Chehalis, WA 98532
Applicant:	Lewis County Public Works
Date:	October 2, 2019
Sheet:	Sheet 4 of 8, Plan View MP 4.2 Site

**Optional: Attach photographs, maps, supporting documents

PROJECT INFORMATION SHEET

Project Name:	**Berwick Creek at Hogue Fish Passage Construction**
Project ID:	**N-07**
Project Location (latitude/longitude)	Berwick Creek, Tributary to Dillenbaugh Creek. Within the Newaukum management unit/Subwatershed Lat/Long: 46.62503, -122.88438
Project Description:	This is the only mainstem private barrier on Berwick Creek. Lewis County is working to remove the county road barriers downstream of this site. This project is ranked number 181 using the Priority Indexes Chehalis Basin Phase 2- Amendment 5 (Verd,2007) criteria. The Lewis Conservation District is currently working on designing a new bridge for Mrs. Hogue. This will implement the new design. 3.29 miles of habitat will be made accessible through completion of this project, following correction of downstream barriers.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The primary fish species to benefit are Coho, Cutthroat, and Steelhead. The secondary species to benefit are River Lamprey and Olympic Mud Minnow.
Is Water Quantity a Limiting Factor In this Subbasin?	Water Quantity is a Tier 3 concern in the Berwick Creek
Location & Spatial Extent of Benefits:	Berwick Creek, extent of benefit is full fish passage to quality habitat 3.29 miles above project site
Anticipated Water Offset (if applicable):	None.
Project-Type Specific Information	Fish Barrier Removal • Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)? o No • To what extent is the existing structure a barrier (33%, 67%, 100%)? o 33 • Is the barrier eligible for streamflow restoration funding? o Yes

	• What seasons and fish life stages are affected? o Project will allow for fish passage of all life stages. • What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains? o Project will restore full fish passage, primarily to Coho and Steelhead rearing habitat, 3.29 miles upstream of the project site. • What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score)? o Tier 2 in the new fish passage rating system • Are there upstream or downstream barriers that still must be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur? o Yes. Project partners are coordinating efforts to remove all fish passage barriers in Berwick Creek
Estimated Project Cost:	Fully funded.
Performance Goals & Measures:	Miles of Stream Made Accessible
Anticipated Local and Partner Support & Barriers to Completion:	This project was made possible through the support of the Lewis Conservation District, NRCS, the Chehalis Basin Lead Entity, SRFB, a
Project Sponsor, Implementation Start Date and End Date:	Lewis Conservation District. (estimated)

PROJECT INFORMATION SHEET

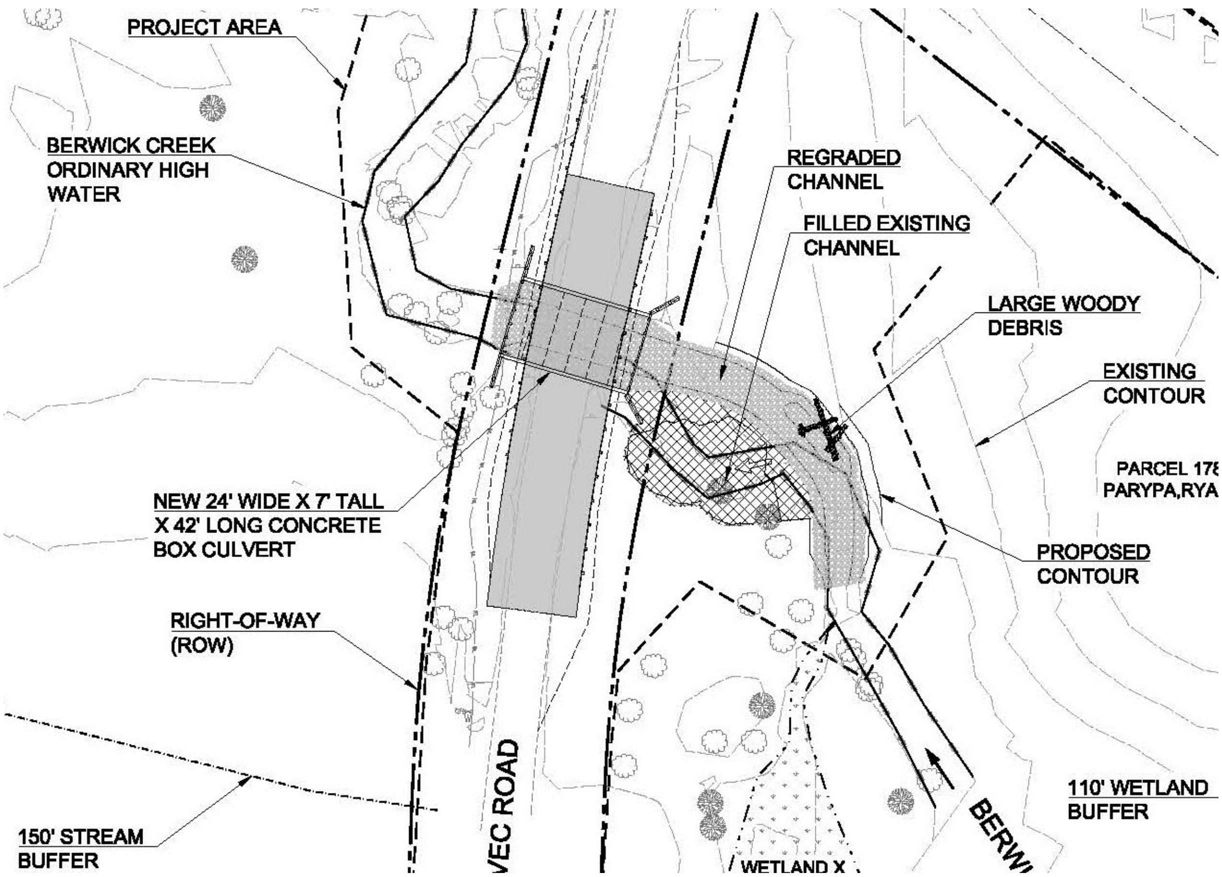
Project Name:	**Berwick Creek at Borovec Fish Passage Construction**
Project ID:	**N-08**
Project Location	Berwick Creek/ Borovec Rd MP 0.032 Lat/Long: 46.619503, -122.9185486
Project Description:	The project proposes to replace two existing 6’ x 4.5’ structural plate steel squash pipes, which are only 67 percent passable due to a velocity barrier, with a 24’ wide x 7‘ tall, 42’ long concrete box culvert. Replacement of this culvert will restore unimpeded access to 0.31 linear miles of potential habitat once the downstream barriers are removed. According to the SWIFD layers provided in the DRAFT – Chehalis Fish Passage Barrier Prioritization interactive mapper total accessible habitat above this culvert, once upstream barriers are removed, is 10.08 linear miles for the Southwest Washington ESU of Coho and 8.38 linear miles for the Southwest Washington DPS of Winter steelhead. The proposed project would improve fish passage, sedimentation, and water quality as well as provide access to areas with high quality riparian cover.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Instream habitat to be restored. Fish passage and floodplain connectivity and function are the limiting factors to be addressed. Coho, Cutthroat and Steelhead are species to benefit from this project. This will replace a roadway culvert. While the existing culvert is functioning, a new culvert will have a longer life expectancy than that which currently exists.
Is Water Quantity a Limiting Factor In this Subbasin?	Water Quantity is a Tier 3 concern in Berwick Creek
Location & Spatial Extent of Benefits:	Berwick Creek. The benefits will be accrued as full fish passage to quality habitat up to 10.08 linear miles above the project site once upstream and downstream barriers are corrected.
Anticipated Water Offset (if applicable):	None.

Project-Type Specific Information	Fish Barrier Removal
	• Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)?
	  o No
	• To what extent is the existing structure a barrier (33%, 67%, 100%)?
	  o 67
	• Is the barrier eligible for streamflow restoration funding?
	  o Yes.
	• What seasons and fish life stages are affected?
	  o Project will allow for fish passage of all life stages.
	• What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains?
	  o Project will restore unimpeded access to 0.31 linear miles of potential habitat once the downstream barriers are removed. Once upstream barriers have been removed, unimpeded access to 10.08 linear miles for the Southwest Washington ESU of Coho and 8.38 linear miles for the Southwest Washington DPS of Winter steelhead.
	• What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score)?
	  o Tier 2 in the new ranking system
	• Are there upstream or downstream barriers that still must be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur?
	  o Yes, this proposed project is downstream of other high priority barriers sponsored by Lewis County (PRISM # 17-1148), and Lewis Conservation District (PRISM # 18-1496 & 19-1280).

Estimated Project Cost:	$1,022,157. Project has not been funded.
Performance Goals & Measures:	Miles of Stream Made Accessible
Anticipated Local and Partner Support & Barriers to Completion:	The culvert is within Lewis County right of way and the county supports the project; the adjacent landowners are Sweet Joist Inc., Web Joist Northwest Corps, Terrance and Elizabeth Pruitt, and Ryan and Hannah Parypa. Signed landowner acknowledgement forms have been received from all property owners.

Project Sponsor, Implementation Start Date and End Date:	Rick Rouse, Port of Chehalis (360) 748-9365. Start: July 2022 End: October 2023

Draw your project site



**Optional: Attach photographs, maps, supporting documents

PROJECT INFORMATION SHEET

Project Name:	Newaukum MAR
Project ID:	N-09
Project Location:	A specific site for this project has not yet been identified, however, there may be opportunity for Managed Aquifer Recharge (MAR) on both private and public property on both the North Fork and South Fork Newaukum Rivers in central Lewis County. All potential sites would be located within the Newaukum Subbasin.
Project Description:	This conceptual project would augment stream flows by increasing surficial aquifer discharge (baseflow) above what occurs under existing conditions. The project concept includes diverting surface water annually from the subject stream(s) between approximately December 1 and April 30 when excess water is available. Diverted water would be conveyed through a collector well adjacent to the stream (e.g. Ranney Collector well) or through an instream surface water intake and piped to a constructed MAR facility. This diverted surface water infiltrates into the shallow aquifer, is transported down-gradient, and ultimately discharges to one or more adjacent streams as re-timed groundwater baseflow. A specific site for this project has not yet been identified, however, there may be opportunity for MAR on public and private property along both the North Fork and South Fork Newaukum Rivers. MAR projects provide year-round benefits to groundwater and surface water resources, but the specific goal of this project is to increase baseflow to the subject streams(s) during the critical flow period, when surface flows are generally lowest. This is accomplished by recharging the aquifer adjacent to the stream(s) and providing additional groundwater discharge to the stream(s) through MAR.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	• Conceptually, this project could provide off-channel storage and release of more than 298 acre-feet (AF) per year of water, through repeated annual diversions. • These benefits would require quantification as part of the Ecology-required Feasibility Study. • The North Fork and South Fork Newaukum Rivers are inhabited by Coho, Cutthroat Trout, Rainbow Trout, and ESA Listed Chinook and Steelhead (WDFW SalmonScape).

	• The project would improve streamflow year-round but particularly in the summer during the critical flow period as retimed groundwater baseflow.
Is Water Quantity a Limiting Factor In this Subbasin?	Yes, Tier 1.
Location & Spatial Extent of Benefits:	The project is expected to provide streamflow benefits in the subject stream(s) and downstream areas. Selected sites along the North Fork and South Fork Newaukum Rivers would be located within the Newaukum Subbasin where surface water is available for beneficial use and soil conditions are amenable to infiltration and groundwater storage.
Anticipated Water Offset (if applicable):	The proposed MAR facility will result in streamflow benefits to the subject streams(s) by diverting and temporarily storing a portion of seasonal high flows into the shallow alluvial aquifer. This project is currently conceptual but we anticipate the ability to divert surface water from the North Fork and/or South Fork Newaukum Rivers at a rate of up to approximately 1 cubic foot per second (cfs) for up to five months (approximately December 1 through April 30), when excess water is available in the river for beneficial use. The goal is to increase streamflow during the critical flow period when demand for water is highest and surface flows are generally lowest. The proposed MAR facility will infiltrate diverted river water into the shallow aquifer and provide increased baseflow to the subject stream and its tributaries, depending on where the facility is sited. Assuming water will be diverted between December 1 and April 30 every year (150 days), the annual diversion volume is estimated to be 298 AF per year calculated by Equation 1: Annual Volume = Diversion Rate x Duration of Diversion Equation 1 It is anticipated that the MAR facility would be constructed as a buried infiltration gallery or an above ground infiltration basin, but design details will be further developed at a later time. Development of this project would augment existing flow in subject stream(s) through an increase in groundwater baseflow, which could be year-round depending on site and down-gradient hydrogeology. The temporal distribution and magnitude of those benefits will be estimated during a feasibility study, which is required before a MAR project can proceed to construction and operation. Those streamflow augmentation benefits will continue to discharge to the river after each year's storage window closes because of the lag time of water moving through an aquifer and the distance of the flow path to the river. The rate at which the infiltrated water enters the river will vary based on in-situ aquifer parameters that will be tested and modeled during the feasibility study.

	It is assumed that this feasibility study will be conducted pursuant with Appendix B of Ecology's Net Ecological Benefit (NEB) guidance and Appendix D of the Streamflow Restoration Grant application requirements, if funding from Ecology is pursued during a future grant round. All values presented in this project description are for planning purposes and may not represent actual site conditions. .

Project-Type Specific Information:	Water Storage and Retiming Projects
	• How much water is likely to be stored?
	  o The annual diversion volume is estimated to be 298 AF per year
	• Has the surface water source for the project been evaluated, and, if so, what is that source?
	  o This project is currently conceptual, but we anticipate the ability to divert surface water from the North Fork and/or South Fork Newaukum Rivers
	• During what period(s) can water be diverted? Is there an instream flow?
	  o The project concept includes diverting surface water annually from the subject stream(s) between approximately December 1 and April 30 when excess water is available.
	• How often is the flow above the minimum instream flow?
	  o TBD
	• What is the proposed rate of diversion?
	  o A rate of up to approximately 1 cubic foot per second (cfs) for up to five months (approximately December 1 through April 30), when excess water is available in the river for beneficial use.
	• What type of water rights would need to be acquired to provide water from that source?
	  o TBD during feasibility study
	• What stream reach likely would benefit from this project and what is the anticipated benefit to that reach?
	  o A reach of the Newaukum, TBD
	• What fish species will benefit?
	  o All species in the Newaukum, notably, Spring Chinook
	• If this is a managed aquifer recharge (MAR) project, is the geology suitable and is the land available?
	  o To be determined during feasibility
	• Has a feasibility study been conducted, and, if so, have the anticipated timing of streamflow benefits been estimated?
	  o The project is a feasibility study
	• What is the potential diversion method(s)?

	o The proposed MAR facility will infiltrate diverted river water into the shallow aquifer and provide increased baseflow
Estimated Project Cost:	To be determined.
Performance Goals & Measures:	The performance goals are to increase water storage in the alluvial aquifer adjacent to the subject stream(s) by infiltrating 298 AF per year through the MAR facility to improve baseflow in the subject stream(s). The performance measures will be an increase in baseflow during the critical flow period in the subject stream(s). The increased baseflow should have the added benefit of reducing water temperatures in the river during the summer and early fall.
Anticipated Local and Partner Support & Barriers to Completion:	A project sponsor has not yet been identified. This project is believed to be in alignment with the goals of the Streamflow Restoration law. MAR is one of the identified project types that could address the new consumptive water use and achievement of NEB. The barriers to completion include identifying a project sponsor, site suitability (to be determined during the feasibility study), funding for construction and O&M costs, and obtaining a water right from the subject stream(s) or the adjacent aquifer for beneficial use at the MAR facility.
Project Sponsor, Implementation Start Date and End Date:	A project sponsor has not yet been identified.

PROJECT INFORMATION SHEET

Project Name:	**Knutsen fish barrier correction and beaver dam analog project.**
Project ID:	**N-10**
Project Location:	Located in the Newaukum subbasin, on the Middle Fork of the Newaukum. It is located at 3414 Centralia Alpha Road, Onalaska, between Griel and Short Roads. Lat/Long: 46.614808, -122.659178
Project Description:	This project removes a fish-blocking culvert and earthen berm, installs a box culvert to allow fish passage, reshapes the stream through a pond and installs two beaver dam analogs.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The problem is a blockage to fish passage and less than ideal habitat. The project will correct the existing culvert and berm which combined is a 67% passable fish passage barrier, opening up and additional 1.12 miles of Coho and Cutthroat habitat. The stream channel will be reshaped above the earthen berm and two beaver dam analogs will be installed.
Is Water Quantity a Limiting Factor In this Subbasin?:	Water Quantity is a Tier 1 concern in the Newaukum subbasin.
Location & Spatial Extent of Benefits:	Approximately 150 feet of unnamed tributary to the Middle Fork of the Newaukum River
Anticipated Water Offset (if applicable):	N/A. BDAs may help retain more ponding water on site.

Project-Type Specific Information	Fish passage barrier
	• Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)?
	    o Unknown
	• To what extent is the existing structure a barrier (33%, 67%, 100%)?
	    o 67%
	• What species and fish life stages are affected?
	    o Coho and Cuthroat fry and juvenilles

	• What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains?
	  o 1.12 miles of spawning and rearing habitat
	• What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score/ Tier concern in new Chehalis Basin Lead Entity barrier prioritization tool)?
	  o Unknown
	• Are there upstream or downstream barriers that still have to be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur?
	  o Unknown

Estimated Project Cost:	$165,000 (fully funded)
Performance Goals & Measures:	Miles of Stream Made Accessible. Opens up approximately 1.12 miles of spawning and rearing habitat for coho and cutthroat. Enhances beaver complex on property.
Anticipated Local and Partner Support & Barriers to Completion:	WDFW, NRCS, RCO and Lewis Conservation District are completing this project in September 2020.
Project Sponsor, Implementation Start Date and End Date:	Lewis Conservation District Construction Start September 2020; End 6/30/2021

9/2/2020 3414 Centralia Alpha Rd - Google Maps

Google Maps 3414 Centralia Alpha Rd

Map data ©2020 200 ft

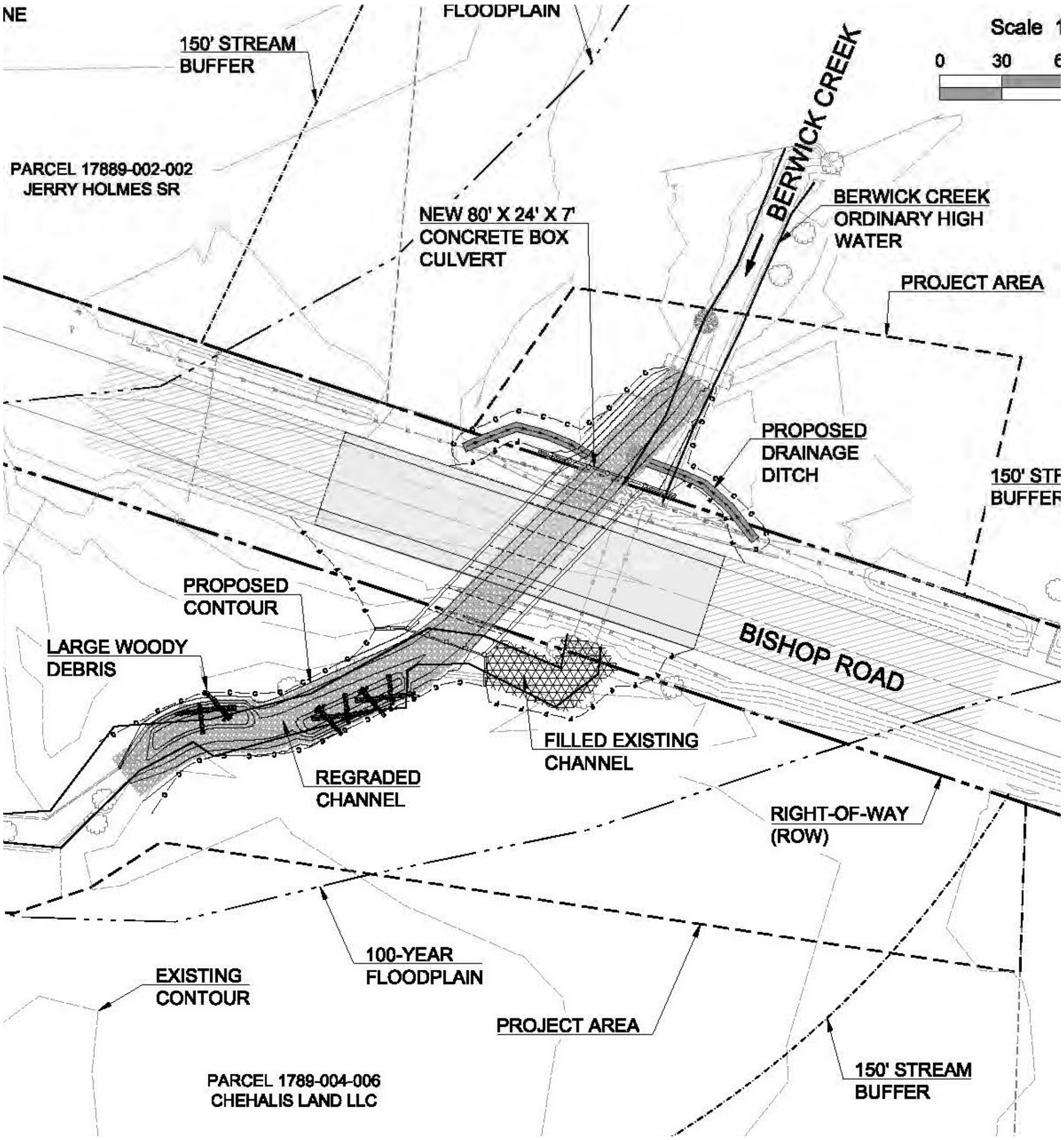
https://www.google.com/maps/place/3414+Centralia+Alpha+Rd,+Onalaska,+WA+98570/@46.6136576,-122.6643247,17z/data=!3m1!4b1!4m5!3m4!1s0x5491505ea7ae48cb:0x7b7eb9a35000725718m2... 1/2


N
Centralia Alpha
Decommission pond. Restore channel and install beaver dam analogs
Remove existing 2' concrete culvert. Replace with 38' long, 14' by 8' fish passable box culvert
0
75
150
300 Feet
GeoEye, Maxar

PROJECT INFORMATION SHEET

Project Name:	**Berwick Creek at Bishop Fish Passage Construction**
Project ID:	**N-11**
Project Location	Berwick Creek/ Bishop Rd MP 2.839 Lat/Long: 46.61829, -122.9127
Project Description:	The project proposes to replace two existing 5-foot corrugated steel pipes, which are only 67 percent passable due to a velocity barrier, with a 24-foot wide x 7-foot tall, 80-foot long concrete box culvert.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The project will replace a priority barrier downstream of other high priority Lewis County and Lewis Conservation District barriers. Replacement of this culvert will restore unimpeded access to 1.60 linear miles of potential habitat once the downstream barriers are removed. According to the SWIFD layers provided in the DRAFT – Chehalis Fish Passage Barrier Prioritization interactive mapper total accessible habitat above this culvert, once upstream barriers are removed, is 9.77 linear miles for the Southwest Washington ESU of Coho and 8.07 linear miles for the Southwest Washington DPS of Winter Steelhead. The proposed project would improve fish passage, sedimentation, and water quality as well as provide access to areas with high quality riparian cover.
Is Water Quantity a Limiting Factor In this Subbasin?	Water Quantity is a Tier 1 concern in the Newaukum subbasin.
Location & Spatial Extent of Benefits:	Berwick Creek. Project reach covers approximately 700 feet upstream and downstream of Bishop Road. Fish passage benefits will extend to next upstream barrier culvert.
Anticipated Water Offset (if applicable):	None.
Project-Type Specific Information	Fish Barrier Removal • Is this a barrier that would eventually be removed as a result of some other legal requirement (such as the culverts case)?

	o No • To what extent is the existing structure a barrier (33%, 67%, 100%)? o 67 • Is the barrier eligible for streamflow restoration funding? o Yes. • What seasons and fish life stages are affected? o Project will allow for fish passage of all life stages. • What is the quantity and quality of upstream habitat that would be made available, and what are the anticipated spawning and rearing habitat lengths and areas gains? o Project will restore unimpeded access to 1.6 miles of potential habitat once downstream barriers have been removed. Once upstream barriers are removed, total accessible habitat is 9.77 miles for the Southwest Washington ESU of Coho and 8.07 linear miles for the Southwest Washington DPS of Winter Steelhead. • What priority is the barrier for removal within the WRIA barrier inventory (e.g. P.I. score)? o Tier 2 in the new rating system • Are there upstream or downstream barriers that still must be addressed, and, if so, what is the likelihood and potential time frame for when this work might occur? o Yes, this proposed project is downstream of other high priority barriers sponsored by Lewis County (PRISM # 17-1148), and Lewis Conservation District (PRISM # 18-1496 & 19-1280).
Estimated Project Cost:	$1,022,157. This project is not yet funded.
Performance Goals & Measures:	Miles of Stream Made Accessible
Anticipated Local and Partner Support & Barriers to Completion:	The culvert is within Lewis County ROW; the adjacent landowners are Chehalis Land LLC and Community Partners. Signed landowner acknowledgement forms have been received from all property owners.
Project Sponsor, Implementation Start Date and End Date:	Port of Chehalis Start: July 2022 End: October 2023


NE
FLOODPLAIN
150' STREAM
BUFFER
Scale
0
30
BERWICK CREEK
PARCEL 17889-002-002
JERRY HOLMES SR
NEW 80' X 24' X 7'
CONCRETE BOX
CULVERT
BERWICK CREEK
ORDINARY HIGH
WATER
PROJECT AREA
PROPOSED
DRAINAGE
DITCH
PROPOSED
CONTOUR
LARGE WOODY
DEBRIS
BISHOP ROAD
FILLED EXISTING
CHANNEL
REGRADED
CHANNEL
RIGHT-OF-WAY
(ROW)
100-YEAR
FLOODPLAIN
EXISTING
CONTOUR
PROJECT AREA
150' STREAM
BUFFER
PARCEL 1789-004-006
CHEHALIS LAND LLC

PROJECT INFORMATION SHEET

Project Name:	**Beaver Dam Analog Pilot Implementation**
Project ID:	**N-12**
Project Location:	Prioritized locations per ASRP-funded BDA Implementation in the Chehalis (20-1900). Includes tributaries of the Newaukum River.
Project Description:	Over the last 150 years, 90 percent of Chehalis marsh and pond habitats have been lost or degraded. BDAs represent a flexible process-based restoration technique to address many of the limiting factors in our target GSUs and elsewhere in the Chehalis Basin. We propose to construct BDAs at five prioritized locations within the watershed and monitor the effectiveness of this restoration technique to improve streamflow, habitat, and water quality parameters. This funding request includes permitting, construction, and monitoring tasks.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	It is expected that construction of BDAs will improve streamflow, habitat, and water quality parameters. We will start a monitoring program to test hypotheses in this regard.
Is Water Quantity a Limiting Factor In this Subbasin?	Initial project work will likely be completed within the Newaukum subbasin where water quantity is a Tier 2 limiting factor.
Location & Spatial Extent of Benefits:	Localized at the project sites and downstream. Locations to be determined.
Anticipated Water Offset (if applicable):	Estimated water offset is 12.5 acre-feet per year. Offset is based on planned installation of five beaver dam analog installations with a benefit of 2.5 acre-feet per year (Dittbrenner, 2019). Reference: Dittbrenner, Benjamin J., 2019. Restoration potential of beaver for hydrological resilience in a changing climate, PhD Dissertation, University of Washington, 164 p.
Project-Type Specific Information	Most questions will be answered by the currently ongoing feasibility study. • What are the projected hydrologic benefits of this project?

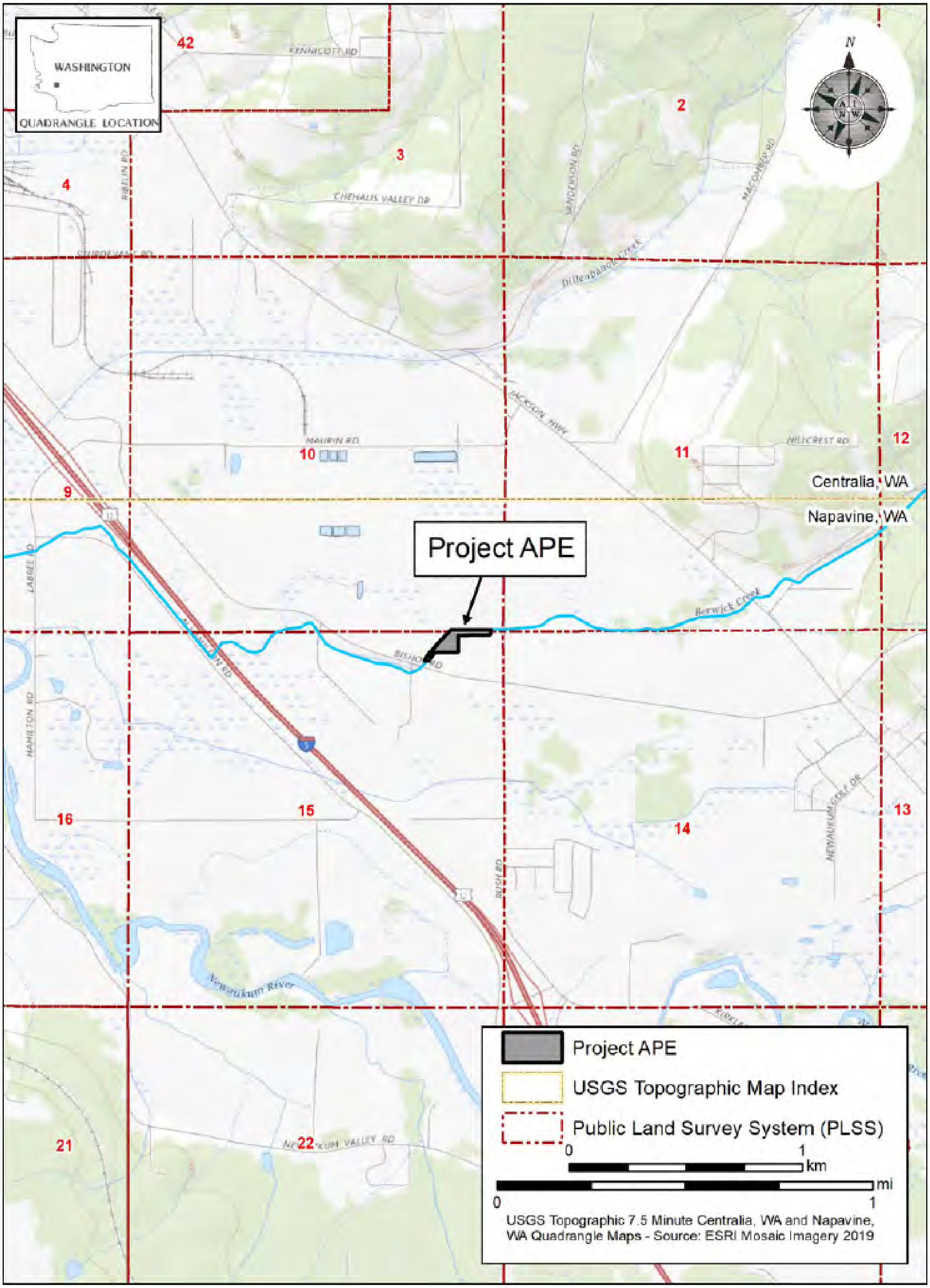
	o Raise local groundwater table, enhance wetland storage. • How will benefits be measured/quantified? o To be determined. • Are there roads, culverts, buildings, infrastructure that may be impacted through raising water levels due to analogues or introduction of beavers? o To be determined, depends on selected locations. • If you expect beaver to use the site as a result of the project: • Is there local documentation or records from WDFW indicating their historic presence? • If not, do WDFW wildlife biologists believe the area could support beavers? • Has beaver intrinsic modeling been performed for the basin/site? o To be determined, depends on selected locations. • Is there a stable food supply to support the beavers? o To be determined, depends on selected locations.
Estimated Proposed Cost:	$125,000
Performance Goals & Measures:	• Miles of Stream Made Accessible • Total Amount of Estuarine / Nearshore Acres Treated • Total Riparian Acres Treated • Total Riparian Miles Streambank Treated • Number of Blockages/Impediments/Barriers Impeding Passage
Anticipated Local and Partner Support & Barriers to Completion:	The first phase of this project was funded by the Aquatic Species Restoration Plan and continued support is likely from that program. The pilot phase of this project is a collaboration between Wild Fish Conservancy, Ducks Unlimited, and WDFW. The Coast Salmon Partnership is also a partner. They are likely to be continued partners. Barriers to project implementation include landowner willingness and acceptance of more wood in streams.
Project Sponsor, Implementation Start Date and End Date:	Wild Fish Conservancy. Start: July 2021 End: December 2022

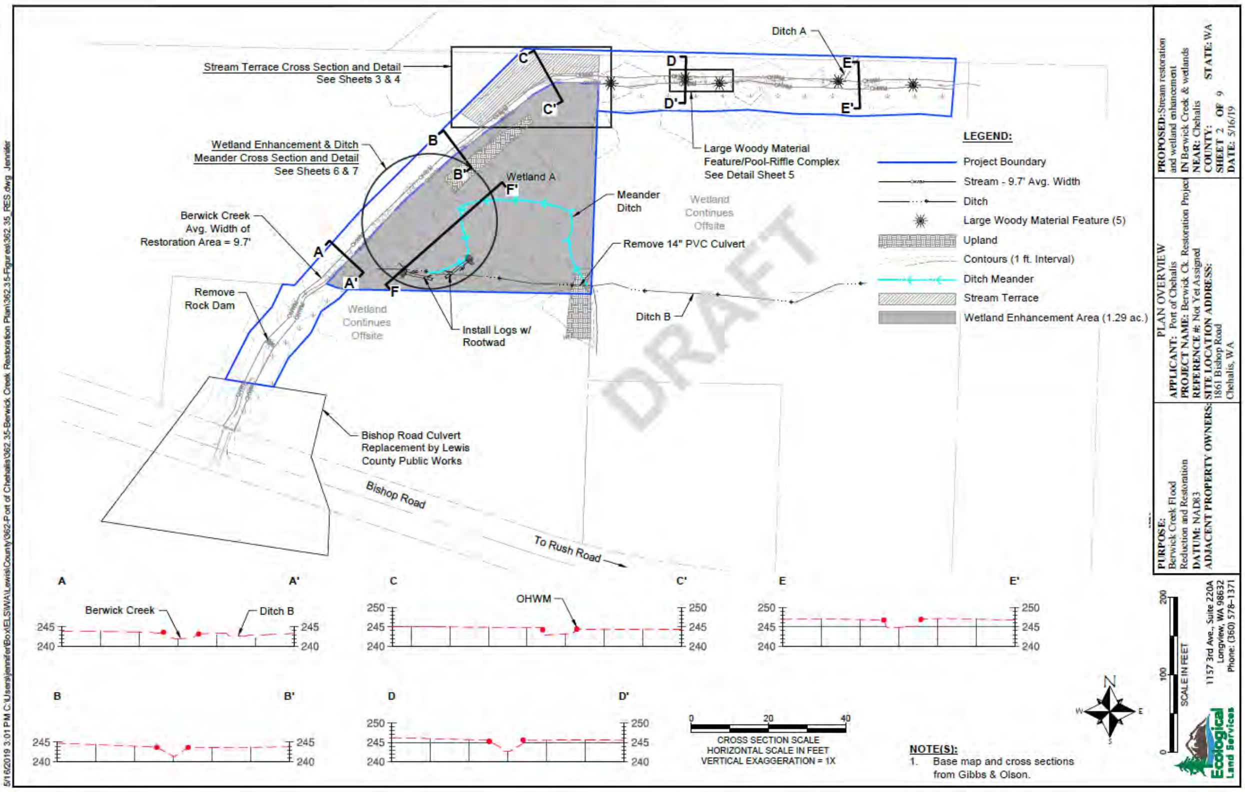
PROJECT INFORMATION SHEET

Project Name:	**Berwick Creek Flood Reduction Restoration**
Project ID:	**N-13**
Project Location:	Sections 10 and 15, Township 13 North, Range 2 West, Willamette Meridian; Berwick Creek in the Chehalis-Salzer subbasin between Rush Road and Bishop Road near Chehalis, Lewis County, WA. Lat/long: 46.619664, -122.908910
Project Description:	The Port of Chehalis has received grant funding from the Washington State Recreation and Conservation Office (RCO Project 18-2614P) for flood reduction and restoration and proposes to restore a degraded stretch of Berwick Creek. The project will restore approximately 1,000 linear feet of Berwick Creek between Rush and Bishop Roads and enhance approximately 1.29-acre emergent class of riverine wetland.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The project will create pool and riffle complexes by constructing 5 large woody material (LWM) structures to slow flow velocity which will accumulate sediment and create pools for rearing and feeding habitat for salmonids. The project will also create stream terraces in the upland areas above ordinary high water for additional flood storage and refugia for salmonids in high water events. A fish-blocking rock dam will be removed. Invasive plant species will be removed along the riparian corridor and wetland enhancement area and native tree and shrub plantings will be installed for wildlife habitat and water shading within the riparian corridor and in approximately 1.3 acres of riverine wetland.
Is Water Quantity a Limiting Factor In this Subbasin?:	Berwick Creek is a tier 2 concern per the Lead Entity Strategy
Location & Spatial Extent of Benefits:	The project will cover approximately 1,000 feet of Berwick Creek and includes the enhancement of wetlands and associated riparian habitat adjacent to Berwick Creek.
Anticipated Water Offset (if applicable):	Water offset is expected but there is insufficient information at this time to quantify potential benefits. Floodplain reconnection may improve groundwater infiltration.

Project-Type Specific Information:	Instream Habitat Restoration
	• What is the problem the instream habitat project proposes to correct?
	  o Channel is a ditch through historic wetland/floodplain habitat. The existing channel banks are heavily downcut and nearly vertical. During high flow events, they provide little to no flood storage.
	• What are the existing and proposed channel forms and cross-sections? (May be conceptual).
	  o Existing = ditch; proposed = create pool and riffle complexes by constructing 5 large woody material (LWM) structures to slow flow velocity which will accumulate sediment and create pools for rearing and feeding habitat for salmonids.
	• How would the proposed channel modifications restore habitat-forming processes and/or historical conditions?
	  o Remeandering and addition of wood will kick-start natural forming process. Terracing, LWM structures, and native plantings will help slow velocities and allow reconnection to the natural floodplain. Riparian plantings will help sustain those processes long term.

Estimated Project Cost:	$100,000 for design. Construction cost unknown.
Performance Goals & Measures:	Total Riparian Miles Streambank Treated / Total Miles of Instream Habitat Treated Berwick Creek is mapped as spawning habitat for Coho (Oncorhynchus kisutch) and Cutthroat. The project will increase spawning and rearing habitat for these species while enhancing existing habitat.
Anticipated Local and Partner Support & Barriers to Completion:	The project sponsor is the Port of Chehalis. Support has been provided by the Chehalis Basin Flood Authority. Barriers to completion include needed cultural resources work.
Project Sponsor, Implementation Start Date and End Date:	Port of Chehalis. Start: July 2021 End: June 2023


WASHINGTON
QUADRANGLE LOCATION
Project APE
Centralia, WA
Napavine, WA
Berwick Creek
Newaukum River
Project APE
USGS Topographic Map Index
Public Land Survey System (PLSS)
km
mi
USGS Topographic 7.5 Minute Centralia, WA and Napavine, WA Quadrangle Maps - Source: ESRI Mosaic Imagery 2019


Stream Terrace Cross Section and Detail
See Sheets 3 & 4
Wetland Enhancement & Ditch
Meander Cross Section and Detail
See Sheets 6 & 7
Berwick Creek
Avg. Width of
Restoration Area = 9.7'
Remove
Rock Dam
Wetland A
Meander
Ditch
Wetland
Continues
Offsite
Remove 14" PVC Culvert
Large Woody Material
Feature/Pool-Riffle Complex
See Detail Sheet 5
Ditch A
Ditch B
Install Logs w/
Rootwad
Bishop Road Culvert
Replacement by Lewis
County Public Works
Bishop Road
To Rush Road
DRAFT
LEGEND:
Project Boundary
Stream - 9.7' Avg. Width
Ditch
Large Woody Material Feature (5)
Upland
Contours (1 ft. Interval)
Ditch Meander
Stream Terrace
Wetland Enhancement Area (1.29 ac.)
OHWM
CROSS SECTION SCALE
HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION = 1X
NOTE(S):
1. Base map and cross sections from Gibbs & Olson.
PROPOSED: Stream restoration and wetland enhancement
IN Berwick Creek & wetlands
NEAR: Chehalis
COUNTY:
STATE: WA
SHEET 2 OF 9
DATE: 5/16/19
PLAN OVERVIEW
APPLICANT: Port of Chehalis
PROJECT NAME: Berwick Ck. Restoration Project
REFERENCE #: Not Yet Assigned
SITE LOCATION ADDRESS:
1861 Bishop Road
Chehalis, WA
ADJACENT PROPERTY OWNERS:
PURPOSE:
Berwick Creek Flood Reduction and Restoration
DATUM: NAD83
SCALE IN FEET
Ecological Land Services
1157 3rd Ave., Suite 220A
Longview, WA 98632
Phone: (360) 578-1371

5/16/2019 3:01 PM C:\Users\jennifer\Box\ELS\WA\Lewis\County\362-Port of Chehalis\362.35-Berwick Creek Restoration Plan\362.35-Figures\362.35_RES.dwg Jennifer

LEGEND:

- Project Boundary
- Stream
- Stream Terrace
- Upland
- Contours (1 ft. Interval)
- Large Woody Material
- Stream Terrace Topographical Break
- Existing Oregon White Oak

NOTE(S):
1. Base map from Gibbs & Olson.

Stream Terrace Plant Specifications

Species	Spacing (feet on center)	Size/ Seed Rate	Quantity		
			Upper Terrace 0.04 ac	Middle Terrace 0.06 ac	Lower Terrace 0.04 ac
Tree Stratum					
Bigleaf maple (*Acer macrophyllum*, FACU)	10	1 gal or larger	TBD	--	--
Red alder (*Alnus rubra*, FAC)	10	1 gal or larger	TBD	--	--
Oregon ash (*Fraxinus latifolia*, FACW)	10	1 gal or larger	TBD	TBD	TBD
Oregon white oak (*Quercus garryana*, FACU)	14	1 gal or larger	TBD	--	--
		Total Trees		**TBD**	

Stream Terrace Plant Specifications (continued)

Species	Spacing (feet on center)	Size/ Seed Rate	Quantity		
			Upper Terrace 0.04 ac	Middle Terrace 0.06 ac	Lower Terrace 0.04 ac
Shrub Stratum					
Black hawthorn (*Crataegus douglasii*, FAC)	6	1 gal or larger	TBD	TBD	--
Red-osier dogwood (*Cornus sericea*, FACW)	6	1 gal or larger	--	TBD	TBD
Nootka rose (*Rosa nutkana*, FAC)	6	1 gal or larger	TBD	TBD	--
Common snowberry (*Symphoricarpos albus*, FACU)	6	1 gal or larger	TBD	--	--
Sitka willow (*Salix sitchensis*, FACW)	6	Min 4-ft live stake	--	--	TBD
		Total Shrubs		**TBD**	
Herbaceous Stratum					
Native Wetland Seed Mix		15-25 lb/ac	--	TBD	TBD
Native Upland Seed Mix		15-25 lb/ac	TBD	--	--

NOTE: Plants are not to scale and locations are approximate as shown. Actual planting locations will be determined in the field, with consideration to the listed spacing and density to produce the most natural appearance possible.

N W E S

0 30 60
SCALE IN FEET

Ecological Land Services
1157 3rd Ave., Suite 220A
Longview, WA 98632
Phone: (360) 578-1371

PURPOSE: Berwick Creek Flood Reduction and Restoration
DATUM: NAD83
ADJACENT PROPERTY OWNERS:

STREAM TERRACE DETAIL
APPLICANT: Port of Chehalis
PROJECT NAME: Berwick Ck. Restoration Project
REFERENCE #: Not Yet Assigned
SITE LOCATION ADDRESS:
1861 Bishop Road
Chehalis, WA

PROPOSED: Stream restoration and wetland enhancement
IN Berwick Creek & wetlands
NEAR: Chehalis
COUNTY: **STATE:** WA
SHEET 4 **OF** 9
DATE: 5/16/19

PROJECT INFORMATION SHEET

Project Name:	**Satsop and Wynoochee Tributary Assessment for Alluvial Water Storage Potential**
Project ID:	**S-00**
Project Location:	Low order tributaries on commercial forest lands within the East Fork, West Fork, and Middle Fork Satsop River and Middle and Upper Wynoochee River. Pilot project locations: Neil Creek Lat/Long: 47.2782, -123.6285 Carter Creek Lat/Long: 47.1608, -123.6157 Still Creek Lat/Long: 47.0913, -123.5937 Schafer Creek Lat/Long: 47.2729 -123.6184
Project Description:	Complete a GIS-based model assessment of the potential to restore alluvial water storage and aquatic species habitat using in-stream restoration techniques within low-order reaches in the Satsop River and Wynoochee River tributary networks, develop a Restoration Strategy for prioritized stream reaches, and design and construct one hand-built pilot demonstration project. Pilot project locations for instream hand-built restoration have been identified on Neil Creek, Carter Creek, Still Creek, and Schafer Creek.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	Widespread channel incision and simplification has resulted in a loss of natural water and sediment storage within stream corridors, which impacts spring and summer water availability and water quality. Channel lowering due to vertical incision exports sediment and lowers groundwater levels within the alluvial valley, thereby reducing the volume and residence time of both floodplain water bodies and local groundwater storage within the channel network. The loss of natural water storage affects riparian water availability, aquatic habitat quality, dry season baseflow quantity, and instream water temperature (Hunt, Fair, & Odland, 2018; Loheide et al., 2009; Loheide & Gorelick, 2006; Tague, Valentine, & Kotchen, 2008). Alluvial groundwater is a critical component of instream flow quantity and quality. Groundwater is released much slower than surface water flow and therefore supplements dry season base flows. Increased surface water-groundwater exchange results in cooler surface water. Initial work shows that reversing channel incision can substantially increase water retention

	and benefit aquatic and riparian habitat along channel networks (T. B. Abbe et al., 2019). This project aims to identify and prioritize reaches to restore natural water storage functions for the benefit of water quantity, water quality, aquatic habitat, and riparian water availability. This project additionally aims to use the screening process to identify a pilot reach for implementation of restoration action and monitoring of hydrogeomorphic effects. The project uses geospatial analysis of high-resolution topographic data along with targeted field verification to efficiently estimate the volume of natural sediment and water storage that has been lost across low order tributaries on commercial forestry lands. The results are used to prioritize stream reaches based on where restoration actions have high potential to increase water and sediment storage, which correlate to high potential for water quantity and quality improvement. The geospatial modeling also includes analysis and relation of numerous datasets that inform the development of a spatially explicit restoration plan. Types of restoration actions and additional considerations for prioritization are based on these analyses, which include peak flow magnitudes and stream power, the extent of infrastructure in the alluvial valley, the presence and usage by fish species, and riparian forest characteristics.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes, natural recharge of aquifers and LWD supplementation are general actions identified for these subbasins. Declining base flows and higher average- month-per year flows are Tier 1 concerns in the West Fork Satsop River; riparian condition and low levels of LWD are Tier 2 concerns. Riparian condition, declining base flows and higher average- month-per year flows are Tier 1 concerns in the Middle Fork Satsop River; low levels of LWD are a Tier 3 concern. Riparian condition is a Tier 1 concern in the East Fork Satsop River, low levels of LWD are a Tier 2 concern; channel incision, declining base flows and higher average- month-per year flows are a Tier 3 concern. Riverbed incision upstream of RM 22 on the Wynoochee is a Tier 1 concern; water temperature and sediment are Tier 2 concerns; riparian species diversity and LWD are Tier 3 concerns. The project's focus is on the low order reaches of the upper Satsop and Wynoochee Rivers, focusing specifically on lands currently held in by timber companies Weyerhaeuser and Green Diamond.

Location & Spatial Extent of Benefits:	In the project reaches listed in Project Location, above. Habitat benefits are expected to be local to treated reaches, and water quantity and quality benefits are expected to be local and downstream of treated reaches.
Anticipated Water Offset (if applicable):	Water offset is expected but there is insufficient information at this time to quantify potential benefits. Alluvial water storage projects are expected to increase local groundwater and surface water storage, with consequent effects on baseflow. The volume of water storage is computed on a reach-by-reach basis using geometric estimates of the volume of the alluvial aquifer (Natural Systems Design, 2017), interpolated estimates of channel incision, and values for specific yield (i.e., drainable porosity) based on NRCS soils data. The volumetric data are then translated to an approximate baseflow contribution based on simplified application of Darcy's law, with a time-invariant release rate. The benefits to the magnitude and duration of baseflow are largely dependent on the spatial extent of implementation of the approach since the benefits scale with the length of stream restored.

Project-Type Specific Information	• How much water is likely to be stored?
	  o Insufficient information to quantify at this stage.
	• Has the surface water source for the project been evaluated, and, if so, what is that source?
	  o Pilot project locations for instream hand-built restoration have been identified on Neil Creek, Carter Creek, Still Creek, and Schafer Creek
	• During what period(s) can water be diverted? Is there an instream flow?
	  o Unknown at this stage.
	• How often is the flow above the minimum instream flow?
	  o Unknown at this stage.
	• What is the proposed rate of diversion?
	  o Unknown at this stage.
	• What type of water rights would need to be acquired to provide water from that source?
	  o None
	• What stream reach likely would benefit from this project and what is the anticipated benefit to that reach?
	  o Low order tributaries on commercial forest lands within the East Fork, West Fork, and Middle Fork Satsop River and Middle and Upper Wynoochee River.

	- Initial work shows that reversing channel incision can substantially increase water retention and benefit aquatic and riparian habitat along channel networks. • What fish species will benefit? - Primary species benefitting: Chinook, Coho, Steelhead, Chum. • Has a feasibility study been conducted, and, if so, have the anticipated timing of streamflow benefits been estimated? - No • What is the potential diversion method(s)? - Natural infiltration.
Estimated Project Cost:	Project budget is $182,000, not including construction of the pilot project
Performance Goals & Measures:	Change in Flow Acres of Off-Channel/Floodplain Connected or Added Also expect: Increase in water table and water storage Lower water temperatures during base flows Monitoring is anticipated to include repeat survey, groundwater and surface water elevation data collection, and riparian vegetation change monitoring.
Anticipated Local and Partner Support & Barriers to Completion:	Support is being provided by Washington State Department of Ecology SFY20 Water Quality Program grant, Grays Harbor Conservation District, Coast Salmon Partnership, Weyerhaeuser, and Green Diamond; barriers to completion include challenges associated with construction access and compatibility with forest land infrastructure and tree harvest cycles.
Project Sponsor, Implementation Start Date and End Date:	Start: December 2019 End: December 2021

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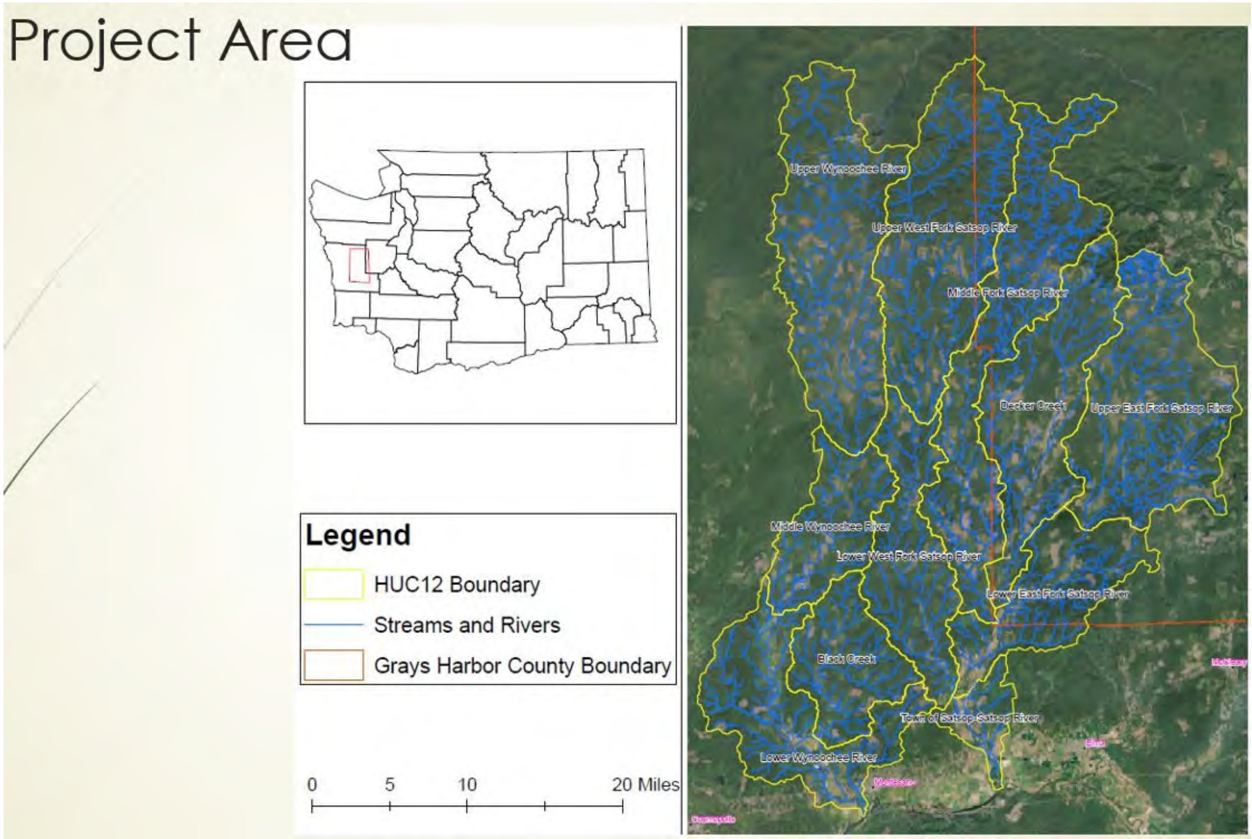


Project location: Satsop and Wynoochee subbasins within Grays Harbor County

PROJECT INFORMATION SHEET

Project Name:	**Tree Fever Conservation Easement**
Project ID:	**S-01**
Project Location:	Located in the Satsop Management Unit in Grays Harbor County, on the West Fork of the Satsop River approximately 7.5 miles upriver from the Monte-Elma Bridge. Lat/Long: 47.1003, -123.5483
Project Description:	The project objective is to purchase a conservation easement on the 136-acre Property that will prohibit subdivision, restrict residential development and road construction and other non-forest uses adverse to river quality and quantity. Additionally, the project will guide forest management and allow for restoration opportunities on over 1 mile of riverbank and riparian area of the river.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	By preventing forest clear cutting, subdivision, and development of this Property, the project benefits the West Fork Satsop River by avoiding pollution, water withdrawals, and habitat destruction. Removal of forests degrade habitat and natural processes. Development and conversion of land to roads, residences, and impervious surfaces results in pollution to surface waters, and withdrawal of surface and groundwater. Further impacts include increasing fine-sediment load to surface water, reducing riparian cover, and increasing stream temperature. All species in this section of the Satsop will benefit including Fall Chinook, Coho, Steelhead, Chum.
Is Water Quantity a Limiting Factor In this Subbasin?:	For the size of the sub-basin, these documented withdrawals are low relative to other problems. However, the frequency of flows lower than base flows merits concern. The West Fork of the Satsop River is ranked as a Tier 1 for water quantity.
Location & Spatial Extent of Benefits:	Satsop Subbasin on subject property; 136.6 acres of forestland and over 1 mile of riverfront. The Property also contains 1,700 feet of an unnamed, fish-bearing stream.
Anticipated Water Offset (if applicable):	N/A

Project-Type Specific Information:	Riparian and Upland Conservation and Restoration. • Is the land proposed for conservation/restoration part of the riparian, floodplain and/or channel migration zone? o Yes • Is the riparian or upland conservation/restoration part of a larger project funded by other sources? o No • If applicable, what is the mechanism for protection (e.g. conservation easement, fee simple, transfer to public lands)? o Conservation Easement • If applicable, is the proposed restoration passive (e.g. fencing), active (e.g. plantings) or both? o Restoration may be a future project stage • For protection projects, is the protection temporary or permanent? o Permanent • For protection projects, is the site under imminent threat? o Yes • For protection, tell us more about the threat: aka, likeliness of subdivision, purchase for development, timber harvest plans, etc. o This parcel's zoning would allow for additional development of homes, creation of impervious surface and associated water quality degradation. The terms of the Conservation Easement will limit number of structures and clearing allowed on site and will also include a forestry plan that protects the unnamed stream and shoreline.
Estimated Project Cost:	$380,400 (This project has been fully funded)
Performance Goals & Measures:	Acres of Land, Wetland or Estuarine Area Conserved by Acquisition Or Lease = 133 The goal of this project is to acquire a conservation easement on 133 acres to permanently retain the property in a forested nature and eliminate subdivision and full development of the property with residential use.
Anticipated Local and Partner Support & Barriers to Completion:	Property owners have submitted a signed Landowner Acknowledgement Form. This project is supported by the Chehalis Basin Lead Entity's Habitat Work Group and the Aquatic Species Restoration Plan Steering Committee.

Project Sponsor, Implementation Start Date and End Date:	Capitol Land Trust in affiliation with 2020 Salmon Recovery Funding Board Start: September 2020 End: 1/1/2022

PROJECT INFORMATION SHEET

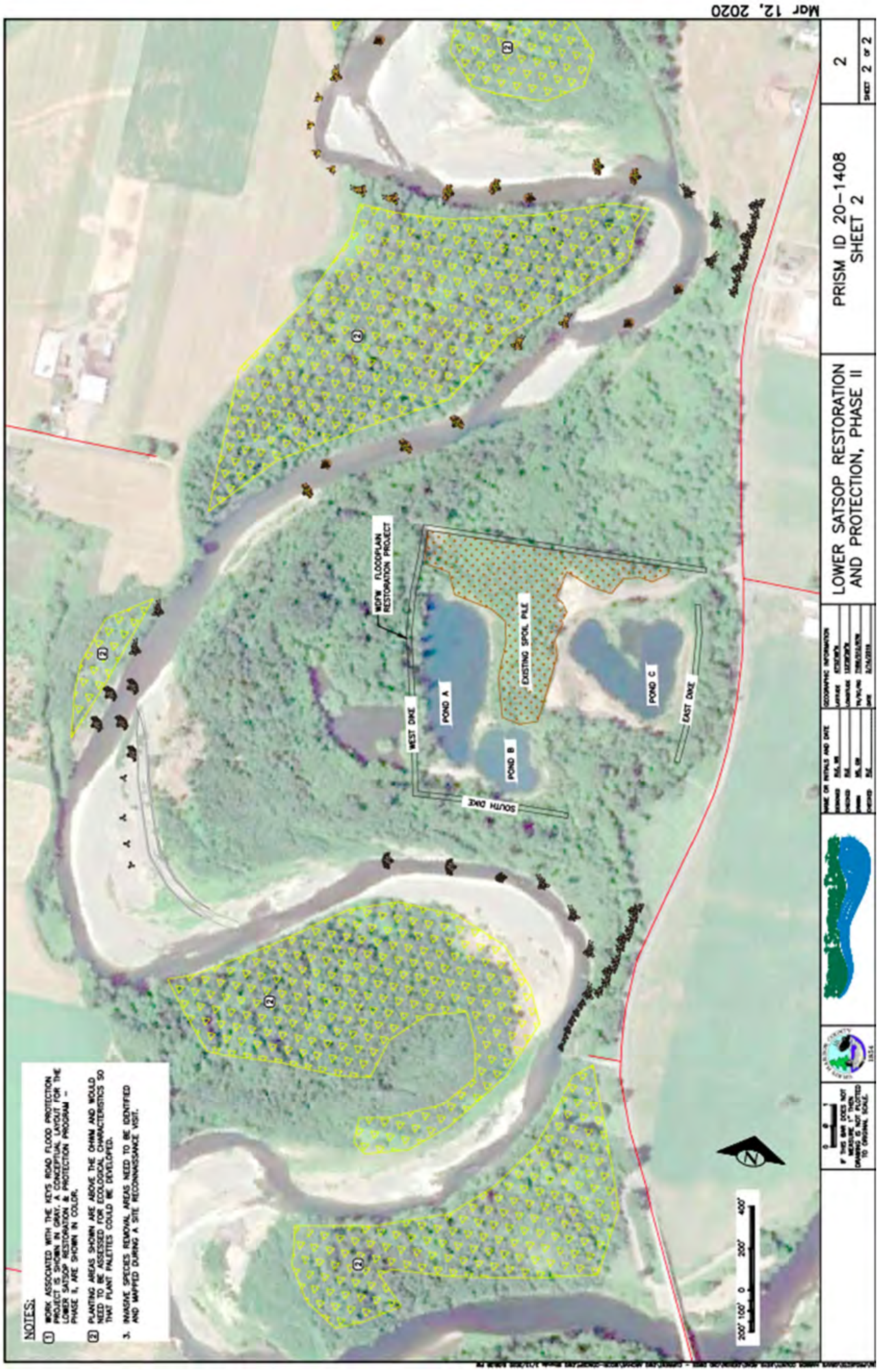
Project Name:	Lower Satsop Restoration, Protection and Aquifer Recharge (Phase II)
Project ID:	S-02
Project Location:	Lower Satsop River mainstem, south of Satsop, located in Grays Harbor County, WA; the project reach spans from the confluence with the Chehalis River to RM 2.3 (bridge along State Highway 12) 46.987960, -123.486648
Project Description:	Goals of this "programmatic" restoration project are to minimize damage from erosion and channel migration by improved floodplain connectivity to spread flood flows throughout the floodplain and restore side channel and off channel habitats for anadromous and resident fish and wildlife. A secondary benefit of the project will be to retime naturally occurring infiltration into the aquifer. It is anticipated that this stored water will discharge naturally back into the Satsop River later in the season, enhancing stream flows and improving conditions for fish. Conceptual design elements for Phase II include placing engineered wood structures in the channel and an invasive plant control and riparian planting program. These actions will: • improve floodplain connectivity, restore main channel, side-channel and off-channel habitats for anadromous and resident fish and wildlife; • protect public and private infrastructure and agricultural lands from Lower Satsop bank erosion. The goals of this project are to reconfigure the floodplain adjacent to the Satsop River to reduce erosion and restore the historic channel migration zone. Structural changes will support riparian vegetation, aquatic habitat, stabilizing the floodplain, and reduce erosion. The project will include riparian plantings, and backwater habitats, and enhanced side-channels. It is anticipated that this project will also provide increased opportunities for aquifer recharge. The project will reduce stream velocity and erosion by redistributing flows across the floodplain creating greater inundated surface area during high flow conditions.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The project will increase groundwater recharge rates in the vicinity of the channel improvements. Benefits to groundwater result from lower stream velocity and greater floodplain connectivity that increase the rate of recharge during high flow conditions.

	The needs this project is intended to address include: High water temperatures; Low habitat diversity; Reduced quantity and quality of instream habitats; and Impaired water quality and floodplain connectivity. Additionally, reducing the rates of channel migration, rehabilitating the riparian vegetation, and developing an invasive species treatment program will reestablish successional riparian growth. Currently the Lower Satsop River system has very high rates of channel migration that disrupt the successional growth of riparian vegetation, increase colonization of invasive species and introduce fine sediment into the river. High rates of channel migration are degrading valuable floodplain habitat, reducing channel length, and concentrating stream power. The proposed engineered wood structures placed in the channel will bring the damaging high rates of erosion and channel migration back to historic rates by sorting sediment, stabilizing gravels, building floodplains, increasing channel length, and reducing stream power. In stream wood structures will improve habitat by scouring pools, providing cover from predation, increasing food production, and locally reducing velocities to sort sediment and maintain stable gravels for spawning.
Is Water Quantity a Limiting Factor In this Subbasin?:	Water Quantity is a Tier 3 concern for the Main-Stem Satsop
Location & Spatial Extent of Benefits:	From the confluence of the Lower Satsop and Chehalis Rivers upstream to the bridge encompassing approximately 2.3 miles of river. The project reach spans along the lower Satsop River, from the confluence with the Chehalis River (RM 0) to RM 2.3 (Monte Elma bridge along State Highway 12).
Anticipated Water Offset (if applicable):	Water offset is expected but there is insufficient information at this time to quantify potential benefits. The goal of this project is the quantification of additional water likely to be stored or retained by the proposed system that would otherwise constitute high velocity stormwater and contribute to flooding. A conceptual feasibility would assess the proposed floodplain and channel design for locations and conditions that support enhanced aquifer recharge. The Lower Satsop River floodplain is approximately 400 acres within the project location and the proposed channelization and floodplain connectivity work will provide additional channel area and potential increased groundwater recharge.
Project-Type Specific Information:	Groundwater Aquifer Recharge • How much water is likely to be stored?

	- Unknown at this stage.
	• Has the surface water source for the project been evaluated, and, if so, what is that source?
	  - Lower Satsop River mainstem
	• During what period(s) can water be diverted? Is there an instream flow?
	  - N/A
	• How often is the flow above the minimum instream flow? What is the proposed rate of diversion?
	  - N/A
	• What type of water rights would need to be acquired to provide water from that source?
	  - None
	• What stream reach likely would benefit from this project and what is the anticipated benefit to that reach?
	  - The project reach spans along the lower Satsop River, from the confluence with the Chehalis River (RM 0) to RM 2.3
	  - It is anticipated that this stored water will discharge naturally back into the Satsop River later in the season, enhancing stream flows and improving conditions for fish.
	• What fish species will benefit?
	  - Primary species benefitting: Chinook, Coho, Steelhead, Chum.
	• Has a feasibility study been conducted, and, if so, have the anticipated timing of streamflow benefits been estimated?
	  - Not yet.
	• What is the potential diversion method(s)?
	  - Natural infiltration

Estimated Project Cost:	Project as currently funded $1,889,382, cost for additional recharge analysis to be determined
Performance Goals & Measures:	• Floodplain acres reconnected • cfs of additional flow based on increased infiltration
Anticipated Local and Partner Support & Barriers to Completion:	Support: Lower Satsop Advisory Group (public agencies and private interests); Lower Satsop landowner community; Grays Harbor County Voluntary Stewardship Program Received partial design funding for Phase II from Chehalis ASRP 2019/20 grant round.
Project Sponsor, Implementation Start Date and End Date:	Grays Harbor County Start construction: Summer 2021 or as soon as funding is available; End 1/1/2023

Lower Satsop Restoration & Protection – Phase II, PRISM ID 20-1408


Mar 12, 2020
LOWER SATSOP RESTORATION AND PROTECTION, PHASE II
PRISM ID 20-1408 SHEET 2
WDFW FLOODPLAIN RESTORATION PROJECT
EXISTING SPOIL PILE
POND A
POND B
POND C
WEST DIKE
EAST DIKE
SOUTH DIKE
NOTES:


Mar 12, 2020
PRISM ID 20-1408
SHEET 2
LOWER SATSOP RESTORATION
AND PROTECTION, PHASE II
2
NOTES:
POND A
POND B
POND C
EXISTING SPOIL PILE
WEST DIKE
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SOUTH DIKE

PROJECT INFORMATION SHEET

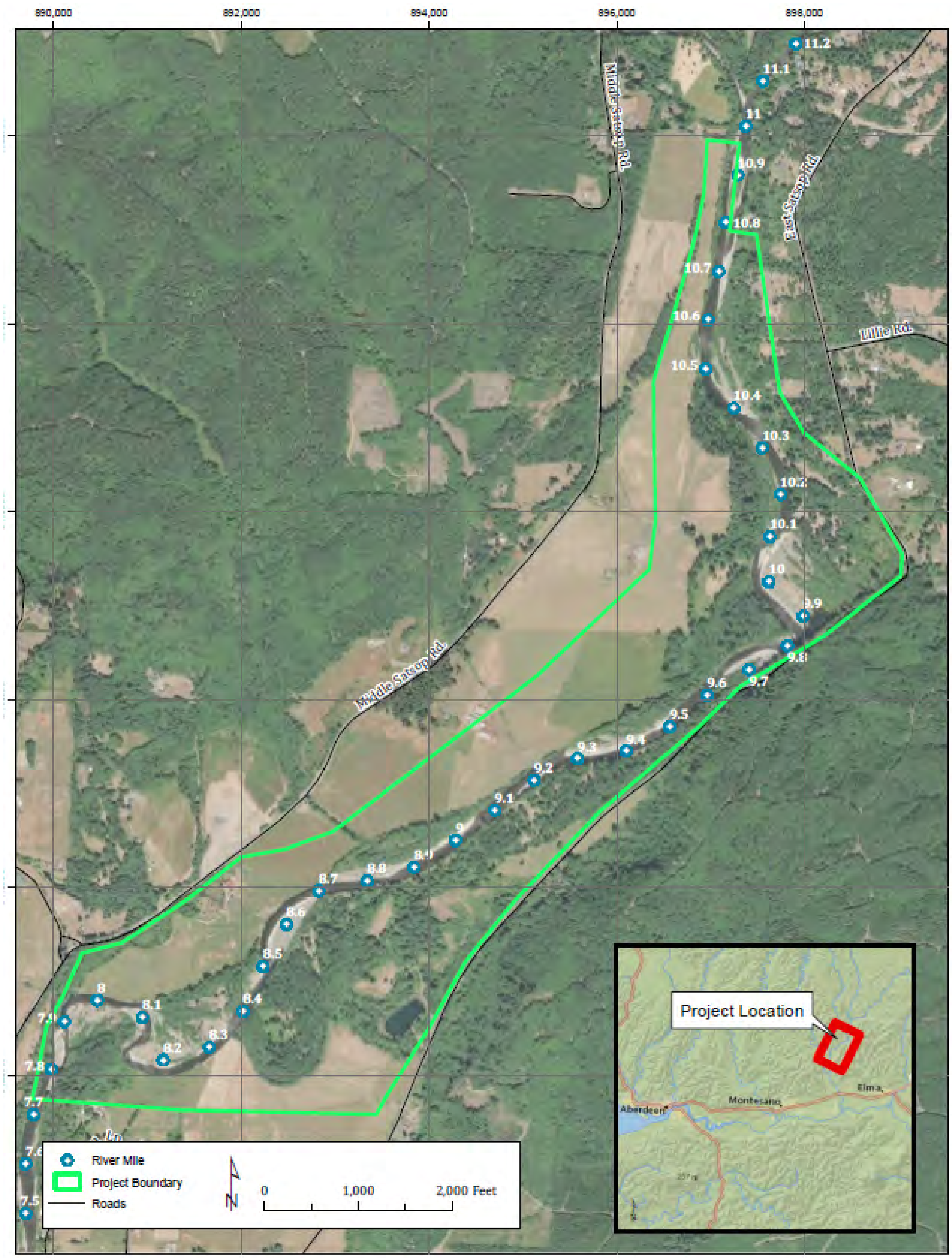
Project Name:	**East Fork Satsop RM 8, Early Action Reach**
Project ID:	**S-03**
Project Location:	East Fork Satsop River, RM 7.8-11.0; Lat/Long: 47.065279, -123.487476 (center of project area)
Project Description:	Three categories of restoration actions are proposed: 1. Placement of engineered log jam structures to alter local channel hydraulics, reduce channel migration rates, increase floodplain habitat inundation frequency and duration, and provide local habitat. 2. The enhancement of existing side channel features to improve inundation duration and vegetative function. 3. Riparian and wetland restoration to convert pasture areas to mixed conifer-deciduous forest, promote conifer succession in existing forested floodplain, stabilize streambanks, control invasive plant species, and rehabilitate and create floodplain wetlands.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Our restoration strategy includes the long-term restoration of a mature riparian forest, which is essential to restarting the floodplain large wood cycle. A mature riparian forest will add stability to the system both by stabilizing the banks and by providing a source of stable large wood to be recruited to the stream. Sufficiently reducing channel migration rates in the short term is essential however, so that riparian forests to have enough time (~100 years) to mature so that they are capable of slowing erosion and channel migration rates. For both the long-term and short-term strategies to be successful, the river must also be given enough space to allow for enough channel migration that allow for habitat forming processes to occur and for floodplains to be connected more frequently while also allowing forests to mature. This strategy will eventually allow the river system to sustain itself while allowing for habitat forming processes necessary to sustain healthy aquatic ecosystems (Natural Systems Design, 2018).
Is Water Quantity a Limiting Factor In this Subbasin?:	It is a Tier 3 limiting factor.

Location & Spatial Extent of Benefits:	East Fork Satsop River, RM 7.8-11.0
Anticipated Water Offset (if applicable):	N/A

Project-Type Specific Information:	Floodplain and Channel Migration Zone Restoration
	• What is the floodplain or channel migration problem (e.g. levee, floodplain fill, bank armoring, anthropogenic-caused channel incision, river training structures, other)?
	    o Channel incision, lack of in-stream stable wood, rapid erosion, lack of a mature riparian tree community
	• What is/are the proposed restoration action(s), and how will the action(s) address the floodplain or channel migration problem?
	    o Engineered log jams to reduce erosion and allow for riparian plants to re-establish; ELJs to engage side channels at lower flows and provide more fish habitat; ELJs to aggrade sediment and form stable islands, scour holes, and create a greater quantity and diversity of aquatic habitat
	• Will the project increase floodplain inundation?
	    o Yes
	Side Channel and Off Channel Habitat
	• What is the problem the side channel and/or off-channel habitat project proposes to correct?
	    o Lack of side channel connection to the river due to channel incision
	• How will the project create, reconnect, or enhance existing habitat?
	    o ELJs will increase inundation of side channels at lower flows than side channels are currently activated, providing more access to floodplain habitat.
	• What type(s) of channel(s) will be restored or created (flow-through, backwater, groundwater, floodplain ponds)?
	    o ELJs will increase backwater in existing backwater areas, direct more water into existing flow-through channels, recharge off-channel wetlands, and increase overall floodplain inundation. No new channels will be created.
	• What valley and reach-scale features indicate potential for side channel or off channel habitat restoration (e.g. floodplain depressions, relic channels, existing side channels that are perched above an incised channel)?
	    o Relic channels, existing side channels, existing backwaters, floodplain wetlands
	Instream Habitat Restoration

	• What is the problem the instream habitat project proposes to correct?
	  o Lack of quantity, quality, and diversity of instream habitat due to a simplified channel from a lack of stable large wood.
	• What are the existing and proposed channel forms and cross-sections? (May be conceptual).
	  o Existing channel form is largely single thread with seasonal inundation of floodplain side channels during flood events. Proposed channel form is split/braided from the hydraulic and geomorphological impacts from instream ELJ structures and more frequent inundation of side channels.
	• How would the proposed channel modifications restore habitat-forming processes and/or historical conditions?
	  o These modifications will increase the quantity, quality, and diversity of habitat for aquatic species by providing more flow paths, a diversity of flow depths/velocities, and greater access to off-channel habitats. Riparian plantings will provide large wood input in the future to supplement the instream structures.

Estimated Project Cost:	$4,213,515. Funding has already been secured through the Office of the Chehalis Basin/Chehalis Basin Strategy.
Performance Goals & Measures:	* Total Riparian Acres Treated= 210 * Total Riparian Miles Streambank Treated= 3.2 Floodplain: acres reconnected= 9 Total Miles of Instream Habitat Treated= 3.2 miles
Anticipated Local and Partner Support & Barriers to Completion:	Support from Grays Harbor Conservation District, the Aquatic Species Restoration Plan Steering Committee, and local landowners
Project Sponsor, Implementation Start Date and End Date:	WDFW, Design underway Start construction: Summer 2021 Closeout by: 1/1/2024


890,000
892,000
894,000
896,000
898,000
Middle Satsop Rd.
East Satsop Rd.
Lillie Rd.
11.2
11.1
11
10.9
10.8
10.7
10.6
10.5
10.4
10.3
10.1
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9
8.8
8.7
8.6
8.5
8.4
8.3
8.2
8.1
8
7.8
7.7
7.5
River Mile
Project Boundary
Roads
0
1,000
2,000 Feet
Project Location
Aberdeen
Montesano
Elma

PROJECT INFORMATION SHEET

Project Name:	**Scatter Creek Water Right Purchase and Dry-Season Streamflow Augmentation (TC #118/119)**
Project ID:	**SC-00**
Project Location:	Black River management unit: Grand Mound UGA, Scatter Creek and Prairie Creek are tributaries of the Chehalis River in southern Thurston County. See Figure 1. Cooke Aquaculture Lat/Long: 46.8288, -123.00000 Grand Mound water system Lat/Long: 46.79433, -123.02485
Project Description:	Conceptually, this water offset project would purchase about 1,500 ac-ft/yr of unused certificated water rights from Cooke Aquaculture, from their facility on Scatter Creek at Case Road SW. In general terms, groundwater from these rights (now held in Trust) would benefit the Scatter Creek aquifer and its streams by being be partitioned into: 1. **Part A: Permanent retirement of part of the Cooke water rights.** A portion of the Cooke water rights would be retired to permanently offset growth in permit exempt consumption from sole-source Scatter Creek Aquifer. The Scatter Creek Aquifer feeds both Scatter Creek and Prairie Creek. 2. **Part B: Augmentation of dry-season streamflow in Scatter Creek.** A portion of the Cooke water rights would be pumped directly to Scatter Creek in the dry season, if needed to maintain baseflows sufficient for salmon. Fish passage could potentially be maintained as far upstream as the Scatter Creek Wildlife Recreation Area owned by the Washington State Department of Fish and Wildlife. 3. **Part C: Connection of the Grand Mound water system to the Cooke water rights' groundwater Place-of-Use.** This connection would be used to both a) reduce the need for Class A Reclaimed Water production by Thurston County; b) provide additional water for projected growth in the Grand Mound UGA; and c) provide a redundant water source less impacted by current/potential future contaminants. 4. **Part D: Augmentation of dry-season streamflow in Prairie Creek.** Part of the Cooke water rights would substitute for the current Grand Mound water system water rights, for an additional water offset credit. The Point-of-Withdrawal for these rights is Township 15N, Range 3W, Section 11. 5. **Part E: Seed water rights for a Scatter Creek Water Bank.** The residents of the Rochester-Grand Mound-Tenino valley are

	currently reliant on a shallow sole-source aquifer. Because both the Rochester and Grand Mound Subarea Plans indicate significant expected growth over the next 20-40 years, current and future residents will benefit from the resource management made possible through a 'Scatter Creek Water Bank,' potentially using part of the water rights from either/both the Cooke or Grand Mound water system. Reduced total groundwater withdrawals would occur as pumping shifted from year-round fish production to seasonal streamflow augmentation. The objective of this overall realignment would be reduction in total withdrawals from the Scatter Creek Aquifer, while supporting both streamflow and growth. The project would consist of four main construction elements: 1. Extend the existing Grand Mound water system main on Elderberry Street SW, to new source well(s) in Township 16N, Range 3W, Section 36 (northeast quarter), as citied in the Cooke Aquaculture (Icicle Acquisition Subsidiary) certificated water rights (est.~9,500 feet of main); 2. Construction of new source wells for the Grand Mound water system (Water System ID 7158) in/near in Township 16N, Range 3W, Section 36 (northeast quarter), likely near parcel ID 99900812700; 3. Construction or refurbishment of pipes and outfall structures to Scatter Creek; 4. Construction or refurbishment of pipes and outfall structures to Prairie Creek. See Figure 2 for details. Cooke Aquaculture's Scatter Creek facility holds large groundwater rights. Of the original 19,431 ac-ft/yr allocated to this facility, Ecology agreed with the water right holder that 12,843 ac-ft was valid. Cooke has placed these rights into Trust as a 'Temporary Donation,' while retaining 2,890 ac-ft for its ongoing operational needs. By placing these rights in Trust, all 12,843 ac-ft are protected temporarily from relinquishment. The current Beneficial Use for these water rights is for fish production, that is typically considered 'non-consumptive.' However, two indicators suggest that these rights are partially consumptive: • Analysis of the James Road stream gage on Scatter Creek indicates that a significant fraction of the Cooke facility discharge reaches that gage;

	• Discharge from the Cooke facility on Case Road SW was once significant - producing at certain times of the year the only source of flow in what would otherwise have been an intermittent stream. In April of 2012 a recirculation system was installed at the Cooke Scatter Creek facility; Scatter Creek immediately became drier in late summer/fall (Note that instead of constantly flushing water through the tanks, water is now recycled. Water from the onsite wells is used only as make-up water, for washing, for the transport of fish, and to maintain an appropriate temperature). Currently (as of March, 2020) the main site water discharge to Scatter Creek (a large part of total facility water use) averaged approximately 1,737 ac-ft per year as reported in PARIS database records for Ecology permit WAG131007 (DMR reports show average discharge of 1,549,440 gallons per day, calculated). This could comprise as much as 60.1% of the facility's 2,890 ac-ft/yr of water rights not held in Trust. The consumptive and non-consumptive fractions of the Cooke water rights would be considered in a Feasibility Study of the partitioning described above, pending a needed Report of Examination (ROE) by a certified Water Rights Examiner (CWRE) and consultations with the Department of Ecology. There are very likely additional conditions in these water rights, and new conditions that will likely be required by Ecology should this conceptual realignment occur. Following this assessment, there are two primary options to leverage the Cooke rights for instream flow benefits to Scatter Creek. The first concept would be to increase withdrawals at the existing facility and develop a direct flow augmentation program by discharging water directly into Scatter Creek. The second approach would be to further assess groundwater/surface water interactions at this site and determine the extent of "passive" benefit to instream flows by continuing to not use the banked water rights. Assuming flow benefits to both Scatter Creek and Prairie Creek, the wetted stream lengths that could be maintained through the dry season are indicated on Figure 2 (attached).
Project Type:	☑ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	• Scatter Creek increased flow: 700 afy or approx. 117 days of streamflow @ 3.0 cfs (@ 1,346 gpm).

	• Prairie Creek increased flow: 200 acre -feetyear or approx. 101 days of streamflow @ 1.0 cfs (@ 449 gpm). • Retirement of 200 acre-feet per year of certificated water rights. • Coho, Chum, and Steelhead would benefit. Coho salmon are the primary salmonid stock within Scatter Creek, spawning and rearing throughout the watershed. Steelhead use the lower portions of Scatter Creek, and chum salmon use has been reported in the past. • Increased length of wetted channel in Prairie Creek and Scatter Creek. • Benefits are potentially scalable: after water rights are purchased, incremental increases in Scatter Creek and Prairie Creek flow augmentation are possible. • Dual benefits: the proposed flow augmentation would include co-located benefits from both permit-required and permit exempt mitigation. • Habitat could be incrementally improved along the newly wetted dry-season channels of Scatter Creek and Prairie Creek. • Scatter Creek and Prairie Creek are a losing/pendant stream in some reaches. If newly wetted by streamflow augmentation, these losing/pendant reaches could provide additional groundwater recharge.
Is Water Quantity a Limiting Factor In this Subbasin?	Scatter Creek is a Tier 1 stream with Water Quantity as a Limiting Factor. Prairie Creek runs dry in summer, so that the proposed water offset would extend the time of creek flow. The project includes co-located benefits from both permit-required and permit exempt mitigation, improving streamflow from this combined benefit.
Location & Spatial Extent of Benefits:	Flows could be increased in Scatter Creek from the location of the Cooke Aquaculture facility downstream to its confluence with the Chehalis River, then onward to Grays Harbor. Fish passage could potentially be maintained as far upstream as the Scatter Creek Wildlife Recreation Area owned by the Washington State Department of Fish and Wildlife. Prairie Creek would likely receive additional wetted length from about Old Highway 99 to the Chehalis River. The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process and would depend in part on the forecasted growth in consumption for the Grand Mound UGA.
Anticipated Water Offset (if applicable):	The planning group has determined that based on the distribution of exempt wells that the Scatter Creek sub basin will have a consumptive

<table>
<tr><td></td><td>deficit of 64.2 acre-feet per year. This equates to 40 gpm. This amount is very small relative to the 9,953 acre-feet held by Cooke.

The potential water offset would depend on the consumptive and non-consumptive fractions of the total water rights purchased, plus the requirements of Thurston County water rights for the Grand Mound system, and any new permit mitigation requirements from Ecology, as well as on the forecasted growth in consumption for the Grand Mound UGA. Provisionally, this would include as much as 700 acre-feet per year specifically benefitting Scatter Creek as a water offset project for permit exempt consumption. However, the cost-benefit of several scenarios should be considered before a final water offset can be estimated.</td></tr>
<tr><td>Project-Type Specific Information</td><td>Water Right Acquisitions
Has the water right been put to beneficial use?
Right has not been put to beneficial use yet but would be if project moves forward.
Are there any relinquishment concerns?
To be determined in feasibility study.
Has work already been conducted to estimate consumptive use, and, if so, what is the estimated consumptive use?
The consumptive and non-consumptive fractions of the Cooke water rights would be considered in a Feasibility Study.
Is the water right uninterruptible (that is, senior to instream flow rules or other senior water rights)?
To be determined in feasibility study.
Where is it anticipated that the benefits would occur?
Flows could be increased in Scatter Creek from the location of the Cooke Aquaculture facility downstream to its confluence with the Chehalis River, then onward to Grays Harbor. Prairie Creek would likely receive additional wetted length from about Old Highway 99 to the Chehalis River. The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process.
What is the anticipated rate and volume of the benefits?
Scatter Creek increased flow of 3.0 cfs (2,172 af/yr); Prairie Creek increased flow of 200 af/yr or 1.0 cfs
If possible, describe hydraulic connectivity with nearby streams, relative importance of streamflow as a limiting factor for fish, information about species present in nearby stream, etc.
Habitat could be incrementally improved along the newly wetted dry-season channels of Scatter Creek and Prairie Creek, benefiting Coho, Chum, and Steelhead. Coho salmon are the primary salmonid stock within Scatter</td></tr>
</table>

	Creek, spawning and rearing throughout the watershed. Steelhead use the lower portions of Scatter Creek, and chum salmon use has been reported in the past.
Estimated Project Cost:	Several million dollars, at minimum, for water rights purchase, engineering, permitting and new infrastructure.
Performance Goals & Measures:	Although additional monitoring may be advisable based on project-specific needs, considerable monitoring is already underway, and has been for many years. Cooke Aquaculture's subsidiary already monitors for its discharge permit WAG131007 per Ecology requirements. Grand Mound water and wastewater system monitoring already occurs as required by for existing DOH and Ecology permit requirements. Streamflow, weather and groundwater level/quality monitoring already occur throughout the Scatter Creek aquifer by Thurston County Water Planning (See: https://www.thurstoncountywa.gov/sw/Pages/monitoring-dashboard.aspx).
Anticipated Local and Partner Support & Barriers to Completion:	Thurston County Public Works is likely to support a solution such as this, which reduces or eliminates the need for very expensive reclaimed water production. Many other partners may support this project.
Project Sponsor, Implementation Start Date and End Date:	Thurston County may sponsor this project, depending upon Feasibility Study outcomes. The project will need a Report of Examination from a CWRE, plus additional hydrogeological, legal and engineering feasibility studies. Start feasibility 7/1/2021 or as soon as funding is available. End by 1/1/2038, end of planning period.

Figure 1 General area of project in Thurston County

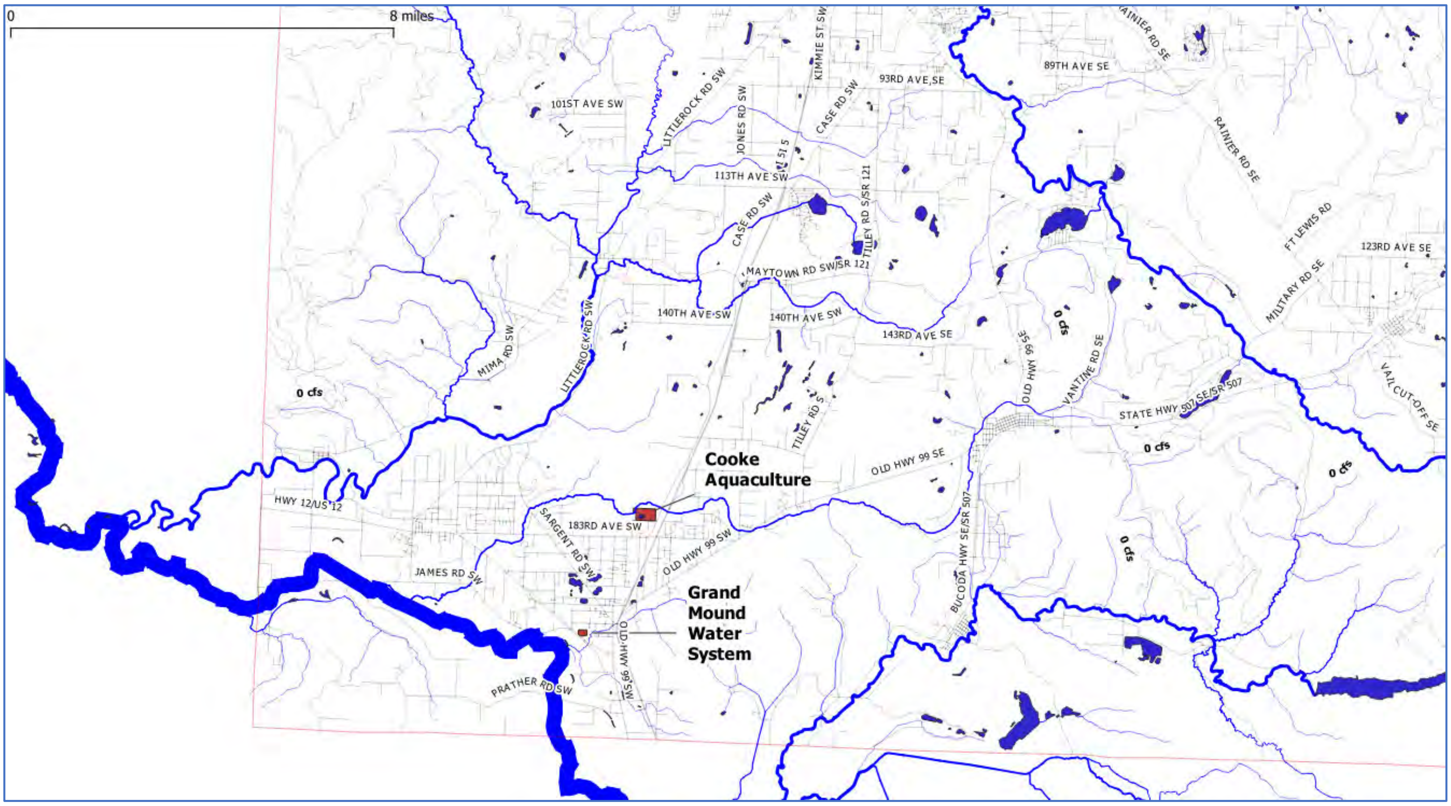


Table 1

Conceptual Allocation of Benefits from a Large Purchase of Water Rights from the Cooke Aquaculture Case Road Facility

18-Aug-20

	Conceptual Partition of Cooke Water Rights Purchase	Grand Mound Water System Public Supply (afy)	Permit-Exempt Water Offset (afy)	Permit-Required Mitigation (afy)	Dry-Season Non-Consumptive Pumping * (afy)	Subtotals (afy)	Dry-Season Total Streamflow Augmentation (afy)	Notes
A	Permanent retirement of part of the Cooke water rights		200			200		
B	Augmentation of dry-season streamflow in Scatter Creek		200			200		
C	Connection of the Grand Mound water system	200				200		
D	Augmentation of dry-season streamflow in Prairie Creek			200		200		
E	Seed water rights for a Scatter Creek Water Bank			200		200		
	Dry-Season Non-Consumptive Pumping (afy)				500	500		
	Total Water Rights Purchase (afy):					**1,500**		
	Scatter Creek Augmentation (afy)		200		500		700	Approx. 117 days of streamflow @ 3.0 cfs (@ 1,346 gpm)
	Prairie Creek Augmentation (afy)			200			200	Approx. 101 days of streamflow @ 1.0 cfs (@ 449 gpm)

Notes: * Non-consumptive fraction is assumed to be 33% of total

PROJECT INFORMATION SHEET

Project Name:	**Weins Farm Off-Channel Water Storage-and-Release (Thurston County ID 90). Assessment/Design/Construction.**
Project ID:	**SC-01**
Project Location:	Project is located south of the James Road crossing of Scatter Creek. Black River management unit: Scatter Creek subbasin. Project includes unnamed tributaries of the Chehalis River in southern Thurston County, south of Scatter Creek at James Road. This is in the Scatter CBP unit. Lat/Long: 46.796675, -123.077055
Project Description:	The Weins Farm is a very large and important parcel adjacent to the Chehalis River. Conceptually, the project includes off-channel storage from high flows on the Chehalis River, with slow drainage feeding water into drier months. Numerous habitat improvement and flood-water storage projects could be envisioned. This project envisions the creation of off-channel water storage adjacent to the Chehalis River. The project location and concept are presented in Figures 1 and 2. The project envisions a high flow (winter) diversion off of the main stem of the Chehalis at a water surface elevation above ~118 feet NAVD88, using one-way gates/valves to retain water up to about elevation 123 NAVD88. The diversion would capture flood waters in repeated high flow cycles annually in abandoned oxbows with a low dike retaining 3-5 feet of ponded water. The lowland area of the abandoned oxbows consists of approximately 32.8 acres total at and below elevation 125 feet NAVD88 including both the Weins Farm and the parcel to the east. Approximately 20.2 acres of the total are on the Weins Farm alone. Floodplain reconnection would occur to seasonally inundate these lowland oxbows, improving habitat, as well as capturing silt and nutrients. If provided with the conceptual low levee (shown on Figure 2), additional flood water storage could be obtained. A combination of natural drainage and one-way inlet/outlet flood gates could be utilized to regulate flow back to the Chehalis River mainstem, supporting midseason and late season flows. We envision the possibility that some flood control benefits may also be possible, and these should be studied as part of the development of the project. Chapter 173-522 WAC “Water Resources Program in the Chehalis River Basin, WRIA-22 and 23” describes the instream flow limits for the Chehalis River reach from Grand Mound to Porter. Using the Porter gage

	as the reference (USGS gage ID 12.0310.00), enough winter flow may exist to support this project. MODFLOW groundwater modeling exists across this project site and can be used to test project concepts. Also, the Chehalis Basin Flood Authority has already modeled the Chehalis River and its associated floodplain, with very sophisticated 2D hydrodynamic modeling. Through this work, the capacity for both water offset, and flood storage can be tested. In addition, significant LiDAR and land survey data are available for project assessments (one-foot LiDAR topography is presented on Figure 2. River cross-sections, models and data layers needed to assess options more rapidly for this project already exist, substantially reducing the cost of assessments. Because this area is already under consideration for habitat improvement, the water offset project would be one component of the larger effort to protect this part of the Chehalis River floodplain, an area of substantial ecological and hydrologic value. We propose an initial screening and review of this opportunity so that the water offset size, possibility of flood control benefits, and potential ecological benefits can be more fully estimated and quantified prior to submission for funding consideration. Following this initial screening effort, the probability of additional grants will be improved prior to utilization of Streamflow Restoration Act funding and assisting with the improvement of habitat.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	• Conceptually, this project could provide off-channel storage and release of 20 to 32 acre-feet water, repeatedly, potentially during each of multiple flooding events across the rainy season. These benefits would require quantification. • Drainage of this area using either natural or engineered methods could be used to provide streamflow benefits later in the year, i.e. direct surface water discharge or groundwater seepage that would subsequently provide stream base flow. • Potential flood control benefits • Wetland/habitat benefits • Scatter Creek watershed and unnamed tributaries to the Chehalis, and the Chehalis River itself would receive water offset benefits.

	• Unnamed tributaries and the Chehalis River would receive additional streamflow, extending the length of wetted stream channel. • The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process and would depend in part on the forecasted growth in consumption for the Grand Mound UGA. • Habitat could be incrementally improved along the Chehalis River floodplain. • Unnamed tributary side channels are likely losing/pendant streams in some reaches during dry months. If wetted by stored water, these losing/pendant reaches could provide additional groundwater recharge.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes. Water Quantity is a Tier 1 concern for the Scatter Creek subbasin. The 2011 Lead Entity strategy states: "Scatter Creek is not meeting base flow requirements and is closed to further appropriations. Scatter Creek has some segments that go dry during the summer months." *http://www.chehalisleadentity.org/documents/*. New habit assessments would be required, but it can be assumed that conditions have not improved since 2011.
Location & Spatial Extent of Benefits:	The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process.
Anticipated Water Offset (if applicable):	Conceptually, this project could provide off-channel storage and release of 20 to 32 acre-feet water, repeatedly, potentially during each of multiple flooding events across the rainy season. These benefits would require quantification.

Project-Type Specific Information	Water Storage and Retiming Projects
	• How much water is likely to be stored?
	    o 20-30 acre feet
	• Has the surface water source for the project been evaluated, and, if so, what is that source?
	    o No
	• During what period(s) can water be diverted? *Rainy season* Is there an instream flow?
	    o Yes
	• How often is the flow above the minimum instream flow?
	    o Will be evaluated during feasibility study
	• What is the proposed rate of diversion?
	    o Will be evaluated during feasibility study

	• What type of water rights would need to be acquired to provide water from that source?
	  o Will be evaluated during feasibility study
	• What stream reach likely would benefit from this project and what is the anticipated benefit to that reach?
	  o Scatter Creek & Mainstem Chehalis
	• What fish species will benefit?
	  o Chinook, Coho

Estimated Project Cost:	Unknown, conceptual
Performance Goals & Measures:	• Change In Water Flow Streamflow and groundwater level monitoring already occurs on the Chehalis River (Prather Road gage by USGS) and Independence Road (USGS/Chehalis Tribe).
Anticipated Local and Partner Support & Barriers to Completion:	Part of this parcel was protected with support by the Salmon Recovery Lead Entity (PRISM 12-1189). A proposed project was rejected for this site given the rapid bank erosion along the mainstem (HWS ID 15-1037) so erosion issues will need to be considered during feasibility study. The current landowners include a land trust and a sustainable farm, owned through a farmland trust, who may approve of additional conservation uses for this land. The Thurston Conservation District is an interested project partner. Barrier: High hydraulic conductivity soils may narrow the return seepage period.
Project Sponsor, Implementation Start Date and End Date:	Thurston Conservation District is interested in initiating feasibility work for this project. Several entities may sponsor this project, depending upon Feasibility Study outcomes. Start 7/1/2021 or as soon as funding is obtained. End 1/1/2038, end of planning period.

Figure 1 – Site Location

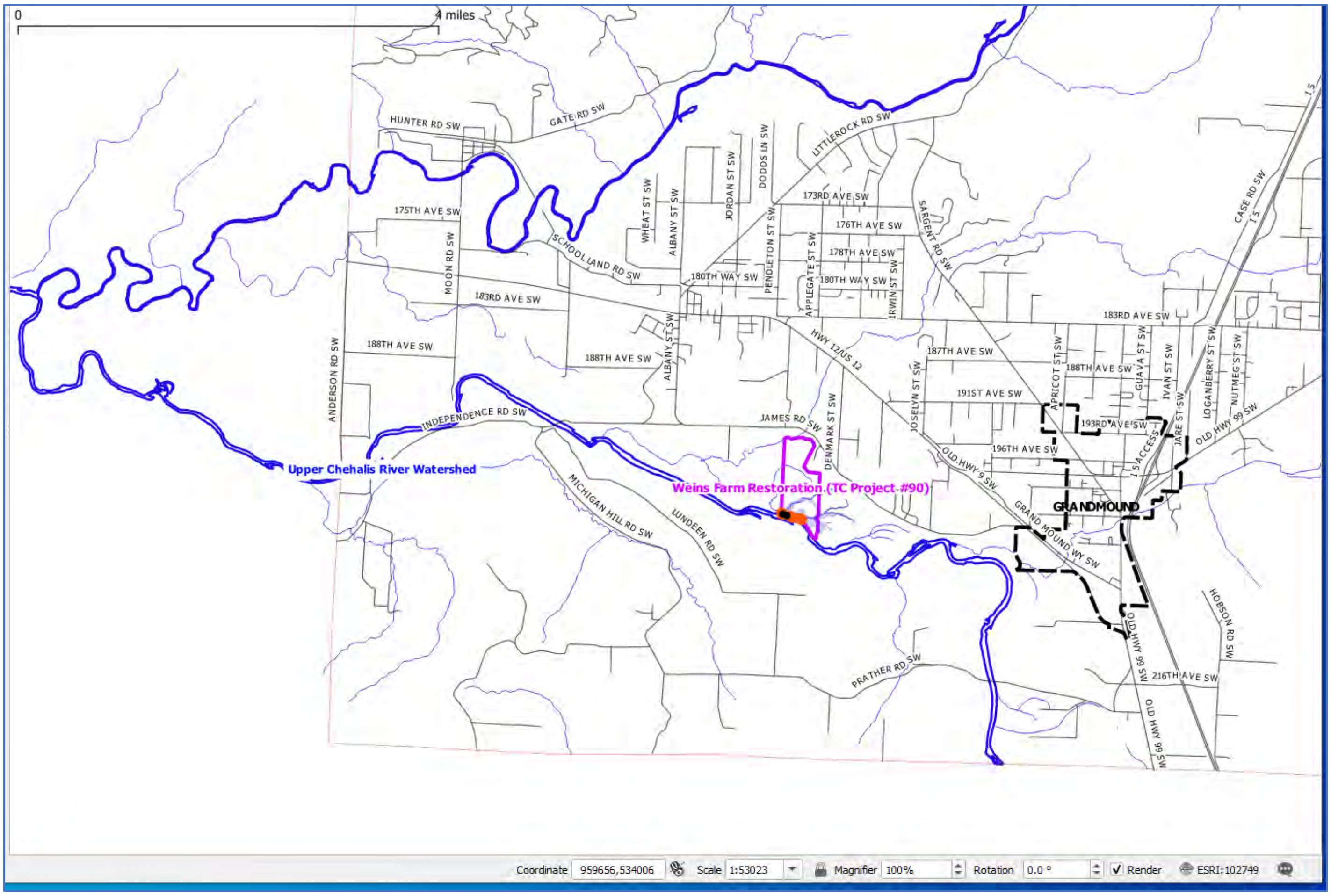
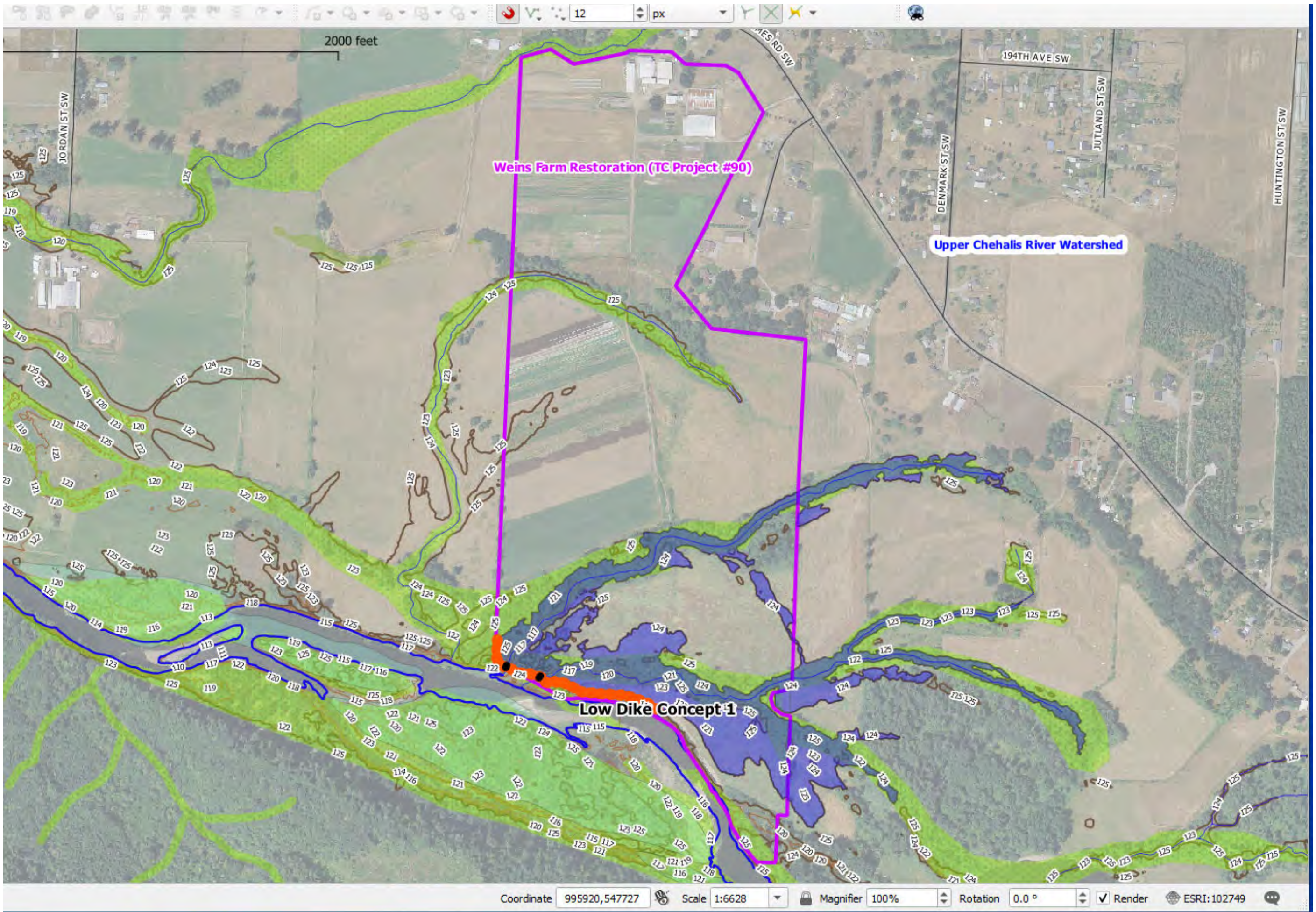


Figure 2 – Project Area showing conceptual off-channel water storage in abandoned oxbows adjacent to the Chehalis River (light blue shading). Water offset storage increases if the low dike concept is added:



PROJECT INFORMATION SHEET

Project Name:	**Upper Scatter Creek Managed Aquifer Recharge (Thurston County ID 89)**
Project ID:	**SC-02**
Project Location:	Project is located east of Tenino, south of State Highway 507 SW in central Thurston County. Scatter Creek management unit: Scatter Creek subbasin. The project includes unnamed tributary streams feeding Scatter Creek. Lat/Long: 46.856, -122.80751
Project Description:	This project concept envisions the wet season diversion of about 80 to 140 acre-feet per year (afy) of high wet-season streamflow off a tributary of Scatter Creek, into an approximately 450-ft-long long pipeline feeding an MAR infiltration gallery located on coarse soils. The diversion off of Scatter Creek would be limited to 0.3 cfs when streamflows are above 10 cfs, collecting at most 3% of winter high flow in this tributary of Scatter Creek, and infiltrating that water into a new Managed Aquifer Recharge (MAR) infiltration site. The location for the MAR facilities is on a single undeveloped parcel currently owned by the Heernet Environmental Foundation. The tributary to be diverted has some flow perennially as it flows over bedrock hills, but it loses flow rapidly after encountering the sands and gravels of the valley floor. The project location and concept are presented in Figures 1 through Figure 3. The NHDPlusHR dataset provides a mean annual discharge from this tributary (QaMA statistic) is 5.2 cubic feet per second (cfs) using the USGS methodology (Viger et al, 2016). The Thurston County MODFLOW groundwater model (v186) provides a baseflow value of 0.3 cfs based on output from the Streamflow Routing (SFR7) module. These estimates suggest that winter flows are in excess of 5.2 cfs. A diversion of 0.3 cfs from November-March could potentially be sustained for recharge at the MAR gallery. MAR infiltration would occur seasonally, between the months of November and March, to avoid impairments to surface water rights holders. The project is located on a single parcel (Parcel #1162131000, approx. 143 acres), owned by the Heernet Environmental Foundation. MODFLOW groundwater modeling exists across this project site and can

	be used to test project concepts. In addition, significant LiDAR data are available for project assessment (one-foot LiDAR topography). **References** Viger, R.J., Rea, A., Simley, J.D., and Hanson, K.M., 2016, NHDPlusHR—A national geospatial framework for surface-water information: Journal of the American Water Resources Association, v. 52, no. 4, p. 901–905. [Also available at https://doi.org/10.1111/1752-1688.12429.]
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	Conceptually, this project could provide infiltration of 80 to 140 afy water offset, through repeated higher-flow diversions (>10 cfs), potentially during each of multiple flooding events across the rainy season, from 1,462-acre feeder area. These benefits would require more detailed quantification as part of the Ecology-required Feasibility Study. Scatter Creek and the Chehalis River would receive water offset benefits. The project would improve streamflow later in the year, i.e. groundwater seepage that would subsequently provide stream base flow. Habitat could be incrementally improved along the Scatter Creek floodplain. The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process, and monitoring during operation. Wetlands may expand as a result of surface seepage created by groundwater mounding near the MAR infiltration facility.
Is Water Quantity a Limiting Factor In this Sub-basin?	Scatter Creek is a Tier 1 stream with Water Quantity as a Limiting Factor.
Location & Spatial Extent of Benefits:	Scatter Creek, from Tenino and downstream.
Anticipated Water Offset (if applicable):	Project water offset is estimated at 53.5 acre feet per year based on the preliminary analysis described below. This includes flow from groundwater seepage after the May 1 closure date. To confirm available winter streamflows, the US Army Corps of Engineers' HEC-HMS watershed modeling software was used to calculate approximate basin yields as briefly summarized in Figures 4 and 5. The basin feeding the conceptual MAR site is approximately 1,462

	acres in size. For hydrologic analysis it was divided into seven sub- basins and seven feeder reaches, including a modeled diversion structure and MAR infiltration gallery (Figure 4). Based on the Thurston County Drainage Design and Erosion Control Manual (DDECM), supplemented with experience at similar sites, ranges of values for subbasin and stream reach hydrologic properties were selected. Sensitivity analysis was performed by repeatedly testing parameters in various combinations. The resulting HEC-HMS model output indicates that 10 cfs may be exceeded for a significant part of the water year, allowing diversions of 0.3 cfs to be accommodated without significant impairment of downstream water users. This concept would divert no more than 3% of winter streamflows, and then only when flows exceeded 10 cfs. **Site hydrogeology** **1. MAR project component:** a. Depth to water: ~6 feet on average below ground from steady-state MODFLOW model v198. b. Hydraulic conductivity: K_{xy} = 1,931 to 599 ft/d, layers 1/2 of MODFLOW model 198. c. Groundwater velocity: v = ((600) x (0.00258))/(0.15) = 10.3 ft/day d. Distance and direction: ~2,244 feet from MAR site to stream, along groundwater streamline determined from steady-state MODFLOW model v198. *e.* Estimated travel time: ~218 days - project-level calculations required. f. Stream connection to aquifer: Partial connection - Project-level calculations required g. Estimated fraction of recharge that discharges to nearest stream: Project-level calculations required h. Initial estimate of streamflow benefit timing: Project-level calculations required i. Suggested Plan benefit estimate: 53 afy, based on 50% of recharge calculated by HEC-HMS sensitivity runs (see below) j. Probability of benefit: High, particularly because of sand/gravel soils (i.e. use 100% of the calculated 53 afy benefit) k. Probability of construction: Moderate – re-timing is small while water quantity is large. However, Heernet Env. Fnd. receptivity to the project is unknown. l. Total Estimated Water offset: 0.3cfs x 86400sec/day x 180 days) /43560] x 0.5 = 53.5 afy
Project-Type Specific Information	Water Storage and Retiming Projects • Has the surface water source for the project been evaluated, and, if so, what is that source?

	- o Scatter Creek. No source evaluation has been conducted yet, and project level calculations will be required. - During what period(s) can water be diverted? Is there an instream flow? - November through April. Stream is closed 1 May through 31 October. - Is there an instream flow? - No - How often is the flow above the minimum instream flow? What is the proposed rate of diversion? - N/A. Diversion period of 180 days per year was assumed for calculations. Proposed diversion rate is 0.3 cfs from November through April. - What type of water rights would need to be acquired to provide water from that source? - Surface water diversion and ASR permit. - What stream reach likely would benefit from this project and what is the anticipated benefit to that reach? - Scatter Creek - What fish species will benefit? - Coho and resident coastal Cutthroat trout - If this is a managed aquifer recharge (MAR) project, is the geology suitable and is the land available? - Geology is suitable: thick sand and gravel above bedrock. Land availability is unknown. - Has a feasibility study been conducted, and, if so, have the anticipated timing of streamflow benefits been estimated? - Feasibility study is anticipated. - What is the potential diversion method(s)? - Unknown.
Estimated Project Cost:	Capital cost of $200,000 to $500,000 based on professional experience
Performance Goals & Measures:	Streamflow, habitat or groundwater monitoring would likely be required for this project.
Anticipated Local and Partner Support & Barriers to Completion:	Heernet Environmental Foundation has considered several projects in this area and owns both the main project parcel and several nearby parcels. Salmon Recovery/HWS project ID 15-1036 was considered, but that project is considered dormant.
Project Sponsor, Implementation Start Date and End Date:	Not yet sponsored.

Figure 1 – Site Location

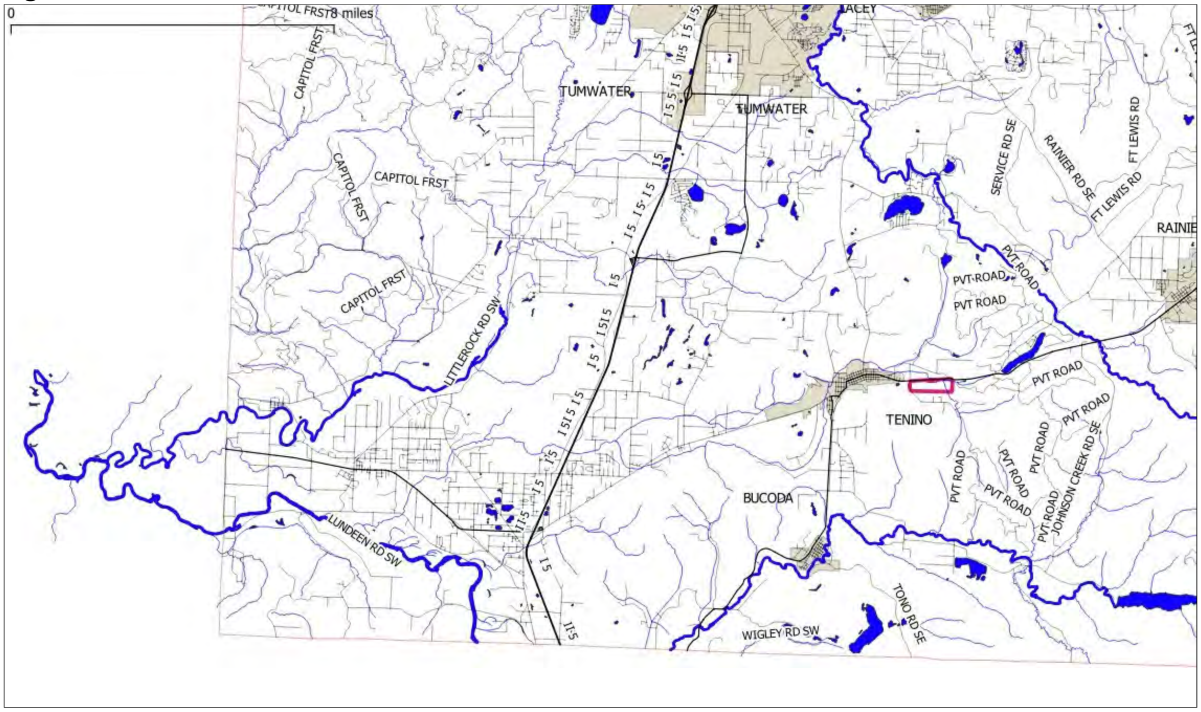


Figure 2 – Project Area showing conceptual Managed Aquifer Recharge (MAR) site fed a diversion off a tributary of Scatter Creek:

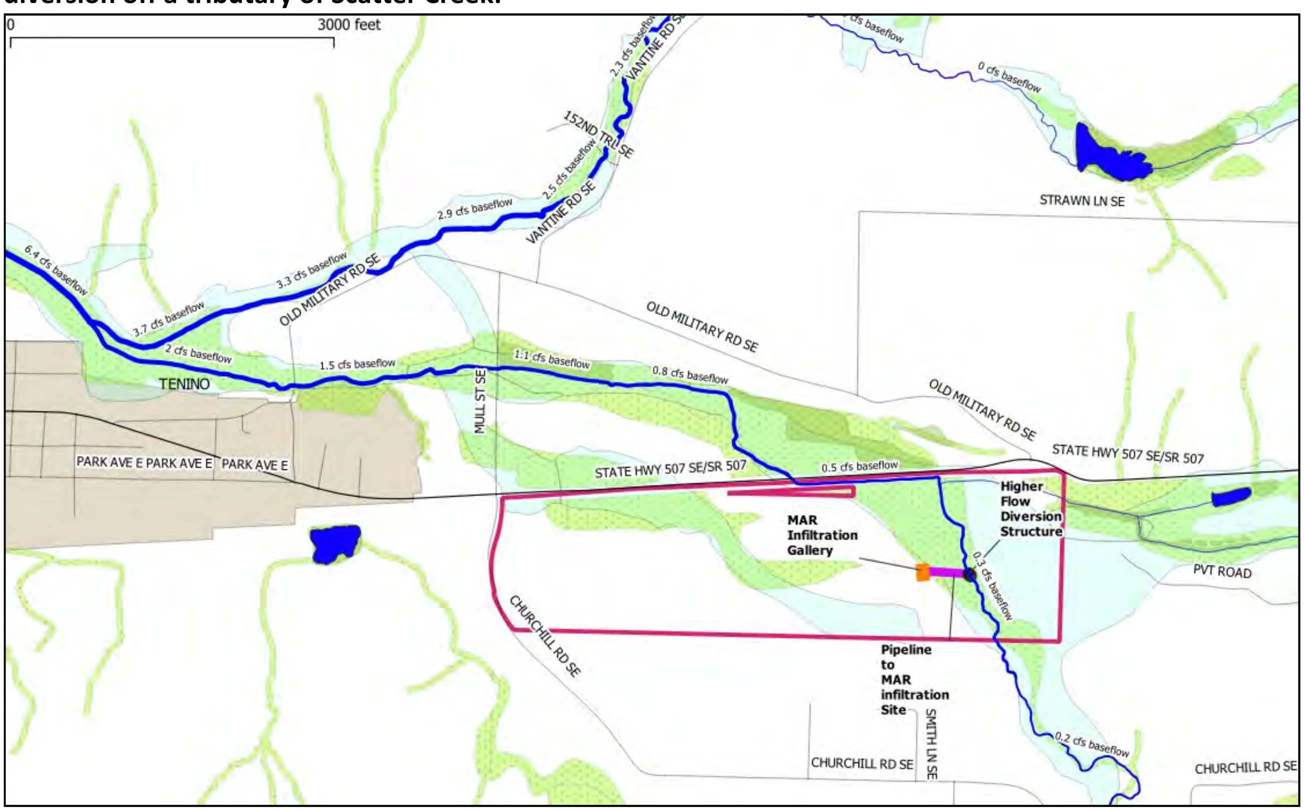


Figure 3 – Close-up of conceptual Project Area showing Managed Aquifer Recharge (MAR) features. Brown Contours - Terrain; Green Contours - Modeled Groundwater Elevation (water table aquifer):

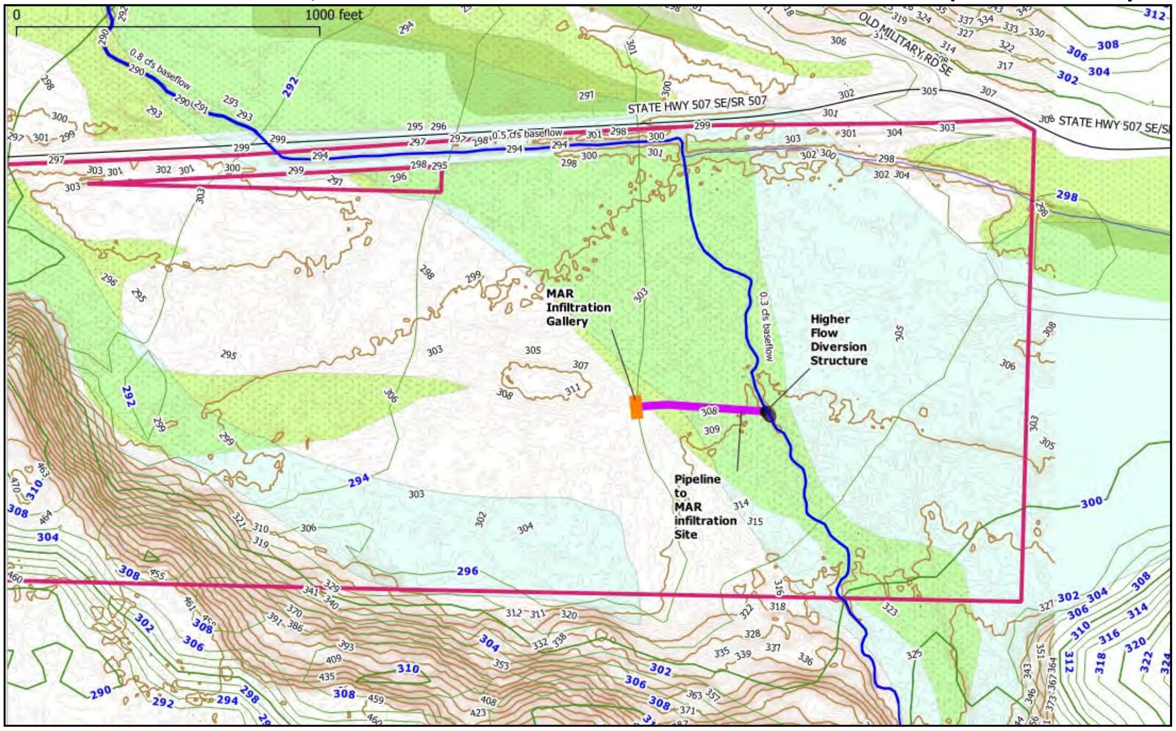


Figure 4 – HEC-HMS Hydrologic Model setup for the 1,462 acre basin feeding the conceptual MAR site, divided into sub-basins and reaches for hydrologic evaluation:

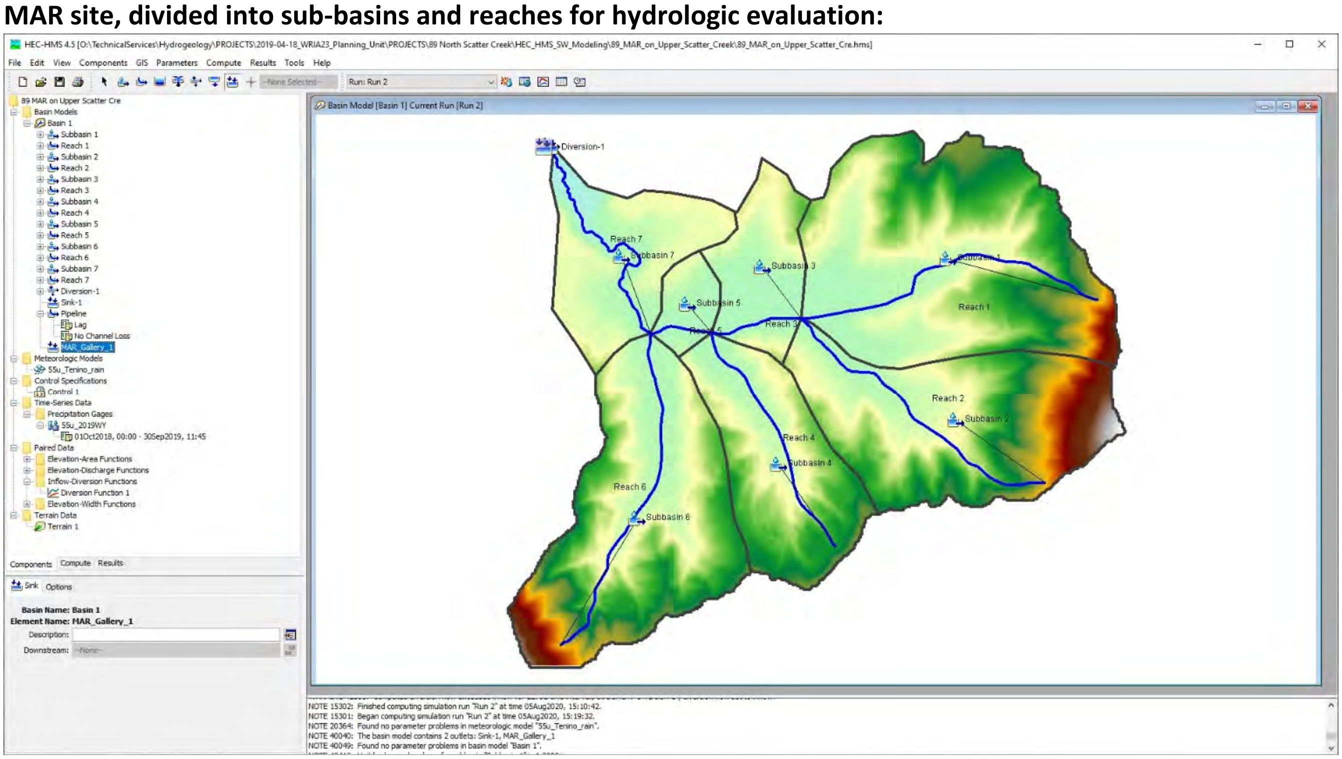
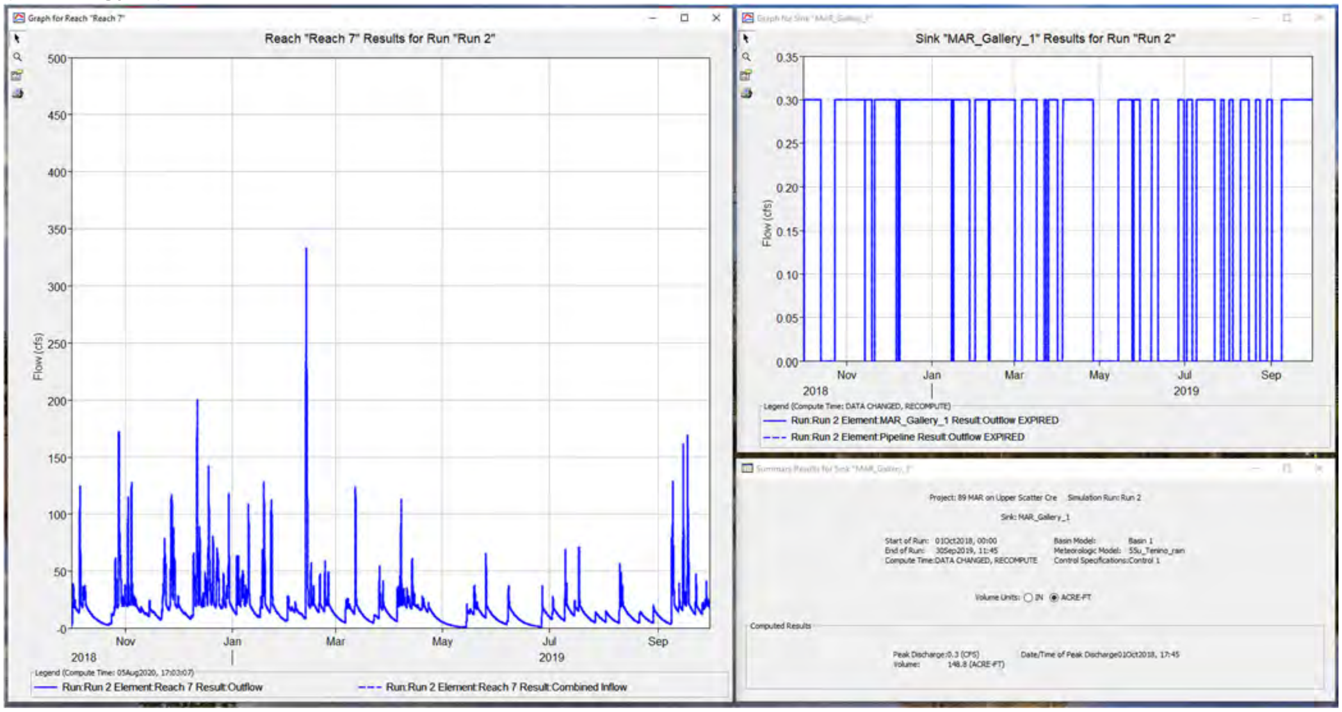


Figure 5 – HEC-HMS Hydrologic Model Output showing the discharge from MAR catchment for 2019 water year (estimated at approximately 148.8 afy) from a diversion of 0.3 cfs (~133.2 gpm) from creek flows above 10 cfs:



PROJECT INFORMATION SHEET

Project Name:	**Sampson Wetlands Restoration and MAR Concept (Thurston County ID 81)**
Project ID:	**SC-03**
Project Location:	Project is located on Churchill Road in central Thurston County, east of the City of Tenino. Black River management unit: Scatter Creek subbasin. Project includes unnamed tributary ditches feeding the east/south branch of Scatter Creek. Lat/Long: 46.848152 / -122.795573
Project Description:	Sampson Wetlands Restoration and MAR concept showing new sinuous 4800 ft long channel, abandoned ditched channels and MAR gallery site concept. This project concept envisions two components: a) diverting part of winter high flows in the east branch of Scatter Creek, then infiltrating that water into a new Managed Aquifer Recharge (MAR) gallery site; and b) blocking wetland issues and constructing a new sinuous channel four scatter creek across the Sampson wetland. Figure is 1, 2 and 3 show these concepts. The location for the MAR facilities is on a single undeveloped parcel 'landlocked' by surrounding wetlands – and owned by the Heernet Environmental Foundation. This location could be accessed by close and land owned by the Washington State department resources (DNR). The removal of existing ditches and replacement of a sinuous channel for Scatter Creek assumes that the ditches are deeply incised, and that the new lower-slope stream designed-meander channel slope will promote overbank flooding into the associated wetlands. Current groundwater modeling results (MODFLOW model v186) suggest that the water table is largely below the base of the Sampson wetlands, providing some unsaturated water storage capacity before wetland inundation. This project is identified in Habitat Work Schedule as project "Sampson Wetland Enhancement Phase I (Conceptual 08-1134)" sponsored with a different scope of work by the Creekside Conservancy. Conceptually, the project includes the diversion of cold winter water from existing ditch(es), conveyed by ~275 feet using a new pipeline, then infiltration into the shallow aquifer via a new gallery constructed for the

	project, with slow drainage feeding water into Scatter Creek during drier months. Related habitat improvement and flood-control projects could be envisioned. Importantly, this project largely avoids impairing continued agricultural land use, focusing instead on the improvement of existing wetlands that are largely undeveloped. The project location and concept are presented in Figures 1 and 2, with a closeup of the MAR concept shown as an inset in Figure 2 – also see the attached summary graphic. MAR infiltration would occur seasonally. MODFLOW groundwater modeling exists across this project site and can be used to test project concepts. In addition, significant LiDAR data are available for project assessment (one-foot LiDAR topography). We propose an initial screening and review of this opportunity so that the water offset size, possibility of flood control benefits, and potential ecological benefits can be more fully estimated and quantified. Following this initial screening effort, the probability of additional grants will be improved.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	• Conceptually, this project could provide storage and release of 104 acre-feet of water, infiltrated during winter rain events. • Soil infiltration capacity is currently believed to be high but would need to be field verified. • These benefits would require quantification as part of the Ecology-required Feasibility Study. • Drainage of the MAR feeder area is about 997 acres. • The project would improve streamflow later in the year, i.e. groundwater seepage that would subsequently provide stream base flow. • Potential flood control benefits (not quantified). • Potential wetland/habitat benefits including beaver habitat • Scatter Creek watershed and the Chehalis River would receive water offset benefits. • The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process. • Habitat could be incrementally improved in the Sampson wetland.

Is Water Quantity a Limiting Factor In this Subbasin?	Yes. Water Quantity is a Tier 1 concern for the Scatter Creek subbasin. The 2011 Lead Entity strategy states: "Scatter Creek is not meeting base flow requirements and is closed to further appropriations. Scatter Creek has some segments that go dry during the summer months." *http://www.chehalisleadentity.org/documents/*. New habit assessments would be required, but it can be assumed that conditions have not improved since 2011.
Location & Spatial Extent of Benefits:	The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process.
Anticipated Water Offset (if applicable):	Total water offset for this project is estimated at 92 acre-feet per year, as documented below, 40 acre-feet per year from the stream realignment and wetland enhancement and 52 acre-feet per year from the MAR component. To confirm available winter streamflows, the US Army Corps of Engineers' HEC-HMS watershed modeling software was used to calculate approximate basin yields as briefly summarized in Figure 4. The basin feeding the conceptual MAR site is approximately 997 acres in size. For hydrologic analysis it was divided into five sub-basins and five feeder reaches, including a modeled diversion structure and MAR infiltration gallery (Figure 3). Based on the Thurston County Drainage Design and Erosion Control Manual (DDECM), supplemented with experience at similar sites, ranges of values for sub-basin and stream reach hydrologic properties were selected. Sensitivity analysis was performed by repeatedly testing parameters in various combinations. The resulting HEC-HMS model output indicates that 10 cfs may be exceeded for a significant part of the water year, allowing diversions of 0.3 cfs to be accommodated without significant impairment of downstream water users. A total water offset benefit of approximately 104 acre-feet per year may be possible. **Site hydrogeology** 1. **Aquifer and thickness:** Shallow hydric/wetland soils overlying ~10-20 feet of coarse glacial outwash (sand/gravel/cobbles) above Miocene claystone/sandstone **2. Stream Restoration/Re-meander project component:** a. **Depth to water:** 2 feet below ground (seasonally averaged depth) from steady-state MODFLOW model v195. **b. Hydraulic conductivity:** K_{xy} = 4,114 feet per day **c. Groundwater velocity:** v = ((4,114) x (0.00331))/(0.3) = 45.4 ft/day d. **Distance and direction**: ~ 2,528 feet average distance from flooded area to stream, along groundwater streamline determined from steady-state MODFLOW model v195.

	e. **Estimated travel time:** travel time average of about 55.7 days on average from recharge to discharge. Kinematic wave can be assumed. f. **Stream connection to aquifer:** Partial connection to the Scatter Creek, with an assumption of no significant streambed conductance losses. g. **Estimated fraction of recharge that discharges to nearest stream:** 50% based on the assumption that half of recharged water is lost to evapotranspiration or pumping in transit. h. **Initial estimate of streamflow benefit timing:** Delayed benefit by 55.7 days. i. **Suggested Plan benefit estimate:** 81 acres of reconnected floodplain, raised by an average of 1-foot equals 81 acre-feet, drained once per year. Based on 50% of drainage reaching Scatter Creek, this results in ~40 acre-feet of annual benefit. j. **Probability of benefit:** High (i.e. use 100% of the calculated 40 afy benefit) k. **Probability of construction:** Moderate **3. MAR project component:** a. **Depth to water:** 15 feet below ground (seasonally averaged depth) from steady-state MODFLOW model v195. **b.** **Hydraulic conductivity:** K_{xy} = 855 ft/d, layer 2 of MODFLOW model 195. **c.** **Groundwater velocity:** v = ((855) x (0.021))/(0.3) = 60 ft/day d. **Distance and direction**: ~ 771 feet from MAR site to stream, along groundwater streamline determined from steady-state MODFLOW model v195. *e.* **Estimated travel time:** travel time average of about 13 days from recharge to discharge. Kinematic wave can be assumed. f. **Stream connection to aquifer:** Partial connection to the Scatter Creek, with an assumption of no significant streambed conductance losses. g. **Estimated fraction of recharge that discharges to nearest stream:** 50% based on the assumption that half of recharged water is lost to evapotranspiration, underflow or pumping in transit. h. **Initial estimate of streamflow benefit timing:** Delayed benefit by 13 days. i. **Suggested Plan benefit estimate:** 52 afy, based on 50% of recharge calculated by HEC-HMS sensitivity runs. j. **Probability of benefit:** High (i.e. use 100% of the calculated 52 afy benefit) k. **Probability of construction:** Moderate – re-timing is small while water quantity is large.

Project-Type Specific Information	Water Storage and Retiming Projects
	• How much water is likely to be stored?
	  o To be determined during feasibility study
	• Has the surface water source for the project been evaluated, and, if so, what is that source?
	  o East branch Scatter Creek
	• During what period(s) can water be diverted?
	  o November through April; stream closed 1 May – 31 October
	• Is there an instream flow?
	  o No
	• How often is the flow above the minimum instream flow?
	  o N/A
	• What is the proposed rate of diversion?
	  o 0.3 cfs from November through April
	• What type of water rights would need to be acquired to provide water from that source?
	  o Surface water diversion and ASR permit
	• What stream reach likely would benefit from this project and what is the anticipated benefit to that reach?
	  o Scatter Creek upstream of Tenino; improved stream baseflow.
	• What fish species will benefit?
	  o Coho and resident coastal Cutthroat trout
	• If this is a managed aquifer recharge (MAR) project, is the geology suitable and is the land available?
	  o Geology is suitable: shallow sand gravel above bedrock. Land may be available from the Heernet Environmental Foundation
	• Has a feasibility study been conducted, and, if so, have the anticipated timing of streamflow benefits been estimated? What is the potential diversion method(s)?
	  o A feasibility study is the first proposed step. Timing has been estimated as documented in the Water Offset section.

Estimated Project Cost:	Conceptual.
Performance Goals & Measures:	Change in Flow. Streamflow monitoring already occurs on Scatter Creek by Thurston County (stream gage at James Rd SW) and could benefit this project.
Anticipated Local and Partner Support & Barriers to Completion:	This project is identified in Habitat Work Schedule as project “Sampson Wetland Enhancement Phase I (Conceptual 08-1134)” sponsored with a different scope of work by the Creekside Conservancy. This parcel was protected with support from the Salmon Recovery Lead Entity (PRISM 07-

	1749) so future actions on the parcel will need to align with salmon recovery goals. Thurston Conservation District has initiated outreach with the landowner and is interested in moving forward with feasibility work. Upstream and downstream landowners would need to be consulted to generate interest and support. Additional land acquisitions may be needed to make this project possible.
Project Sponsor, Implementation Start Date and End Date:	Not yet sponsored. Thurston County could conduct initial screening. Thurston Conservation District has expressed interest in sponsoring the feasibility work. Start 7/1/2021, or as soon as funding is obtained. End 1/1/2038, end of planning period.

Figure 1 – Site Location

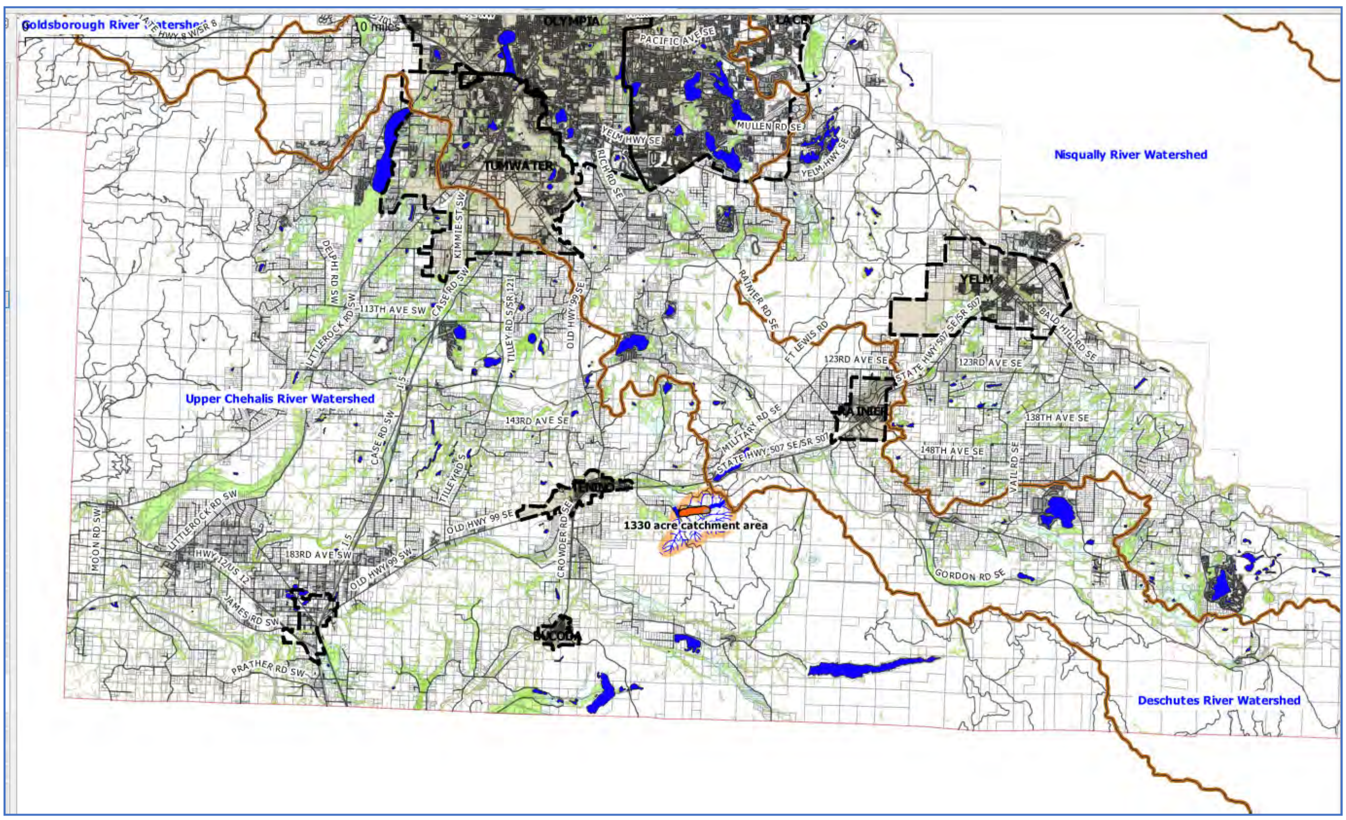


Figure 2 – Project Area showing conceptual ditch removal and stream re-meandering with a possible Managed Aquifer Recharge (MAR) site fed by ~1330 acres of catchment:

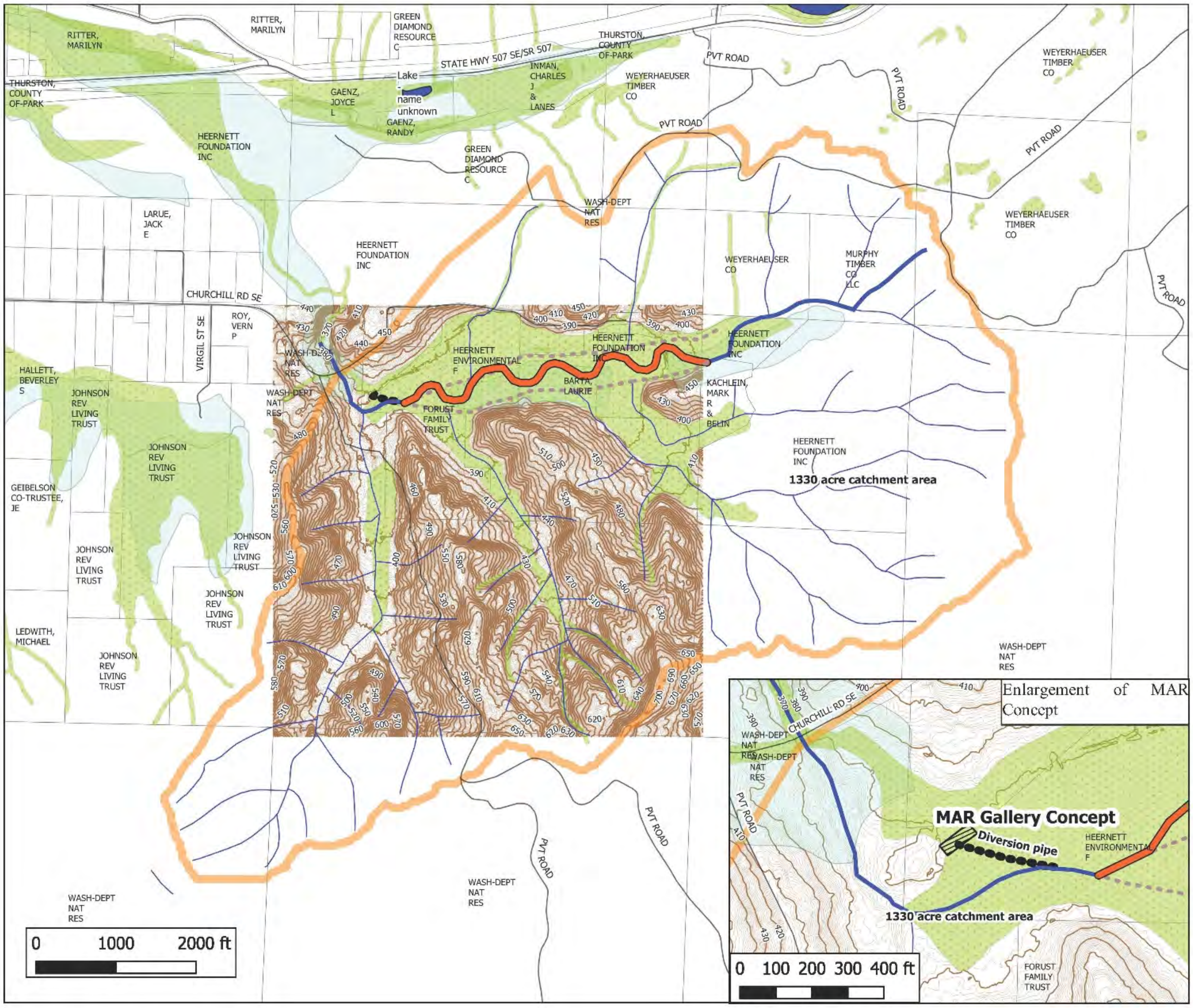
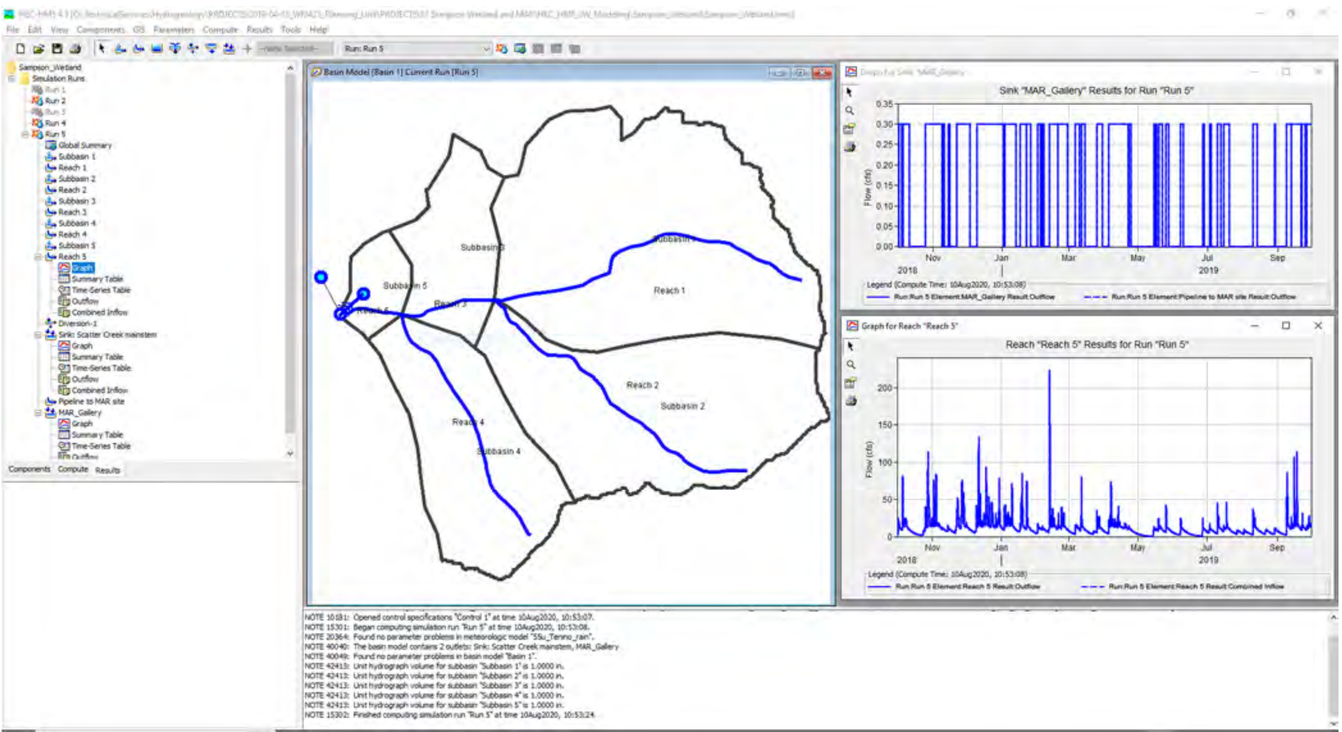


Figure 3 – HEC-HMS hydrologic model output showing model domain, lowermost reach stream discharge and MAR gallery inflow. Output shows the expected availability of 0.3 cfs diversion to MAR gallery site:



PROJECT INFORMATION SHEET

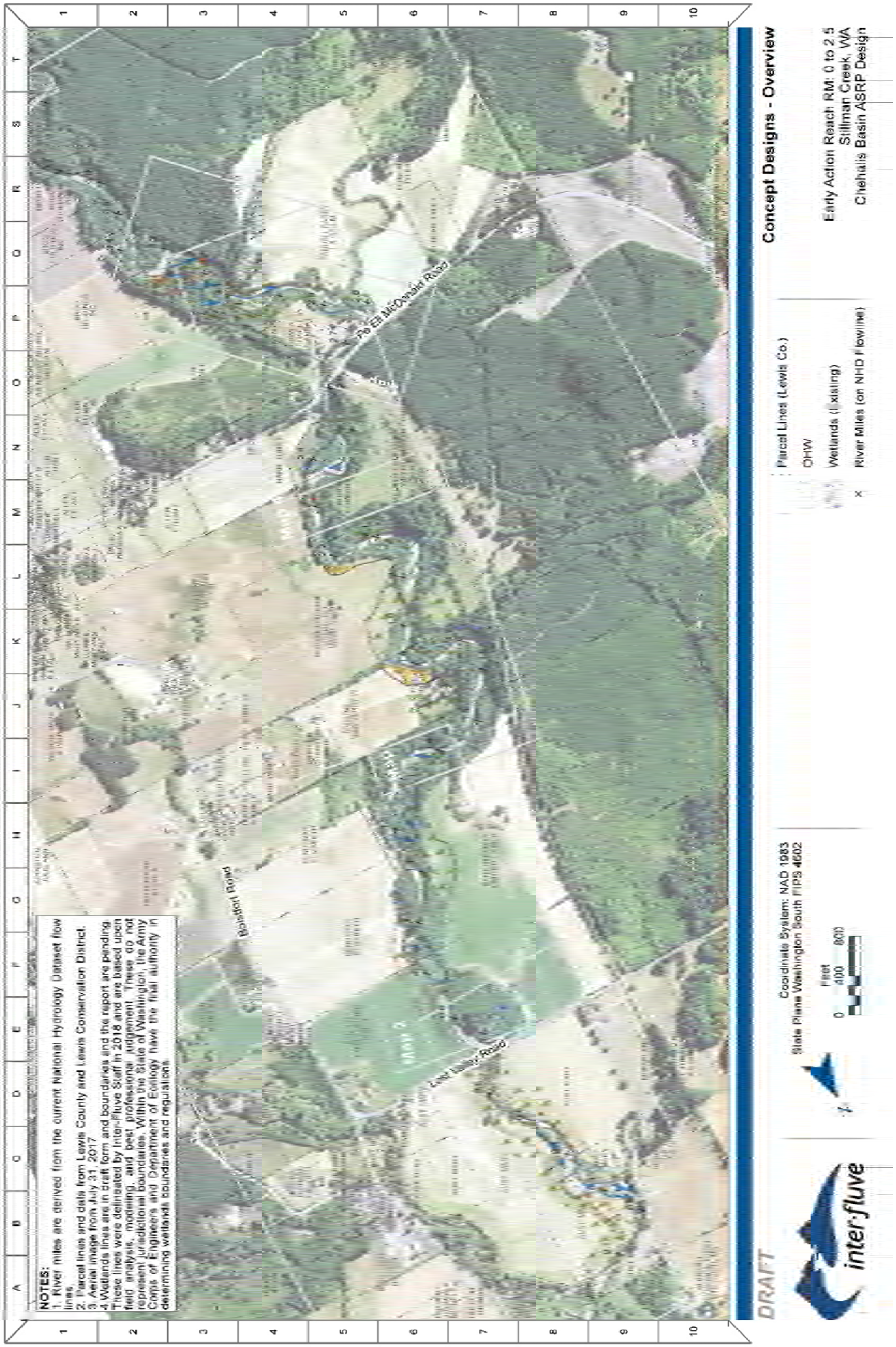
Project Name:	**Chehalis Basin Early Action Reach Restoration Design: Stillman Cr. RM 0-2.5**
Project ID:	**C-00**
Project Location:	Stillman Creek (River Mile 0 to 2.5) off the South Fork Chehalis; Lat/long: 46.54, -123.14
Project Description:	The Stillman Creek reach project will increase salmon and steelhead productivity by taking a series of actions along about three miles of the creek. Restoration actions will include installing instream large wood structures, creating side channels, creating backwater alcoves, and planting trees on the stream bank. The project will help restore some of the habitat loss from the 2007 floods and encourage the creek to function more naturally.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The project will include land protection and restoration, enhancement, and creation of instream and floodplain habitat. Specific protection measures include land use conversion incentive programs, conservation easements, and acquisitions by restoration-focused entities, as well as actions in adjacent areas to reduce or eliminate potential sources of impairment (e.g. upstream fine sediment source reduction, downstream headcut mitigation, and run-off erosion reduction). Floodplain areas will be reconnected and restored, including levee removal or setback, side channel reactivation, and riparian vegetation management. The project will also use large wood placements to increase floodplain roughness; excavate side channels and flood plains to emulate conditions characteristic of channel migration or avulsion; and add large wood structures and bank treatments to emulate and reestablish natural controls and channel migration rates, providing time for natural tree growth and wood recruitment.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes
Location & Spatial Extent of Benefits:	Stillman Creek from its mouth to river mile 2.5

Anticipated Water Offset (if applicable):	This project will include a water right acquisition, but that is not being evaluated as a water offset for the purposes of this plan.

Project-Type Specific Information	Floodplain and Channel Migration Zone Restoration
	• What is the floodplain or channel migration problem (e.g. levee, floodplain fill, bank armoring, anthropogenic-caused channel incision, river training structures, other)?
	    o Bank armoring with riprap, channel simplification, agricultural land use, wood removal, and riparian area clearing have all impacted channel migration rates in the project area.
	• What is/are the proposed restoration action(s), and how will the action(s) address the floodplain or channel migration problem?
	    o Restoration actions include large wood structures, bank treatments (S. Fork Newaukum R. EAR only), floodplain reconnection, riprap removal, off channel habitat creation (side channels and alcoves), and riparian and upland vegetation management (planting natives, removing invasive species). In several areas, riprap will be replaced with large wood and riparian plantings to restore more natural bank conditions in near and long terms.
	• Will the project increase floodplain inundation?
	    o Yes the project will increase floodplain inundation during winter high flows and moderate floods (e.g. 1-yr to 10-year return period events). However, to comply with current County and Federal (FEMA) floodplain management regulations as well as landowner interests the project are design to not increase the regulatory base flood elevation (i.e. the 100-year flood elevation).
	Side Channel and Off Channel Habitat
	• What is the problem the side channel and/or off-channel habitat project proposes to correct?
	    o Existing side channel habitat in the project reach is limited due to bank armoring that prevents lateral channel migration, channel simplification, and lack of large wood.
	• How will the project create, reconnect, or enhance existing habitat?
	    o The project will increase frequency of inundation in existing floodplain areas through floodplain and inlet channel grading. New side channel and alcove habitat will be created through grading and large wood placement. Mainstem complexity will be improved with large wood placements and bank treatments (bank treatments on S. Fork Newaukum R. EAR only). Riparian revegetation will be used to improve the long-term ecological trajectory of the site.

	• What type(s) of channel(s) will be restored or created (flow-through, backwater, groundwater, floodplain ponds)? o Flow-through side channels and backwater alcoves. • What valley and reach-scale features indicate potential for side channel or off channel habitat restoration (e.g. floodplain depressions, relic channels, existing side channels that are perched above an incised channel)? o Floodplain depressions, relic channels, and existing side channels. Instream Habitat Restoration • What is the problem the instream habitat project proposes to correct? o Lack of in-stream complexity and wood due to channel simplification and wood removal. • What are the existing and proposed channel forms and cross-sections? o Pool-riffle channel form under existing and proposed conditions. Existing conditions single thread channel at bankfull, proposed conditions split flow (active side channels) at bankfull. • How would the proposed channel modifications restore habitat-forming processes and/or historical conditions? o Adding large wood will restore habitat-forming processes such as sediment sorting and pool scour, while moderating accelerated bank migration rates. Increasing floodplain connectivity reduces shear stress in the main channel promoting more sediment deposition rather than transport, which is dominant under existing conditions. This will lead to improved bedform diversity and habitat complexity.
Estimated Project Cost:	Estimated Construction Cost Estimate = $4,133,500. This estimate is based on Reduced Restoration Intensity Concepts, August 2019. Funding has already been secured through the Office of the Chehalis Basin/Chehalis Basin Strategy.
Performance Goals & Measures:	Total Riparian Acres Treated= 9.9 acres Total Riparian Miles Streambank Treated= 3.3 river miles of habitat enhancement Acres of Upland Habitat Area Treated= 17.0 acres Floodplain acres planted= 7.0 acres Floodplain: Acres reconnected= 2.2 acres Total Miles of Instream Habitat Treated= 3.3 river miles Floodplain Areas Protected = Estimated at least 20 acres

Anticipated Local and Partner Support & Barriers to Completion:	The project concept was developed by Inter-Fluve in collaboration with the landowners, the Lewis Conservation District, the Chehalis Basin Lead Entity, and the Washington Department of Fish & Wildlife as part of the Chehalis Basin ASRP Pilot Project Design contract for Early Action Project Reach assessment, evaluation, and design.
Project Sponsor, Implementation Start Date and End Date:	Sponsorship by Washington Department of Fish and Wildlife. Start: June 2019 End: December 2021


NOTES:
1. River miles are derived from the current National Hydrology Dataset flow lines.
2. Parcel lines and data from Lewis County and Lewis Conservation District.
3. Aerial image from July 31, 2017
4 Wetlands lines are in draft form and boundaries and the report are pending. These lines were delineated by Inter-Fluve Staff in 2018 and are based upon field analysis, modeling, and best professional judgement. These do not represent jurisdictional boundaries. Within the State of Washington, the Army Corps of Engineers and Department of Ecology have the final authority in determining wetlands boundaries and regulations.
Pe Ell McDonald Road
Boistfort Road
Lost Valley Road
DRAFT
inter-fluve
Coordinate System: NAD 1983
State Plane Washington South FIPS 4602
Feet
0 400 800
Parcel Lines (Lewis Co.)
OHW
Wetlands (Existing)
River Miles (on NHD Flowline)
Concept Designs - Overview
Early Action Reach RM: 0 to 2.5
Stillman Creek, WA
Chehalis Basin ASRP Design

PROJECT INFORMATION SHEET

Project Name:	TransAlta Water Right Acquisition
Project ID:	SK-00
Project Location:	The project is located in the Skookumchuck sub basin as defined by the Chehalis Basin Partnership. The approximate location of the water right diversion is RM 7.8. Lat/Long: 46.805077, -122.862556
Project Description:	This project represents the most significant water offset opportunity available to the WRIA 22/23 (Chehalis Basin Partnership) Planning Unit. A major industrial water right holder, TransAlta, is currently in the process of evaluating conversion options for its two coal-fired power plants in Lewis County and is seeking buyers for a portion of its significant surface water right certificate for a diversion from the Skookumchuck River. Quinault Indian Nation (QIN) proposes to conduct the necessary feasibility study and due diligence prior to seeking additional Streamflow Restoration grant funding to acquire a portion of that water right for transfer into the State's Trust Water Rights Program in perpetuity to benefit instream flow. The feasibility study would lay the groundwork for acquiring a portion of the water right for instream flow on behalf of the Chehalis Basin Partnership and is composed of the following tasks: • Extent and validity evaluation to provide an independent determination of the water usage and legal ability for Ecology to accept the water right for permanent dedication to instream flow. • Evaluation for effectiveness for instream flow – Determine whether returning a portion of the TransAlta water right to instream flow will be an effective measure to improve instream flow conditions. This includes comparing other water rights in the Skookumchuck watershed to assess whether such a transaction would result in realized flow increases and identification of risk factors that would decrease the effectiveness of the proposed water right transaction. • Fair market valuation of water right to provide a basis for negotiating a price for the proposed acquisition and seeking funds for that purchase. Pending positive results from this feasibility study, QIN intends to submit an additional grant application during the next Streamflow Restoration grant round for Phase II of the project to purchase a portion of this water right (approximately 4 cfs or 2,898 acre-feet), and place it into the State's

	Trust Water Rights Program as a permanent dedication for instream flow purposes.
Project Type:	☑ Water Right Acquisition ☐ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	Many aquatic species rely on the Skookumchuck River watershed for multiple life stages. Anadromous fish stocks include spring- and fall-run Chinook, coho, winter steelhead and cutthroat trout (Grays Harbor County Lead Entity Habitat Work Group, 2011) for spawning, rearing, and adult life stages. Non-salmon species include coastal tailed frog, Van Dyke's salamander, northern red-legged frog, North American beaver, Olympic mudminnow, largescale sucker, mountain whitefish, Pacific lamprey, riffle and reticulate sculpin, speckled dace, and Western ridged mussel (Aquatic Species Restoration Plan Steering Committee, 2019). Aquatic birds include great blue heron and wood duck. Spring Chinook enter the Skookumchuck River mid-February through late July and after holding in deep pools for several months, spawn in all suitable portions of the mainstem up to the dam. Spawning occurs from early September to mid-October with egg incubation starting in September and continuing through February. Fry begin to emerge in January and out-migrate between July and August after emergence. The Skookumchuck subbasin is one of only two remaining core spawning and rearing areas for Chehalis Basin spring Chinook salmon, a severely depressed stock. These salmon rely on instream flows more than many species because they return to freshwater spawning areas in the early summer and must survive over the summer period when flows are lowest and water temperatures are highest before spawning in the early fall. The potential value of the additional instream flow that could be provided through this project could extend downstream through the mainstem Chehalis River and could improve the flow and habitat conditions through a highly degraded mainstem reach that all salmonid life stages utilize for migration corridors, juvenile rearing, and spawning, ultimately extending benefits to the entire basin. In addition to a basinwide potential benefit, there will likely be immediate direct benefits near the project site for all life stages of salmonids. Washington Department of Fish and Wildlife 2018 escapement data identified spring Chinook and Coho redds just downstream of the proposed project area at river mile 7.4. Fall Chinook redds were abundant at the project location at river mile 7.8. The feasibility study will evaluate specific aquatic species benefits that could be attained through acquisition of this water right for permanent instream flow benefit and deliver findings in an aquatic species benefits report.

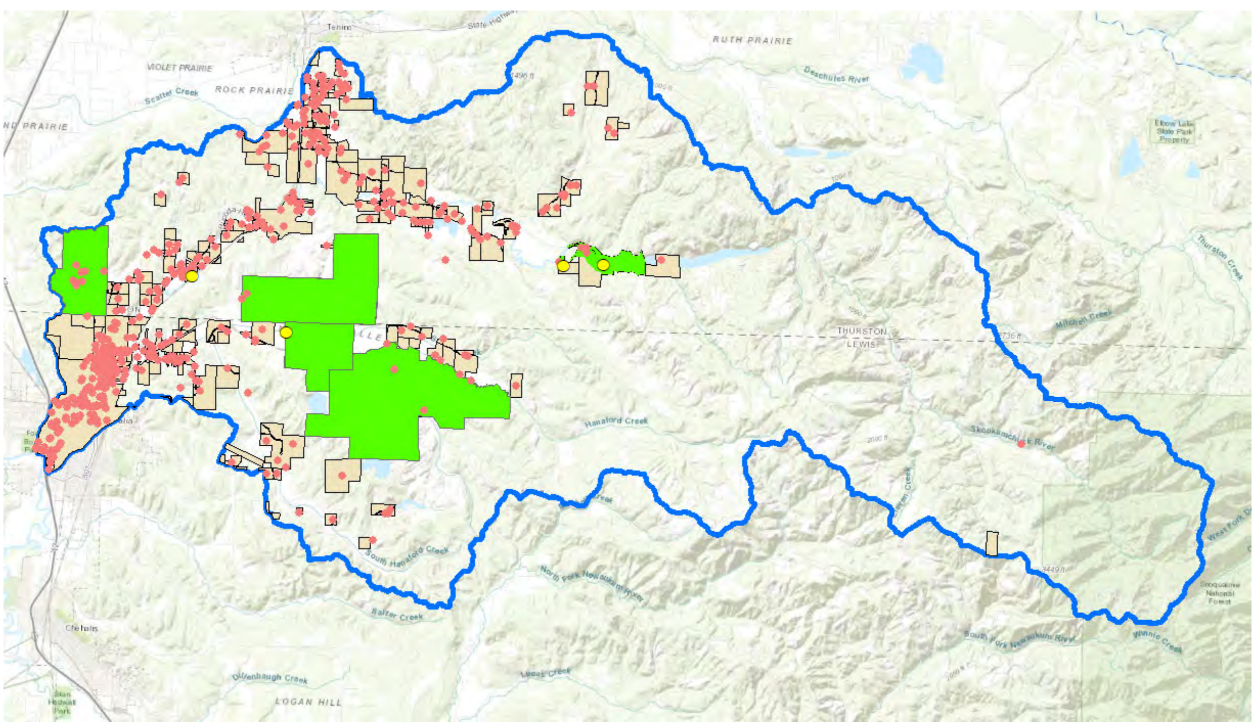
	Aquatic resource degradation causes have been evaluated through numerous studies and analyses that supported development of the Chehalis Basin Aquatic Species Restoration Plan and the Lead Entity Strategy. There is also a major aquatic habitat restoration project to be constructed in summer 2020 upstream from the water right point of diversion, illustrating the worthwhile investment recognized for restoration actions in the Skookumchuck. Low flows in the lower Skookumchuck are known to create problems for aquatic species. As described in the Chehalis Basin Phase 1 Aquatic Species Restoration Plan (Aquatic Species Restoration Plan Steering Committee, 2019), the lower reach of the Skookumchuck River suffers from high summer temperatures that regularly exceed the 16°C (61°F) core summer salmonid habitat criterion from May through September, and they typically exceed the 13°C (55°F) supplemental spawning incubation criterion (September 15 to July 1) in September and May to July. The Upper Chehalis River Basin Temperature TMDL (Ecology 2001) has designated a goal of 18°C (64°F) for the upper Chehalis River. The TMDL also states that it is critical to prevent further reductions in flows and to improve low flows if feasible. Recent temperature modeling by Washington Department of Fish and Wildlife projects that mean August temperatures are projected to increase to 75% by 2040 and 96% by 2080 without intervention (Winkowski and Zimmerman 2019). *References:* Aquatic Species Restoration Plan Steering Committee, 2019. Chehalis Basin Strategy Aquatic Species Restoration Plan. Washington State Department of Ecology Pub. #19-06-009. Grays Harbor County Lead Entity Habitat Work Group (2011). The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23. Grays Harbor County. 100 W Broadway, Montesano, WA. Washington Department of Ecology, 2001. Upper Chehalis River Basin Temperature Total Maximum Daily Load. Ecology Publication No. 99-52, revised July 2001. Winkowski, J. and M. Zimmerman, 2019. Thermally Suitable Habitat for Juvenile Salmonids and Resident Trout Under Current and Climate Change Scenarios in the Chehalis River, WA. Washington Department of Fish and Wildlife.

Is Water Quantity a Limiting Factor In this Subbasin?:	Water Quantity is identified as a tier 2 limiting factor for the Skookumchuck subbasin
Location & Spatial Extent of Benefits:	The subject of the feasibility study will be water right certificate #S2-14966C, held by TransAlta, in the quantity of 51.6 cubic feet per second (cfs) maximum instantaneous and 28,033 acre-feet per year maximum volume. The certificate has a priority date of November 28, 1966 and the purpose of use is industrial with year-round use period. The point of diversion is at RM 7.8 on the Skookumchuck River, within the Chehalis Basin, WRIA 23. The project will benefit the lower Skookumchuck River reach from RM 7.8 downstream to the confluence with the mainstem Chehalis River. Benefits will continue downstream the mainstem Chehalis River to its outflow to Grays Harbor in WRIA 22. Summer low flows in the Skookumchuck River near Bucoda (near the TransAlta diversion) typically drop below 40 cfs each year and in drought years have dropped significantly lower. The table below highlights low flow statistics for recent years, which shows that seven-day low flows have been in the low-mid 20 cfs range in three of the last five years. The addition of 4 cfs purchased during Phase II would increase these August low flows significantly, ranging from 14.0% to 18.5% when compared to the seven-day low flows for each year.
Anticipated Water Offset (if applicable):	The proposed acquisition will dedicate 2,898 acre-feet per year (4 cfs) to instream flows in the Skookumchuck River.

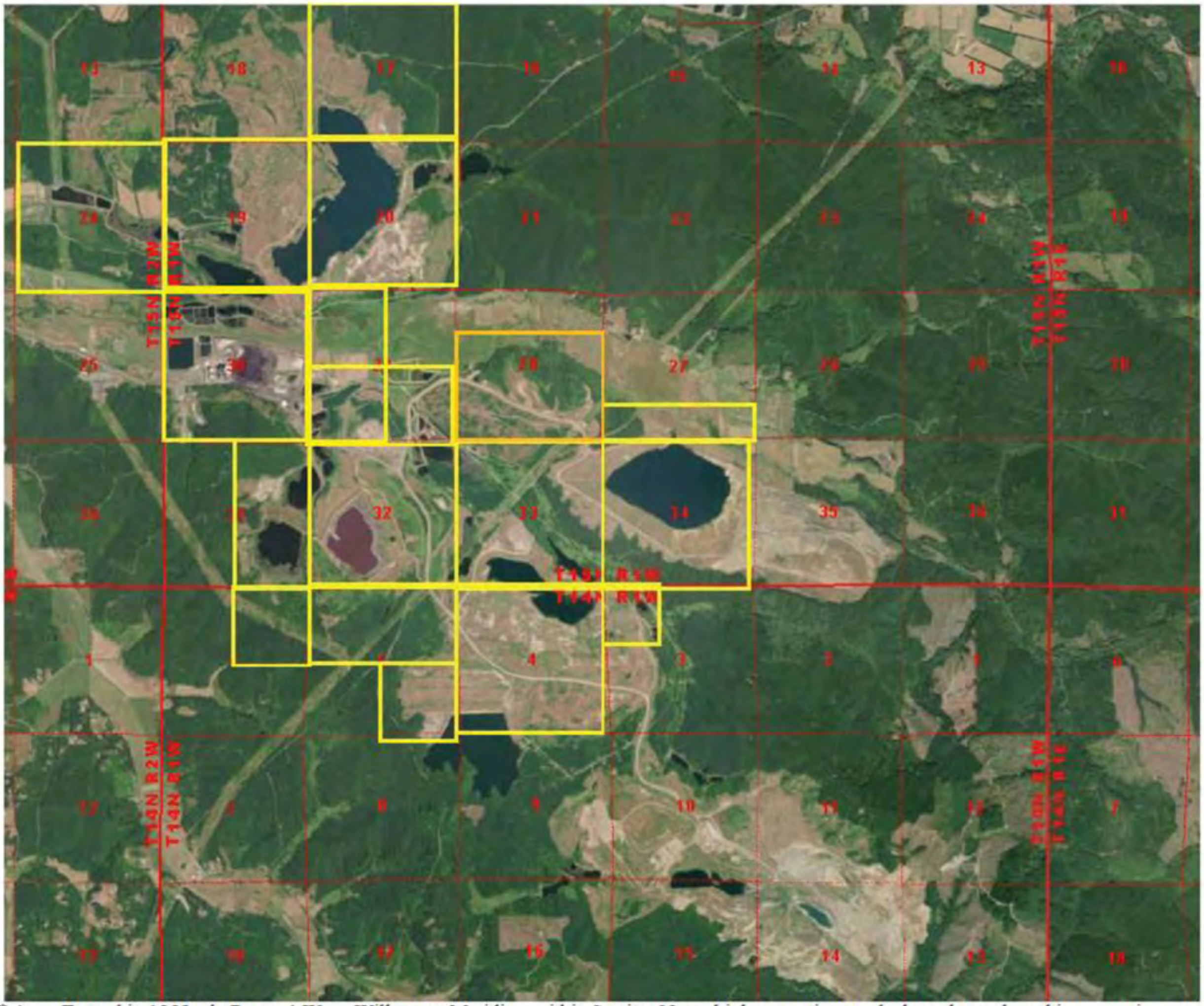
Project-Type Specific Information	Water Right Acquisitions
	• Has the water right been put to beneficial use?
	    o Right has not been put to beneficial use yet but is expected in the near future.
	• Are there any relinquishment concerns?
	    o Not anticipated. TransAlta is currently seeking buyers for a portion of the surface water right.
	• Has work already been conducted to estimate consumptive use, and, if so, what is the estimated consumptive use?
	    o Preliminary consumptive use estimates of 93% have been provided by TransAlta.
	• Is the water right uninterruptible (that is, senior to instream flow rules or other senior water rights)?
	    o The water right is uninterruptable.
	• Where is it anticipated that the benefits would occur?

	- The potential value of the additional instream flow that could be provided through this project could extend downstream through the mainstem Chehalis River and could improve the flow and habitat conditions through a highly degraded mainstem reach that all salmonid life stages utilize for migration corridors, juvenile rearing, and spawning, ultimately extending benefits to the entire basin. In addition to a basin wide potential benefit, there will likely be immediate direct benefits near the project site for all life stages of salmonids. • What is the anticipated rate and volume of the benefits? - The addition of 4 cfs (2,898 acre-feet) purchased during Phase II would likely increase August low flows significantly, ranging from 14.0% to 18.5% when compared to the seven-day low flows for each year. • If possible, describe hydraulic connectivity with nearby streams, relative importance of streamflow as a limiting factor for fish, information about species present in nearby stream, etc. - Hydraulic connectivity with small tributaries and off channel habitat can be low during summer low flows and particularly evident during drought years. - The Skookumchuck subbasin is one of only two remaining core spawning and rearing areas for Chehalis Basin spring Chinook salmon, a severely depressed stock. These salmon rely on instream flows more than many species because they return to freshwater spawning areas in the early summer and must survive over the summer period when flows are lowest and water temperatures are highest before spawning in the early fall.
Estimated Project Cost:	Phase I: $148,500.00 Phase II: TBD pending Phase I findings.
Anticipated Local and Partner Support & Barriers to Completion:	This project was well supported by CBP members when presented at meetings in January, March, and April CBP meetings. The project was received by formal approval vote at the March 2019 CBP meeting. Quinault has been actively involved in project development dialogue with TransAlta and Ecology. TransAlta has also provided QIN a letter of support for Phase I. Known potential risks and uncertainties include the following: • Returned water to the Skookumchuck River could potentially be diverted by another water user.

	• Water right could be acquired by another entity for consumptive use. • Exercise of water right is dependent on upstream storage in Skookumchuck Reservoir during summer months. The long-term ownership and use of Skookumchuck Dam and reservoir are uncertain, and if the dam were to be removed, it would no longer be possible to exercise the water right. QIN is minimizing risks and uncertainties by establishing productive dialogue with key entities needed to realize the water right acquisition, and by conducting the thorough feasibility study proposed here.
Project Sponsor, Implementation Start Date and End Date:	QIN is laying the groundwork for acquiring a portion of the water right for instream flow on behalf of the Chehalis Basin Partnership. Phase I: Feasibility Assessment was submitted to Ecology for the 2020 streamflow restoration completive grants program. Once funded Phase I is expected to be completed by Summer of 2021. If results are positive, Phase II will be submitted to Ecology the following grant round. Start: 2020, or as soon as funding obtained. End of acquisition: up to 2025



Locations for water withdrawals and places of use based on data included in the GWIS database. The bright green places-of-use and the larger yellow point locations are associated with the TransAlta water rights.



* As to Township 15 North, Range 1 West, Willamette Meridian, within Section 28, multiple exceptions to the boundary selected in map exist, see details in legal description below. This area is outlined in Orange.

Place of Use Map (provided by TransAlta).

Low flow statistics for recent years and improvements with completed final project.

Table 3 - Skookumchuck River Low Flow Statistics for Recent Drought Years (USGS #12026400, Skookumchuck River near Bucoda)				
Water Year	Daily Low Flow (cfs)	Monthly Average Flow for August (cfs)	7-Day Low Flow (cfs)	Streamflow Improvement to 7-Day Low Flow with 4 cfs Addition
2015	21.0	27.2	21.6	18.5%
2016	27.5	35.2	28.3	14.1%
2019	24.7	30.7	26.6	15.0%

PROJECT INFORMATION SHEET

Project Name:	**Skookumchuck Dam release**
Project ID:	**SK-01**
Project Location:	The Skookumchuck Dam is located at RM 23.5. Lat/Long: 46.785575, -122.718517
Project Description:	Increasing flows from the Skookumchuck Dam would have ramifications to TA's water rights, thus this project may have both an Acquisition and a habitat element. The intent of the project is to assess if it would be possible to increase the release of water from the Skookumchuck Dam to a level above what is currently needed. TransAlta Centralia owns and operates the Skookumchuck Dam. The dam impounds water and serves to regulate flows in the Skookumchuck River making it possible for TransAlta to divert water for its industrial needs. The dam also regulates flows to meet other obligations. TransAlta holds water rights for the impoundment of 35,000 acre-feet which is released into the river for diversion downstream (Reservoir Certificate R11862). Reservoir Certificate R11862 includes provisions that require the maintenance of fish flows below the dam. The structure is a run-of-river dam constructed in 1970 for the purposes of regulating instream flows in the river. The dam creates a 4-mile long reservoir. TransAlta's intake is situated 13 miles downstream from the dam. The Skookumchuck Dam is an earth fill structure approximately 190 feet high and 1,340 feet long. In 1990, a small powerhouse was constructed to produce hydro power from the site. The dam has a multi-level intake system located at elevations of 449, 420, and 378 feet that allows water temperature below the dam to be maintained at less than 60 degrees Fahrenheit. The Washington Department of Fish and Wildlife (WDFW) uses a portion of the water for a fish-rearing facility downstream of the dam. From April 1 to September 10, the flow below the dam is supposed to amount to 140 cfs. That flow is targeted to include 95 cfs of the natural river flow (reservoir inflow) plus 50 cfs from reservoir storage, whichever is less. After completion of spawning and at an agreed upon yearly termination date, the minimum flow from the dam can be reduced to 95 cfs. That flow remains in effect until April 1 to provide for egg incubation.

	However, the discharge from the dam may be reduced below 95 cfs but not less than 50 cfs during the incubation period if conditions of low natural flow prevail during this period, such that the reservoir would not refill to it target elevation 477 by April 1. This proposal is to investigate the possibility of increasing the amount of water that is physically released from the dam to an amount that exceeds what is currently required. This project would require an evaluation of potential reservoir capacity relative to released flows in order to determine if additional water could be released while still preserving flow requirements on a year-round basis.
Project Type:	☑ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Many aquatic species rely on the Skookumchuck River watershed for multiple life stages. Anadromous fish stocks include spring- and fall-run Chinook, coho, winter steelhead and cutthroat trout (Grays Harbor County Lead Entity Habitat Work Group, 2011) for spawning, rearing, and adult life stages. Non-salmon species include coastal tailed frog, Van Dyke's salamander, northern red-legged frog, North American beaver, Olympic mudminnow, largescale sucker, mountain whitefish, Pacific lamprey, riffle and reticulate sculpin, speckled dace, and Western ridged mussel (Aquatic Species Restoration Plan Steering Committee, 2019). Aquatic birds include great blue heron and wood duck. Spring Chinook enter the Skookumchuck River mid-February through late July and after holding in deep pools for several months, spawn in all suitable portions of the mainstem up to the dam. Spawning occurs from early September to mid-October with egg incubation starting in September and continuing through February. Fry begin to emerge in January and out-migrate between July and August after emergence. The Skookumchuck subbasin is one of only two remaining core spawning and rearing areas for Chehalis Basin spring Chinook salmon, a severely depressed stock. These salmon rely on instream flows more than many species because they return to freshwater spawning areas in the early summer and must survive over the summer period when flows are lowest and water temperatures are highest before spawning in the early fall. The potential value of the additional instream flow that could be provided through this project could extend downstream through the mainstem Chehalis River and could improve the flow and habitat conditions through a highly degraded mainstem reach that all salmonid life stages utilize for migration corridors, juvenile rearing, and spawning, ultimately extending benefits to the entire basin. In addition to a basin

	wide potential benefit, there will likely be immediate direct benefits near the project site for all life stages of salmonids. Low flows in the lower Skookumchuck are known to create problems for aquatic species. As described in the Chehalis Basin Phase 1 Aquatic Species Restoration Plan (Aquatic Species Restoration Plan Steering Committee, 2019), the lower reach of the Skookumchuck River suffers from high summer temperatures that regularly exceed the 16°C (61°F) core summer salmonid habitat criterion from May through September, and they typically exceed the 13°C (55°F) supplemental spawning incubation criterion (September 15 to July 1) in September and May to July. The Upper Chehalis River Basin Temperature TMDL (Ecology 2001) has designated a goal of 18°C (64°F) for the upper Chehalis River. The TMDL also states that it is critical to prevent further reductions in flows and to improve low flows if feasible. Recent temperature modeling by Washington Department of Fish and Wildlife projects that mean August temperatures are projected to increase to 75% by 2040 and 96% by 2080 without intervention (Winkowski and Zimmerman 2019). References: Aquatic Species Restoration Plan Steering Committee, 2019. Chehalis Basin Strategy Aquatic Species Restoration Plan. Washington State Department of Ecology Pub. #19-06-009. Grays Harbor County Lead Entity Habitat Work Group (2011). The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23. Grays Harbor County. 100 W Broadway, Montesano, WA. Washington Department of Ecology, 2001. Upper Chehalis River Basin Temperature Total Maximum Daily Load. Ecology Publication No. 99-52, revised July 2001. Winkowski, J. and M. Zimmerman, 2019. Thermally Suitable Habitat for Juvenile Salmonids and Resident Trout Under Current and Climate Change Scenarios in the Chehalis River, WA. Washington Department of Fish and Wildlife.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes, Water Quantity is identified as a Tier 2 limiting factor for the Skookumchuck subbasin. Summer low flows in the Skookumchuck River near Bucoda (near the TransAlta diversion) typically drop below 40 cfs each year and in drought years have dropped significantly lower.

Location & Spatial Extent of Benefits:	The dam is located at RM 23.5 on the Skookumchuck River, within the Chehalis Basin, WRIA 23. This project could benefit the Skookumchuck River reach from RM 23.5 to RM 7.8 at which point TA diverts under its existing water rights. In tandem with TA's proposed Water Bank, which will result in a reduction of diversions at RM 7.8, the benefit could be extended from the dam structure downstream to the confluence with the mainstem Chehalis River. Benefits will continue downstream the mainstem Chehalis River to its outflow to Grays Harbor in WRIA 23.
Anticipated Water Offset (if applicable):	This project is closely coupled with the TransAlta water bank, however it differs in that increasing releases from the dam would benefit the stretch of river between the dam and the current intake as well as flows below the dam that would occur as a result of water banking. The amount of additional water TA could release from the dam would depend on retaining the ability to continue to ensure that flows were met, and other commitments. TransAlta careful manages releases and maintains a detailed reservoir drawdown plan. The dam operator reports that in most years there is not additional water that could be discharged, however we know that TransAlta's own needs will be decreasing, and we also know that the reservoir is sized so as to be able to supply the City of Centralia with a regulated source. If contractually pressed TransAlta could manage flows to provide the 3.7 cfs agreed to between the City and TransAlta's predecessor. However, to do so would result in less water being provided to meet fish needs. A smaller amount of additional discharge (1.0 cfs) could likely be provided without impacting fish flows based on conditions during most years.
Project-Type Specific Information	This project can be categorized as a modification to Reservoir Operations. Additional research would need to be done to assess when the additional water would be released, and how much water above and beyond existing minimum flow and other requirements would be available. The impoundment and subsequent release of water is based on the issuance of water rights. These rights would need to be modified, and the operator compensated for the changes should the retiming result in impairment. Instream flow in the Skookumchuck River are gauged and additional streamflow releases could be measured.

Estimated Project Cost:	Conceptual Project
Performance Goals & Measures:	• Acre Feet of Water Purchased/Leased • Cfs (Cubic Feet Per Second) Of Water Purchased/Leased • Changes in Water Flow
Anticipated Local and Partner Support & Barriers to Completion:	Unknown; TransAlta is finalizing the formation of a Trust Water Bank that will provide water for its ongoing needs, the needs of other entities that will use the proposed bank as mitigation - including those needs related to instream flow benefits. TransAlta has no plans to change its operation of the dam but would likely be open to discussions provided it could still meet its needs and obligations.
Project Sponsor, Implementation Start Date and End Date:	Conceptual

PROJECT INFORMATION SHEET

Project Name:	**Skookumchuck RM 19-22 Early Action Reach**
Project ID:	**SK-02**
Project Location:	Skookumchuck River Lat/Long: 46.79027778, -122.73638889
Project Description:	Restore functioning stream processes in the section of the Skookumchuck River immediately below the dam (RM 19-22) to benefit Spring Chinook and other species.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The Skookumchuck River sub-basin has degraded watershed processes and multiple limiting factors for aquatic species including: • Reduced sediment and wood delivery from the upper watershed because of Skookumchuck Dam • Limited in-channel structure and habitat diversity • Limited floodplain connectivity • Poor to moderate riparian condition and function To address these degraded processes, several restoration actions are proposed that will promote the long-term function of natural processes and provide immediate habitat benefits: • Install engineered wood structures in the river • Remove bank armoring and reduce other impediments to geomorphic process • Excavate pilot side channels • Manage invasive species • Native riparian forest/shrub plantings to restore forest in existing fields and enhance conifer succession in areas of existing deciduous forest Removing bank armoring and other impediments will allow the channel to migrate into former floodplain habitats, while in-channel structures will form diverse in-channel habitats immediately and promote floodplain connectivity. The long-term restoration of riparian forest over a wide extent of the floodplain will allow the river to form and sustain a diverse array of habitats over the long-term.

<table>
<tr><td>Is Water Quantity a Limiting Factor In this Subbasin?:</td><td>Yes, it is a Tier 2 concern.</td></tr>
<tr><td>Location & Spatial Extent of Benefits:</td><td>Skookumchuck River, RM 19-22, including instream, streambank, and surrounding riparian area and some uplands.</td></tr>
<tr><td>Anticipated Water Offset (if applicable):</td><td>N/A</td></tr>
<tr><td>Project-Type Specific Information</td><td>Floodplain and Channel Migration Zone Restoration

What is the floodplain or channel migration problem (e.g. levee, floodplain fill, bank armoring, anthropogenic-caused channel incision, river training structures, other)?
Anthropogenic-caused channel incision
What is/are the proposed restoration action(s), and how will the action(s) address the floodplain or channel migration problem?
Install engineered log jams (ELJs) and excavate pilot side channel and floodplain benches to promote bed aggradation, floodplain inundation and formation of off-channel habitats.
Will the project increase floodplain inundation?
Yes, more frequent floodplain inundation; initially at 10 acres, increasing slowly over time.

Side Channel and Off Channel Habitat

What is the problem the side channel and/or off-channel habitat project proposes to correct?
Lack of connectivity with side channel habitats due to channel incision and low levels of channel migration.
How will the project create, reconnect, or enhance existing habitat?
Install engineered log jams (ELJs) and excavate pilot side channel and floodplain benches to promote bed aggradation, floodplain inundation and formation of off-channel habitats.
What type(s) of channel(s) will be restored or created (flow-through, backwater, groundwater, floodplain ponds)?
Both flow-through and backwater channels
What valley and reach-scale features indicate potential for side channel or off channel habitat restoration (e.g. floodplain depressions, relic channels, existing side channels that are perched above an incised channel)?
Floodplain swales and existing side channels that are perched above an incised channel

Instream Habitat Restoration</td></tr>
</table>

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<tr><td></td><td>

What is the problem the instream habitat project proposes to correct?
Uniform habitat (primarily glides) and few pools, lack of cover
What are the existing and proposed channel forms and cross-sections? (May be conceptual).
Existing relatively rectangular channel, to be modified by installing ELJs to aggrade sediment for gravel bars and riffles, scour pools and locally raise water elevations to flow into off-channel habitats
How would the proposed channel modifications restore habitat-forming processes and/or historical conditions?
Install engineered log jams (ELJs) and excavate pilot side channel and floodplain benches to promote bed aggradation, floodplain inundation and formation of off-channel habitats.

</td></tr>
<tr><td>Estimated Project Cost:</td><td>Construction estimate of $1.8 million. Funding has already been secured through the Office of the Chehalis Basin/Chehalis Basin Strategy.</td></tr>
<tr><td>Performance Goals & Measures:</td><td>For the Skookumchuck project, the following specific objectives/benefits were developed:

Increase main channel and side channel length
Increase connectivity and duration of side channels and floodplain habitats.
Increase in-channel structure and stability.
Increase quantity and quality of pools in reach, particularly deep pools.
Increase channel migration and formation of habitats.

* Total Riparian Acres Treated= 60
* Total Riparian Miles Streambank Treated= 1.1
Acres of Upland Habitat Area Treated= 17
Floodplain acres planted= less than 60
Floodplain: Acres reconnected= 10
Total Miles of Instream Habitat Treated= 1.1
Miles of streambank treated for plant removal/control= 1.1</td></tr>
<tr><td>Anticipated Local and Partner Support & Barriers to Completion:</td><td>WDFW, TransAlta, Green Diamond, Mueller family. Support from Thurston Conservation District, Chehalis Basin Lead Entity for Salmon Recovery The design team has been working with all four landowners in the reach to develop this plan and all are interested in participating.</td></tr>
<tr><td>Project Sponsor, Implementation Start Date and End Date:</td><td>WDFW
Start: October 2019 End: October 2021</td></tr>
</table>

PROJECT INFORMATION SHEET

Project Name:	**Satsop Business Park water right to reclaimed water and water right retirement**
Project ID:	**NW-00**
Project Location:	The Satsop Development Park (SDP) is located about 22 miles east of the City of Aberdeen, situated south of the Chehalis River, and accessed by Keyes Road. Lat/long: 46.959692, -123.467717
Project Description:	Develop reclaimed water treatment capacity as a means of reducing future demands from industrial tenants at the business park. The SDP holds rights to withdraw 13,405 gpm (30 cfs) and 19,622 acre-feet a year from the Chehalis River. By building onsite treatment for individual tenants and promoting reclaim water the amount of water removed from the Chehalis River be reduced, and the SDP could forgo the development of additional supply.
Project Type:	☑ Water Right Acquisition ☐ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	The development of future reclaimed water treatment plants by individual tenants will reduce the amount of water that needs to be diverted from the facility’s Ranney Collectors, which would increase flows in the Chehalis River below the business park’s current intake.
Is Water Quantity a Limiting Factor In this Subbasin?:	No, not in the tidally influenced reaches of the Chehalis River below the confluence with the Satsop River.
Location & Spatial Extent of Benefits:	From RM 16 on the Chehalis River downstream to Grays Harbor
Anticipated Water Offset (if applicable):	Water offset is expected but there is insufficient information at this time to quantify potential benefits.

Project-Type Specific Information	Reclaimed and reused water
	• Does the existing facility discharge treated wastewater into the Chehalis River?
	    • No
	• Is the current reclaimed water already needed for other uses?
	    o N/A

	• What is the current capacity of the facility and is the facility meeting that capacity?
	    • N/A
	• What purple pipe infrastructure already exists in relation to the proposed water user or infiltration facility?
	    o None.
	• If providing an alternative water source to replace an existing water right that would be acquired for the trust water rights program, what water right?
	    • TBD
	• And where is the streamflow benefit?
	    o Streamflow benefit would be the lower mainstem Chehalis River.

Estimated Project Cost:	TBD, but would depend on individual tenants.
Performance Goals & Measures:	Acre feet water conserved/ CFS of water conserved/ Change in water flow/
Anticipated Local and Partner Support & Barriers to Completion:	Port of Grays Harbor / Barriers to completion include the fact that a water customer needs to be identified for the reclaimed water before the project can proceed.
Project Sponsor, Implementation Start Date and End Date:	Port of Grays Harbor N/A - Conceptual

PROJECT INFORMATION SHEET

Project Name:	**Grays Harbor County Forest Practices and Flow Assessment**
Project ID:	**EJ-01, HQ-03, HT-01, W-00, WY-01**
Project Location:	Grays Harbor County.
Project Description:	The Grays Harbor County Forestry Department manages approximately 36,000 acres of land. These holding are distributed across the county with significant blocks of acreage in the Humptulips, Hoquiam, Wishkah, and Elk-Johns subbasins, and a smaller holding in the Wynoochee subbasin. The County proposes to evaluate these tracts and determine if changes to forest management can be used to increase flow contributions in the targeted subbasins. This project will quantify the potential streamflow benefits from forest management practice opportunities throughout the County's holdings. The effort will include: • Review of existing GHC forest management plans for potential opportunities, by assessing existing harvest cycles and harvest/planting plans to establish baseline conditions. • GIS analyses to map key subbasin, tributary, soils, and hydrogeologic features. • Identification of up to approximately 550 acres for enhanced management practices (approximately 2% of the County's managed lands). • VELMA modeling to quantify streamflow benefits from proposed changes in forestry practices.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	For all five subbasins, the goal is to improve instream flows and enhance the natural complexity of instream habitat. Grays Harbor County manages approximately 36,000 acres of forestland, a portion of which is located within WRIAs 22 and 23. Intentional management of this land may have significant favorable effects on the water budget of the Humptulips, Hoquiam, Wishkah, Elk-Johns, and Wynoochee drainages. The Visualizing Ecosystem Land Management Assessments (VELMA) ecohydrological model is a predictive tool created to assess potential

	improvements in water quality and flow to streams, rivers, and estuaries via changes in land management (EPA, 2018). This model couples hydrological and biogeochemical processes at plot- to entire watershed-scales to dynamically predict the impacts on streamflow from forestland management. VELMA modeling of changes in forest practices has successfully demonstrated that increasing harvest cycle duration, or withholding stands from harvest, provides net benefits to streamflow when compared to stand rotations less than 40 years. Forty years has been identified as a critical threshold for forest stand age, in which anything younger is faster growing with higher groundwater uptake, and negatively impacts stream flows while uptake declines as stands mature beyond 40 years, providing increasing benefit to streamflow with stand age (Hall et al., 2018). Proposed changes will be evaluated using a VELMA analysis to quantify improvements to instream flows. Assuming similar results to the VELMA modeling completed for the Nisqually Plan Addendum of 0.13 to 0.15 ac-ft/yr benefit per acre of improved management, 550 acres would result in approximately 72 to 83 ac-ft/year benefit to the watershed.
Is Water Quantity a Limiting Factor In this Subbasin?:	Humptulips – Tier 3 with low summer flows in the mainstem constitutes a major problem. Low flows are also noted in the major tributaries including Big Creek. Hoquiam– Tier 3 Wishkah– Tier 3 Wynoochee – Tier 3 flows dip below established base flows in the summer months Elk-Johns – Tier 3
Location & Spatial Extent of Benefits:	Numerous sites located across Grays Harbor County
Anticipated Water Offset (if applicable):	Water offset for the Wishkah subbasin is estimated at 10 acre-feet per year, as described below. Water offset results presented in the Nisqually Watershed Plan Addendum suggest that if a 40-year-old forest is allowed to mature to become a 100-year-old forest, then the September low flow in the basin would increase by 9 cfs (from 2 cfs to 11 cfs; or 6,514 acre-feet) over the 60-year period for a 53,760-acre basin. The annualized streamflow benefit for this type of project (Tables 4.2 and 4.3 of the Plan Addendum)

<table>
<tr><td></td><td>present a range from 0.13 to 0.15 ac-ft/year per acre benefit (Nisqually Watershed Planning Unit, 2019, Addendum to the Watershed Management Plan).

As flow benefits compound after 40-years, it is difficult to determine the exact magnitude of streamflow benefit in Grays Harbor County as forest stand ages are unknown at this phase of the project. However, estimates of benefits for each sub-basin within WRIA 22 containing county-managed forestland is provided below, based on a range of 0.13 to 0.15 ac-ft/year streamflow benefit per acre of enhanced forest management.

Using this metric, the following describes the potential quantities that could be mitigated based on enhanced management of 2% of the GHC forestland acreage within each sub-basin.

• <u>Humptulips:</u> 7,586.9 acres of managed forest, 2% could mitigate up to 19.7 to 22.8 ac-ft/yr.
• <u>Hoquiam:</u> 6,369.6 acres of managed forest, 2% could mitigate up to 16.6 to 19.1 ac-ft/yr.
• <u>Wishkah</u>: 3,759 acres of managed forest, 2% could mitigate up to 9.8 to 11.3 ac-ft/yr.
• <u>Elk-Johns:</u> 8,933.1 acres of managed forest, 2% could mitigate up to 23.2 to 26.8 ac-ft/yr
• <u>Wynoochee</u>: 873.8 acres of managed forest, 2% could mitigate up to 2.3 to 2.6 ac-ft/yr

In total, a change to the management of 2% of GHC's holding could result in a combined 72 to 83 ac-ft/year of increased streamflow contributions. Depending on actual forest stand age distribution, these numbers could over- or under-predict actual benefits to streamflow. This is meant to serve as an order of magnitude estimate and could be refined with more data in a future study.</td></tr>
<tr><td>Project-Type Specific Information</td><td>This is a streamflow augmentation project, based on the supportable premise that forest management can result in increased flows to surface water bodies. Further assessment would need to be done to identify the specific reaches.</td></tr>
<tr><td>Estimated Project Cost:</td><td>TBD but could be grant funded and would involve an assessment of GHC's holdings for suitability coupled with use of the USGS VELMA model to confirm a range of flow benefits.</td></tr>
<tr><td>Performance Goals & Measures:</td><td>• Change in Water Flow
• Miles of stream with increased flows</td></tr>
</table>

Anticipated Local and Partner Support & Barriers to Completion:	Grays Harbor County owns and manages this property.
Project Sponsor, Implementation Start Date and End Date:	Grays Harbor County. Feasibility study can begin by 7/1/2021 or as soon as funding is obtained. Project complete by 1/1/2038 - end of planning horizon.

References

Hall, J., Kane, J., Swedeen, P., Blair, G., Webster, M., Hodgson, S., Ellings, C., Benson, L., Stonington, D., McKane, R., Barnhart, B., Brookes, A., Halama, J., Pettus, P., and Djang, K. (May 2018). Nisqually Community Forest VELMA modeling to evaluate effects of forest management scenarios on streamflow and salmon habitat.

Nisqually Watershed Planning Unit (2019). Nisqually Watershed Response to the 2018 Streamflow Restoration Act (RCW 90.94): Addendum to the Nisqually Watershed Management Plan. Olympia, WA.

Smith, Carol and Wanger, Mark. May 2001. Chehalis Basin and Nearby Drainages, Water Resource Inventory Areas 22 and 23. Washington State Conservation Commission.

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Washington Department of Fish and Wildlife. June 2000. Salmonid Stock Inventory, Coastal Cutthroat Trout.

Washington Department of Fish and Wildlife. October 2004. Salmonid Stock Inventory, Bull Trout/Dolly Varden.

Washington State Department of Fisheries. 1975. A catalog of Washington streams and salmon utilization, 4 vols. http://docs.streamnetlibrary.org/Washington/DFW/StreamCatalog/22-23-WRIA.pdf

PROJECT INFORMATION SHEET

Project Name:	**Wynoochee RM 14 ASRP Early Action Reach**
Project ID:	**WY-00**
Project Location:	Wynoochee River, RM 14 Lat/Long: 47.085373,-123.691426
Project Description:	Restore functioning stream processes in a reach of the Wynoochee River through a multi-faceted riparian and instream restoration project. The project will benefit native salmonids and other aquatic species.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The Wynoochee River Existing Conditions Assessment (Natural Systems Design, 2018) examined limiting factors within the Wynoochee River RM 14 project area and provides recommended actions for addressing degraded habitat conditions and an increase in erosion and flood risks. Addressing existing impairment will require restoration of the natural riverine processes and large wood cycle so the river can create the range and complexity of habitats necessary to support a diversity of aquatic species. Our restoration strategy includes the long-term restoration of a mature riparian forest, which is essential to restarting the floodplain large wood cycle. A mature riparian forest will add stability to the system both by stabilizing the banks and by providing a source of stable large wood to be recruited to the stream. Sufficiently reducing channel migration rates in the short term is essential however, so that riparian forests to have enough time (~100 years) to mature so that they are capable of slowing erosion and channel migration rates. For both the long-term and short-term strategies to be successful, the river must also be given enough space to allow for enough channel migration that allow for habitat forming processes to occur and for floodplains to be connected more frequently while also allowing forests to mature. This strategy will eventually allow the river system to sustain itself.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes, Tier 3
Location & Spatial Extent of Benefits:	Wynoochee River, RM 0 - 14

Anticipated Water Offset (if applicable):	N/A

Project-Type Specific Information	Floodplain and Channel Migration Zone Restoration
	• What is the floodplain or channel migration problem (e.g. levee, floodplain fill, bank armoring, anthropogenic-caused channel incision, river training structures, other)?
	    o Channel incision, lack of in-stream stable wood, rapid erosion, lack of a mature riparian tree community
	• What is/are the proposed restoration action(s), and how will the action(s) address the floodplain or channel migration problem?
	    o Engineered log jams to reduce erosion and allow for riparian plants to re-establish; ELJs to engage side channels at lower flows and provide more fish habitat; ELJs to aggrade sediment and form stable islands, scour holes, and create a greater quantity and diversity of aquatic habitat
	• Will the project increase floodplain inundation?
	    o Yes
	Side Channel and Off Channel Habitat
	• What is the problem the side channel and/or off-channel habitat project proposes to correct?
	    o Lack of side channel connection to the river due to channel incision
	• How will the project create, reconnect, or enhance existing habitat?
	    o ELJs will increase inundation of side channels at lower flows than side channels are currently activated, providing more access to floodplain habitat.
	• What type(s) of channel(s) will be restored or created (flow-through, backwater, groundwater, floodplain ponds)?
	    o ELJs will increase backwater in existing backwater areas, direct more water into existing flow-through channels, recharge off-channel wetlands, and increase overall floodplain inundation. No new channels will be created.
	• What valley and reach-scale features indicate potential for side channel or off channel habitat restoration (e.g. floodplain depressions, relic channels, existing side channels that are perched above an incised channel)?
	    o Relic channels, existing side channels, existing backwaters, floodplain wetlands
	Instream Habitat Restoration
	• What is the problem the instream habitat project proposes to correct?

	o Lack of quantity, quality, and diversity of instream habitat due to a simplified channel from a lack of stable large wood. • What are the existing and proposed channel forms and cross-sections? (May be conceptual). o Existing channel form is largely single thread with seasonal inundation of floodplain side channels during flood events. Proposed channel form is split/braided from the hydraulic and geomorphological impacts from instream ELJ structures and more frequent inundation of side channels. • How would the proposed channel modifications restore habitat-forming processes and/or historical conditions? o These modifications will increase the quantity, quality, and diversity of habitat for aquatic species by providing more flow paths, a diversity of flow depths/velocities, and greater access to off-channel habitats. Riparian plantings will provide large wood input in the future to supplement the instream structures.
Estimated Project Cost:	$3,336,523. Funding has been secured through the Office of the Chehalis Basin/Chehalis Basin Strategy
Performance Goals & Measures:	• Increase perennial channel length, sinuosity, and multi-thread channels. • Increase inundation duration of side channels and floodplain habitats. • Increase wood loading, recruitment, and stability. • Increase pools per unit channel length and pool quality. • Increase vegetative cover through the water column. • Increase lateral edge stability while maintaining a dynamic channel. • Decrease channel migration rates. • Increase life expectancy of riparian forests. Total Riparian Acres Treated = 57.7 acres Total Riparian Miles Streambank Treated = 1.9 miles Acres of Off-Channel/Floodplain Connected or Added = 11.6 acres Total Miles of Instream Habitat Treated = 1.9 miles
Anticipated Local and Partner Support & Barriers to Completion:	The Grays Harbor Conservation District has been working with the private landowners within the project reach. We currently have complete landowner support for the conceptual designs.

Project Sponsor, Implementation Start Date and End Date:	WDFW Start construction: Summer 2021 End/close-out: 1/1/2024

PROJECT INFORMATION SHEET

Project Name:	**Grays Harbor County Forest Practices and Flow Assessment**
Project ID:	**EJ-01, HQ-03, HT-01, W-00, WY-01**
Project Location:	Grays Harbor County.
Project Description:	The Grays Harbor County Forestry Department manages approximately 36,000 acres of land. These holding are distributed across the county with significant blocks of acreage in the Humptulips, Hoquiam, Wishkah, and Elk-Johns subbasins, and a smaller holding in the Wynoochee subbasin. The County proposes to evaluate these tracts and determine if changes to forest management can be used to increase flow contributions in the targeted subbasins. This project will quantify the potential streamflow benefits from forest management practice opportunities throughout the County's holdings. The effort will include: • Review of existing GHC forest management plans for potential opportunities, by assessing existing harvest cycles and harvest/planting plans to establish baseline conditions. • GIS analyses to map key subbasin, tributary, soils, and hydrogeologic features. • Identification of up to approximately 550 acres for enhanced management practices (approximately 2% of the County's managed lands). • VELMA modeling to quantify streamflow benefits from proposed changes in forestry practices.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	For all five subbasins, the goal is to improve instream flows and enhance the natural complexity of instream habitat. Grays Harbor County manages approximately 36,000 acres of forestland, a portion of which is located within WRIAs 22 and 23. Intentional management of this land may have significant favorable effects on the water budget of the Humptulips, Hoquiam, Wishkah, Elk-Johns, and Wynoochee drainages. The Visualizing Ecosystem Land Management Assessments (VELMA) ecohydrological model is a predictive tool created to assess potential

	improvements in water quality and flow to streams, rivers, and estuaries via changes in land management (EPA, 2018). This model couples hydrological and biogeochemical processes at plot- to entire watershed-scales to dynamically predict the impacts on streamflow from forestland management. VELMA modeling of changes in forest practices has successfully demonstrated that increasing harvest cycle duration, or withholding stands from harvest, provides net benefits to streamflow when compared to stand rotations less than 40 years. Forty years has been identified as a critical threshold for forest stand age, in which anything younger is faster growing with higher groundwater uptake, and negatively impacts stream flows while uptake declines as stands mature beyond 40 years, providing increasing benefit to streamflow with stand age (Hall et al., 2018). Proposed changes will be evaluated using a VELMA analysis to quantify improvements to instream flows. Assuming similar results to the VELMA modeling completed for the Nisqually Plan Addendum of 0.13 to 0.15 ac-ft/yr benefit per acre of improved management, 550 acres would result in approximately 72 to 83 ac-ft/year benefit to the watershed.
Is Water Quantity a Limiting Factor In this Subbasin?:	Humptulips – Tier 3 with low summer flows in the mainstem constitutes a major problem. Low flows are also noted in the major tributaries including Big Creek. Hoquiam– Tier 3 Wishkah– Tier 3 Wynoochee – Tier 3 flows dip below established base flows in the summer months Elk-Johns – Tier 3
Location & Spatial Extent of Benefits:	Numerous sites located across Grays Harbor County
Anticipated Water Offset (if applicable):	Water offset for the Wynoochee subbasin is estimated at 2.3 acre-feet per year, as described below. Water offset results presented in the Nisqually Watershed Plan Addendum suggest that if a 40-year-old forest is allowed to mature to become a 100-year-old forest, then the September low flow in the basin would increase by 9 cfs (from 2 cfs to 11 cfs; or 6,514 acre-feet) over the 60-year period for a 53,760-acre basin. The annualized streamflow benefit for this type of project (Tables 4.2 and 4.3 of the Plan Addendum)

<table>
<tr><td></td><td>present a range from 0.13 to 0.15 ac-ft/year per acre benefit (Nisqually Watershed Planning Unit, 2019, Addendum to the Watershed Management Plan).

As flow benefits compound after 40-years, it is difficult to determine the exact magnitude of streamflow benefit in Grays Harbor County as forest stand ages are unknown at this phase of the project. However, estimates of benefits for each sub-basin within WRIA 22 containing county-managed forestland is provided below, based on a range of 0.13 to 0.15 ac-ft/year streamflow benefit per acre of enhanced forest management.

Using this metric, the following describes the potential quantities that could be mitigated based on enhanced management of 2% of the GHC forestland acreage within each sub-basin.

• <u>Humptulips:</u> 7,586.9 acres of managed forest, 2% could mitigate up to 19.7 to 22.8 ac-ft/yr.
• <u>Hoquiam:</u> 6,369.6 acres of managed forest, 2% could mitigate up to 16.6 to 19.1 ac-ft/yr.
• <u>Wishkah</u>: 3,759 acres of managed forest, 2% could mitigate up to 9.8 to 11.3 ac-ft/yr.
• <u>Elk-Johns:</u> 8,933.1 acres of managed forest, 2% could mitigate up to 23.2 to 26.8 ac-ft/yr
• <u>Wynoochee</u>: 873.8 acres of managed forest, 2% could mitigate up to 2.3 to 2.6 ac-ft/yr

In total, a change to the management of 2% of GHC’s holding could result in a combined 72 to 83 ac-ft/year of increased streamflow contributions. Depending on actual forest stand age distribution, these numbers could over- or under-predict actual benefits to streamflow. This is meant to serve as an order of magnitude estimate and could be refined with more data in a future study.</td></tr>
<tr><td>Project-Type Specific Information</td><td>This is a streamflow augmentation project, based on the supportable premise that forest management can result in increased flows to surface water bodies. Further assessment would need to be done to identify the specific reaches.</td></tr>
<tr><td>Estimated Project Cost:</td><td>TBD but could be grant funded and would involve an assessment of GHC’s holdings for suitability coupled with use of the USGS VELMA model to confirm a range of flow benefits.</td></tr>
<tr><td>Performance Goals & Measures:</td><td>• Change in Water Flow
• Miles of stream with increased flows</td></tr>
</table>

Anticipated Local and Partner Support & Barriers to Completion:	Grays Harbor County owns and manages this property.
Project Sponsor, Implementation Start Date and End Date:	Grays Harbor County. Feasibility study can begin by 7/1/2021 or as soon as funding is obtained. Project complete by 1/1/2038 - end of planning horizon.

References

Hall, J., Kane, J., Swedeen, P., Blair, G., Webster, M., Hodgson, S., Ellings, C., Benson, L., Stonington, D., McKane, R., Barnhart, B., Brookes, A., Halama, J., Pettus, P., and Djang, K. (May 2018). Nisqually Community Forest VELMA modeling to evaluate effects of forest management scenarios on streamflow and salmon habitat.

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Washington Department of Fish and Wildlife. October 2004. Salmonid Stock Inventory, Bull Trout/Dolly Varden.

Washington State Department of Fisheries. 1975. A catalog of Washington streams and salmon utilization, 4 vols. http://docs.streamnetlibrary.org/Washington/DFW/StreamCatalog/22-23-WRIA.pdf

PROJECT INFORMATION SHEET

Project Name:	**Satsop and Wynoochee Tributary Assessment for Alluvial Water Storage Potential**
Project ID:	**WY-02**
Project Location:	Low order tributaries on commercial forest lands within the East Fork, West Fork, and Middle Fork Satsop River and Middle and Upper Wynoochee River. Pilot project locations: Neil Creek Lat/Long: 47.2782, -123.6285 Carter Creek Lat/Long: 47.1608, -123.6157 Still Creek Lat/Long: 47.0913, -123.5937 Schafer Creek Lat/Long: 47.2729, -123.6184
Project Description:	Complete a GIS-based model assessment of the potential to restore alluvial water storage and aquatic species habitat using in-stream restoration techniques within low-order reaches in the Satsop River and Wynoochee River tributary networks, develop a Restoration Strategy for prioritized stream reaches, and design and construct one hand-built pilot demonstration project. Pilot project locations for instream hand-built restoration have been identified on Neil Creek, Carter Creek, Still Creek, and Schafer Creek.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Widespread channel incision and simplification has resulted in a loss of natural water and sediment storage within stream corridors, which impacts spring and summer water availability and water quality. Channel lowering due to vertical incision exports sediment and lowers groundwater levels within the alluvial valley, thereby reducing the volume and residence time of both floodplain water bodies and local groundwater storage within the channel network. The loss of natural water storage affects riparian water availability, aquatic habitat quality, dry season baseflow quantity, and instream water temperature (Hunt, Fair, & Odland, 2018; Loheide et al., 2009; Loheide & Gorelick, 2006; Tague, Valentine, & Kotchen, 2008). Alluvial groundwater is a critical component of instream flow quantity and quality. Groundwater is released much slower than surface water flow and therefore supplements dry season base flows. Increased surface water-groundwater exchange results in cooler surface water. Initial work shows that reversing channel incision can substantially increase water retention

	and benefit aquatic and riparian habitat along channel networks (T. B. Abbe et al., 2019). However, the appropriate method for triggering re-aggradation in a particular reach will vary with stream power, geomorphic context, access, and nearby infrastructure. Thus, a key component of this project is the development of a restoration strategy that leverages extensive geospatial analysis to link individual reaches with one or more restoration actions to consider. This project aims to identify and prioritize reaches to restore natural water storage functions for the benefit of water quantity, water quality, aquatic habitat, and riparian water availability. This project additionally aims to use the screening process to identify a pilot reach for implementation of restoration action and monitoring of hydrogeomorphic effects. The project uses geospatial analysis of high-resolution topographic data along with targeted field verification to efficiently estimate the volume of natural sediment and water storage that has been lost across low order tributaries on commercial forestry lands. The results are used to prioritize stream reaches based on where restoration actions have high potential to increase water and sediment storage, which correlate to high potential for water quantity and quality improvement. The geospatial modeling also includes analysis and relation of numerous datasets that inform the development of a spatially explicit restoration plan. Types of restoration actions and additional considerations for prioritization are based on these analyses, which include peak flow magnitudes and stream power, the extent of infrastructure in the alluvial valley, the presence and usage by fish species, and riparian forest characteristics. The end product provides a framework for stakeholders and project sponsors to 1) identify reaches for possible restoration of natural storage functions, and 2) provide a starter list of compatible restoration actions for the reach, ranging from hand-built “low tech” wood structures (Wheaton, Bennett, Bouwes, Maestas, & Shahverdian, 2019) to engineered log jams (T. Abbe & Brooks, 2013) to “stage 0” valley resets (Powers, Helstab, & Niezgoda, 2019).
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes, natural recharge of aquifers and LWD supplementation are general actions identified for these subbasins. Declining base flows and higher average- month-per year flows are Tier 1 concerns in the West Fork Satsop River; riparian condition and low levels of LWD are Tier 2 concerns.

	Riparian condition, declining base flows and higher average- month-per year flows are Tier 1 concerns in the Middle Fork Satsop River; low levels of LWD are a Tier 3 concern. Riparian condition is a Tier 1 concern in the East Fork Satsop River, low levels of LWD are a Tier 2 concern; channel incision, declining base flows and higher average- month-per year flows are a Tier 3 concern. Riverbed incision upstream of RM 22 on the Wynoochee is a Tier 1 concern; water temperature and sediment are Tier 2 concerns; riparian species diversity and LWD are Tier 3 concerns.
Location & Spatial Extent of Benefits:	The project's focus is on the low order reaches of the upper Satsop and Wynoochee Rivers, focusing specifically on lands currently held in by timber companies Weyerhaeuser and Green Diamond. Habitat benefits are expected to be local to treated reaches, and water quantity and quality benefits are expected to be local and downstream of treated reaches.
Anticipated Water Offset (if applicable):	Water offset is expected but there is insufficient information at this time to quantify potential benefits. Alluvial water storage projects are expected to increase local groundwater and surface water storage, with consequent effects on baseflow. The volume of water storage is computed on a reach-by-reach basis using geometric estimates of the volume of the alluvial aquifer (Natural Systems Design, 2017), interpolated estimates of channel incision, and values for specific yield (i.e., drainable porosity) based on NRCS soils data. The volumetric data are then translated to an approximate baseflow contribution based on simplified application of Darcy's law, with a time-invariant release rate. The benefits to the magnitude and duration of baseflow are largely dependent on the spatial extent of implementation of the approach since the benefits scale with the length of stream restored.
Project-Type Specific Information:	This project aims to identify and prioritize low order reaches for restoration of natural storage functions and to link each reach to one or more types of restoration actions. The primary goal of alluvial water storage projects is to slow the flow of water out of a channel network and reverse channel incision by aggrading or raising the stream bed. This in-turn raises groundwater levels and water storage. • How much water is likely to be stored? o Insufficient information to quantify at this stage.

	• Has the surface water source for the project been evaluated, and, if so, what is that source?
	  o Pilot project locations for instream hand-built restoration have been identified on Neil Creek, Carter Creek, Still Creek, and Schafer Creek
	• During what period(s) can water be diverted? Is there an instream flow?
	  o Unknown at this stage.
	• How often is the flow above the minimum instream flow?
	  o Unknown at this stage.
	• What is the proposed rate of diversion?
	  o Unknown at this stage.
	• What type of water rights would need to be acquired to provide water from that source?
	  o None
	• What stream reach likely would benefit from this project and what is the anticipated benefit to that reach?
	  o Low order tributaries on commercial forest lands within the East Fork, West Fork, and Middle Fork Satsop River and Middle and Upper Wynoochee River.
	  o Initial work shows that reversing channel incision can substantially increase water retention and benefit aquatic and riparian habitat along channel networks.
	• What fish species will benefit?
	  o Primary species benefitting: Chinook, Coho, Steelhead, Chum.
	• Has a feasibility study been conducted, and, if so, have the anticipated timing of streamflow benefits been estimated?
	  o No
	• What is the potential diversion method(s)?
	  o Natural infiltration.

Estimated Project Cost:	Project budget is $182,000, not including construction of the pilot project
Performance Goals & Measures:	Change In Flow Increase in water table and water storage Increase in off channel and floodplain habitats. Lower water temperatures during base flows Higher base flow discharge. Monitoring is anticipated to include repeat survey, groundwater and surface water elevation data collection, and riparian vegetation change monitoring.
Anticipated Local and Partner Support & Barriers to Completion:	Support is being provided by Washington State Department of Ecology SFY20 Water Quality Program grant, Grays Harbor Conservation District, Coast Salmon Partnership, Weyerhaeuser, and Green Diamond; barriers

	to completion include challenges associated with construction access and compatibility with forest land infrastructure and tree harvest cycles.
Project Sponsor, Implementation Start Date and End Date:	Start: December 2019 End: December 2021

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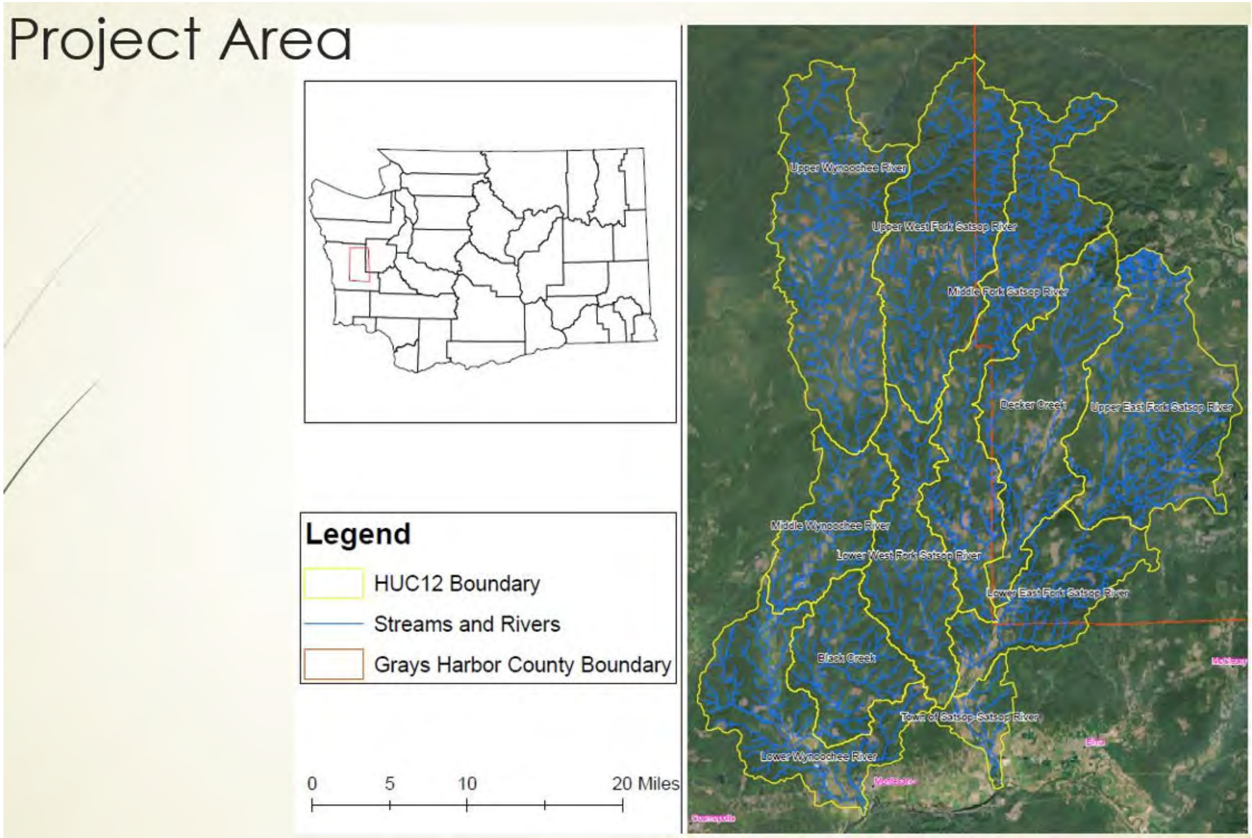


Project location: Satsop and Wynoochee subbasins within Grays Harbor County

PROJECT INFORMATION SHEET

Project Name:	**Beaver Dam Analog Implementation**
Project ID:	**BW-00**
Project Location:	Prioritized locations per ASRP-funded BDA Implementation in the Chehalis (20-1900). Includes tributaries of the Newaukum River.
Project Description:	Over the last 150 years, 90 percent of Chehalis marsh and pond habitats have been lost or degraded. BDAs represent a flexible process-based restoration technique to address many of the limiting factors in our target GSUs and elsewhere in the Chehalis Basin. We propose to construct BDAs at prioritized locations within the watershed and monitor the effectiveness of this restoration technique to improve streamflow, habitat, and water quality parameters.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	It is expected that construction of BDAs will improve streamflow, habitat, and water quality parameters. We will start a monitoring program to test hypotheses in this regard.
Is Water Quantity a Limiting Factor In this Subbasin?	Locations to be determined. Initial project work will likely be completed within the Newaukum subbasin where water quantity is a Tier 2 limiting factor.
Location & Spatial Extent of Benefits:	Localized at the project sites and downstream. Locations to be determined.
Anticipated Water Offset (if applicable):	Water offset is not yet quantified, as the number and locations of beaver dam analog installations has not yet been determined beyond pilot installations in the Newaukum subbasin. Each BDA is expected to provide water offset of 2.5 acre-feet per year (Dittbrenner, 2019). Reference: Dittbrenner, Benjamin J., 2019. Restoration potential of beaver for hydrological resilience in a changing climate, PhD Dissertation, University of Washington, 164 p.
Project-Type Specific Information	Most questions will be answered by the currently ongoing feasibility study. • What are the projected hydrologic benefits of this project? o Raise local groundwater table, enhance wetland storage.

	• How will benefits be measured/quantified?
	  o To be determined.
	• Are there roads, culverts, buildings, infrastructure that may be impacted through raising water levels due to analogues or introduction of beavers?
	  o To be determined, depends on selected locations.
	• If you expect beaver to use the site as a result of the project:
	  • Is there local documentation or records from WDFW indicating their historic presence?
	  • If not, do WDFW wildlife biologists believe the area could support beavers?
	  • Has beaver intrinsic modeling been performed for the basin/site?
	  o To be determined, depends on selected locations.
	• Is there a stable food supply to support the beavers?
	  o To be determined, depends on selected locations.

Estimated Proposed Cost:	Conceptual
Performance Goals & Measures:	• Miles of Stream Made Accessible • Total Amount of Estuarine / Nearshore Acres Treated • Total Riparian Acres Treated • Total Riparian Miles Streambank Treated • Number of Blockages/Impediments/Barriers Impeding Passage
Anticipated Local and Partner Support & Barriers to Completion:	The first phase of this project was funded by the Aquatic Species Restoration Plan and continued support is likely from that program. The pilot phase of this project is a collaboration between Wild Fish Conservancy, Ducks Unlimited, and WDFW. The Coast Salmon Partnership is also a partner. They are likely to be continued partners. Barriers to project implementation include landowner willingness and acceptance of more wood in streams.
Project Sponsor, Implementation Start Date and End Date:	Wild Fish Conservancy. Start: July 2021 End: December 2022

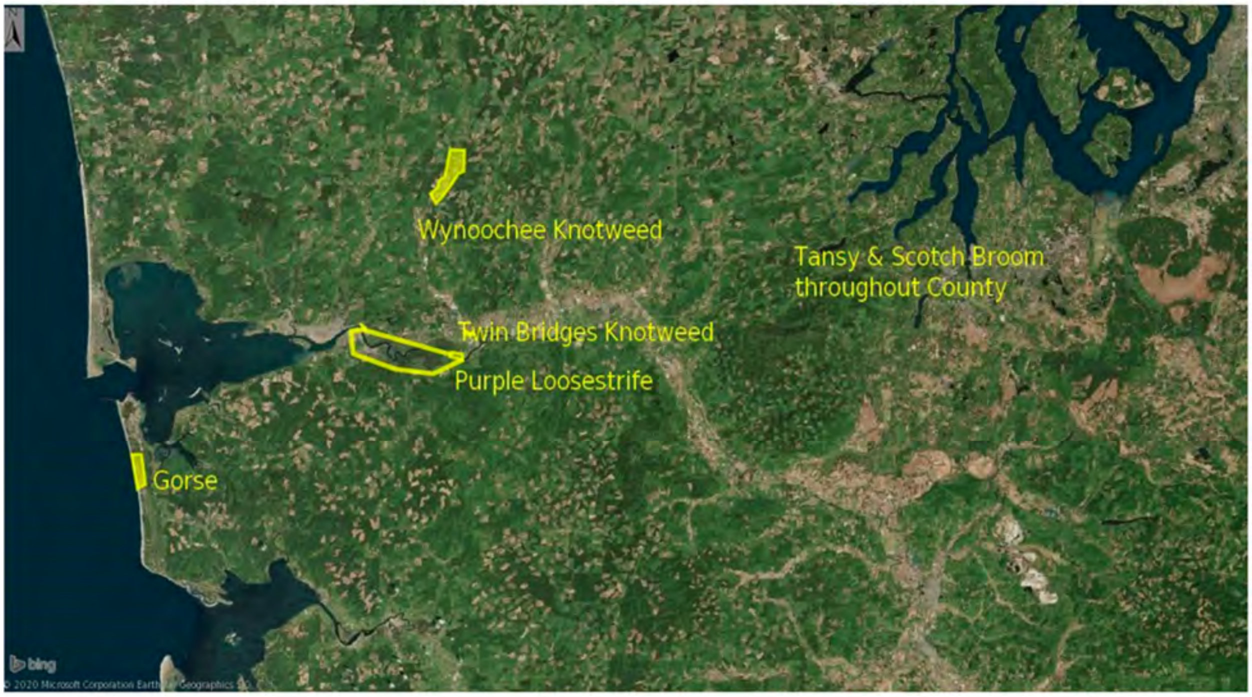
PROJECT INFORMATION SHEET

Project Name:	**Chehalis Basin Cooperative Weed Management**
Project ID:	**BW-01**
Project Location:	This project proposes work throughout Grays Harbor County, within WRIA 22. Project sites within the watershed will include roads, gravel mines, parks, recreational sites, restoration projects, and will expand and support existing invasive control efforts in the region's rivers, streams, and wetlands. Lat/long: 46.981210, -123.603845
Project Description:	This project aims to control noxious weeds and coordinate efforts for collaboration in the Chehalis Basin between partners. The project will focus on the Chehalis Basin Cooperative Weed Management Area and will prioritize control efforts in Grays Harbor to target weed populations that are increasingly impactful such as scotch broom, gorse, tansy ragwort, knotweed, and purple loosestrife.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	The project seeks to address Grays Harbor County's extensive noxious weed issues that degrade riparian habitat, forest ecosystems, and wetlands. Invasive plants compete with native species for essential resources, interrupting food webs, altering nutrient cycling, increasing soil erosion, and posing a serious threat to our salmon, wildlife, and native plant populations. All native salmonids within treated river-corridors will benefit.
Is Water Quantity a Limiting Factor In this Subbasin?:	Water Quantity is a limiting factor (tier 1 concern) in a number of the sub-basins that would fall under this cooperative weed management area.
Location & Spatial Extent of Benefits:	This project proposes work throughout Grays Harbor County, within WRIA 22. Project sites within the watershed will include roads, gravel mines, parks, recreational sites, restoration projects, and will expand and support existing invasive control efforts in the region's rivers, streams, and wetlands.
Anticipated Water Offset (if applicable):	N/A

Project-Type Specific Information	The planned prioritization strategy will tackle the largest infestations of scotch broom, gorse, tansy, knotweed, and purple loosestrife. The sponsor and staff will focus efforts and coordination for scotch broom, gorse, and tansy. The project will contract treatment work for knotweed and purple loosestrife. Ecologically sensitive areas, recreation access, and the largest vectors for noxious weed dispersal will be addressed with the highest priority. The priority sites will be selected from extensive surveys in 2020/2021/2022 and then discussed amongst the Grays Harbor Noxious Weed Control Board and the Chehalis Basin Cooperative Weed Management Area. The Wynoochee River has been selected as a priority river to focus attention on knotweed control because of the initial work conducted in 2019, the landowner support, and the other restoration work being planned for the river that will benefit greatly from reduced knotweed populations.
Estimated Project Cost:	$415,880
Performance Goals & Measures:	• Acres of riparian treated for plant removal/control: 100 • Acres treated for upland vegetation management: 200 • Miles of streambank treated for plant removal/control: 15 • Number of Outreach/Education events: 10 • Number of interpretative signs: 25 • Number of different locations that signs/posters/exhibits were exhibited: 25 • Number of landowners contacted: 60 • Acres of riparian area surveyed for non-native plants: 500 • Number of riparian acres maintenance/treatment area: 90 • Number of survey/treatment cycles: 1 • Acres of upland area surveyed for non-native plants: 1000
Anticipated Local and Partner Support & Barriers to Completion:	Support: • Grays Harbor Conservation District: Grant management support, collaboration on weed control and revegetation efforts. • WDFW and DNR: Collaboration on site specific weed control and use of equipment such as boats. • WSDA: Grant match support for knotweed control on the Wynoochee River. • Grays Harbor County Stream Team: Partnering on volunteer engagement and education outreach. • Noxious Weed Control Programs of Lewis, Thurston, and Mason County: Mentorship in Noxious Weed Program management. • Grays Harbor County Water Keepers: Survey support in sloughs, wetlands, and rivers. • Audubon Society: Collaboration on vegetation management on local properties.

	• Port of Grays Harbor: Collaboration and support to control vegetation on properties. • Green Diamond and Weyerhaeuser Timber Companies: Collaboration and support for control on properties and revegetation supplies. • Chehalis Basin Cooperative Weed Management Area: Overall support, coordination, and collaboration on site specific and regional control projects. • Grays Harbor County Vegetation Management Department: Support on site specific projects, equipment, and roadside spraying. • 10,000 Year Institute non-profit: Grant management mentorship and collaboration on site specific control projects and outreach. • Washington State Parks: Collaboration on site specific control projects. USFS: Support through Title II funding to conduct pit inspections and site specific control project collaborations. • Quinault Indian Nation: Direct support from Invasive Species Coordinator serving as the chair for the Grays Harbor County Noxious Control Board and grant management mentorship. • Chehalis Tribe: Collaboration on site specific control projects. • WSDOT: Collaboration and coordination along highways.
Project Sponsor, Implementation Start Date and End Date:	Grays Harbor County Noxious Weed Board. Start: July 2021 End: July 2023

WCRRI Proposal Sites



Tansy Ragwort

PROJECT INFORMATION SHEET

Project Name:	**Agricultural Irrigation Efficiencies & Water Conservation Program**
Project ID:	**BW-02**
Project Location:	Specific landowner partners have not been identified yet. The project could be applied in any of the planning subbasins.
Project Description:	This effort will focus on engaging agricultural landowners in an irrigation management planning and implementation process. The program will provide technical assistance to help farmers to develop Irrigation Management Plans (IMPs) so that they can upgrade to efficient irrigation infrastructure, improve water use timing, water quantity applications, and identify opportunities to conserve water, ultimately using the most efficient tools available. Identifying sources of funding for cost-share incentives will assist landowners with IMP implementation, helping farmers upgrade irrigation infrastructure to limit water waste. Work will focus primarily in the Black River and Skookumchuck Management Units of the Chehalis Watershed. The initiative is designed to support ongoing agricultural sustainability while also integrating water conservation efforts that will benefit in-stream flow. Helping landowners understand their crop-specific (including pasture) watering needs, and the most efficient way to irrigate without waste, will enable farms to meet production goals within their water rights. This initiative will also explore innovative ways to increase agricultural landowner participation and strategies to conserve water during periods of abundance for use later in the water year. Work will focus on achieving the following: 1. identify barriers and opportunities to effectively engage private landowners in actions that involve on-farm water conservation 2. increase community awareness and support for water conservation as well as alternative tools and programs that can benefit both instream flow and farmers, such as those developed at Washington Water Trust 3. develop property-specific irrigation management plans 4. incentivize system upgrades to achieve efficiency and waste reduction 5. explore landowner interest in additional strategies that could result in on-farm water retention, infiltration, and storage that can provide input for late-summer stream flows 6. reduce potential water waste on agricultural properties, leaving additional water in aquifers or streams to support in-stream flow and habitat.

	This initiative would aim to result in a suite of options that benefit sustainable agricultural in Thurston County while also providing long-term benefits to water quantity and streamflow. Benefits would result from changes in landowner water management behavior. Given the current lack of landowner engagement in water conservation actions, there is a need to identify the barriers to participation, as well as incentives or innovative tools that might make desired water conservation actions more acceptable to private landowners. This effort will explore these issues directly with landowners to determine a practical and effective path forward.
Project Type:	☐ Water Right Acquisition ☑Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Water quantity and stream flow and water quality are the limiting salmonid factors to benefit from this project. Groundwater extraction is another resource issue to be addressed.
Is Water Quantity a Limiting Factor In this Subbasin?	Yes. This is a Tier 1 concern for the Black River and Skookumchuck River.
Location & Spatial Extent of Benefits:	Exact locations would be determined once the project is underway.
Anticipated Water Offset (if applicable):	Water offset is expected but there is insufficient information at this time to quantify potential benefits. Water use efficiencies will likely lead to conservation and reduced use of source waters but cannot be quantified at this point.

Project-Type Specific Information	Water Conservation
	• What does the program propose to do?
	    o This effort will focus on engaging agricultural landowners in an Irrigation Management Planning and implementation process.
	• Is the program active or passive?
	    o Active
	• Is the program voluntary or required?
	    o Voluntary
	• What is the process for landowner engagement?
	    o Conservation District staff will identify the barriers to participation, as well as incentives or innovative tools that might make desired water conservation actions more acceptable to private landowners. This effort will

	explore these issues directly with landowners to determine a practical and effective path forward.
	• What is the incentive structure?
	  o This project will use information about barriers to participation to find the appropriate incentives. Incentives will include tools that help landowners improve efficiencies on their farms and save money.
	• Will water conservation measures be measured?
	  o Could in a future phase of this project
	• Are the savings permanent?
	  o By developing water conservation tools that work for landowners and help farmers meet their bottom line, there will be a stronger likelihood that savings will continue into the future.
	• What is the mechanism to ensure the savings remain instream?
	  o Less water extracted is more left in groundwater and streams
	• What evidence is there that the conserved water will remain instream?
	  o The program will aim to find measures that result in net benefits for streams

Estimated Project Cost:	Conceptual.
Performance Goals & Measures:	Change in Flow
Anticipated Local and Partner Support & Barriers to Completion:	Thurston Conservation District has existing positive relationships with agricultural operators. Successful projects on these properties will likely lead to increase adoption by additional operators. The project's goal is to identify current barriers to adoption of irrigation efficiencies, and ways to get past those barriers.
Project Sponsor, Implementation Start Date and End Date:	Thurston Conservation District. Start: 7/1/2021 or as soon as funding is obtained. End: 1/1/2025

PROJECT INFORMATION SHEET

Project Name:	Eager Beaver Collaboration
Project ID:	BW-03
Project Location:	Chehalis Basin Lat/long: 47.020588, -122.944291
Project Description:	This program will work with landowners in the Chehalis region to identify barriers and opportunities to increasing tolerance for the presence of beavers on their properties, with an emphasis on developing a framework for “managing” beaver habitat. The current approach to beaver management tends to focus on trapping and removing beaver, with a subsequent decrease in the multitude of benefits created by active beaver presence in stream systems and floodplains. The intent of this effort is to explore ways to increase tolerance for beaver activity on private land while also maintaining viable agricultural operations or other land uses (participation will not be limited to agricultural properties. It will focus on working with and learning from landowners who have appropriate habitat conditions or potential habitat on their properties). This work focuses on achieving the following: 1. Identify barriers and opportunities to effectively engage private landowners in actions that involve beaver habitat stewardship 2. Increase community awareness and support for beaver as a part of the “local neighborhood” 3. Design conceptual projects in partnership with landowners, WDFW biologists, and USFWS 4. Develop monitoring and adaptive management framework for potential future projects 5. Explore options to develop restoration projects in cooperation with landowners 6. Ultimately, increase the presence of and tolerance for beaver on private properties. This initiative could result in significant long-term benefits to water quantity and streamflow based on changes in landowner tolerance for wetland systems, seasonal flooding, or other wetland-tolerant actions. Given the current lack of landowner engagement in stewardship actions there is a need to identify the barriers to participation, as well as the incentives or innovative tools that might make desired stewardship actions more acceptable to private landowners. This effort will explore these issues with landowners directly to determine a practical and effective path forward.

Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	Wetland, riparian and upland habitat types will benefit from this project. Water quality, floodplain connectivity and function, large woody debris recruitment, water quantity and stream flow are salmonid limiting factors to be addressed. Beavers will be the primary species to benefit from this project. This project will potentially benefit bank protection and flood plain connectivity.
Is Water Quantity a Limiting Factor In this Subbasin?	Yes. This is a Tier 1 for the Black River and Skookumchuck River.
Location & Spatial Extent of Benefits:	Work will target Black River and Skookumchuck. Specific locations TBD.
Anticipated Water Offset (if applicable):	This initiative could result in significant long-term benefits to water quantity and streamflow based on changes in landowner tolerance for wetland systems, seasonal flooding, or other wetland-tolerant actions.

Project-Type Specific Information:	Beaver Reintroduction or Beaver Dam Analogs
	• Is there local documentation or records from WDFW indicating their historic presence?
	    • Yes, documentation in Tim Beechie's work for the ASRP
	• Has beaver intrinsic modeling been performed for the basin/site?
	    • Yes, a BIP was developed by Ben Dittenbrenner for the whole Chehalis Basin and is being refined by the Wild Fish Conservancy and WDFW.
	• Are there roads, culverts, buildings, infrastructure that may be impacted through raising water levels or introduction of beavers?
	    • Yes. The project goal is to reduce intolerance to beavers by showing the stream benefits they provide.
	• Is there a stable food supply to support the beavers?
	    • Yes.

Estimated Project Cost:	Conceptual.
Performance Goals & Measures:	Change in Flow

Anticipated Local and Partner Support & Barriers to Completion:	The Thurston Conservation District has local support and strong connections in the basins this project will work in. Additional partnership support is likely from the Wild Fish Conservancy's work on finding ideal locations for BDAs in other parts of the Chehalis Basin. This project aims to identify and overcome barriers to implementation of BDAs and reintroduction of beaver.
Project Sponsor, Implementation Start Date and End Date:	Thurston Conservation District. Start: 7/1/2021 or as soon as funding is available. End: 1/1/2025

PROJECT INFORMATION SHEET

Project Name:	**Managed Aquifer Recharge (MAR) Opportunity Assessment**
Project ID:	**BW-04**
Project Location:	Specific sites for this project have not yet been identified, however, there may be opportunity for Managed Aquifer Recharge (MAR) on both private and public property within the Upper and Lower Chehalis River basins. Potential sites could be located within any of the planning subbasins if site suitability requirements are met.
Project Description:	This conceptual project would augment stream flows by increasing surficial aquifer discharge (baseflow) above what occurs under existing conditions. The project concept includes diverting surface water annually from the subject stream(s) between approximately December 1 and April 30 when excess water is available. Diverted water would be conveyed through a collector well adjacent to the stream (e.g. Ranney Collector well) or through an instream surface water intake and piped to a constructed MAR facility. This diverted surface water infiltrates into the shallow aquifer, is transported down-gradient, and ultimately discharges to one or more adjacent streams as re-timed groundwater baseflow. MAR projects provide year-round benefits for groundwater and surface water resources, but the specific goal of this project is to increase baseflow to the subject stream(s) during the critical flow period, when surface flows are generally lowest. This is accomplished by recharging the aquifer adjacent to the stream(s) and providing additional groundwater discharge to the stream(s) through MAR.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	Conceptually, this project could provide off-channel storage and release of more than 200 acre-feet (AF) per year of water, through repeated annual diversions. These benefits would require quantification as part of an Ecology-required feasibility study, which must be completed before a MAR project can proceed to construction and operation. The Upper and Lower Chehalis Rivers and their tributaries are inhabited by Coho, Spring Chinook, Fall Chinook, Chum, Cutthroat Trout, Rainbow Trout, and Winter Steelhead (SWIFD). The project would improve streamflow year-round but particularly during the critical flow period as retimed groundwater baseflow. The increased baseflow should have the added benefit of reducing water temperatures in the river during the summer and early fall.

	It is anticipated that MAR facilities would be constructed as buried infiltration galleries or above-ground infiltration basins, but design details will be further developed at a later time. Development of this project would augment existing flow in subject stream(s) through an increase in groundwater baseflow, which could be year-round depending on site and down-gradient hydrogeology. The temporal distribution and magnitude of those benefits will be estimated during the feasibility study. Those streamflow augmentation benefits will continue to discharge to the river after each year's storage window closes because of the lag time of water moving through an aquifer and the distance from the facility to the receiving stream. The rate at which the infiltrated water enters the river will vary based on in-situ aquifer parameters that will be tested and modeled during the feasibility study.
Is Water Quantity a Limiting Factor In this Subbasin?	Will depend on locations. Priority would be on identifying projects in quantity-limited subbasins.
Location & Spatial Extent of Benefits:	The project is expected to provide streamflow benefits in the subject stream(s) and downstream areas. Selected sites could be located throughout the Upper and Lower Chehalis River basins where surface water is available for beneficial use and soil conditions are amenable to infiltration and groundwater storage.
Anticipated Water Offset (if applicable):	For planning purposes, a water offset of 200 acre-feet per year has been assumed for this project. This offset could be exceeded depending on project locations and hydrogeologic conditions, period of time flows are available for diversion, or if multiple MAR projects are implemented. Given the cost to develop and implement an MAR project, it is unlikely that a site providing less than a 200 acre-foot per year benefit would be feasible. The proposed MAR facility will result in streamflow benefits to the subject streams(s) by diverting and temporarily storing a portion of seasonal high flows into the shallow alluvial aquifer. This project is currently conceptual but we anticipate the ability to divert surface water from the subject stream(s) at a rate of up to approximately 1 cubic foot per second (cfs) for up to five months (approximately December 1 through April 30) when excess water is available in the river for beneficial use. The goal is to increase streamflow during the critical flow period when demand for water is highest and surface flows are generally lowest. The proposed MAR facility will infiltrate diverted river water into the shallow aquifer and provide increased baseflow to the subject stream and its tributaries, depending on where the facility is sited.

	Assuming water will be diverted between December 1 and April 30 every year (150 days), the annual diversion volume could be as high as 298 acre-feet per year calculated as: Annual Volume = Diversion Rate x Duration of Diversion It is assumed that a feasibility study will be conducted pursuant with Appendix B of Ecology's Net Ecological Benefit (NEB) guidance and Appendix D of the Streamflow Restoration Grant application requirements, if funding from Ecology is pursued during a future grant round. All values presented in this project description are for planning purposes and may not represent actual site conditions.
Estimated Project Cost:	Conceptual project, to be determined.
Performance Goals & Measures:	The performance goals are to increase water storage in the alluvial aquifer adjacent to the subject stream(s) by infiltrating at least 200 acre-feet per year through the MAR facility to improve baseflow in the subject stream(s). The performance measure will be an increase in baseflow during the critical flow period in the subject stream(s).
Anticipated Local and Partner Support & Barriers to Completion:	A project sponsor has not yet been identified. This project is believed to be in alignment with the goals of the Streamflow Restoration law. MAR is one of the identified project types that could address the new consumptive water use and achievement of NEB. The barriers to completion include identifying a project sponsor, site suitability (to be determined during the feasibility study), funding for construction and O&M costs, and obtaining a water right from the subject stream(s) or the adjacent aquifer for beneficial use at the MAR facility.
Project Sponsor, Implementation Start Date and End Date:	A project sponsor has not yet been identified. Start feasibility study 7/30/2021 or as soon as funding is obtained. End 1/1/2038, end of the Streamflow Restoration Plan.

PROJECT INFORMATION SHEET

Project Name:	**Stormwater Recharge Opportunity Assessment**
Project ID:	**BW-05**
Project Location:	Specific sites have not yet been identified but are most likely to occur in more developed areas (e.g. Olympia, Chehalis, Centralia) with existing stormwater facilities.
Project Description:	Identify locations in the Chehalis watershed where stormwater infiltration can be enhanced to increase return of surface stormwater runoff to groundwater. To provide water offset, infiltration must be in addition to existing infiltration and infiltration required to meet flow control requirements. Applicable projects could include retrofits of existing ponds to expand infiltration area; routing or conversion of existing impervious surface to infiltrating bioretention, permeable pavement, or other "low impact development" (LID) type facilities; or construction of regional stormwater facilities with infiltration capacity in excess of what is required to meet stormwater standards.
Project Type:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	Stormwater infiltration facilities capture surface runoff from developed areas via stormwater drainage systems and return a portion (often a majority) of that flow to local groundwater. This more closely replicates natural land surface runoff, where the majority of rainfall infiltrates into the soil and reaches streams and wetlands via subsurface flow. Stormwater infiltration would be expected to enhance local groundwater supply, potentially increasing and extending summer baseflows. It also reduces flashiness of surface runoff contributions to streamflow, which reduces erosion potential and associated habitat and biological impacts.
Is Water Quantity a Limiting Factor In this Subbasin?:	Water quantity is a limiting factor in the majority of the Chehalis subbasins. This project would target identification of opportunities basinwide.
Location & Spatial Extent of Benefits:	Depends on project locations identified. Infiltration would contribute to local groundwater recharge and reduced flow flashiness in receiving streams.
Anticipated Water Offset (if applicable):	For planning purposes, a water offset of 10 acre-feet per year has been assumed for this project. This offset could be exceeded depending on

	project locations and infiltration rates and number of stormwater projects implemented. Potential offsets will depend on the number of projects, size of contributing areas, and infiltration capacity at each project. A rough estimate of potential infiltration offsets for a typical project can be made using assumed project characteristics (infiltration area and rate) and rainfall frequency characteristics to estimate availability of inflow for infiltration. Assuming a typical pond infiltration footprint of 8,000 square feet, infiltration rates ranging from 0.5 inches per hour to 3 inches per hour, and an average of 887 hours of rain per year (based on Olympia airport precipitation data), each pond could be expected to infiltrate between 7 and 41 acre-feet per year on average.
Project-Type Specific Information	This project would be a stormwater project. Stormwater would be delivered to facilities via existing storm drainage systems. Retrofit projects, by definition, do not have associated stormwater requirements, but some projects may combine retrofit of prior impacts and mitigation of additional development. Hydrologic modeling can be used to determine the portion of the facility inflow and storage associated with new or redevelopment versus retrofit of existing development. Water quality treatment is required prior to infiltration of stormwater, which would need to be incorporated into facility designs. Permitting requirements for retrofit of existing facilities are generally limited to local permits, though if facility outflows are significantly modified, there could be impacts to downstream receiving waters that may require additional permits.
Estimated Project Cost:	$100,000 for basinwide planning study. Design and construction costs depend on types of projects.
Performance Goals & Measures:	Number of projects, project size (infiltration area), contributing area, water infiltrated.
Anticipated Local and Partner Support & Barriers to Completion:	To be determined. City public works departments would likely be supportive of projects that improve their stormwater infrastructure.
Project Sponsor, Implementation Start Date and End Date:	Sponsor not identified. Start feasibility 7/1/2021, or as soon as funding is obtained. End 1/1/2038, end of planning horizon.

PROJECT INFORMATION SHEET

Project Name:	**Trust Water Rights Acquisitions**
Project ID:	**BW-06**
Project Location:	Basinwide, specifically the Satsop, Skookumchuck, Black, Scatter, Newaukum, and Curtis subbasins
Project Description:	Ecology's Water Right Application Tracking System (WRATS) shows that, basinwide, 23 water rights have been placed in Trust as Temporary Donations. As issued these rights allow for 28,069 acre-feet per year and represent an average flow of 38.8 cfs. While some of these water rights, such as the Cooke Aquaculture rights, have already been identified as acquisition targets, others have not been investigated. This project involves investigation of these rights to determine their relative extent and validity, the willingness of the individual owners to sell some or all of their water right, and finally the potential for streamflow benefits.
Project Type:	☑ Water Right Acquisition ☐ Non-Acquisition Water Offset ☐ Habitat/Other
Description of Benefits:	Water right acquisition is generally considered to be Ecology's preferred mechanism for ensuring water budget neutrality. Water rights that have been placed in Temporary Trust represent water that is not currently being used and may be available to buy and retire. A preliminary review of the water rights currently flagged as being held in Trust has identified holdings in several subbasins: • Satsop – Potentially 947 acre-feet per year (1.31 cfs) • Skookumchuck - Potentially 17 acre-feet per year (0.02 cfs) • Black - Potentially 7,000 acre-feet per year (9.67 cfs)* • Scatter - Potentially 19,800 acre-feet per year (27.35 cfs)* • Newaukum - Potentially 265 acre-feet per year (0.37 cfs) • Curtis - Potentially 40 acre-feet per year (0.06 cfs) * All Black River and a significant amount of Scatter Creek holdings have already been accounted for in other project descriptions.
Is Water Quantity a Limiting Factor In this Subbasin?:	Yes, it is a Tier 1 limiting factor in many of the targeted subbasins.

Location & Spatial Extent of Benefits:	Basinwide
Anticipated Water Offset (if applicable):	Water offset would be provided but there is insufficient information at this time to quantify potential benefits. Total water rights amount to potential of 28,069 acre-feet/year, which equates to 38.8 cfs. Cooke Aquaculture water rights on the Black River and Scatter Creek currently held in Temporary Trust are identified as separate projects in the plan. Remaining water rights not including Cooke Aquaculture amount to 1,636 acre-feet per year (2.26 cfs).
Project-Type Specific Information	This project would be categorized as a water right acquisition. Additional research would need to be done to assess whether any of these water rights are available for purchase.
Estimated Project Cost:	Conceptual Project.
Performance Goals & Measures:	• Acre Feet of Water Purchased/Leased • CFS (Cubic Feet Per Second) Of Water Purchased/Leased • Changes in Water Flow
Anticipated Local and Partner Support & Barriers to Completion:	Current water rights holders would need to be contacted and supportive of the new use for the water right.
Project Sponsor, Implementation Start Date and End Date:	Sponsor not yet identified. Start feasibility work 7/1/2021, or as soon as funding is obtained. End 1/1/2038, end of planning horizon.

PROJECT INFORMATION SHEET

Project Name:	**USGS Groundwater Discharge Zone Delineation**
Project ID:	**BW-07**
Project Location:	Streams and rivers in the Black, Scatter, Newaukum, Skookumchuck, Cloquallum-N-Delezene, Curtis, and Chehalis-Salzer subbasins.
Project Description:	USGS and partners will collect longitudinal water-temperature profiles at ambient stream velocity of select reaches (Vaccaro and Maloy, 2006) and measure bulk streamflow gains and losses of the Chehalis and its tributaries during the summers of 2021 and 2022. During the summer, the contrast between cold groundwater and warm surface water is greatest and groundwater discharge constitutes a larger proportion of total streamflow, making groundwater inputs most evident. Water-temperature data will be collected by data-logging thermistors towed behind kayaks floating at ambient river velocity and will be georeferenced to simultaneously recorded global positioning system (GPS) data. Longitudinal water-temperature profiles have been used successfully by the USGS and its partners to identify groundwater discharge to streams and cold-water refugia in a number of watersheds in Washington State, including the Yakima (Gendaszek and others, 2014), Nooksack (Cox and others, 2005), and Stillaguamish (Gendaszek, 2011). This information will be used to identify reaches with groundwater discharge to inform managers where increased consumptive use from exempt wells may impact streamflow. Longitudinal water-temperature profiles, which delineate the zones of groundwater recharge, may be supplemented by a series of near simultaneous discharge measurements termed a “seepage run” to quantify the volume of bulk gains and losses of streamflow. Although Ecology and this watershed plan assume “steady state” impacts of well impacts on streamflow, this work will more directly correlate groundwater input with stream health. As a result of this project, both habitat restoration and offset projects can be targeted to further improve habitat conditions and streamflow. References: Cox, S.E., Simonds, F.W., Doremus, Llyn, Huffman, R.L., and Defawe, R.M., 2005, Ground water/surface water interactions and quality of discharging ground water in streams of the lower Nooksack River Basin, Whatcom County, Washington: U.S. Geological Survey Scientific Investigations Report 2005-5255, 46 p.

	Gendaszek, A.S., Ely, D.M., Hinkle, S.R., Kahle, S.C., and Welch, W.B., 2014, Hydrogeologic framework and groundwater/surface-water interactions of the upper Yakima River Basin, Kittitas County, central Washington: U.S. Geological Survey Scientific Investigations Report 2014–5119, 66 p., http://dx.doi.org/10.3133/sir20145119. Gendaszek, A.S., 2011, Thermal profiles for selected river reaches in the Stillaguamish River basin, Washington, August 2011: U.S. Geological Survey Data Series 654, 4 p. Vaccaro, J.J., and Maloy, K.J., 2006, A thermal profile method to identify potential ground-water discharge areas and preferred salmonid habitats for long river reaches: U.S. Geological Survey Scientific Investigations Report 2006-5136, 16 p.
Project Type:	☐ Water Right Acquisition ☐ Non-Acquisition Water Offset ☑ Habitat/Other
Description of Benefits:	This project will identify zones of groundwater discharge to streams. This work will be focused on streams that are projected to have exempt well growth (CBP, Draft Watershed Plan Addendum, 2020), known to have low summer flow issues, and where fish stocks are closest to being impaired (CBLE, 2011). This information will be used to understand where rural exempt well development is most likely to negatively affect streamflow, and thereby will allow the planning unit to develop more offset and water conservation projects in these areas throughout the remainder of the 20-year planning period. The project will result in projects that will be most likely to offset rural exempt well water impacts in Chehalis Basin streams.
Is Water Quantity a Limiting Factor In this Subbasin?:	All of the listed basins have Water Quantity as a Tier 1 limiting factor.
Location & Spatial Extent of Benefits:	These locations will be identified as a result of this work.
Anticipated Water Offset (if applicable):	None. Areas to focus implementation of water offset projects will be identified as a result of this work.
Project-Type Specific Information	Streamflow augmentation, water conservation and efficiency, water right, and habitat projects could all be developed in critical locations as a result of this work.
Estimated Project Cost:	Longitudinal Profiles: $60,000 Seepage Run: $17,500

	These two estimates are scalable. They reflect assumptions about the number of thermal profiling days (10 days) and the product – a non-interpretive data release of the thermal profiles similar to the Stillaguamish report (Gendaszek, 2011). The seepage run assumes 40 measurements done within 1 or 2 days; this is comparable in size to the previous seepage runs published for the Chehalis. USGS can match usually on the order of 30% USGS to 70% external funding.
Performance Goals & Measures:	N/A
Anticipated Local and Partner Support & Barriers to Completion:	The Chehalis Basin Strategy's Aquatic Species Restoration Plan's Monitoring and Adaptive Management Subcommittee has also expressed an interest in conducting temperature profiles and identifying key areas of groundwater input in order to protect and enhance refugia for Chinook and other salmonids. At the time of this writing, this work is not written into their work plan, but they would be strong supporters and may add financial and other technical expertise by the time this project starts. For this project, there is possible supplementation with existing FLIR data. Gains and losses of streamflow could be analyzed in the context of WDFW Thermalscape data to understand baseline conditions.
Project Sponsor, Implementation Start Date and End Date:	Project sponsor = USGS. Start date 7/1/2021, or as soon as funding is obtained. End 2022 or 2023.

APPENDIX C - NEB Summary Table

Project ID	Project Name	Project Type: Water Right Acquisition	Project Type: Non-Acquisition Water Offset	Project Type: Habitat/ Other	Water Offsets: Subbasin Consumptive Use Estimate (af/yr)	Water Offsets: Estimated Water Offset (af/yr)	Streamflow Benefits: Directly Adds Streamflow in Critical Period(s)	Streamflow Benefits: Recharges Groundwater	Streamflow Benefits: Shifts Flow to Critical Period(s)	Other Ecological Benefits: Enhances Habitat for Critical Periods/ Species Reach Length (ft)	Other Ecological Benefits: Provides Temperature Reduction or Refugia Reach Length (ft)	Other Ecological Benefits: Preserves/ Restores Natural Land Cover Area (ac)	Other Ecological Benefits: Increases Habitat Connectivity Added Length (mi)	Other Notes
Black River		1	3	6	141.1	192.4				-	0	55.0	5.0	
B-00	TC #91 Holm Farm Ditch Removal and Floodplain Reconnection		x	x		13.5		x	x					Offset based on estimated groundwater table rise and extents
B-01	Allen Creek MAR		x			26		x	x					Offset estimate based on modeling by Thurston County assuming 1 cfs diversion for 15 days in late March.
B-02	Cooke Aquaculture Water Right - Black River Reach	x				141	x							7000 af/yr water right held in trust. Purchased water could be directly added to streamflow, possibly using existing wells. Offset assumed to mitigate consumptive use for subbasin (0.8 cfs flow augmentation over 3-month low flow period).
B-03	Black River Basin Project Development: Oregon Spotted Frogs, farms & Wetlands Project			x										Pilot landowner outreach project
B-04	Black River Confluence			x										Assessment of potential floodplain connection and instream bank restoration near confluence with Chehalis R
B-05	Albany Street Stormwater Pond		x			11.9		x						Offset estimate based on surface and groundwater flow modeling.
B-06	Beaver Creek Conservation Easement			x								27		Easement Acquisition
B-07	Seiler Conservation Easement - Mima Creek			x				x				28		Easement Acquisition
B-08	Jones Road Culvert Replacement			x									5	Fish Passage. Would also open up 250 ac wetland habitat. Project complete.
Chehalis-Salzer		0	2	3	9.2	0				-	0	10.0	1.8	
CS-00	Coal Creek Floodplain Storage - City of Chehalis		x	x		NQ		x	x					City-owned site, no project concept developed yet. Offset anticipated but insufficient information to quantify at this time.
CS-01	Berwick Creek at Labree Fish Passage Design			x									1.79	Fish passage; fully funded
CS-02	Flood Hazard Reduction Master Plan and Chehalis Wastewater Treatment Plant Project		x	x		NQ		x	x			10		Planning stage. Offset anticipated but insufficient information to quantify at this time.
Chehalis Headwaters		0	0	1	5.2	0				1,500	0	0.0	7.0	
CH-00	Marker 19 Oxbow Restoration			x						1,500			7	West Fork Chehalis River; funded through ASRP grant process
Cloquallum - N. Delezene		0	0	5	29.1	0				7,461	0	15.6	8.3	
CD-00	Cloquallum Creek LWD Construction			x						3,696				
CD-01	Upper Middle Fork Wildcat Creek Restoration			x						2,000		15.6		Includes wetland restoration and riparian planting
CD-02	Sam's Canal Culvert Removal and Restoration			x						1,765			1.0	Daylight canal through McCleary, restore canal bed and riparian wetlands
CD-03	McConkey Lane Channel Naturalization			x										Project extents tbd
CD-04	Wildcat Road Barrier Construction			x									7.29	Fish pssage
West Capitol Forest		0	0	0	1.8	0				-	-	0.0	0.0	
WC-														
Elk - Johns River		0	1	1	1.5	23				-	0	178.7	0.0	
EJ-00	Newskah Road Fish Barrier Correction			x									1.34	Install fish passable structure on an unnamed tributary to Newskah Creek on Newskah Road south of Aberdeen
EJ-01	Grays Harbor County Forest Practices and Flow Assessment		x	x		23			x			179		Preservation of established forest stands representing 2% of GHC forest holdings. Water offset estimated based on VELMA modeling results indicating 0.39 ac-ft/yr of flow increase per acre of forestland.
East Willapa		0	2	2	39.8	9.5				-	0	0.0	0.8	
EW-00	Garrard Creek Floodplain Restoration Opportunity Assessment		x	x		5		x	x					Assessment of potential floodplain connection and instream bank restoration. Beaver dam analogs could be used to engage side channel and floodplain area. Potential water offset not yet quantified.
EW-01	Convert Galvin to Centralia Water		x			4.5		x	x					Public health benefits. Offset based on 40 homes @ calculated residential CU.
EW-02	Scammon Creek Hamilton Fish Passage Construction			x									0.79	Fish Passage; fully funded
Hanaford		0	1	2	4.2	3				3,500	0	33.0	0.0	
H-00	China Creek Flood and Habitat Mitigation Phase 2		x	x		3			x	3,500				Offset from information provided by Ramboll for storage/release from typical flood event
H-01	Port Blakely Hanaford Acquisition			x								33		Very conceptual. Parcel available from Port Blakely; no partner identified yet.
Hoquiam		0	1	6	3.1	17				1,320	0	394.4	3.5	
HQ-00	Port Blakely West Hoquiam Acquisition			x								34		
HQ-01	2020 West Hoquiam Acquisitions			x						1,320		39		Restoration of 5 acres of riparian area along West Hoquiam River
HQ-02	Middle Fork Hoquiam Tidal Restoration			x								113	3.5	10 barrier removals will open up estuarine habitat

APPENDIX C - NEB Summary Table

		Project Type			Water Offsets		Streamflow Benefits			Other Ecological Benefits				Other Notes
Project ID	Project Name	Water Right Acquisition	Non-Acquisition Water Offset	Habitat/ Other	Subbasin Consumptive Use Estimate (af/yr)	Estimated Water Offset (af/yr)	Directly Adds Streamflow in Critical Period(s)	Recharges Groundwater	Shifts Flow to Critical Period(s)	Enhances Habitat for Critical Periods/ Species Reach Length (ft)	Provides Temperature Reduction or Refugia Reach Length (ft)	Preserves/ Restores Natural Land Cover Area (ac)	Increases Habitat Connectivity Added Length (mi)	
HQ-03	Grays Harbor County Forest Practices and Flow Assessment		x	x		17			x			127		Preservation of established forest stands representing 2% of GHC forest holdings. Water offset estimated based on VELMA modeling results indicating 0.39 ac-ft/yr of flow increase per acre of forestland.
HQ-04	East Hoquiam - Granberg Acquisition			x								78		
HQ-05	East Hoquiam - Griswold Acquisition			x								3		
Humptulips		0	2	2	1.0	20				-	0	157.1	5.3	
HT-00	Kirkpatrick Road Fish Barrier Correction Design			x									5.31	Fish Passage
HT-01	Grays Harbor County Forest Practices and Flow Assessment		x	x		20			x			157		Preservation of established forest stands representing 2% of GHC forest holdings. Water offset estimated based on VELMA modeling results indicating 0.39 ac-ft/yr of flow increase per acre of forestland.
HT-02	Ocean Shores Water Reclamation and Reuse		x			0								Project expected to make 160 af/yr of water available for other uses but will not offset projected consumptive use as defined in this addendum.
Mox Chehalis		0	0	0	4.5	0				-	0	0.0	0.0	
MC-														
Newaukum		0	5	13	80.1	600.5				101,848	89,760	1.3	16.2	
N-00	City of Chehalis Alternate Water Supply Intake		x	x		280			x	89,760	89,760			Alternate diversion point for Newaukum water right on Chehalis mainstem; leave additional ~1.5 cfs in 18 mi of river in summer. Offset estimate based on 1 MGD left in river during summer period (~95 days).
N-01	MF Newaukum Trib-Kruger Fish Passage Construction			x									3.09	Fish Passage
N-02	Newaukum Lake Restoration & Enhancement Planning		x	x		10		x	x					Offset estimate based on assumed 2.5 af/yr offset per BDA
N-03	MF Newaukum at Centralia Alpha Fish Passage Construction			x									3.5	Fish passage
N-04	South Fork Newaukum Early Action Reach			x						11,088				Riparian and instream restoration, floodplain reconnection & storage
N-05	Lucas Creek Trib MP 4.39 - Fish Passage Construction			x									1.88	Fish passage
N-06	Lucas Creek Trib MP 4.24 - Fish Passage Construction			x									1.36	Fish passage
N-07	Berwick Creek at Hogue Fish Passage Construction			x									3.29	Fish passage; fully funded
N-08	Berwick Creek at Borovec Fish Passage Construction			x									0.32	Fish passage
N-09	Newaukum MAR Concepts		x			298								Offset estimated based on 1 cfs diversion December-March (~150 days per year). Potential locations on north and south forks.
N-10	Knutsen Fish Barrier Correction and BDAs			x									1.12	Fish pasage. Potential for water offset from BDAs not counted.
N-11	Berwick Creek at Bishop Fish Passage Construction			x									1.6	Fish pasage
N-12	Beaver Dam Analog Pilot Implementation		x	x		12.5								Construct and monitor BDAs at five prioritized locations on Newaukum tributaries. Offset estimate based on assumed 2.5 af/yr offset per BDA.
N-13	Berwick Creek Flood Reduction Restoration (Port of Chehalis)		x	x		NQ			x	1,000		1.3		Channel restoration, reconnect floodplain and wetland storage. Offset anticipated but insufficient information to quantify at this time.
Satsop		0	2	4	28.4	0				36,040	0	137.0	0.0	
S-00	Satsop/Wynoochee Tributary Assessment		x	x		NQ		x	x					Planning stage. Offset anticipated but insufficient information to quantify at this time.
S-01	Tree Fever Conservation Easement			x						7,000		137		
S-02	Lower Satsop Restoration, Protection, and Aquifer Recharge-Phase II		x	x		NQ				12,144				Offset anticipated but insufficient information to quantify at this time.
S-03	East Fork Satsop RM 8 Early Action Reach			x						16,896				Riparian and instream restoration, floodplain reconnection & storage
Scatter Creek		1	4	5	64.2	866				72,912	0	788	0.0	
SC-00	TC #118/119 Scatter Creek Water Right & Streamflow Augmentation	x		x		700	x			68,112				9953 af/yr water right held in trust. Purchased water added to Prairie and Scatter Creeks, extending wetted length up to 13 miles.
SC-01	TC #90 Weins Farm Restoration		x	x		20			x					Estimated 20-32 af of storage/release capacity
SC-02	TC #89 Upper Scatter Creek MAR		x	x		53.5								Wet season diversion to MAR. Thurston Co estimates 80-140 af/yr based on modeling.
SC-03	TC #81 Sampson Wetlands Restoration and MAR		x	x		92		x	x	4,800		10		Water offset estimated by Thurston Co assuming 0.3 cfs diversion to MAR when flows exceed 10 cfs.
SC-04	TC #127 Scatter Creek Upper Basin Forestry		x	x		NQ		x	x			778		Other actions possible but not identified. Offset anticipated but insufficient information to quantify at this time.

APPENDIX C - NEB Summary Table

		Project Type			Water Offsets		Streamflow Benefits			Other Ecological Benefits				Other Notes
										Enhances Habitat for Critical Periods/ Species	Provides Temperature Reduction or Refugia	Preserves/ Restores Natural Land Cover	Increases Habitat Connectivity	
Project ID	**Project Name**	Water Right Acquisition	Non-Acquisition Water Offset	Habitat/ Other	Subbasin Consumptive Use Estimate (af/yr)	Estimated Water Offset (af/yr)	Directly Adds Streamflow in Critical Period(s)	Recharges Groundwater	Shifts Flow to Critical Period(s)	Reach Length (ft)	Reach Length (ft)	Area (ac)	Added Length (mi)	
Curtis		0	0	1	18.9	0				13,725	0	0.0	0.0	
C-00	South Fork/Stillman Creek Early Action Reach			x					x	13,725				Riparian and instream restoration, floodplain reconnection & storage
Skookumchuck		2	0	2	62.4	3221				129,888	82,896	17.0	0.0	
SK-00	TransAlta Water Right Acquistion	x				2898	x			41,184				Restores flow to core area for spring Chinook, a severely depressed stock; supports coho, fall Chinook and steelhead too.
SK-01	Skookumchuck Dam Release	x		x		323	x		x	82,896	82,896			Explore whether additional releases are possible to enhance flows from dam (RM 23.5) to RM 7.8. Additional release of 1 cfs believed likely to be possible. Offset assumes 1 cfs release April 1-Sept 10
SK-02	Skookumchuck Early Action Reach			x						5,808		17		Instream and side channel habitat restoration, riparian planting
Northeast Willapa		1	0	0	8.7	0				-	0	0.0	0.0	
NW-00	Satsop Business Park Water Right to Reclaimed Water	x					x							SDP has 19,600 af/yr water right. Not specified how much reduction is anticipated.
Wishkah		0	1	1	0	10				-	0	75	0.0	
W-00	Grays Harbor County Forest Practices and Flow Assessment		x	x		10			x			75		Preservation of established forest stands representing 2% of GHC forest holdings. Water offset estimated based on VELMA modeling results indicating 0.39 ac-ft/yr of flow increase per acre of forestland.
Wynoochee		0	2	3	1.4	2.3				10,032	10032	17.5	0.0	
WY-00	Wynoochee River RM 14 Early Action Reach			x						10,032	10,032			Riparian and instream restoration, floodplain reconnection & storage
WY-01	Grays Harbor County Forest Practices and Flow Assessment		x	x		2.3			x			17		Preservation of established forest stands representing 2% of GHC forest holdings. Water offset estimated based on VELMA modeling results indicating 0.39 ac-ft/yr of flow increase per acre of forestland.
WY-02	Satsop/Wynoochee Tributary Assessment		x	x		NQ		x	x					Planning stage. Offset anticipated but insufficient information to quantify at this time.
Basinwide Concepts		1	5	5		210				79,200	0	300.0	0.0	
BW-00	Beaver Dam Analog Implementation		x	x		NQ								Identify locations throughout Chehalis basin. Water offset assumed to be 2.5 af/yr per BDA; quantity not yet known.
BW-01	Chehalis Basin Cooperative Weed Management			x						79,200		300		Goal to treat 300 acres of upland and riparian area, 15 miles of streambank
BW-02	Agricultural Irrigation Efficiencies & Water Conservation		x	x		NQ								Engagement intiative. Identify crop-specific water needs and conservation of water for irrigation. Offset anticipated but insufficient information to quantify at this time.
BW-03	Eager Beaver Collaboration		x	x		NQ		x	x					Landowner outreach to explore increasing tolerance for beavers to allow for increased beneficial beaver activity
BW-04	Managed Aquifer Recharge Opportunity Assessment		x			200		x						Offset expected to range from ~200-300 af/yr per project for 1 cfs diversion depending on withdrawal period. Potential locations still being investigated.
BW-05	Stormwater Recharge Opportunity Assessment		x			10		x						Offset range ~7-40 af/yr per project for a "typical" detention pond retrofit, depending on infiltration rate.
BW-06	Trust Water Rights Acquisitions	x					x							Identify additional water rights for purchase and dedication to streamflow. Up to 1638 AF/yr of water rights currently in trust not already included in project list.
BW-07	USGS Groundwater Discharge Zone Delineation			x										No direct benefit but would help target locations for future projects and contribute to adaptive management.